More Advanced Issues in the Semantics of Aspect

1. The Existence of ‘Neutral Aspect’

In our current system, there are three different subcategories of aspect: ‘perfective’ (PRV), ‘imperfective’ (IMPRV), and ‘perfect’ (PERF).

- However, following Smith (1991), many claim that there is also a fourth category of aspect that languages can encode: so-called ‘neutral’ aspect (NEUT)

(1) The Main Features of (Alleged) ‘Neutral’ Aspect

Allegedly, ‘neutral aspect’ (NEUT) combines certain qualities of perfective and imperfective aspect.

a. Similarity to Perfective Aspect:
   With ‘punctual’ event predicates (achievements & semelfactives), neutral aspect entails that the event occurred (once) in the past and is now over.

   (i) **Neutral Aspect in Hindi** (Singh 1998):
   Us-ne galtii se pyaala toRaa
   He-ERG mistake by cut break.NEUT.PST
   ‘He broke a cup by mistake.’
   **Judgment:** Cannot be felicitously followed by ‘but not all of it’

   (ii) *(cf.)* **Imperfective Aspect (in English)**
   He was breaking a cup, but he didn’t break all of it.

b. Similarity to Imperfective Aspect:
   With durative telic event predicates (*i.e.* accomplishments), neutral aspect does not entail that the event ‘culminated’

   (i) **Neutral Aspect in Hindi** (Singh 1998):
   Mae-ne apnaa kek khaayaa.
   I-ERG my cake eat.NEUT.PST
   ‘I ate my cake’
   **Judgment:** Can be felicitously followed by ‘but I didn’t finish it’

   (ii) *(cf.)* **Perfective Aspect (in English)**
   # I ate my cake but I didn’t finish it.

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1 The material in this handout is loosely based upon the content in von Fintel & Heim 2018 [pages 1-31]. Similar material is presented slightly differently in Oghihara 2011 [Sections 1-2, 4-5] and von Stechow 2009 [Sections 1-11.2]. The material in Sections 1 and 2 are based upon the work of Pancheva (2003) (and also Altshuler (2014)).

(2) Smith’s (1991) Informal Characterization of ‘Neutral’ Aspect

Neutral aspect ‘encompasses’ the beginning of an event and part of its internal duration (if it has one), but not necessarily the end of the event.

```
<table>
<thead>
<tr>
<th>Topic Time</th>
<th>Event Time</th>
<th>Utterance Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>I eat my cake</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

- Thus, with a **durative** telic event (i.e. an accomplishment, like ‘eat my cake’), neutral aspect will **not** entail that the natural ‘end point’ of the event was reached, only the beginning and part of the middle.

```
<table>
<thead>
<tr>
<th>Topic Time</th>
<th>Event Time</th>
<th>Utterance Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>I break a cup</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
```

- But, with **punctual** events (i.e., achievements like ‘break a cup’), there is no distinction between the beginning and the end of the event, and so neutral aspect **will** end up entailing that the ‘end point’ (= beginning) of the event was reached.


a. \[ [[ \text{NEUT} ]] = \]

\[
\lambda P_{<,\triangleright} : [ \lambda t': \exists e . P(e) = T \land T(e) \cap t' \neq \emptyset \land \\
\exists t'' . t'' \in t' \land \forall t''' . t''' \in T(e) \Rightarrow t'' < t''']
\]

‘ET (T(e)) overlaps TT (t’), and there are moments in TT (t’) that completely precede ET’

- **Note:** If ET (T(e)) is a non-singleton interval (durative), then (3a) will not entail that the final point in ET is contained within the TT (1b)

- **Note:** If ET (T(e)) is a **singleton** interval (punctual), then (3a) will entail that the final point (= only point) in ET is contained within the TT (1a)
(4) **The Disputed Existence of ‘Neutral’ Aspect**

It remains controversial whether ‘neutral’ (2)-(3) is indeed a fourth subcategory of aspect.

- While the facts in (1) are by no means disputed – and have been replicated across a wide variety of unrelated languages…

- … as we will see later, others argue that such sentences exhibit *perfective aspect* (Singh 1998, Bar-El et al. 2005, Altshuler 2014)

- According to this opposing view (which we’ll explore in depth later) there exist subtle cross-linguistic differences in either (i) the semantics of *perfective* aspect (Altshuler 2014), or (ii) the semantics of accomplishment predicates (Bar-El et al. 2005).

  - And it is these differences (rather than a distinct ‘neutral’ aspect) that lead *perfective* accomplishments in some languages to not entail the ‘culmination/endpoint’ of their events

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2. **Improving upon the Perfect: The ‘Perfect Time Span’ (PTS) Analysis**

Under our current system, ‘perfect’ (PERF) is a subcategory of aspect, occupying the same AspP as the heads ‘perfective’ (PRV) and ‘imperfective’ (IMPRV).

(5) **Our Current Clausal Architecture**

\[
[TP \{ [PST], [PRES] \} [ModP WOLL [AspP \{ [PRV], [IMPRV], [PERF] \} VP ]\ldots]
\]

(6) **Problem: English Perfect Progressives**

- In English, it is possible for the perfect construction to take a progressive in its scope

  a. Dave has **been dancing**.

  - With this in mind, we might view ‘simple perfects’ like (6b,c) as cases where a perfect construction takes either ‘perfective’ or (stative) imperfective in its scope.

  b. Dave has **danced**.
  
  c. Dave has **loved Tom**.

- But, if [PERF] can co-occur with both [PRV] and [IMPRV], this must mean that they aren’t all competing for the same AspP projection.

  - (Just as the co-occurrence with [PRS]/[PST] and ‘woll’ entails that the latter is not a tense like the former…)
Let us therefore revise our assumptions regarding the syntactic position of \([\text{PERF}]\)...

(7) **Revised Clausal Architecture**

Let us take ‘PERF’ to be a so-called ‘high aspect’ (High-Asp). It heads a ‘High-AspP’ just above (regular) AspP and just below ModP and TP.

\[
\begin{align*}
\text{TP} & \quad \text{ModP} \\
\{\text{PST}, \text{PRES}\} & \quad \text{Mod} \quad \text{WOLL} \\
& \quad \text{High-AspP} \\
& \quad \text{Asp} \quad \text{VP} \\
& \quad \{\text{PRV}, \text{IMPRV}\} \\
\end{align*}
\]

(8) **Revised Semantics for \([\text{PERF}]\) (First Attempt)**

- Note that because the sister to \([\text{PERF}]\) is now \(<i, t>\) rather than \(<e, t>\), we need to revise our lexical semantics for it.

- Let us begin by simply making a minor adjustment to the semantics we already have.

a. \[\text{[[ PERF ]] = \[ \lambda t, i, l : \lambda t' : \exists t'' : t' < t'' < t' & P(t'') = T \]}\]

(9) **Illustration of Revised Analysis of the Perfect Construction, Part 1**

a. **Sentence:** Dave has danced.

b. **LF:** \[[\text{TP} \text{Dave} [\text{TP} 1 [\text{TP} \text{PRES2} [\text{H-AspP PERF [AspP PRV [VP t1 dance ]]}]]]]\]

c. **Predicted Truth-Conditions:**
   For simplicity, I will assume throughout the pronominal semantics for tense
   \[\exists t'. \quad t' < g(2) & \exists e. \quad T(e) \subseteq t' & \text{dance}(e) & \text{Ag}(e) = \text{Dave}\]
   - Presupposition: \(g(2) = t_{\text{now}}\)

   ‘There is a temporal interval before now that contains an event of Dave dancing’
(10) **Illustration of Revised Analysis of the Perfect Construction, Part 2**

a. **Sentence:** Dave has been dancing.

b. **LF:**  
   \[
   [\text{TP} \text{Dave} [\text{TP} 1 [\text{TP} \text{PRES2} [\text{H-AspP} \text{PERF} [\text{AspP} \text{IMPRV} [\text{VP} t_1 \text{dance}]]]]]]
   \]

c. **Predicted Truth-Conditions:**
   \[
   \exists t'. t' < g(2) \land \exists e. t' \subseteq T(e) \land \text{dance}(e) \land \text{Ag}(e) = \text{Dave}
   \]
   
   - Presupposition: \( g(2) = t_{\text{now}} \)

   ‘There is a temporal interval before now that lies within an event of Dave dancing’

(11) **Problem: The Meaning of English Perfect Progressives & Statives**

Although our system is now generating sentences like (10a) and assigning them an interpretation, *it isn’t exactly the right meaning*.

- That is, although there *is* a reading of (10a) that is akin to (10c), that’s not actually the most salient reading that (10a) has.

- Instead, perfect progressives most naturally occur in sentences like (11ai), where they seem to have the truth-conditions in (11aii).

a. (i) **Sentence:** Dave has been dancing since 6PM.

   (ii) **Truth-Conditions (Informal):**
       There is an interval of time stretching from 6PM until now, and Dave’s dancing covers that entire span of time (and perhaps more)

   \[
   \begin{array}{c}
   \text{Dave’s Dancing} \\
   \hline
   \text{Since 6PM} \hfill \text{Utterance-Time / now}
   \end{array}
   \]

   - The same also seem to be true for ‘simple perfects’, when the verb is stative

b. (i) **Sentence:** Dave has loved Time since the moment they met.

   (ii) **Truth-Conditions (Informal):**
       There is an interval of time stretching from the moment Dave and Tom met until now, and Dave’s love for Tom covers that entire interval

   \[
   \begin{array}{c}
   \text{Dave’s love for Tom} \\
   \hline
   \text{Since Meeting} \hfill \text{Utterance-Time / now}
   \end{array}
   \]
(12) **Terminology: ‘U-Perfect’ and ‘E-Perfect’**

- The interpretation of the English perfect construction in (11) has come to be known as the ‘Universal Perfect’ or ‘U-Perfect’ (for short).[^3]

a. **U-Perfect:** Reading of the perfect where it states that an event holds throughout *all* of an interval of time.

- The interpretation in (10) – which is the only one we capture so far – has come to be known as the ‘Existential Perfect’ or ‘E-Perfect’.

b. **E-Perfect:** Reading of the perfect where it states that an event holds at *some* of an interval of time (i.e., that the interval contains *some* event of the kind described by the VP).

As noted in (11), there seems (in English) to be a correlation between the form of the perfect and which of the two readings above it can get.

(13) **Key Generalization Regarding ‘U-Perfect’ and ‘E-Perfect’ in English (Part 1)**

- The U-Perfect reading is possible only if the perfect takes scope over either a progressive (11a) or a lexical stative (11b).

a. **No U-Perfect with a Perfect of a Simple Eventive**

   (i) **Sentence:** Dave has eaten since 6PM.
   (ii) **Truth-Conditoins:** Within the interval of time between 6PM and now, *there is some event of Dave eating.*

- The E-Perfect reading is (in principle) available for every perfect construction.

b. **Illustration of the E-Perfect with Perfect Progressive and Perfect Stative**

   (i) Dave *has been dancing.* That’s why he’s laying down all sweaty right now.
   (ii) Dave *has loved Tom* before, and he will love him again.

(14) **Burning Question:**
Can we amend our semantics for [PERF] so that it capture both (i) the possibility of ‘U-Perfect’ readings, and (ii) the key generalization in (13)?

(15) The ‘Perfect Time Span’ Analysis (Iatridou et al. 2001, Panceva 2003)\(^4\)

- Under our earlier semantics in (8a), [PERF] relates two intervals of time – \(t'\) and \(t''\) – and it states that the former follows the latter.

- Let us instead imagine that [PERF] says rather that \(t'\) lies at the end of \(t''\)

  a. First Ingredient: ‘P(erfect) T(ime) S(pan)’: 
  \[
  PTS(t'',t') \text{ holds if (i) } t' \subseteq t'' \text{ and (ii) } \exists t''' . t''' \subseteq t'' \text{ & } t' < t'''
  \]
  \(t'\) is a strict subinterval of \(t''\) and there is no later subinterval of \(t''\)

  b. The ‘PTS’ Semantics for Perfect
  \[
  [[\text{PERF}]] = \left[ \lambda P_{<,>} : \left[ \lambda t' : \exists t'' . PTS(t'',t') \text{ & } P(t'') = T \right] \right]
  \]

(16) A Cludge Regarding ‘Since’-Phrases
Rather than develop a compositional semantics for ‘since’-phrases, we’ll assume that they (somehow) specify the ‘left edge’ of the ‘perfect time span’

  a. First Ingredient: ‘L(eft) E(dge)’: 
  \[
  LE(t', t'') \text{ holds if } \forall t''' . t''' \in t'' \implies t' \leq t''
  \]
  \(t'\) is earlier or equal to all times in \(t''\)

  b. Stipulated Semantics for ‘Since’:
  \[
  [[\text{PERF} [\text{since} \ XP]]] = \left[ \lambda P_{<,>} : \left[ \lambda t' : \exists t'' . PTS(t'',t') \text{ & } LE(t'', [[\text{XP}]] \text{ & } P(t'') = T \right] \right]
  \]

(17) First Result: ‘E-Perfect’ Readings for ‘Simple Perfects’ of Eventives

Following our earlier ideas (6)-(9), we’ll assume that the ‘simple perfect’ of an eventive verb involves [PERF] scoping over [PRV] aspect.

  a. Sentence: 
  Dave has danced since 6PM

  b. LF: 
  [TP PRES2 [H-Asp PERF [since 6PM] [AspP PRV [VP Dave dance ]...]]

  c. Truth-Conditions:
  \[
  \exists t''' . PTS(t', g(2)) \text{ & } LE(t', 6PM) \text{ & } \exists e. T(e) \subseteq t'' \text{ & dance} \text{ & } Ag(e) = Dave
  \]
  • Presupposition: \(g(2) = t_{\text{now}}\)

  There is an interval of time \(t''\) stretching from 6PM until now, and within that interval of time is an event of Dave eating.

\(^4\) Though further developed in the work of Panceva (2003), this semantics was first put forth in the following paper: Iatridou, Sabine, Elena Anagnostopoulou, and Roumy Izvorsky. 2001. “Observations About the Form and Meaning of the Perfect.” In Michael Kentowicz (ed) Ken Hale: A Life in Language. MIT Press.

   a. **Sentence:** Dave has been dancing since 6PM
   
   b. **LF:** \[TP \text{PRES}_2 \text{[H-Asp PERF [since 6PM] [AspP IMPRV [VP Dave dance ]...]]}\]
   
   c. **Truth-Conditions:**
   \[\exists t'' . \text{PTS}(t'', g(2)) \& \text{LE}(t'', 6PM) \& \exists e. t'' \subseteq T(e) \& \text{dance}(e) \& \text{Ag}(e) = \text{Dave}\]
   
   • Presupposition: \(g(2) = t_{\text{now}}\)

   *There is an interval of time \(t''\) stretching from 6PM until now, and that interval of time \(t''\) is contained within an event of Dave dancing (11a)*

19. **Major Result, Part 2: ‘U-Perfect’ Readings for Perfect Statives**

   Following our earlier ideas (6)-(9), we’ll assume that the ‘simple perfect’ of a stative verb involves [PERF] scoping over [IMPRV] aspect.

   a. **Sentence:** Dave has loved Tom since 2011
   
   b. **LF:** \[TP \text{PRES}_2 \text{[H-Asp PERF [since 2011] [AspP IMPRV [VP Dave love Tom ]...]]}\]
   
   c. **Truth-Conditions:**
   \[\exists t''. \text{PTS}(t'', g(2)) \& \text{LE}(t'', 2011) \& \exists s. t'' \subseteq T(s) \& \text{love}(s) \& \text{Exp}(s) = \text{Dave} \& \text{Thm}(s) = \text{Tom}\]
   
   • Presupposition: \(g(2) = t_{\text{now}}\)

   *There is an interval of time \(t''\) stretching from 2011 until now, and that interval of time \(t''\) is contained within a state of Dave loving Tom.*

So far, we correctly predict that U-Perfect readings can arise for ‘perfect progressives’ and ‘simple perfect statives’, but not ‘simple perfect eventives’!...

20. **Problem:** What about the fact that both ‘perfect progressives’ and ‘simple perfect statives’ do also allow for ‘E-Perfect’ readings (13b)?

21. **Option 1: Ambiguity in the Perfect**

   • Our earlier ‘precedence’-based semantics for [PERF] in (8) predicted only ‘E-perfect’ readings for everything…

   • Thus, if we supposed (8) was also a reading for [PERF], we could generate ‘E-perfect’ readings for perfect progressivs and perfect statives!
Prediction of Option 1:

- There should be languages where the ‘precedence-based’ perfect and the ‘perfect time span’ perfect are lexicalized differently, or…
- There should be languages where only one of those two readings of ‘perfect’ aspect exists (so, either no U-Perfects, or perfective statives cannot get E-Perfect readings)

Option 2: Ambiguity in Imperfective Aspect (Pancheva 2003)

a. Opening Observation:
Our semantics for [IMPRV] isn’t quite right for English. Both progressives and statives in English in principle allow the ET to lie within the TT

   (i) *Sentence:* On Sunday, Dave *was singing.*
       *Judgment:* <Consistent with singing starting and ending on Sunday>

   (ii) *Sentence:* On Sunday, Dave *was sick.*
      *Judgment:* <Consistent with sickness starting and ending on Sunday>

b. Key Proposal:
Perhaps [IMPRV] is ambiguous in English! In addition to the ‘regular imperfective’ (IMPRV), there’s also a version that has the semantics of neutral aspect (3a)

\[
\left[ [\text{IMPRV}_{\text{Neut}}] \right] = \\
\left[ \lambda P_{\text{<v,t>}} : \left[ \lambda t_1 : \exists e . T(e) = T & T(e) \cap t' \neq \emptyset & \exists t'' . t'' \in t' & \forall t''' . t''' \in T(e) \Rightarrow t'' < t''' \right] \right]
\]

- Under this reading, an imperfective (*i.e.*, progressive/statative) would state that the TT contains the beginning of the ET (and possibly its end too)

c. Key Prediction:
If we give ‘IMPRV’ the ‘neutral’ reading in (23b), we predict ‘E-perfect’ readings for progressives and statives!

   (i) *Sentence:* Dave has *loved Tom*

   (ii) *LF:* \([\text{TP PRES}_2 [H-Asp PERF [AspP IMPRV}_{\text{Neut}} [VP Dave love Tom]...]

   (iii) *Truth-Conditions:*
      \[ \exists t' . PTS(t', t_{\text{now}}) \land \exists s . \text{love}(s) \land \text{Exp}(s) = \text{Dave} \land \theta(s) = \text{Tom} \land T(s) \cap t' \neq \emptyset \land \exists t'' . t'' \in t' \land \forall t''' . t''' \in T(s) \Rightarrow t'' < t''' \]

      ‘There is an interval of time stretching until now, and that interval of time contains the beginning of a state of Dave loving Tom (and maybe its end)’
(24) **Prediction of Option 2:**
There should be languages where ‘true imperfective’ is lexicalized differently from ‘neuter imperfective’, and…

a. In these languages, we should find that the perfects of ‘true imperfectives’ *do not* allow for any E-perfect readings

b. In these languages, we should find that the perfects of ‘neuter imperfectives’ *only* allow for E-perfect readings.

(25) **Claim of Pancheva (2003):** Bulgarian witnesses the predictions in (24)!!

- However, the actual details regarding the morpho-syntactic forms of perfects in Bulgarian are rather messy, and it’s not as perfect an example of (24) as we might like

3. **The ‘Imperfective Paradox’ and Imperfective as a Modal Operator**

Our current semantics for imperfective aspect is as in (26); together with T and VP, it contributes the information that the TT is contained within the time of an event/state that the VP is true of.

(26) **Our Current Semantics for IMPRV Aspect**

\[
[[ \text{IMPRV} ]]^{w,A,g} = \left[ \lambda P_{<v,P>}: [ \lambda t_1: \exists e. t_1 \subseteq T(e) \& P(e) = T ] \right]
\]

However, as first observed by Bennett & Partee (1978),⁵ there’s a rather serious problem that this semantics faces with *telic* VPs. Consider, for example, the truth-conditions predicted for (27a)…

(27) **Our Semantics for IMPRV with Telic VPs**

a. **Sentence:** Dave was eating the cookie.

b. **LF:** \([TP \text{Dave} [TP \text{1} [TP \text{PST}_2 [AspP \text{IMPRV} [VP t_1 \text{eat the cookie}] \ldots]]]]\)

c. **Predicted Truth-Conditions:** \([[\text{(27b)}]]^{w,A,g} \text{ is defined only if } g(2) < t\]

If defined, \([[\text{(27b)}]]^{w,A,g} = T \text{ iff} \]

\[\exists e. g(2) \subseteq T(e) \& \text{eat}(e) \& \text{Ag}(e) = \text{Dave} \& \text{Thm}(e) = \text{the cookie}\]

‘The past time g(2) is surrounded by an event of Dave eating the cookie’

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(28) **The Problematic Entailment of (27c)**

The truth-conditions in (27c) clearly entail the following:

a. **Entailment of (27c):**

\[ \exists e . \text{eat}(e) \land \text{Ag}(e) = \text{Dave} \land \text{Thm}(e) = \text{the cookie} \]

‘There is (in the actual world) a (complete) event of Dave eating the cookie’

- Therefore, our semantics in (27) entails that Dave does eventually eat the entire cookie.

- **But this is clearly wrong, as continuations like (28b) show.**

b. Dave was eating the cooking. *But then he dropped it down a sewer grate, and so he never got to finish it.*

- Following Dowty (1977), this property of imperfective aspect has come to be known as ‘the Imperfective Paradox’.

  - (even tho it’s not really a *paradox*… just a fact that our analysis doesn’t capture yet…)

(29) **The Imperfective Paradox (Bennett & Partee 1972, Dowty 1977)**

If a VP is telic, then a sentence of the form ‘[T [IMPFV VP]]’ does not entail that there is event e in the actual world such that [[VP]]^w.t,g(e) = T

(30) **Burning Question:**

How do we revise our semantics for IMPFV so that it avoids this prediction and is harmonious with the ‘paradox’?

(31) **The Prevailing View: Imperfective Aspect is Modal**

There is a ‘modal’ aspect to the meaning of IMPFV; it introduces quantification over (and evaluation at) other possible worlds (and not just the actual world).

*But how do we characterize the possible worlds that IMPRV aspect quantifies over?*

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(32) **Introducing ‘Inertia Worlds’ (Dowty 1977)**

We say that w’ \textbf{inertia world} for world w at time t \textit{iff}

(i) w and w’ are exactly the same up to time t

(ii) After time t, everything that is ‘going on’ in w’ at t continues in w’ until it is ‘normal’ for it to stop on the basis of its ‘internal properties’

a. **Illustration of Inertia World:**

   o Suppose that in w at t, Dave is in the process of eating the cookie.

   o Suppose that at a later time t’ in w, Dave accidentally drops the cookie down a storm drain.

   o Now, consider a world w’ that is just like w up to time t, but at time t’ in w’, Dave doesn’t actually drop the cookie.
     - Instead, he eventually finishes the cookie in w’

   o We would say that w’ is an \textbf{inertia world} for w at t

b. **The ‘Inertial’ Modal Base**

\[
\text{INERT}(w,t) = \{ w' : w' \text{ is an inertia world for } w \text{ at } t \}
\]

\[
= \{ w' : \text{matches the ‘facts’/ ‘circumstances’ in } w \text{ up to time } t \text{ \text{and}}
\]
\[
\text{after } t, \text{ everything that is ‘going on’ in } w' \text{ at } t \text{ continues in } w' \text{ until it is ‘normal’ for it to stop on the basis of its ‘internal properties’} \}
\]

c. **Observation 1:**

Due to its worlds ‘matching the facts’ in w up to time t, the ‘Inertial Base’ in (32b) is actually a subspecies of \textit{circumstantial base} (Portner 1998).\(^7\)

d. **Observation 2:**

A world w \textbf{need not} be a member of Inert(w,t)

   o After all, the real world w might be such that \textit{not} everything ‘going on’ at time t continues until it’s ‘normal’ for it to stop (\textit{e.g.}, scenario (28b))

\[
\text{With this concept of ‘inertia world’ in place, we can now provide a modal semantics for IMPRV!}
\]

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(33) Revised, Modal Semantics for IMPRV Aspect

\[
[[ \text{IMPRV} ]]^{w,t,g} = \\
[ \lambda P_{s<v,t}> : \left[ \lambda t' : \forall w' \in \text{INERT}(w,t') \cdot \exists e . t' \subseteq T(e) & P(w')(e) = T \right] ]
\]

‘In all the inertia worlds stemming from \(w\) at time \(t\), \(t\) is contained within a \(P\)-event/state’

(34) Concomitant Adjustments to Our Semantics for VPs

- Note that ‘IMPRV’ in (33) is type \(<s, <v, t>>\); it takes as argument a property (not predicate) of eventualities.

- We’ll therefore have to make some slight (modalized) adjustments to our event-semantics for verbs.

\[ a. \quad [[ \text{dance} ]]^{w,t,g} = [ \lambda x_e : \lambda e : \text{dance}(e,w) & \text{Ag}(e,w) = x ] \]
\[ b. \quad [[ \text{love} ]]^{w,t,g} = [ \lambda y_e : \lambda x_e : \lambda s_e : \text{love}(s,w) & \text{Exp}(e,w) = x & \text{Thm}(e,w) = y ] \]
\[ c. \quad [[ \text{eat} ]]^{w,t,g} = [ \lambda y_e : \lambda x_e : \lambda e : \text{eat}(e,w) & \text{Ag}(e,w) = x & \text{Thm}(e,w) = y ] \]

(35) Predicted Truth-Conditions for Imperfective Telic VPs

a. **Sentence:** Dave was eating the cookie.

b. **LF:**
   \[ [\text{TP} \text{Dave} \left[ \text{TP} 1 \left[ \text{TP PST}_2 \left[ \text{AspP IMPRV} \left[ \text{VP} t_1 \text{ eat the cookie } \right] \ldots \right] \right] \right] ] \]

c. **Predicted Truth-Conditions:**
   \[
   \forall w' \in \text{INERT}(w, g(2)) \cdot \exists e . g(2) \subseteq T(e) & \text{eat}(e, w') & \text{Ag}(e, w') = \text{Dave} & \text{Thm}(e, w') = \text{the cookie}
   \]

   For all the inertia worlds \(w'\) stemming out from \(w\) at past time \(g(2)\),

   There is an event in \(w'\) of Dave eating the cookie, whose time surrounds \(g(2)\)

(36) On The Solution to the ‘Paradox’ in (29), Part 1

- The predicted truth-conditions in (35c) no longer entail that there is a (complete) event of Dave eating the cooking in the actual world.

- Such complete ‘cookie-eatings’ only exist at the inertia worlds, and the actual world need not be an inertia worlds(32f)
On the Solution to the ‘Paradox’ in (29), Part 2

- Since \( g(2) \) is contained within a complete cookie-eating event at the inertia-worlds, it follows that in those inertia worlds, there is some ‘cookie-eating process’ going on at and before \( g(2) \) (i.e., parts of the cookie are eaten at these times…)

- Moreover, since the inertia worlds in (35c) must match the actual world up to time \( g(2) \) (32a,b), it follows that such (partial) ‘cookie-eating processes’ also do go on in the actual world at and prior to the past time \( g(2) \)!

\[
\text{Dave eats the cookie.}
\]

Inertia World:  \[\leftarrow \quad \text{[ET]} \quad \rightarrow \quad \text{g(2)} \quad \rightarrow \quad \]

(Partial) Cookie-eating

Actual World:  \[\leftarrow \quad \text{g(2)} \quad \rightarrow \quad \]

- Thus, our semantics does correctly predict that sentence (35a) entails that Dave ate part of the cookie!

On the Solution to the ‘Paradox’ in (29), Part 3

Our semantics also correctly predicts that sentence (38ai) will entail that there is a complete event of Dave dancing in the actual world; that is, (38ai) does entail (38aii).

a. The Entailments of Imperfective Atelic VPs  
   (i) Dave was dancing.  
   (ii) Dave danced.

- Note that atelic VPs famously have the ‘divisibility property’ in (38b)

b. Divisibility of Atelic VPs:  
   If VP is an atelic VP and \([\text{VP}](e)\), then for all subevents \( e' \leq e \), \([\text{VP}](e') = T \)

- Now consider the predicted truth-conditions for sentence (38ai):

c. \( \forall w' \in \text{INERT}(w, g(2)). \exists e. g(2) \subseteq T(e) \& \text{dance}(e, w') \& \text{Ag}(e, w') = \text{Dave} \)

- Again, (38c) states that in every inertia world \( w' \) for \( w \) at \( g(2) \), \( g(2) \) is surrounded by an event of Dave dancing.
   - Given (38b), however, this means that there is a (sub-)event of Dave dancing that takes place in \( w' \) at and before \( g(2) \) [see diagram in (37)]
   - And, since \( w' \) must match the actual world \( w \) in the facts up to \( g(2) \), this means that that (sub-)event of Dave dancing also holds at and before \( g(2) \) in the actual world!
(39) **An Obvious Shortcoming of the Analysis: The Definition of ‘Inertia Worlds’**

The definition in (32) is presently just ‘programmatic’…

- We’d definitely need to spell out some objective criteria for saying when it’s ‘normal’ for something to stop on the basis of its ‘internal properties’…
- There is a significant amount of literature that wrestles with this problem (some of which is summarized by Altshuler (2014), Arregui *et al.* (2014, and Ferreira (2016))

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4. **The Habitual Reading of Imperfective Aspect**

Thus far, our formal semantics for aspect has been leaving aside the ‘habitual’ reading of imperfective aspect, which allegedly arises in sentences like (40a,b).

(40) **Imperfective Aspect Under its ‘Habitual’ Construal**

a. **English:** Dave dances.

b. **Tlingit:** Cháayu adaná tea IMPRV.3sgS. drink
   ‘He is drinking tea’ OR ‘He drinks tea’

(41) **Key Observation: The ‘Habitual’ Reading of Imperfective is Also Modal**

Just as in the ‘ongoing’ reading of imperfective with telic VPs (28)-(29), imperfective VPs under a ‘habitual’ construal do not entail that there is any event such that $[[VP]](e)$

a. (i) **Sentence:** This printer prints 100 pages a minute.
   (ii) **Judgment:** <Printer doesn’t ever have to have been used before>\(^8\)

b. (i) **Sentence:** This car goes 190mph.
   (ii) **Judgment:** <Car needn’t ever have reached that speed before>

c. (i) **Sentence:** Mary handles any mail from Antarctica.\(^9\)
   (ii) **Judgment:** <There doesn’t have to have been any mail from Antarctica>

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\(^8\) This example was originally put forth in Green, Lisa. 2000. “Aspectual Be-Type Constructions and Coercion in African American English.” *Natural Language Semantics* 8: 1-25.

Key Idea:
Given our new modal semantics for IMPRV in (33), maybe we can obtain its ‘habitual construal’ by adjusting the modal base that it quantifies over?

A Modal Semantics for ‘Habitual’ Imperfective (IMPRV\textsubscript{HAB})

a. Key Ingredient: The Modal Base ‘HABIT’
\[ \text{HABIT}(w,t) = \{ w' : \text{the ‘habits’ and ‘dispositions’ in } w \text{ are actualized in } w' \} \]

- Thus, if Mary has the job of handling the mail in Antarctica (41c), all the worlds in \text{HABIT}(w,t) are ones where she does in fact handle such mail.
- And, if my car has the capacity to go 190mph (41b), all the worlds in \text{HABIT}(w,t) are ones where the car does eventually reach that speed.

b. Lexical Entry for the ‘Habitual’ Imperfective
\[
[[ \text{IMPRV\textsubscript{HAB}} ]]^{w,t,g} = \lambda P_{<,<,\triangleright} : [ \lambda t' : \forall w' \in \text{HABIT}(w,t') . \exists e . t' \subseteq T(e) \& P^*(w')(e) = T ]]
\]
‘In all the worlds where the habits/dispositions of w at t’ are realized, t’ is surrounded by a plurality of P-events/states’

c. Illustration:
(i) Sentence: Dave dances.

(ii) LF:
\[ [\text{TP Dave TP 1 TP PRES}_2 [\text{AspP IMPRV\textsubscript{HAB} [VP } t_1 \text{ dance ] ... } ]] \]

(iii) Truth-Conditions:
\[ \forall w' \in \text{HABIT}(w, t_{\text{now}}) . \exists e . t' \subseteq T(e) \& \text{dance}^*(e,w) \& \text{Ag}(e,w) = \text{Dave} \]
‘In all the worlds where the habits/dispositions of w at t_{\text{now}} are realized, \( t_{\text{now}} \) is surrounded by a plurality of events of Dave dancing.’

Some Comments:
- The semantics for IMPRV\textsubscript{HAB} (43) and the regular ‘ongoing’ IMPRV (33) are nearly identical, differing only in:
  (i) The modal bases that are quantified over
  (ii) The existence of pluralities of events with the IMPRV\textsubscript{HAB}, vs. only a single event with IMPRV

- As we’ll see, the semantic literature on ‘imperfective’ is largely devoted to further, deeper unification of these readings, ultimately aiming to provide just a single, unified lexical entry for ‘IMPRV’…
5. Our Final Picture of Tense and Aspect in English (and Possibly Other Languages)

(45) The Clausal Architecture of Tense and Aspect (in English)

```
TP
    T
  PST ModP
{ PRES }
Mod       High-AspP
WOLL      High-Asp
          PERF
          AspP
          VP
          PRV
          IMPRV
{ IMPRV_HAB } Asp
```

(46) Semantics for Tense (‘Pronominal / Referential’ Version)

a. \[[ PST_i \]]^{w,t,g} \text{ is defined only if } g(i) < t \text{ ; if defined } \[[ PST_i \]]^{w,t,g} = g(i)
b. \[[ PRES_i \]]^{w,t,g} \text{ is defined only if } g(i) = t \text{ ; if defined } \[[ PRES_i \]]^{w,t,g} = g(i)

(47) Semantics for \textit{WOLL}

\[[ \textit{WOLL} \]]^{w,t,g} = \\
\[ \lambda P_{<i,<t>} : [ \lambda t' : \forall w' \in CIRCUM(w, t') : \exists t'' . t' < t'' \& P(w')(t'') = T ] \]

(48) Semantics for \textit{PERF} (‘Perfect Time Span’ Version)

\[[ \textit{PERF} \]]^{w,t,g} = \\
\[ \lambda P_{<i,t>} : [ \lambda t' : \exists t'' . PTS(t'', t') \& P(t'') = T ] \]

(49) Semantics for Aspect

a. \[[ \textit{PRV} \]]^{w,t,g} = \\
\[ \lambda P_{<v,t>} : [ \lambda t' : \exists e . T(e) \subseteq t' \& P(e) = T ] \]
b. \[[ \textit{IMPRV} \]]^{w,t,g} = \\
\[ \lambda P_{<v,<t>} : [ \lambda t' : \forall w' \in INERT(w, t') . \exists e . t' \subseteq T(e) \& P(w')(e) = T ] \]
c. \[[ \textit{IMPRV}_{HABIT} \]]^{w,t,g} = \\
\[ \lambda P_{<v,<t>} : [ \lambda t' : \forall w' \in HABIT(w, t') . \exists e . t' \subseteq T(e) \& P^*(w')(e) = T ] \]

(50) Observation:
Under this analysis, ‘Aspect’ broadly construed (\textit{i.e.}, the ‘stuff’ between VP and T) is semantically and syntactically quite heterogeneous:
- ‘Perfect’ occupies a distinct, higher position than (IM)PRV, and has a different type
- IMPRV and \textit{WOLL} (Future/Prospectival) are modal, while PRV and PERF are not