Chapter 6: Tense and Aspect

6.0 Locating events in time

In the previous chapter, we developed a theory according to which a verb may describe an eventuality (event or state), adverbs further specify the nature of the eventuality and argument-DPs describe the participants in the eventuality. The eventualities themselves are located in time. Languages provide a number of devices for indicating where in time an eventuality is located. Consider the following examples:

(1) Jack arrived in the fall of 1999.
(2) Jack graduated 10 years ago.

The expressions '*in the fall of 1999*' and '*10 years ago*' are both **temporal adverbials**. They serve to locate in time the events described by the verbs. In (1), '*in the fall of 1999*' helps to locate the arrival by making reference to a definite period on the calendar. In (2), '*10 years ago*' locates the event of graduating relative to the event of uttering the sentence. It measures from the time that (2) is uttered back 10 years and locates the graduation then. Adverbials that locate relative to the utterance event are **deictic** temporal adverbials. **Auxiliary** verbs are another device used to locate events in time. In the sentence:

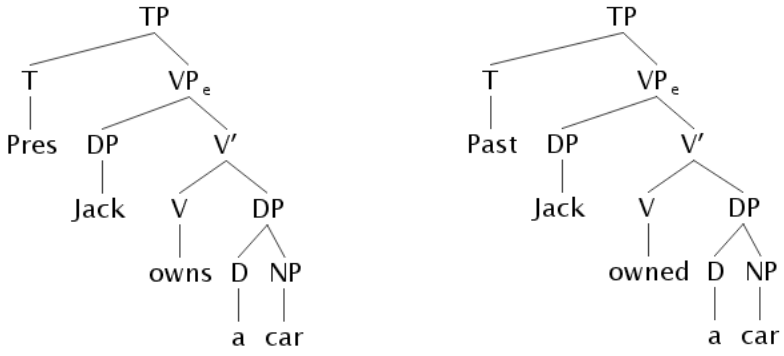
(3) Jack will buy a car.

The auxiliary verb '*will*' is used to locate the event of buying in the future relative to the utterance event. A third device that serves to locate events in time is verbal **inflection**. Compare the following pair of sentences:

(4) Jack owns a car.
(5) Jack owned a car.

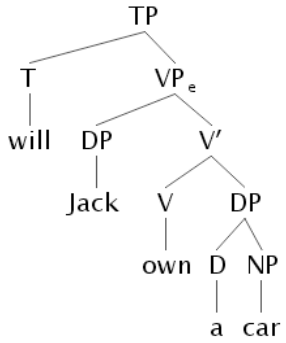
In the first sentence, the form of the verb tells us that the state of owning is simultaneous with the utterance event. In the second sentence, the form of the verb tells us that the state of owning precedes the utterance event. In the first case, the verb has the **present** tense form and in the second case, the verb has the **past** tense form.

In our structures, tenses will show up as heads of a **Tense Phrase** (TP), as the following Deep Structures illustrate:



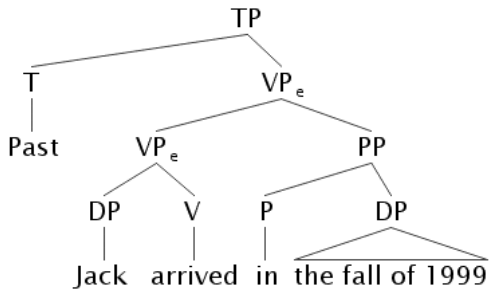
Our rules will interpret the heads of TP (e.g. Pres or Past) and the verbs themselves will continue to be interpreted as one-place predicates of events and states.

Although *will* is an auxiliary verb and not a verbal inflection, for our purposes here, it will suffice to assume that it too heads a TP:



Treating temporal adverbials as adjuncts, the sentence in (1) has the following structure:

(1) Jack arrived in the fall of 1999.



In this sentence, the temporal location of the arriving event is specified by the PP '*in the fall of 1999*' but it is also specified by the tense. If this sentence is uttered now, in 2015, then the tense is redundant, given that any event that occurred in the fall of 1999 has to be in the past relative to an utterance event in 2015. But that is the nature of inflection: it is required even if redundant.

6.1 Tense

For temporal relations among events and states we will use the 2-place predicates '>', '<' and '≈'. Using 'e' for eventualities of both kinds, we read these predicates as follows:[1]

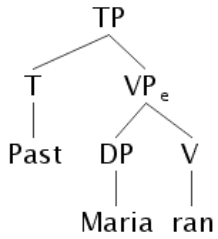
$e < e'$	e is before e'
$e > e'$	e is after e'
$e \approx e'$	e overlaps e' (e is neither before nor after e')

[1] In our symbolic language, 2-place predicates precede their arguments. For example, we have 'AGT(e, x′)'. In the case of the predicates ordering events in time (i.e. temporal relations), we write 'e < utt' when technically it should be '<(e, utt)'. In applying our semantic rules, we need to undo that for these temporal relations.

When tense occurs on the main verb of a sentence, its meaning is understood in terms of the time of the utterance of that sentence. We will use 'utt' as a special individual constant that stands for the utterance event. A rough guide to the semantics is given by the following:

(6)	Maria ran.	an event *e* of Maria's running is such that $e < utt$
(7)	Maria owns a car.	a state *s* of Maria's owning a car is such that $s \approx utt$
(8)	Maria will run.	an event *e* of Maria's running is such that $e > utt$

For (6), we want the following LF and logical form:

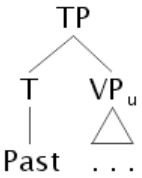


$\exists e\ (e < utt\ \&\ \text{AGT}(e, \textbf{maria})\ \&\ \textbf{run}(e))$

The quantifier '$\exists e$' has to come outside of the temporal-locating expression, '$e < utt$'. We could continue to assume a silent '$\exists$' in the LF, as in the preceding chapter, only now it would have to come above TP. Another option, the one we will explore, is to include the existential quantification in the tense itself. The following rule shows how that works:

TP-PAST

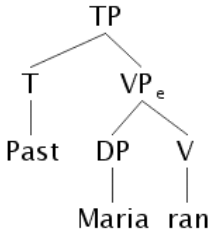
Anything of the form:



has the logical form: $\exists u\ (u < utt\ \&\ \phi)$

'ϕ' is the logical form assigned to VP_u

Now we can interpret the LF structure:



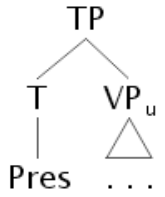
Subtree dominated by node:	**Rule that applies to that subtree**	**Logical form assigned to that subtree**
V	VERB	run'(e)
VP_e	NONBRANCHING DP	AGT(e, **maria**) & **run**(e)
TP	TP-PAST	∃e (e < utt & AGT(e, **maria**) & **run**(e))

Now that we have an account of tense, we can use the infinitive form of the verb to create a predicate of eventualities in the symbolic language. So above, the logical form for '[V *ran*]' is given as '**run**(e)'.

Using the TP-PAST rule as a guide, we arrive at the rules for present and future:

TP-PRES

Anything of the form:

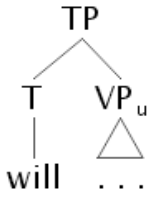


has the logical form: ∃u (u ≈ utt & ϕ)

'ϕ' is the logical form assigned to VP_u

TP-FUTURE

Anything of the form:



has the logical form: ∃u (u > utt & ϕ)

'ϕ' is the logical form assigned to VP_u

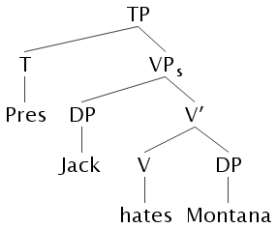
Since tense now does the job of introducing an existential quantifier, we no longer include a separate '∃' adjoined to VP, so we abandon that syntactic assumption and the translation rule that goes with it.

EXERCISE A

At this point, the Grammar consists of the 3 tense rules just introduced along with the rules used in previous chapters. Below are four sentences and below that the LF and logical form for the first sentence followed by a list of the translation rules that were used to arrive at that logical form. For the remaining three sentences, provide the LF structure, the logical form assigned by the Grammar and a list of the rules that were used to arrive at that form. Remember: We have abandoned the idea that a '∃' is part of the LF.

(1) Jack hates Montana.
(2) Every dog barked.
(3) Jill will arrive.
(4) Jack knows Jill.

(1)



∃s (s ≈ utt & IN(s, **jack**) & THM(s, **montana**) & **hate**(s))

VERB, NONBRANCHING DP (2x), TP-PRES

EXERCISE B

Consider the following formulas of the symbolic logic:

a. ∃e (e < utt & AGT(e, **jack**) & ¬ **escape**(e))

b. ∃e (e < utt & ¬AGT(e, **jack**) & **escape**(e))

c. ¬∃e (e < utt & AGT(e, **jack**) & **escape**(e))

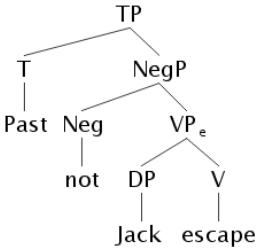
d. ∃e (e < utt & ¬(AGT(e, **jack**) & **escape**(e)))

(i) Describe a situation in which Jack escaped at some point before the utterance event and in which at least 3 of the 4 statements in a-d above are true.

(ii) Say which of the statements in a-d above are true in the situation you described.

EXERCISE C

There is good reason to believe that NEGP should be below TP. So for the past tensed sentence '*Jack didn't escape*' we have the following LF structure:



(i) The Grammar does not assign a logical form to this structure. Explain why not.

(ii) Consult your intuitions about the meaning of the sentence '*Jack didn't escape*'. Based on that, write what you think the logical form should be for that sentence.

(iii) Is there a way to modify the Grammar so that the logical form you proposed in (ii) will be assigned to the LF above? Your modification could involve syntactic rules, translation rules, semantic rules or a combination of these.

EXERCISE D

We have just introduced 3 new tense rules. There is a lot of repetition across the three rules. Is there some way we can collapse them into one rule?

EXERCISE E

Consider the following snippet of discourse:

> *I was at a party last week where I met two kids named Bobby and Lucia. Bobby resembled Elton John, which explains why Lucia kept referring to him as Elton.*

(i) Provide the logical form for the sentence '*Bobby resembled Elton*'

(ii) Hearing this snippet, one is likely to conclude that Bobby still resembles Elton John. Is this intuition compatible with the logical form you provided? Explain.

(iii) If you said in (ii) that the logical form is not compatible with the intuition, then there is a problem with our grammar. If there is such a problem, how could it be fixed?

6.1.1 Utterance event

In our discussion so far we've talked about "the utterance event". But there isn't one particular utterance event. There are many, many utterance events. Every time someone says something there is an utterance event. So what do we mean when we talk about "**the** utterance event"? Why does it sound right to spell out the tenses in terms of the utterance event? And how can we say that the event constant 'utt' stands for the utterance event when there is no such thing?

The answer to all these questions comes from removing a simplifying assumption we made early on. Up to now we assumed that we count a logical form as true if and only if it is true relative to *E*, the lexicon that assigns logical symbols the meanings of the corresponding English words. But now that we are bringing tense into the picture, we need to recognize that the truth or falsity of a sentence depends on <u>when</u> it is uttered. If 10 years ago, Jack uttered the sentence '*Obama was president of the United States*' what he said was false. If in 10 years time, he utters the very same sentence '*Obama was president of the United States*' what he says will be true. Sentences aren't true or false once and for all. Rather, they are true or false relative to the event in which they are uttered. We need to modify our grammar so that it specifies whether or not a sentence is true relative to the particular event in which that sentence is uttered. Making this modification will lead directly to a method for interpreting 'utt'.

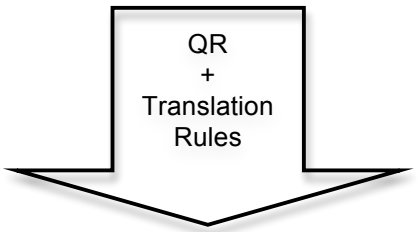
Below is a rule for assigning truth relative to an utterance event. It makes use of an event metavariable 'ê'.

UTTERANCE RULE

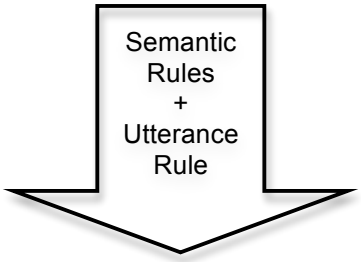
If a sentence with logical form ϕ is uttered in an event $\hat{e}$, the utterance is true if ϕ is true relative to $E+\langle \text{utt}, \hat{e} \rangle$.

With this rule, along with our other semantic rules, we can assign truth conditions to a logical form assigned to a TP. Here is a chart of how things now work:

ENGLISH *Bruce sang*



SYMBOLIC LANGUAGE $\exists e\ (e < utt\ \&\ AGT(e, \mathbf{bruce})\ \&\ \mathbf{sing}(e))$



when uttered at 2pm on 2/4/2014 in utterance event e_{14}, the sentence 'Bruce sang' *is true iff:*

There is an object o, o occurs before e_{14}, and o is an event of singing and Bruce is the agent of o.

Note: don't let 'e_{14}' confuse you! Recall that in our Utterance Rule, we used the metavariable ê over utterance events. This means that any utterance event, e_{14} or e_{144}, will do. The numbered index is completely arbitrary.

EXERCISE F

(i) Provide an LF for the sentence '*Jack laughed*'.

(ii) Provide the logical form assigned by the Grammar to your LF.

(iii) Using our semantics rules as well as the UTTERANCE RULE introduced above, calculate the truth conditions of '*Jack laughed*' when uttered in event *e99*. Submit the first three lines of your calculation.

EXERCISE G

The UTTERANCE RULE provided in the text is incomplete. Because it has '*if*' and not '*iff*' it doesn't say when a sentence is false (When the condition isn't met, is it false or not?). For unambiguous sentences, this problem is easily solved by changing '*if*' to '*iff*'. But once we take ambiguous sentences into consideration, the statement of the rule is a bit more involved. Propose a revised rule that deals with this problem.

EXERCISE H

The UTTERANCE RULE codifies the discovery that the truth or falsity of a sentence is relative to the particular event in which it is uttered. We made this discovery by paying attention to how tense affects interpretation. '*Obama was president of the U.S.*' is true when uttered in events occurring in the distant future, but false when uttered in events occurring in the distant past. Dependence on the utterance event can also be illustrated with a first person pronoun. An utterance of '*I am President of the U.S.*' is true if the speaker in the utterance event happens to be the president at the time, and it is false if the speaker in the utterance event happens not to be the president at the time.

Suppose we translate '*I*' with '**I**' following our standard translation procedure. Then we get the translation in (2) for the sentence in (1):

(1) I fell.

(2) $\exists e\ (e < utt\ \&\ \text{AGT}(e, \mathbf{I})\ \&\ \mathbf{fell}(e))$

If we apply our semantic rules to (2), we'll come to a point where we will have a lexicon, and it will be applying to the symbol '**I**'. The lexicon will be *E* augmented with assignments for some variables. At that point, we'll need to appeal to a rule of the form:

(3) For any lexicon *M*, $M(\mathbf{I})$ = _____

Our goal here will be to complete the rule in (3) so that (2) is a good translation for (1). As a first step, use the semantic rules and calculate the truth conditions for (2) assuming that it was uttered in an event we'll call e_{88}. Your calculation should begin with the UTTERANCE RULE. At some point in your calculation, you will have an expression of the form $M(\mathbf{I})$, where *M* is instantiated by a particular lexicon. Write that expression on the left side of the equal sign in (4) and fill in the right side with a description of the individual we would intuitively want '**I**' to pick out in event e_{88}.

(4) _____ = _____

Repeat this procedure, this time assuming an utterance event e_{99}.

Now study your two answers and come up with a generalization that will work to complete (3).

EXERCISE I

Following the method used in the previous exercise, outline a way to extend our grammar so that it captures the intuitive truth conditions of the following utterances:

(a) You fell. (b) Jack swam here.

EXERCISE J

Discuss the contribution *now* makes to the truth conditions of sentences containing it. Consider the examples below as well as others that might illustrate your ideas.

(a) Jack owns a bike now. (b) #Jack owned a bike now.
(c) Jack will own a bike now. (c) Jack will open the door now.

6.2 Aspect

6.2.1 The Progressive

Compare the following two sentences:

(9) Jack opened the bottle.
(10) Jack was opening the bottle.

They are both in the past tense – hence they both describe an eventuality that is located in the past. And they both make reference to an opening event whose patient is a bottle and whose agent is Jack. Nevertheless, the sentences seem to have slightly different meanings and they are constructed using different forms of the verb. The second sentence has the sequence *be* VERB+*ing*, known as the **progressive**. Since *be* is in the past tense, the second sentence is called a past progressive. Our goal here is to get a syntax and semantics for the progressive. We'll begin by pinning down the difference in meaning between the two sentences above. Compare the following two narratives:

(11) Jill walked in. She took off her coat. Jack opened a bottle of wine. They started to discuss the election.

(12) Jill walked in. She took off her coat. Jack was opening a bottle of wine. They started to discuss the election.

In the first narrative, it is natural to understand Jack's opening the bottle as following Jill's coat removal. As expected, the eventive sentence *Jack opened the bottle* moves the reference time of the narrative forward. By contrast, in the second narrative, it is natural to understand the bottle opening to be occurring while Jill took off her coat. So the progressive sentence *Jack was opening the bottle* behaves like a stative – it does not move the narrative forward. We tentatively conclude that the progressive *be* ___+*ing* combines with an eventive verb to form a new predicate that is stative. Further evidence for this conclusion comes from the use of the present tense. Recall that present tense eventive sentences in English may describe habits, but they are not good for describing an event that is happening at the moment of utterance.[2] The odd sequence below illustrates this:

(13) #Hey, look! Jack makes an omelet.

By contrast, a stative sentence is generally fine in the present tense as a description of current facts. It follows then that if the progressive is stative, we should be able to put the verb *make* in the progressive and the result will be a present tense sentence that describes what is happening at the moment of utterance. This prediction is fulfilled in the sequence below:

(14) Hey, look! Jack is making an omelet.

[2] Note that this is a property unique to English. In other Germanic languages such as German or Dutch, the present tense eventive sentences are used to describe an event that is happening at the moment of utterance.

A final piece of evidence for the stativity of progressive sentences comes from how states develop in time. 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, by contrast, usually do not occur in 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. However, at any point during the lift we can use the sentence below to describe what is happening at that moment:

(15) Jill is lifting Jack.

This is then one more piece of evidence that the progressive forms a predicate of states. This example starts to give us an idea of what kind of state a progressive verb describes. Whereas '*lift*' describes an event of lifting, '*be lifting*' describes a state that holds while a lifting is in progress. To capture this idea, we'll use a 2-place predicate in the symbolic language, 'InProgress', and we'll understand the formula:

(16) InProgress(s,e)

to be true if *s* is a state of *e* being in progress. In other words, *E*(InProgress) is a relation that holds between a state and an event, just in case the state is a state of the event being in progress.

We can now specify a progressive state further by specifying what kind of event is in progress:

(17) $\exists$e(InProgress(s,e) & AGT(e, **jill**) & PAT(e, **jack**) & **lift**(e))

That formula says there is an event *e* and *s* is a state of that event being in progress, and the event is an event of Jill lifting Jack. We can further locate that state in the present by saying that it overlaps the utterance event:

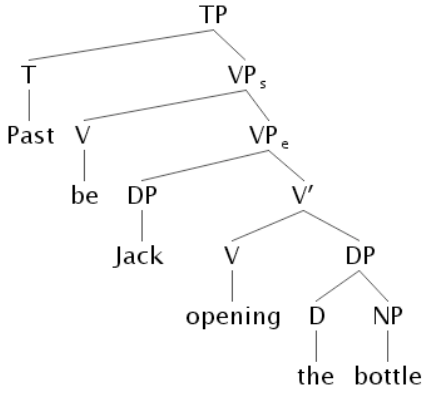
(18) $\exists$s(s $\approx$ utt & $\exists$e(InProgress(s,e) & AGT(e, **jill**) & PAT(e, **jack**) & **lift**(e)))

This says there is a state that holds at the time of utterance and it is a state that holds when an event of Jill lifting Jack is in progress.

The meaning of '*Jack was opening the bottle*' will be captured by the symbolic logic sentence:

(19) $\textbf{the}_x\{\textbf{bottle}(x)\}\exists s(s < utt \;\&\; \exists e(InProgress(s,e) \;\&\; AGT(e, \textbf{jack}) \;\&\; PAT(e, x) \;\&\; \textbf{open}(e)))$

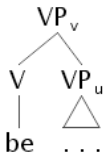
We can summarize the result of our semantic investigation by saying that the progressive contributes a 2-place predicate, InProgress, that relates states to events. To incorporate this in our grammar, we'll need a syntactic structure in which the parts of the progressive are spelled out. To that end, we adopt the following syntax for '*Jack was opening the bottle*':



The lower VP is indexed 'e', because it describes an event of bottle opening. The higher VP is indexed 's' because it describes the state of that event being in progress.

The following rule allows us to assign logical forms to progressive verb phrases, which are headed by '*be*':

PROGRESSIVE Anything of the form:



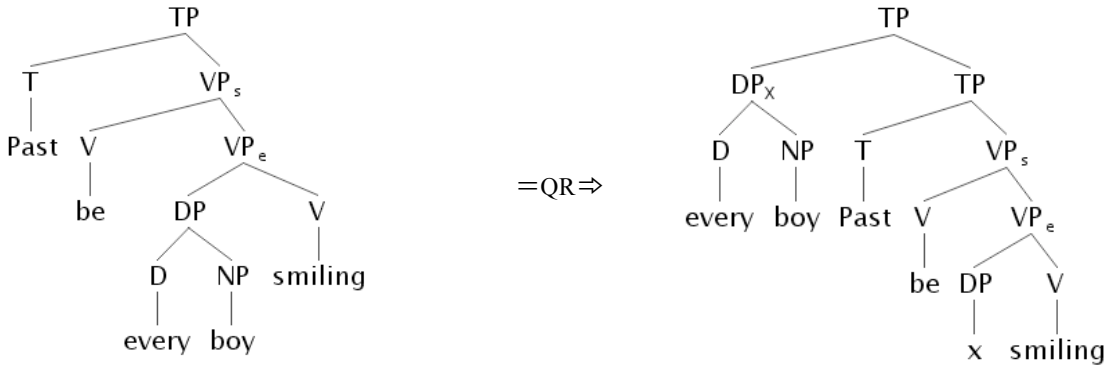
has the logical form: $\exists u$ (InProgress(v,u) & ϕ)

'ϕ' is the logical form of VP_u.

Let's now use this rule to arrive at the logical form for the sentence:

(20) Every boy was smiling.

We start with the phrase structure tree on the left and then apply QR to arrive at the LF structure on the right:



Subtree dominated by node:	Rule that applies to that subtree	Logical form assigned to that subtree
V	VERB	**smile**(e)
VP_e	NONBRANCHING DP	(AGT(e,x) & **smile**(e))
VP_s	PROGRESSIVE	∃e(InProgress(s,e) & AGT(e,x) & **smile**(e))
TP (lower)	TP-PAST	∃s (s < utt & ∃e(InProgress(s,e) & AGT(e,x) & **smile**(e)))
TP (higher)	BRANCHING DP	**every**$_x${**boy**(x)} ∃s(s < utt & ∃e(InProgress(s,e) & AGT(e, x) & **smile**(e)))

So the logical form for the sentence is:

(21) **every**$_x${**boy**(x)} ∃s(s < utt & ∃e(InProgress(s,e) & AGT(e,x) & s**mile**(e)))

Note that we translate all forms of the verb the same. '**smile**' is the 1-place predicate in the symbolic language corresponding to English '*smile*' and to '*smiling*'.

EXERCISE K

Review the derivation above for the LF structure and logical form for the sentence '*Every boy was smiling*'. Using that pattern as a guide, do (i)-(iv):

(i) Provide an LF structure for (a) and (b) below.
(ii) Provide the logical form assigned by the Grammar to the LFs you provided for (i).
(iii) Provide a list of the rules that were used to arrive at the logical form you provided for (ii).
(iv) Following our semantic rules, provide the truth-conditions assigned to the logical form for (a). Do not include the intermediate steps in your calculation.

(a) *Jack will be dancing*. (b) *No guest is laughing*.

EXERCISE L

Above we calculated the logical form for '*Every boy was smiling*'. According to that logical form, for each boy, there is a past state in which that boy is smiling. That leaves open the possibility that each of the boys was smiling at a different time. Discuss this aspect of the logical form.

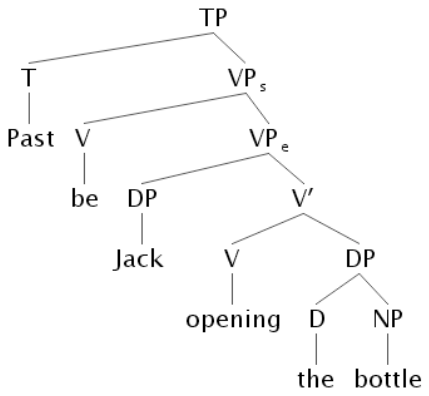
- What factors determine whether or not a quantified statement describes eventualities that are simultaneous or not?
- Can this be captured in the rules that assign logical forms? How?
- Should it be encoded in these rules?

EXERCISE M

In the previous chapter, it was noted that in many dialects of English, progressives formed from stative verbs do not sound good. '#*Jack is owning Fido*' is one such example. Provide the logical form that is assigned to that sentence. How could we explain the infelicity in terms of what the logical form says?

Summary of Some of the Main Points in §6.2.1

- Evidence that progressive forms are stative:
  a. good in the present tense to describe what's happening at the moment of utterance
  b. can be true at a moment
  c. narrative progression
- Conclusion: '*be lifting*' describes a state that holds while a lifting event is in progress.
- A new 2-place predicate 'InProgress' was added to the symbolic language.
- *E*(InProgress) is a relation that holds between a state *s* and an event *e* just in case *s* is the state of *e* being in progress.
- Syntax for the progressive:



The lower VP is indexed 'e', because it describes an event of bottle opening. The higher VP is indexed 's' because it describes the state of that event being in progress.

- New rule of translation:

PROGRESSIVE Anything of the form:

has the logical form: $\exists u$ (InProgress(v,u) & ϕ)

'ϕ' is the logical form of VP_u.

6.2.2 The Perfect

The title of this chapter is 'Tense and Aspect'. The term 'aspect' can be used to describe constructions whose meaning has to do with what stage of development an event is at. The progressive is one such construction. It is used to describe an event in progress. We turn our attention now to another aspectual construction in English: the **perfect**.

Compare the following two sentences:

(22) Jack spoke to Jill about her book.
(23) Jack has spoken to Jill about her book.

The first sentence is in the past tense. Despite the similarity in meaning to the first sentence, the second sentence uses the present tense '*has*' (not past '*had*'), so it appears to be in the present tense. Further evidence for this idea comes from adverbial modification. Whereas it is fine to modify the past tensed sentence with '*yesterday*':

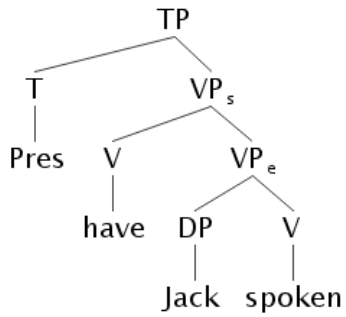
(24) Yesterday, Jack spoke to Jill.

The second sentence sounds odd with this modifier:

(25) *Yesterday, Jack has spoken to Jill.

This result seems puzzling.[3] Even though the first sentence is past-tensed and the second present-tensed, they both appear to describe an event of speaking that occurred before the utterance event. To solve this puzzle, we'll need to pay attention to the fact that the sentences are constructed with different verb forms. Whereas the first sentence has a simple past tense '*spoke*', the second sentence ,'*has spoken*' has the present tensed verb '*has*'. As such, we say that '*has spoken*' is a present perfect sentence. Our goal here is to get a syntax and semantics for the perfect that will explain how a present perfect sentence can come to describe an eventuality that occurred in the past.

We'll start with the syntax this time. Our first assumption is that the verb '*have*' takes a VP complement:



[3] That (25) is odd is a reflex of the present perfect in English. In German, for example, the present perfect '*hat*' can occur with a past adverbial like '*yesterday*'.

This structure will serve as input to interpretation. It also serves as input to the process that yields a surface string. On the way to the surface structure, the subject is raised and the tense lowers on to the verb *have* to give us *has*.

(26) Jack has spoken.

Note that *'spoken*' is the past participle of '*speak*'. Similarly, '*fallen*' is the past participle of '*fall*', as in '*the sky has fallen*' and '*sung*' is the past participle of '*sing*' as in '*she has sung a song*'. For many verbs, the past participle is identical to the simple past. Compare '*she has visited us*' and '*she visited us*'. There may be dialects in which the simple past and the past participle forms are always the same. And in dialects where they are different, for some verbs, speakers are unsure what the past participle form is.

Let's now we turn to the semantics of the perfect. Following our discoveries concerning the progressive, we hypothesize that the perfect creates a predicate that describes a state defined in terms of the eventuality described by its complement VP. So '*have spoken*' would somehow describe a state related to a speaking event. As we did with the progressive, first, we'll point to some evidence for the stativity of the perfect. Following that, we'll try to say more about what the relation is between states of having spoken and events of speaking.

In fact, we've already got one piece of evidence that perfects are statives. Recall that we determined above that '*Jack has spoken to Jill about her book'* is in the present tense. But that sentence does not report a habit of Jack's (compare: '*Jack speaks to Jill about her book*'). In other words, the present perfect behaves like a stative not like an eventive in the simple present. For another piece of evidence we turn to narrative progression. Compare the following two narratives:

(27) The Butler family arrived home from their vacation at 7pm. They quickly got out of the car and went in the house. Mr. Butler spoke to Billy about his poor performance in school. Everyone was tired, so they ate some cold pizza and went to bed.

(28) The Butler family arrived home from their vacation at 7pm. They quickly got out of the car and went in the house. Mr. Butler had spoken to Billy about his poor performance in school. Everyone was in a bad mood, so they ate some cold pizza and went to bed.

In (27), it is natural to understand Mr. Butler's speaking to Billy as following the house entry. As expected, the eventive sentence '*Mr. Butler spoke to Billy…*' moves the reference time of the narrative forward. By contrast, in the second narrative, it is natural to understand Mr. Butler's speaking to Billy as preceding the house entry. This is unlike the eventive sentence, supporting the view that the perfect is stative. Still, it seems to work differently from other statives we've seen. With other statives, we understand the state to overlap a previously described event. Recall that in the narrative where Jack was opening the bottle, the opening-state overlaps the previously mentioned event of taking off the coat. But with the perfect '*had spoken*' the speaking precedes the previously mentioned entering event. That's a clue about how the 'perfect state' relates to the event in terms of which it is defined. We'll return to that clue in a moment. But now, having shown that perfects are statives, we turn to the truth conditions of a perfect.

Suppose that Jack decides to cross Main Street. The event of crossing begins when he steps off the sidewalk and ends when he reaches the other side. As discussed in the previous section, at any moment between the stepping off and the reaching the other side, we can truthfully use the progressive to describe what is happening:

(29) Jack is crossing the street.
And now we observe that as soon as Jack reaches the other side, we can truthfully use the present perfect to describe what happened:

(30) Jack has crossed the street.

This example starts to give us an idea of what the meaning of the perfect is. Whereas '*cross*' describes an event of crossing, '*has crossed*' describes a state that holds as soon as the crossing is completed.[4] To capture this idea, we'll use a 2-place predicate in the symbolic language, 'Completed', and we'll understand the formula:

(31) Completed(s,e)

to be true if *s* is a state of *e* being completed. In other words, *E*(Completed) is a relation that holds between a state and an event, just in case the state is the state of the event being completed.

We can specify a completion state further by describing the kind of event that is completed:

(32) ∃e(Completed(s,e) & AGT(e, **jill**) & PAT(e, **jack**) & **lift**(e))

That formula says there is an event e, that event is in a state of completion and s is that state. Furthermore, e is an event of Jill lifting Jack. We can further locate the state in the present by saying that it overlaps the moment of utterance:

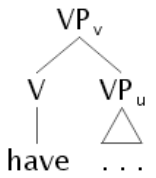
(33) ∃s (s≈utt & ∃e(Completed(s,e) & AGT(e, **jill**) & PAT(e, **jack**) & **lift**(e))

This says there is a state that holds at the time of utterance and it is a state that holds due to the completion of an event of Jill lifting Jack. That is the logical form we'll assign to the sentence '*Jill has lifted Jack'*. The logical form for '*Mr. Butler had spoken*' will be:

(34) ∃s (s < utt & ∃e(Completed(s,e) & AGT(e, **mr.butler**) & **speak**(e))

The following rule allows us to assign logical forms to perfect verb phrases headed by '*have*':

PERFECT Anything of the form:

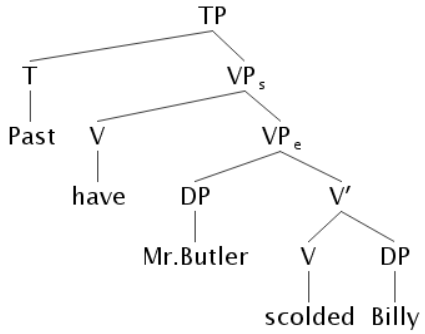


has the logical form: ∃u (Completed(v,u) & ϕ)
'ϕ' is the logical form of VP_u.

[4] The word '*perfect*' usually means "ideal" but it can also mean "complete", as in "that makes perfect sense" or "perfectly reasonable" ≈ "completely reasonable". The completeness meaning is the source of the grammatical term '*perfect'*.

Let's now use this rule to arrive at the logical form for the sentence:

Mr. Butler had scolded Billy



Subtree dominated by node:	Rule that applies to that subtree	Logical form assigned to that subtree
V	VERB	**scold**(e)
V′	NONBRANCHING DP	PAT(e, **billy**) & **scold**(e)
VP_e	NONBRANCHING DP	AGT(e, **mr.butler**) & PAT(e, **billy**) & **scold**(e)
VP_s	PERFECT	∃e(Completed(s,e) & AGT(e, **mr.butler**) & PAT(e, **billy**) & **scold**(e))
TP	TP-PAST	∃s (s < utt & ∃e(Completed(s,e) & AGT(e, **mr.butler**) & PAT(e, **billy**) & **scold**(e)))

In the LF tree above, we indexed the lower VP with 'e', since it is headed by the eventive verb '*speak*'. The higher VP is indexed 's', because it is headed by perfect '*have*' which creates a stative predicate.

EXERCISE N

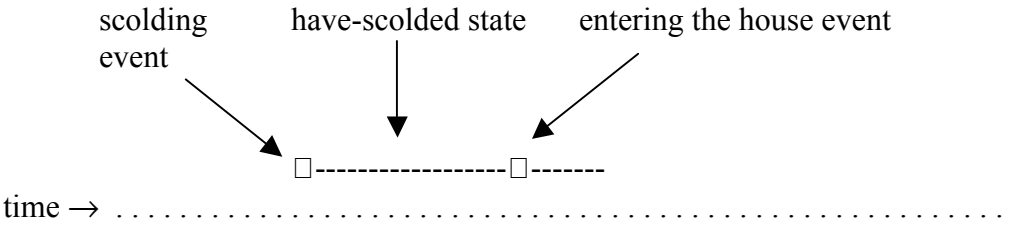
Review the derivation in the text for the LF-structure and logical form for the sentence *Mr. Butler had scolded Billy*. Using that pattern as a guide, for both of the sentences below provide an LF structure, the logical form assigned by the Grammar to that LF and a list of the rules you used to arrive at that form.

(i) Jack will have eaten.
(ii) No guest has eaten.

Now that we have an analysis for the perfect we can explain its behavior in the narrative discussed above, repeated here:

(35) The Butler family arrived home from their vacation at 7pm. They quickly got out of the car and went in the house. Mr. Butler had spoken to Billy about his poor performance in school. Everyone was in a bad mood so they ate some cold pizza and went to bed.

Recall, we noted that the perfect '*had spoken*' seemed to work differently from other statives. The speaking doesn't overlap the entering – it precedes it. Compare *'everyone was in a bad mood*' which is stative and is understood to overlap the house-entering. This behavior is actually predicted by our analysis of the perfect. The state that the perfect sentence describes is the state of the speaking event being completed. That state of completion begins after the speaking and continues on. That state does overlap the going into the house. Here's a picture of a possible time line:



It is because the have-scolded state overlaps the entering that the scolding itself must precede the entering.

EXERCISE O

Compare the narrative above, in (35), to the one below:

> *The Butler family arrived home from their vacation at 7pm. They quickly got out of the car and went in the house. Mr. Butler has spoken to Billy about his poor performance in school. Everyone was in a bad mood, so they ate some cold pizza and went to bed.*

The underlined sentence in the perfect is now in the present tense (rather than past) and the discourse is odd. Do our rules explain the oddity of this discourse? Why or why not?

The time line pictured above may lead one to wonder how long a completion state lasts. It turns out that the perfect can be used in at least two different ways, leading to different answers to this question. Sometimes the perfect describes a state of completion that lasts as long as the effects of the completed event are around. Under that use '*I have spilled my coffee on the table*' would be a true thing to say while the coffee is on the table. It would be a funny thing to say after the coffee is cleaned up and even odder to say the next day (assuming you didn't spill

the coffee again in the meantime).[5] There is another use of the perfect in which an experience is described. This is the use you find in examples like '*I've heard worse things than that*' and in questions like '*Have you ever tasted eggplant*?' In this experiential use, the completion state seems to last forever. A person can truthfully answer 'yes' to this question, no matter how long ago the event of tasting eggplant occurred. There are languages that explicitly distinguish these two uses of the perfect.

EXERCISE P

(i) Provide the logical forms our grammar assigns to the following two past tensed sentences:

(1) *Jack was crossing Mass Ave.*
(2) *Jack had crossed Mass Ave.*

(ii) We'd now like to know whether your logical forms make the right predictions. Your logical forms should include the individual constant 'utt'. The meaning of that constant will depend on when the sentence was uttered. Suppose the sentences in (1) and (2) were uttered at 8:00am on January 4, 1990 in events *e8a* and *e8b*. Let's now add the following facts:

(3) *FACTS*: Jack stepped off the sidewalk at 10:00am on July 1, 1989, he walked across Mass Ave and arrived at the other side at 10:07am.

(a) Is the logical form you gave for sentence (1) true when uttered in *e8a*?
(b) Is the logical form you gave for sentence (2) true when uttered in *e8b*?

IMPORTANT: For each of your answers in (a) and (b), if the logical form is true, say what state makes the sentence true and when that state holds.

(iii) Do these results conform to your intuitions? In other words, could someone truthfully utter the sentence in (1) at 8:00am on January 4, 1990 on the basis of the facts in (3)? Could someone truthfully utter the sentence in (2) at 8:00am on January 4, 1990 on the basis of the facts in (3)?

Observe that the perfect '*have*' can have a stative complement such as '*owned a car*':

(36) Jack has owned a car.

How are we to represent this? Here is what we suggest:

(37) $\mathbf{atlst1}_x\{\mathbf{car}(x)\}\exists s_1(s_1 \approx \text{utt} \ \& \ \exists s_2 \ (\text{Completed}(s_1, s_2) \ \& \ \text{IN}(s_2, \mathbf{jack}) \ \& \ \text{THM}(s_2, x) \ \& \ \mathbf{own}(s_2)))$

First notice that QR applies to the direct object '*a car*', leaving behind a variable in the theme relation (THM). Also notive that there are two states described: the state of owning a car s_2 and the completion of this state s_1, which is related to the utterance event utt. We will continue to use underscore indices when there is more than one eventuality in the logical form.

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[5] This example comes from: Higginbotham, J. (2008) "The English Perfect and the Metaphysics of Events," in Jacqueline Guéron and Jacqueline Lecarme (eds.) *Time and Modality. Series: Studies in Natural Language and Linguistic Theory*, Vol. 75, pp. 173-193.

Notice that the logical form in (37) above includes the statement 'Completed(s_1, s_2)' which says that s_1 is the state of s_2 being completed. To make sense of this we need to say what it means for a state to be completed. The exercises below are designed to address this question.

EXERCISE Q Give the LF structure that is assigned the logical form above.

EXERCISE R

Suppose Jack owns a car for one year – beginning January 1, 1989 and ending December 31, 1989. Suppose he never owned a car before or after. Let's assume then that there is a state, s_2, it is a state of Jack owning a car and it lasts throughout 1989. To keep things simple, let's assume that Jack named his car 'Ruby' and so the following is true:

$\exists s_2(\text{IN}(s_2, \textbf{jack}) \ \& \ \text{THM}(s_2, \textbf{ruby}) \ \& \ \textbf{own}(s_2))$

We're interested in knowing when it is true to say:

Jack has owned Ruby.

and how that bears on the logical form our grammar assigns to that sentence:

$\exists s_1(s_1 \approx \text{utt} \ \& \ \exists s_2(\text{Completed}(s_1, s_2) \ \& \ \text{IN}(s_2, \textbf{jack}) \ \& \ \text{THM}(s_2, \textbf{ruby}) \ \& \ \textbf{own}(s_2)))$

Let's define some terms so we can formulate the question more generally. When a perfect is formed from a stative VP, we'll call that a **perfect of a stative**. Examples of perfects of statives are:

Jack has owned a car.
Jack had owed money.
Jack had known Jill.
Jack will have believed me.
Jack has been washing dishes.
Jack has been sick.
Jack had seemed unhappy.
Jack will have owed me money.
Jack will have been in New Hampshire.

We'll call a state described by the VP complement of '*have*' an **underlying state**. Recall, s_2 is the state of Jack owning Ruby that lasts throughout 1989. So, s_2 is an underlying state for the sentence '*Jack has owned Ruby*'. We can now formulate the question as follows:

(i) When is a present perfect of a stative true? During the underlying state? Once the underlying state ends? For how long after the underlying state ends?

Start by answering the question for the example '*Jack has owned a car'* where s_2 is the underlying state. Then expand your inquiry considering various examples. Think about discourses in which the example might be used. Consider examples in which an adverbial occurs in the perfect sentence, including adverbials like *'since Monday*' and '*for two days*'. Consider different stative verbs. Consider the special case of perfect progressives (e.g. *Jack has been washing the dishes*) where the underlying state is given by a progressive VP.

(ii) Once you have arrived at an answer to the question in (i), comment on the analysis of perfects proposed in the text. Does it make sense in terms of completion? For the cases you considered, are there states that are completed? What is a state of completion of a state and how long does it last?

EXERCISE S

The sentence in (1) contains the present perfect progressive and the sentences in (2) contains the present progressive perfect. Why is the perfect progressive good and the progressive perfect bad?

(1) Jack has been sleeping.

(2) *Jack is having slept.

Summary of Some of the Main Points of section 6.2.2

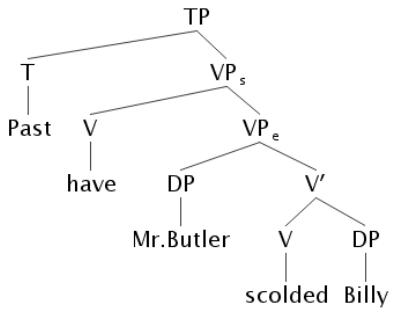
- Evidence that perfect forms are stative:

  a. good in the present tense to describe the moment of utterance

  b. narrative progression: perfects don't advance the reference time.

  Conclusion: *has lifted* describes a state that holds when a lifting is completed.

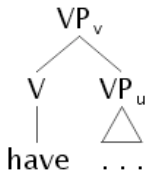
- A new 2-place predicate 'Completed' was added to the symbolic language.
- *E*(Completed) is a relation that holds between a state *s* and an event *e* just in case *s* is the state of *e* having been completed. The *E*(Completed) relation also holds between an underlying state *s′* and a state *s* when *s* is the state of completion of *s′*.
- Syntax for the perfect:



The lower VP is indexed 'e', because it describes an event of scolding. The higher VP is indexed 's' because it describes the state of completion of that event.

- New rule of translation:

PERFECT Anything of the form:

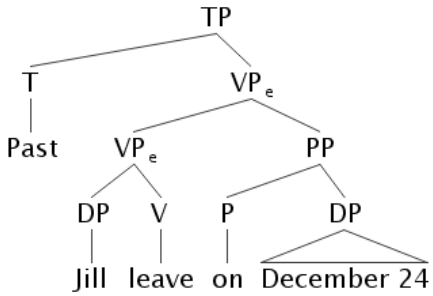


has the logical form: $\exists u$ (Completed(v,u) & ϕ)

'ϕ' is the logical form of VP_u.

6.2.3 Adverbials and aspect.

In the beginning of this chapter, we discussed the use of temporal adverbials to locate an event in time. These adverbials can be treated as VP adjuncts, just like the ones discussed in the previous chapter. So we have structures like the one below which gets assigned the logical form below it:



Jill left on December 24

$\exists$e (e < utt & AGT(e, **jill**) & **leave**(e) & **on**(e, **dec.24**))

We're using '**dec.24**' as an individual constant standing for a time period. '**on**(e, **dec.24**)' requires the event 'e' to occur on December 24th.

EXERCISE T

Name the rule that assigns a logical form to the higher VP node in the tree above.

EXERCISE U

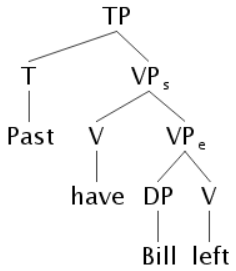
(i) Provide the logical form that gets assigned to the sentence: '*Jill left today*'. Assume '*today*' is an AdvP adjoined to VP and that it is translated into the one place event predicate '**today**'.

(ii) When truth conditions are assigned to logical forms, the one place event predicate '**today**' will be assigned a set. Complete the following definition:

For any lexicon *M, M*(**today**) is the set_____

(HINT: Review EXERCISE H in section 6.1.1 – page 9)

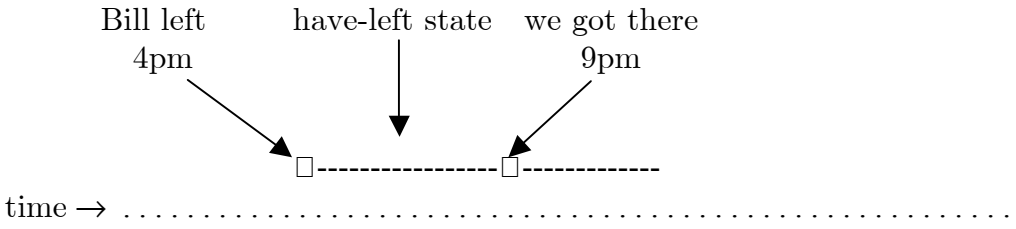
In the previous section, we adopted a syntax whereby a sentence with the perfect contains two VPs. For example, the sentence '*Bill had left*' has this structure:



If temporal adverbials are VP adjuncts, it follows that when a temporal adverbial is found in a sentence using the perfect, it could be attached to the higher VP, the one headed by '*have'* or it could be attached to the lower VP, the complement of *have.* It turns out that the choice of attachment point affects the meaning. To see that, we compare two narratives. Here is the first one:

(38) There was no one in the house when we got there at 9pm. Bill had left at 4.

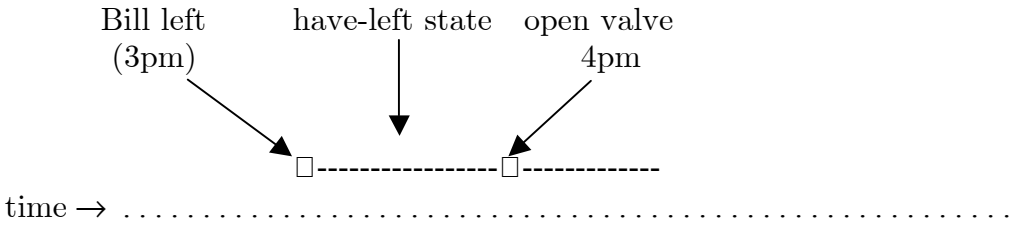
In this case, Bill's departure occurred at 4pm. So the past perfect sentence reports on a past state that held as the result of a 4pm leaving event. In other words, there is an event of Bill leaving at 4pm and the sentence describes the state of that event being completed. Given the way narrative progression works with statives, we naturally understand that state as holding at 9pm. So at 9pm, there was a state, the state of completion of a 4pm departure by Bill.



Here's the second discourse:

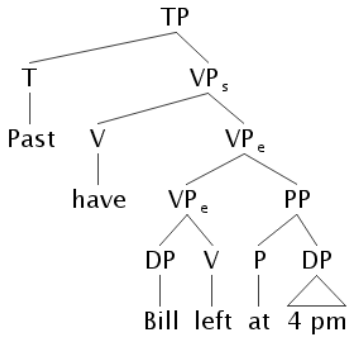
(39) Lawyer: At 4pm, you opened the valve. Did you ask Bill, your supervisor, for permission?
Witness: No
Lawyer: Why not?
Witness: At 4pm Bill had already left. He usually leaves around 3.

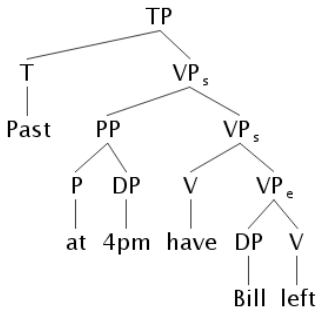
In this case, Bill's departure occurred most likely at 3pm, but the state of his having left held at 4pm. So the past perfect sentence reports on a past state that held as the result of Bill's leaving and it was a state that held at 4pm. In other words, there is an event of Bill leaving and the sentence describes the state of that event being completed, a state that held at 4pm.



Comparing the two discourses now, the adverbial '*4pm*' describes the time of the event of leaving, while in the second, it describes the time of the state of completion.

Here are two potential syntactic structures corresponding to the two readings:





EXERCISE V

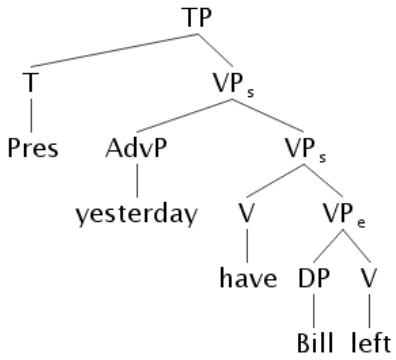
Provide the logical forms assigned by the Grammar to the two trees above (one logical form per tree). Follow the model used earlier in this section for the sentence '*Jill left on December 24th*'. Treat '**4pm'** as an individual constant standing for a time. List the rules you used in arriving at your logical forms. Verify that your logical forms capture the meanings that were salient in the two discourses – the tree on the left for the first discourse, the tree on the right for the second discourse. If there are any discrepancies, note them.

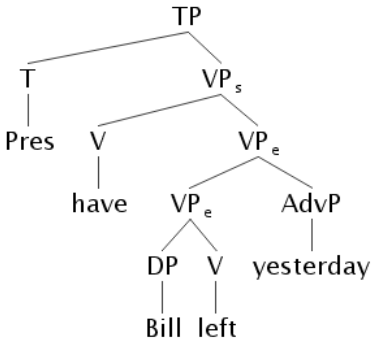
EXERCISE W

In the beginning of our discussion of the perfect, we observed that present perfects do not combine well with past adverbials:

**Yesterday, Jack has spoken to Jill*

Consider now the following LFs:





(i) What logical forms are assigned to these structures?

(ii) Assuming the LF on the left is the LF for '**Yesterday, Bill has left*', does the logical form assigned help explain why that sentence is odd?

(iii) Assuming now that the LF on the right is for '**Bill has left yesterday*', does the logical form assigned help explain why that sentence is odd?

(iv) Complete the following definition:

For any lexicon *M, M*(**yesterday**) is the set_____

(HINT Review EXERCISE H in section 6.1.1 – page 9)

EXERCISE X

We've just seen that a sentence in the perfect has two VPs and an adverbial can modify either one of them. Recall, now, that sentences in the progressive also have two VPs.

(i) Provide an LF structure for each of the sentences below, assuming attachment of the adverbial to the higher VP for the first sentence and attachment of the adverbial to the lower VP for the second one.

On Thursday, Bill was dancing.

Bill was dancing on Thursday.

(ii) Provide the logical forms that the Grammar assigns to your two structures.

(iii) Describe any truth conditional differences between the two logical forms.

(iv) Do you perceive any truth conditional differences between the English sentences? Can you think of an example of your own where the attachment site of the adverbial in the progressive affects the meaning?

Summary of Some of the Main Points of §6.2.3

- Temporal adverbials are treated like other VP adverbials, as worked out in Chapter 5
- Perfects allow multiple attachment points for temporal adverbials leading to attachment ambiguities.

6.2.4 Different kinds of events: Ontological explanations

The following describes what happened one day while Jack and Jill were spending their summer vacation with their Aunt Betty:

(40) Before lunch, Jack was writing a letter to his friend Pete.
(41) Before lunch, Jill was playing volleyball with the neighbors.
(42) After lunch, they all went swimming.

That evening, Aunt Betty was on the phone with Jack and Jill's father and she told him:

(43) Jill played volleyball with the neighbors before lunch and Jack wrote a letter to his friend Pete. After lunch, we all went swimming.

Jack overheard this conversation and he politely corrected his Aunt Betty. He told her he was writing a letter to Pete but he hadn't finished it. Jack's correction is possible because '*Jack **was writing** a letter*' does not entail '*Jack **wrote** a letter*'. Using the symbol '$\nvDash$' to mean 'doesn't entail' we can record this fact as:

(44) Jack was writing a letter before lunch $\nvDash$ Jack wrote a letter before lunch.

While Jack corrected Aunt Betty, there is no way that Jill could have made a similar correction. That's because if Jill was playing volleyball before lunch, then she played volleyball before lunch. Using the symbol '⊨' to mean 'entails' we have:

(45) Jill was playing volleyball before lunch ⊨ Jill played volleyball before lunch

In the first case, the non-entailment makes some sense. There was an event of Jack's writing a letter that was ***in progress*** before lunch. Nothing guarantees that it was finished before lunch, so it doesn't follow that there was an event of Jack writing a letter before lunch. That means we do not expect any entailment in this case, which is a good thing. The problem is that we can say exactly the same thing about the second case: there was an event of Jill's playing volleyball that was ***in progress*** before lunch. Nothing guarantees that it was finished before lunch, so it doesn't follow that there was an event of Jill playing volleyball before lunch. The logic of being 'in progress' seems to predict that a progressive sentence should never entail the corresponding non-progressive. This prediction seems intuitively correct when you're talking about writing a letter but not when you're talking about playing volleyball. The entailment from '*Jill was playing volleyball*' to '*Jill played volleyball*' still needs to be explained.

We can explain how this entailment comes about by providing some more detail about the nature of volleyball playing events and about what it means for them to be in progress. One can conceive of an event of playing volleyball as consisting of a chain of smaller events of playing volleyball. Whatever it takes to be playing volleyball (serving the ball, preventing the ball from landing in your court, directing the ball back over the net, scoring points) those things go on again and again throughout the period of play. So any 'big', say hour long, event of playing volleyball consists of a chain of smaller volleyball-playing events. That means that if one of those 'big' events is in progress, it will follow that some of the smaller events have already occurred. So if Jill was playing volleyball before lunch, there was a big event of playing volleyball, it was in progress before lunch and it may or may not have been completed. But even if it was not completed, some of the smaller events were completed and any one of them will make it true that Jill played volleyball before lunch.[6]

We've just explained a difference in the semantics of the two sentences *Jill was playing volleyball* and *Jack was writing a letter*; a difference that shows up in contrasting entailment patterns. Our explanation does not lead us to formulate any new rules of translation. That's because the explanation is not about how meanings are assigned to expressions of the language differently in our two sentences (*Jill was playing ...* vs. *Jack was writing...*). Rather, the explanation is about the nature of the entities on which our theory is based. We contrasted volleyball playing events and letter writing events. This type of explanation is **ontological** or **metaphysical** – two terms that refer to the nature of things.

[6] Event chains and their role in understanding the progressive comes from:
Parsons, T. (1989) "The Progressive in English: Events, States and Processes," *Linguistics and Philosophy* **12.2**:213-241

EXERCISE Y

In this section, we consulted our intuitions about entailment relations between a past progressive sentence and the corresponding simple past sentence. Here are two more examples of the kind of data discussed here:

Jack was crossing the street. ⊭ *Jack crossed the street.*
Jack was wearing a tuxedo. ⊨ *Jack wore a tuxedo.*

(i) Provide three more examples of past progressive sentences that do not entail the corresponding simple past.

(ii) Provide three more examples of past progressive sentences that do entail the corresponding simple past.

(iii) In the text, an ontological explanation was given for why the entailment goes through with '*was playing volleyball*'. The explanation was based on the nature of volleyball playing events. Does that type of explanation work for the three examples you gave in (ii)? Pick one of your examples and say how the ontological explanation does or does not apply.

EXERCISE Z

In the text, we reasoned about the non-entailment from '*Jack was writing a letter*' to '*Jack wrote a letter*'. The reasoning made use of the fact that the progressive describes an event in progress and that an event can be in progress before lunch without actually being finished before lunch – or without ever being finished.

The question we want to address now is what exactly our Grammar says about these sentences.

(i) Draw an LF for the sentence '*Jack was writing a letter*' and provide the logical form that is assigned to that LF.

(ii) Provide the logical form for '*Jack wrote a letter*'.

(iii) Can an argument be made that the logical form you provided in (i) entails the one you provided in (ii)? If yes, explain why, by saying what events and objects would have to exist for the logical form in (i) to be true and then explaining how those events and objects would make the logical form in (ii) true. If no, describe a situation where the logical form in (i) is true and the logical form in (ii) is false.

[Depending on how your explanation goes, you might find it useful to have a definition for entailment that reflects the facts encoded in our UTTERANCE RULE. Here's a definition:

ϕ **entails** ψ *iff* for any utterance event $\hat{e}$, if ϕ is true with respect to $E+\langle utt, \hat{e}\rangle$ then ψ is true with respect to $E+\langle utt, \hat{e}\rangle$.]

6.3 Summary of Chapter 6

In the previous chapter we introduced an event semantics based on the idea that verbs are one-place eventuality predicates and thematic roles are used to connect DP arguments to eventualities. In this chapter, we've covered tense and temporal adverbials (expressions that serve to locate eventualities in time) and aspect (expressions that are used to say up to what point an eventuality has developed – is it in progress or has it completed).

On the syntactic side, the deep structure for a sentence is now a TP, headed by a tense. Aspectual verbs take VP complements. The aspectual verbs discussed here are progressive '*be*' and perfect '*have*'.

On the semantic side, we've introduced new rules of translation. In addition, since in main clauses tense meanings are given in terms of an utterance event, we have a new rule that states when a sentence is true in terms of the event in which the sentence was uttered.

The full list of rules appears on the next page. With these rules, we now have the means to assign logical forms to a range of sentence types. Here are some examples to think about. In each case, consider what the deep structure, LF and logical form would be. Some of these sentences are ambiguous and should be assigned multiple logical forms.

A student from New Hampshire has visited MIT today.

Jack had not seen Jill yesterday.

Some Canadian farmer will be quietly feeding a donkey tomorrow.

Every passenger wasn't running quickly.

Jill entered and Jack opened a bottle.

Jill entered and Jack was opening a bottle.

At least one man had called every woman on Thursday.

The reporter had described a plane crash on Thursday. (3 way attachment ambiguity)

Metavariables:

ê	events	π	predicates (1-place and 2-place)
θ	thematic roles (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.

Utterance Rule:

If a sentence with logical form ϕ is uttered in an event ê, the utterance is true if ϕ is true relative to E+⟨utt, ê⟩.

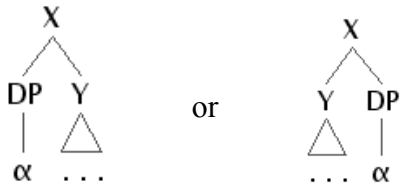
Rules of Translation:

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.

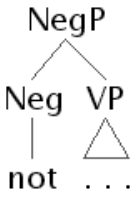
NONBRANCHING DP
Anything of the form:



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.

NEGATION
Anything of the form



has the logical form: ¬ϕ

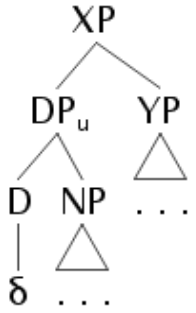
where 'ϕ' is the logical form of the VP.

NON-BRANCHING NP
Anything of the form:

has the logical form: **π**(**u**)

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

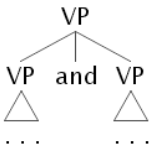
BRANCHING DP:
Anything of the form:



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

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

AND
Anything of the form:

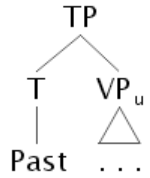


has the logical form: (ϕ & ψ)

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

TP-PAST

Anything of the form:

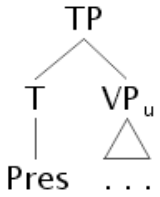


has the logical form:
$\exists u\ (u < utt\ \&\ \phi)$

where 'ϕ' is the logical form assigned to VP_u

TP-PRES

Anything of the form:

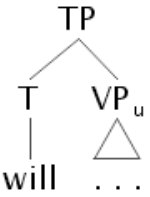


has the logical form:
$\exists u\ (u \approx utt\ \&\ \phi)$

where 'ϕ' is the logical form assigned to VP_u

TP-FUTURE

Anything of the form:

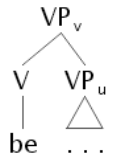


has the logical form:
$\exists u\ (u > utt\ \&\ \phi)$

where 'ϕ' is the logical form assigned to VP_u

PROGRESSIVE

Anything of the form:

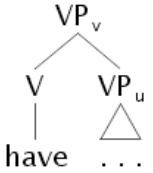


has the logical form:
$\exists u(InProgress(v,u)\ \&\ \phi)$

where 'ϕ' is the logical form of VP_u

PERFECT

Anything of the form:

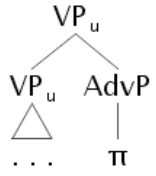


has the logical form:
$\exists u\ (Completed(v,u)\ \&\ \phi)$

'ϕ' is the logical form of VP_u.

ADVERB

Anything of the form:

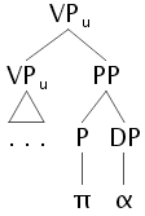


has the logical form: $(\phi\ \&\ \pi(u))$

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

PP ADVERBIAL

Anything of the form:



has the logical form: $(\phi\ \&\ \pi(u, \alpha))$

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

Semantic Rules:

ATOMIC-1
'$\pi(\alpha)$' is true with respect to M *iff* $M(\alpha) \in M(\pi)$

ATOMIC-2
'$\pi(\alpha,\beta)$' is true with respect to M *iff* $M(\alpha)$ bears the relation $M(\pi)$ to $M(\beta)$

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

NOT
'$\neg\phi$' is true with respect to M *iff* it is not the case that: 'ϕ' is true with respect to M

EXIST
'$\exists u\phi$' 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
'$\forall u\phi$' is true with respect to M *iff* every object o is such that 'ϕ' is true with respect to M+<u,o>

EVERY
'$\mathbf{every}_u\{\phi\}\ \psi$' 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
'$\mathbf{no}_u\{\phi\}\ \psi$' 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
'$\mathbf{the}_u\{\phi\}\ \psi$' 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
'$\mathbf{some}_u\{\phi\}\ \psi$' 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
'$\mathbf{atlst1}_u\{\phi\}\ \psi$' 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.