Tense and aspect[1]

1 Introduction: Tense and aspect in English

English verbal morphology allows for the independent specification of two features we call *tense* and *aspect*:

(1) **Tense vs aspect in English verbal morphology:**

	Past	Present	Future
Aspect		**Tense**	
Perfective (Simple)	*danced*	*dances*	*will dance*
Imperfective (Progressive)	*was dancing*	*is dancing*	*will be dancing*
Perfect	*had danced*	*has danced*	*will have danced*

The actual morphosyntax of tense and aspect in English is complicated, so we will simplify the syntax in some places today. (Which appears higher, tense or aspect?)

2 Mathematical preliminaries

In the beginning, there is (was?) time:

(2) **Assumptions about time:**

   a. <u>Moments:</u> Time is made up of infinitesimally small '*moments*' (or 'instants').

     Moments are type i; M = the set of moments (instants) = D_i

   b. <u>Ordering:</u> Elements of M have a dense, strict total ordering ($<$)

     • If $a < b$, then it's false that $b < a$ asymmetric

     • If $a < b$ and $b < c$, then $a < c$ transitive

     • For all $a \in M$, it's false that $a < a$ irreflexive

     • For all $a, b \in M$, either $a < b$, $b < a$, or $a = b$ total

     • For all $a, b \in M$, if $a < b$, there is a $c \in M$ such that $a < c$ and $c < b$ dense

   c. <u>Intervals:</u> We also refer to spans of time, which we call '*intervals*.'

     Interval I of M: $I \subseteq M$ and for all $a, b \in I$, if $a < c$ and $c < b$, then $c \in I$

(3) **Relations between intervals:**

   a. <u>Subinterval:</u> $I \subseteq I'$ iff $I \subseteq I'$ (as sets)

   b. <u>Precedence:</u> $I < I'$ iff for all $i \in I$ and $j \in I'$, $i < j$ (every moment in I precedes every moment in I')

---

[1]Based on handouts by Seth Cable

3 Tense

The truth of some sentences is dependent on the time of utterance:

(4) "E-scooters are illegal (except on cycling paths)."

    a. November 4, 2019, noon: false

    b. November 5, 2019, noon: true

▶ The sentence should be evaluated *relative to an evaluation time parameter*: $[\![...]\!]^t$

  – Just as we did when we added a world parameter w to the evaluation function, all our regular compositional rules (FA, PA, etc.) should be modified to pass the same evaluation time between mothers and daughters.

  – Right now we allow the evaluation time t to be a moment or an interval of moments.

(5) $[\![\text{E-scooters are illegal}]\!]^t = \neg \text{Legal}(\text{e-scooters}, t)$ [2]

    a. $[\![\text{E-scooters are illegal}]\!]^{\text{November 4, 2019, noon}} = 0$

    b. $[\![\text{E-scooters are illegal}]\!]^{\text{November 5, 2019, noon}} = 1$

Here in (a) and (b) (and some below), I am lazy and use $[\![...]\!]$ to return truth values in real life; i.e. convert to predicate logic and then also evaluate that predicate logic formula in a model M compatible with the facts of the real world.

3.1 Tense as operators

Tense appears to shift the evaluation time:

(6) Today:

    a. $[\![\text{E-scooters } \textbf{are} \text{ legal}]\!]^{\text{November 13, 2019}} = 0$

    b. $[\![\text{E-scooters } \textbf{were} \text{ legal}]\!]^{\text{November 13, 2019}} = 1$

Intuitively, (6b) is true today because there is a past time t' ($t' <$ November 13, 2019) such that e-scooters are legal at t'.

(7) Right after the ban was announced:

    a. $[\![\text{E-scooters } \textbf{are} \text{ illegal}]\!]^{\text{November 4, 2019}} = 0$

    b. $[\![\text{E-scooters } \textbf{will be} \text{ illegal}]\!]^{\text{November 4, 2019}} = 1$

Similarly, (7b) is true because there is a future time t' (November 4, 2019 $< t'$) such that e-scooters are illegal at t'.

---

[2]Since we have not discussed the analysis of plurals, we will be sloppy and discuss "e-scooters" as if it is simply an individual in D_e.

(8) **Past and future as existential quantifiers:**

    a. $[\![\text{E-scooters } \textbf{are } \text{legal}]\!]^t = \text{Legal(e-scooters}, t)$

    b. $[\![\text{E-scooters } \textbf{were } \text{legal}]\!]^t = \exists t' \left[t' < t \wedge \text{Legal(e-scooters}, t') \right]$

    c. $[\![\text{E-scooters } \textbf{will be } \text{legal}]\!]^t = \exists t' \left[t < t' \wedge \text{Legal(e-scooters}, t') \right]$

We assume the VP-internal subject hypothesis and that tense semantics is in T. Auxiliary verbs in English (including the copula *be* in the sentences above) are pronounced in T (via head-movement) but this has no semantic effect. Let's assume the verb simply stays low at LF.
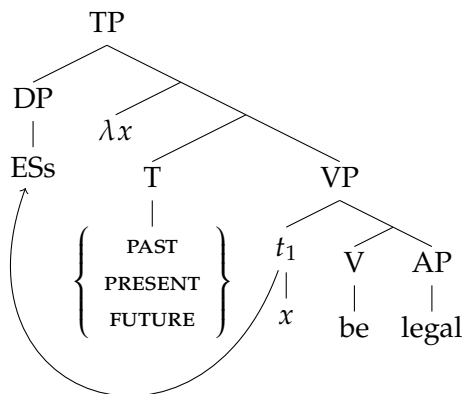
- PAST.PL + *be* = *were*

- PRES.PL + *be* = *are*

- FUT + *be* = *will be*

(9) $[\![\text{legal}]\!]^t = \lambda x_e \ . \ \text{Legal}(x, t)$

(10) $[\![\text{illegal}]\!]^t = \lambda x_e \ . \ \neg \text{Legal}(x, t)$

(11) **Special tense rules:**

    a. $\left[\!\!\left[\overbrace{\text{PRES} \quad \text{XP}} \right]\!\!\right]^t = [\![\text{XP}]\!]^t$

    b. $\left[\!\!\left[\overbrace{\text{PAST} \quad \text{XP}} \right]\!\!\right]^t = \exists t' \left[t' < t \wedge [\![\text{XP}]\!]^{t'} \right]$

    c. $\left[\!\!\left[\overbrace{\text{FUT} \quad \text{XP}} \right]\!\!\right]^t = \exists t' \left[t < t' \wedge [\![\text{XP}]\!]^{t'} \right]$

Exercises:

- Compute time-sensitive predicate logic formulas for *E-scooters were legal* and *E-scooters will be illegal*.

- What reading do we get for *E-scooters will not be legal*? Is this what we want?

3.2 Tense as anaphors (pronouns)

Consider this classic example from Partee (1973):

(12) <u>Context:</u> You've just baked some cookies, and are driving them over to a friend's house. While you're on the road, you suddenly realize that you left the stove on.
"(Oh no!) I didn't turn off the stove!"

(13) **Predictions of our existential quantifier semantics for PAST (11b):**

    a. <u>If PAST > NEG, we predict:</u>

      $\exists t' \, [t' < t \wedge \neg[\text{TurnOff}(\text{I}, \text{stove}, t')]]$

      This truth-condition is *too weak*: it is made true by the fact that I've been driving for the past few minutes.

    b. <u>If NEG > PAST, we predict:</u>

      $\neg[\exists t' \, [t' < t \wedge \text{TurnOff}(\text{I}, \text{stove}, t')]]$

      This truth-condition is *too strong*: it requires that I've never turned off the stove in the past.

Intuitively, (12) is referring to a particular time (span) in the past. Roughly, *at the time when you took out the cookies*, it's false that you turned the stove off.

▶ Past tense sentences are (often) not generic statements about the entire "past," but instead about a specific time made salient by the conversation. In this way, tenses behave a little bit like pronouns (Partee, 1973).

3.3 Temporal adverbs

(14) Yesterday e-scooters were legal.

(15) $\left[\!\!\left[\, \overbrace{\text{yesterday XP}} \, \right]\!\!\right]^{t} = \exists t' \left[[\![\text{XP}]\!]^{t'} \wedge t' \text{ is (in) the day before } t \right]$

Exercise: Compute (14) using (15) and your result for *E-scooters were legal* from the previous page. There's a problem — what is it?

4 Aspect

Tense and aspect can be thought of as relating three different times (or time intervals):

(16) **Three times to care about:** (Reichenbach, 1947; Klein, 1994; a.o.)

    a. Utterance Time (UT): When a sentence is asserted.

    b. Topic Time (TT): The time "under discussion" in the sentence.

    c. Event Time (ET): The time of the event/state described.

Above, we had collapsed TT and ET, and took PAST/PRES/FUT to relate TT/ET to UT. Instead, we have to consider the role of *Topic Times*:

(17) a. <u>At 3pm</u>, I was washing my car.

      • TT = 3pm

    b. <u>When Bill was in the kitchen</u>, Dave ate a sandwich.

      • TT = the time when Bill was in kitchen

    c. I didn't turn off the stove!

      • TT = the time between removal of cookies and when I left the house

▶ *Tense* relates UT and TT; *aspect* relates TT and ET.

(18) **Tense:**

    a. Present: $UT \subseteq TT$

    b. Past: $TT < UT$

    c. Future: $UT < TT$

(19) **Aspect:**

    a. Perfective: $ET \subseteq TT$

    b. Imperfective: $TT \subseteq ET$

    c. Perfect: $ET < TT$

Some examples:

(20) When Bill was in the kitchen, Dave **was eating** a sandwich.

    a. TT = the time when Bill was in the kitchen

    b. Past Tense: $TT < UT$

    c. Imperfective Aspect: $TT \subseteq ET$

    Thus, we capture the observations that:

      • (20) places Bill's being in the kitchen inside the sandwich-eating.

      • (20) is consistent with the sandwich-eating still continuing at present.

(21)   When Bill was in the kitchen, Dave **ate** a sandwich.

   a. Past Tense: TT < UT

   b. Perfective Aspect: ET $\subseteq$ TT

Thus, we capture the observations that:

- (21) places the sandwich-eating inside Bill's being in the kitchen.
- (21) entails that the sandwich eating does not continue into the present.

(22)   When Bill was in the kitchen, Dave **had** (just) **eaten** a sandwich.

   a. Past Tense: TT < UT

   b. Perfect Aspect: ET < TT

Thus, we capture the observations that:

- (22) places the sandwich-eating before Bill's being in the kitchen.
- (22) entails that the sandwich eating does not continue into the present.

Exercises:

What do we predict for the relationships between UT, TT, and ET below? Does this agree with our intuitions?

(23)   After he bought his e-scooter, Kenyon **rode** his scooter to Yishun.

(24)   When e-scooters were made illegal, Kenyon **was riding** his scooter.

(25)   Before they were made illegal, Kenyon **had bought** an e-scooter.

(26)   After they were made illegal, Kenyon **has ridden** his e-scooter (illegally).

(27)   Today, e-scooters **have been** illegal <u>for one week</u>.

5 Lexical aspect / Aktionsarten

Different predicates (VPs) have their own, lexically-determined temporal classification, often called *lexical aspect* or *Aktionsart* (action type).

(28) **The hierarchy of Aktionsarten:**

- *States*:
  Involve no change over their duration; e.g. *hate, know, tall*
- *Events*:
  Involve some change. Can be further classified by *telicity* (whether there is a defined 'culmination' or not) and whether it is punctual or durative:

	Telic	Atelic
Punctual	achievement	semelfactive
	die, win, arrive	*sneeze, jump, kick*
Durative	accomplishment	activity
	build a house, cross the street, eat the cookie	*run, eat cookies, think about semantics*

This classification is interestingly and importantly also observed across languages of the world, although they may have different morphosyntactic properties in different languages.

Some observations about the Aktionsarten:

- States:

  'Sound funny' or get a special, non-stative interpretation in the imperfective:

  (29) ??loving curry rice; ??being tall

- Telicity:

  – Telic predicates combine with modifiers of the form 'in X time':

  (30) a.   Dave built a house/crossed the street/ate the cookie <u>in an hour</u>.   *telic*

       b. ?? Dave built houses/danced/sneezed <u>in an hour</u>.   *atelic*

  – Atelic predicates combine with modifiers of the form 'for X time':

  (31) a.   Dave built houses/danced/sneezed <u>for an hour</u>.   *atelic*

       b. ?? Dave built a house/crossed the street/ate the cookie <u>for an hour</u>.   *telic*

- Semelfactives:

  Semelfactives have no culmination, and yet they inherently take a very short time interval. Therefore their imperfectives are necessarily interpreted as involving repetition:

  (32)   a.   Dave was sneezing/jumping/kicking.   *semelfactive*
              (entails multiple sneezing/jumping/kicking events)

          b.   Dave was dancing/cooking.   *activity*
              (does not entail multiple events)

References

Klein, Wolfgang. 1994. *Time in language*. Routledge.

Partee, Barbara Hall. 1973. Some structural analogies between tenses and pronouns in english. *Journal of Philosophy* 70.

Reichenbach, Hans. 1947. The tenses of verbs. In *Elements of symbolic logic*, 287–98. The Macmillan Company.