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:**

	Tense		
Aspect	Past	Present	Future
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. Moments: Time is made up of infinitesimally small '*moments*' (or 'instants').
Moments are type i; M = the set of moments (instants) = D_i

b. Ordering: 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. Intervals: 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. Subinterval: $I \subseteq I'$ iff $I \subseteq I'$ (as sets)

b. Precedence: $I < I'$ 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) "Donald Trump is President."

a. January 20, 2017, 11am: false

b. January 20, 2017, 1pm: true

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

– Just as we did when we added assignment function parameter g 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) $[\![\text{Donald Trump is president}]\!]^t = 1$ iff Donald Trump is president at time t

a. $[\![\text{Donald Trump is president}]\!]^{\text{January 20, 2017, 11am}} = 0$

b. $[\![\text{Donald Trump is president}]\!]^{\text{January 20, 2017, 1pm}} = 1$

3.1 Tense as operators

Tense appears to shift the evaluation time:

(6) Today:

a. $[\![\text{Barack Obama } \textbf{is} \text{ president}]\!]^{\text{November 3, 2017}} = 0$

b. $[\![\text{Barack Obama } \textbf{was} \text{ president}]\!]^{\text{November 3, 2017}} = 1$

Intuitively, (6b) is true today because there is a past time t' ($t' <$ November 3, 2017) such that Obama is president at t'.

(7) At the beginning of the year:

a. $[\![\text{Donald Trump } \textbf{is} \text{ president}]\!]^{\text{January 1, 2017}} = 0$

b. $[\![\text{Donald Trump } \textbf{will be} \text{ president}]\!]^{\text{January 1, 2017}} = 1$

Similarly, (7b) is true because there is a future time t' (January 1, 2017 $< t'$) such that Trump is president at t'.

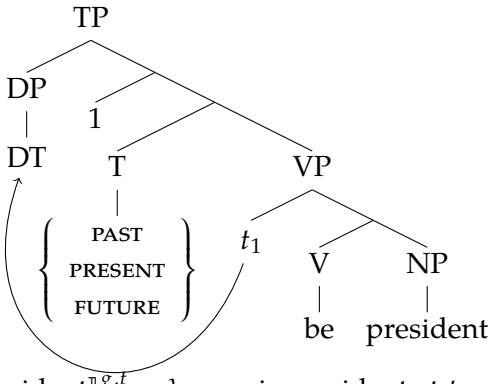
(8) **Past and future as existential quantifiers:**

a. $[\![\text{Donald Trump } \textbf{is} \text{ president}]\!]^t = 1$ iff Donald Trump is president at time t

b. $[\![\text{DT } \textbf{was} \text{ president}]\!]^t = 1$ iff $\exists t' \,.\, t' < t$ and DT is president at time t'

c. $[\![\text{DT } \textbf{will be} \text{ president}]\!]^t = 1$ iff $\exists t' \,.\, t < t'$ and DT is president at time t'

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.3SG + *be* = *was*
- PRES.3SG + *be* = *is*
- FUT.3SG + *be* = *will be*

(9) $[\![\text{president}]\!]^{g,t} = \lambda x_e \,.\, x$ is president at t

(10) **Special tense rules:**

a. $\left[\!\!\left[\begin{array}{c} \diagup\diagdown \\ \text{PRES} \quad \text{XP} \end{array} \right]\!\!\right]^{g,t} = [\![\text{XP}]\!]^{g,t}$

b. $\left[\!\!\left[\begin{array}{c} \diagup\diagdown \\ \text{PAST} \quad \text{XP} \end{array} \right]\!\!\right]^{g,t} = 1$ iff $\exists t' \,.\, t' < t$ and $[\![\text{XP}]\!]^{g,t'} = 1$

c. $\left[\!\!\left[\begin{array}{c} \diagup\diagdown \\ \text{FUT} \quad \text{XP} \end{array} \right]\!\!\right]^{g,t} = 1$ iff $\exists t' \,.\, t < t'$ and $[\![\text{XP}]\!]^{g,t'} = 1$

Exercises:

- Compute time-sensitive truth-conditions for *DT was president* and *DT will be president*.
- What reading do we get for *Donald Trump will not be president*?

3.2 Tense as anaphors (pronouns)

Consider this classic example from Partee (1973):

(11) Context: 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!"

(12) **Predictions of our existential quantifier semantics for PAST (10b):**

a. If PAST > NEG, we predict:
1 iff $\exists t' \,.\, t' < t$ and it's false that [I turn off the stove at 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. If NEG > PAST, we predict:
1 iff it's false that [$\exists t' \,.\, t' < t$ and I turn off the stove at t']
This truth-condition is *too strong*: it requires that I've never turned off the stove in the past.

Intuitively, (11) 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

(13) Yesterday DT was president.

(14) $[\![\overbrace{\text{yesterday XP}}]\!]^t = 1$ iff $\exists t' \,.\, t' < t$ and $[\![\text{XP}]\!]^{t'} = 1$ and t' is (in) the day before t

Exercise: Compute (13) using (14). There's a problem — what is it?

4 Aspect

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

(15) **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:

(16) a. At 3PM, I was washing my car. (TT = 3PM)

b. When Bill was in the kitchen, Dave ate a sandwich. (TT = the time 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.

(17) **Tense:**

a. Present: UT ⊆ TT

b. Past: TT < UT

c. Future: UT < TT

(18) **Aspect:**

a. Perfective: ET ⊆ TT

b. Imperfective: TT ⊆ ET

c. Perfect: ET < TT

Some examples:

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

a. Past Tense: TT < UT

b. Imperfective Aspect: TT ⊆ ET

Thus, we capture the observations that:

- (19) places Bill's being in the kitchen inside the sandwich-eating.
- (19) is consistent with the sandwich-eating still continuing at present.

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

a. Past Tense: TT < UT

b. Perfective Aspect: ET ⊆ TT

Thus, we capture the observations that:

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

(21) 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:

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

5 Lexical aspect / Aktionsarten

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

(22) **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 *die, win, arrive*	semelfactive *sneeze, jump, kick*
Durative	accomplishment *build a house, cross the street, eat the cookie*	activity *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:

  (23) ??loving curry rice; ??being tall; ??hating DT

- Telicity:

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

    (24) a. Dave built a house/crossed the street/ate the cookie in an hour. *telic*
    b. ?? Dave built houses/danced/sneezed in an hour. *atelic*

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

    (25) a. Dave built houses/danced/sneezed for an hour. *atelic*
    b. ?? Dave built a house/crossed the street/ate the cookie for an hour. *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:

  (26) 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

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