1 Introduction

- **Last Time:** Kratzer 1996’s VoiceP - a functional phrase for introducing external arguments

- **Proposal:** The causative/active occupies a functional head (Voice) that
  1. Selects VP as its complement
  2. Introduces the **EXTERNAL ARGUMENT** as its specifier, and
  3. Assigns **ACCUSATIVE CASE** to the specifier of VP

  - **Kratzer 1996** Voice combines with VPs via the new compositional rule
    **Event Identification**

- **Restriction:** Event Identification can only apply if the events have compatible **AKTIONSARTEN**/aspectual classes
  - The VP (g(e) is stative, and the Voice head f(e,x) is stative - eg., **HOLDER(e,x)**
  - The VP (g(e) is eventive, and the Voice head f(e,x) is eventive - eg., **AGENT(e,x)**

**Q:** What is **AKTIONSARTEN**?
• **Vendler 1957/Rothstein 2004**: VPs fall into different aspectual classes; these are semantically-defined

<table>
<thead>
<tr>
<th>VERB CLASS</th>
<th>Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statives</td>
<td>know, have, like, understand, desire, ...</td>
</tr>
<tr>
<td></td>
<td>“non-dynamic situations”</td>
</tr>
<tr>
<td>Activities</td>
<td>run, walk, sleep, drink water, eat apples, ...</td>
</tr>
<tr>
<td></td>
<td>“open-ended processes”</td>
</tr>
<tr>
<td>Accomplishments</td>
<td>read the book, eat an apple, run a marathon, sink, ...</td>
</tr>
<tr>
<td></td>
<td>“processes with a natural endpoint”</td>
</tr>
<tr>
<td>Achievements</td>
<td>recognize, find, reach the top, ...</td>
</tr>
<tr>
<td></td>
<td>“near-instantaneous events” with change of state</td>
</tr>
</tbody>
</table>

Table 1: English Lexical Aspect Classes

• These different semantic properties result in different semantic interactions with VP-adverbials, **grammatical aspect** and **tense**

• **Terminology Note 1**: There are TWO kinds of ASPECT

  1. **Verbal/Lexical Aspect** (aka **aktionsart**)  
     → This is a way of categorizing verbs/VPs/events  
     (according to their semantic temporal properties)

     *eg.*, stative, activity, accomplishment, achievement, semelfactive

  2. **Grammatical/Viewpoint Aspect**  
     → This is used to **modify** the interpretation of the verb/VP/event  
     (in terms of its semantic temporal properties)

     *eg.*, progressive (be -ing), simple (-s/-ed), perfect (have -en/ed)...

• **Terminology Note 2**: **Grammatical Aspect ≠ Tense**

  3. **Tense** → This locates the **reference time**  
     with respect the **utterance/speech time**

     *eg.*, **past** and **present**

2 The Empirical Ground

2.1 The STATIVE/EVENTIVE Distinction

• **Observation 1**: The English **progressive** aspect can’t attach to all verbs:

<table>
<thead>
<tr>
<th>VERB</th>
<th>PROGRESSIVE ASPECT</th>
<th>SIMPLE ASPECT</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. run</td>
<td>She is running</td>
<td>She runs\textsuperscript{HAB}</td>
</tr>
<tr>
<td>b. eat</td>
<td>She is eating an apple</td>
<td>She eats an apple\textsuperscript{HAB}</td>
</tr>
<tr>
<td>c. recognize</td>
<td>*She is recognizing me</td>
<td>She recognizes me\textsuperscript{HAB}</td>
</tr>
<tr>
<td>d. find</td>
<td>*She is finding a dog</td>
<td>She finds a dog\textsuperscript{HAB}</td>
</tr>
<tr>
<td>e. know</td>
<td>*She is knowing me</td>
<td>She knows me</td>
</tr>
<tr>
<td>f. have</td>
<td>*She is having a brother\textsuperscript{PROSP}</td>
<td>She has a brother</td>
</tr>
<tr>
<td>g. like</td>
<td>*She is liking a singer</td>
<td>She likes a singer</td>
</tr>
</tbody>
</table>

Table 2: Diagnostics: Progressive and Simple Aspect

→ The progressive cannot attach to **achievement** or **static** verbs

• **Observation 2**: The English **progressive** aspect has systematically different interpretations depending on what verb it attaches to

→ The progressive cannot is sometimes interpreted as **in-progress**,  
and sometimes as **habitual**
(1) a. Habitual Reading
   \[ t' \]
   \[ \tau(e) \quad \tau(e) \quad \tau(e) \quad \tau(e) \quad \tau(e) \]
b. In-Progress Reading
   \[ t' \]
   \[ \tau(e) \]

**CONTEXT: Ongoing State/Event**

Kim is writing an exam, and she’s on the final question. Luckily, the question is asking about the definition of a morpheme, which she has studied carefully. She starts writing down the correct definition.

(2) Lexical Aspects with SIMPLE PRESENT

a. Kim knows the answer
b. # Kim writes
c. # Kim writes an answer
d. # Kim finishes her exam

(3) Lexical Aspects with PRESENT PROGRESSIVE

a. #Kim is knowing the answer
b. Kim is writing
c. Kim is writing an answer
d. Kim is finishing her exam

- We can use these empirical differences as diagnostics to distinguish between **stative** and **eventive** verbs (where eventive = {activities, accomplishments, achievements})
  - (i) Interpretation with the **simple** (semantic diagnostic)
  - (ii) Acceptability with the **progressive** (morphological diagnostic)

<table>
<thead>
<tr>
<th>ASPECT</th>
<th><strong>Stative</strong></th>
<th><strong>Eventive</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Simple</td>
<td>Ongoing</td>
<td>Habitual</td>
</tr>
<tr>
<td>Progressive</td>
<td>N/A (%)</td>
<td>Ongoing</td>
</tr>
</tbody>
</table>

Table 3: Stative/Eventive Diagnostics

- **Basic Idea**: Stative and Eventives differ according to a semantic property: **dynamicity** = i.e., whether they involve change over time or not
- The English progressive **s-selects** for dynamic predicates.


2.2 The Telic/Atelic Distinction

- **Observation 1**: The combination of PAST PROGRESSIVE has different entailments with ACCOMPLISHMENTS VS ACTIVITIES
  1. **Activity** entails the SIMPLE PAST form
  2. **accomplishment** does NOT entail the SIMPLE PAST form

**REVIEW: Entailment DEFINITION**

A sentence, \( S_1 \), entails another sentence, \( S_2 \), iff, whenever \( S_1 \) is true, \( S_2 \) is also true.
CONTEXT: Interrupted event

I thought it was Sunday, so started reading a book this morning. Then I looked at my calendar and realized it was actually Monday and had to come into work. I left my book, unfinished, at home.

(4) a. I was reading this morning. (T)  
   |= I read this morning. (T)

b. I was reading a book this morning. (T)  
   |= I read a book this morning. (F)

CONTEXT: Interrupted event

I was thirsty yesterday and found a bottle of milk in my fridge, so I started drinking it. But after a couple sips, realized that it tasted strange, so threw it out without finishing it.

(5) a. I was drinking milk yesterday. (T)  
   |= I drank milk yesterday. (T)

b. I was drinking a bottle of milk yesterday. (T)  
   |= I drank a bottle of milk yesterday. (F)

• Aristotle’s Metaphysics (1048): verbs differ according to whether or not they are TELIC

→ TELIC events description ENCODE an inherent endpoint
They require an ENDPOINT before they are considered complete

→ ATELIC events description LACK an inherent endpoint
They do not require an endpoint to be considered complete

Observation 2: Telic and Atelic VPs can also be distinguished by the “For X time” VS “In X time” diagnostic

ATELIC: compatible with “for X minutes/hours/weeks”
TELIC: compatible with “in X minutes/hours/weeks”

(6) a. Mary had a car for two hours  
   #Mary had a car in two hours  
   atelic state

b. Mary ran for two hours  
   #Mary ran in two hours  
   atelic activity

c. Mary ran a marathon in three hours  
   #Mary ran a marathon for three hours  
   telic accomplishment

d. Mary found her car in three hours  
   #Mary found her car for three hours  
   telic achievement

1Aristotle actually distinguished between “kinesis” and “energia” but we’ll use Vendler 1957’s terms for simplicity.
Table 4: Dynamicity and Telicity

<table>
<thead>
<tr>
<th>Lexical Aspect</th>
<th>Dynamic</th>
<th>Telic</th>
</tr>
</thead>
<tbody>
<tr>
<td>States</td>
<td>×</td>
<td>×</td>
</tr>
<tr>
<td>Activities</td>
<td>✓</td>
<td>×</td>
</tr>
<tr>
<td>Accomplishments</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Achievements</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Semelfactives</td>
<td>✓</td>
<td>×</td>
</tr>
</tbody>
</table>

2.3 The Punctual/Durative Distinction

- Recall, the English progressive cannot attach to *ACHIEVEMENTS*

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- **Bach 1986**: *ACCOMPLISHMENTS* and *ACHIEVEMENTS* verbs differ according to whether or not they have *DURATION*.

Instantaneous events occur *at a point in time*

Durative events occur *over an interval of time*

3 Modelling the Semantics of Lexical Aspect

We have proposed three basic semantic features used to categorize VPs (*DYNAMICITY, TELICITY, DURATIVITY*)

But how can we model these in the semantic component of the grammar?

How can we define these?

3.1 The Punctual/Durative Distinction

1. Introduce a domain of times/instants, I, into the ontology, where these instants are points ordered by a temporal precedence relation, <

\[ t_0 < t_1 < t_2 < t_3 < t_4 < \ldots \]

2. Define *INTERVALS* as concatenated of contiguous instants

\[ t_1 + t_2 + t_3 \]

3. Define \( \tau \) as the run-time function

\[ \tau(e) = t, \text{ where } t \text{ is the run-time of the event, } e \]

- Durative events have intervals as runtimes, eg., \{t_1, t_2, ..., t_n\}
- Instantaneous events instants as runtimes, eg., \{t_2\}

* (There are lots of other ways of doing this too)
**Idea:** The progressive\(^3\) locates the reference time as a proper part of the runtime of a P-event

\[\tau'(t - \cdots - t - \cdots - t)\]

\[\tau(e)\]

• This is impossible if the runtime of P-event is an instant; it has no proper parts\(^4\)

• This is why the progressive cannot combine with achievements, which are instantaneous transitions from one state to another

### 3.2 The Telic/Atelic Distinction

• **Krifka 1989, 1992:** Telicity and Atelicity are associated with the semantically-defined properties of **quantization** and **cumulativity**\(^5\)

#### REVIEW: Cumulativity DEFINITION

A predicate/property, \(P(x)\), is **cumulative** if

- it has at least two distinct entities in its denotation, and

  for any \(a\) and \(b\) in \(P\), \(a \oplus b\) is also in \(P\).

\(P\) is **cumulative** iff:

\[\exists x \exists y [P(x) \land P(y) \land \neg x \subseteq y \land \forall x \forall y [P(x) \land P(y) \rightarrow P(x \oplus y)]\]

---

\(^3\)This is a MAJOR simplification of the progressive. Much ink has been dedicated to analyzing the complexities of the progressive. This is actually a version of Reichenbach’s analysis of the imperfective.

\(^4\)For simplicity, I’ve assumed something that most people don’t assume - i.e., that time is not strongly homogeneous. If you want to know more, feel free to ask.

\(^5\)This definition of cumulativity looks different from the last one we saw! It additionally requires that there are at least two distinct entities in \(P\). The previous definition technically would allow a predicate with a single entity in it to satisfy the definition of cumulativity, since the sum of a single entity is itself.

### Quantization DEFINITION

A predicate/property, \(P(x)\), is **quantized** if

- for any \(a\) and \(b\) in \(P\), neither \(a\) nor \(b\) can be a proper part of the other.

\(P\) is **quantized** iff:

\[\forall x \forall y [P(x) \land P(y) \rightarrow (x \subseteq y \rightarrow x = y)]\]

• **Atelic** event descriptions like *run* are **cumulative**:

  if \(e_1\) is a running event, and \(e_2\) is a running event
  then \(e_1 \oplus e_2\) is a running event

• **Telic** event descriptions like *eat three apples* are **not cumulative**:

  if \(e_1\) is an eating-three-apples event, and \(e_2\) is an eating-three-apples event
  then \(e_1 \oplus e_2\) is not an eating-three-apples event\(^6\)

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\(^6\)Rothstein 2004 argues that Krifka 1989, 1992’s approach to the telic/atelic distinction is problematic because the plural predicate like *eat-three-apples*, where the events are individuated by participants, would fit his definition. She proposes an alternative property, \(s\)-**cumulativity**, which forms singular entities from sums. See Rothstein 2004 for more information.
Krifka 1989, 1992 was interested in observed parallels between
the semantic properties of certain VPs, and
the semantic properties of their internal arguments

(7) a. Bob [ate [apples]_{DP}]_{VP}
   VP: cumulative, non-quantized
   DP: cumulative, non-quantized
b. Bob ate [three apples]_{DP} \_VP
   VP: non-cumulative, quantized
   DP: non-cumulative, quantized

He proposed that for verbs of creation/consumption, there was a structure-preserving mapping from the internal argument to the event:[4]

The “apple scale” maps onto the “time scale” of the “eat the apple” event

Due to the mapping between events and objects, if the object is
1. **QUANTIZED**: then the temporal structure of the event is quantized
2. **NON-QUANTIZED**: then the temporal structure of the event is non-quantized

Some Extra Things for Keen Students to Worry About

**What about predicates like eat more than three apples?**

- ✓ **CUMULATIVE**: If I eat four apples, and then eat six apples, altogether I eat ten apples. All three of those events are events where I ate more than three apples
- × **NON-QUANTIZED**: If I ate seven apples, a subevent is me eating four apples, and another subevent is me eating three apples. One of those subevents is still an event where I ate more than three apples.
- We predict this to be **ATELIC**, but based on the empirical diagnostics, it behaves as if **TELIC**

(8) a. Mary ate more than three apples in an hour/# for an hour
b. Mary was eating more than three apples
   ≠ Mary ate more than three apples

→ Many people have proposed modifications to Krifka’s semantic characterization of the telic/ateelic distinction

4“Imagine a context where Mary is a child, and she’s taking turns taking bites out of five different apples. In this case, you can say “Mary was eating more than three apples” even if she was interrupted in the process after only taking one or two bites out of each of the five apples.

Krifka also proposed a related property **HOMOGENEITY**: (Rothstein 2004)

(i) **VERY WEAKLY HOMOGENOUS**: \( \exists x [P(x) \rightarrow \exists y (y \subseteq x \land \neg y = x \land P(y))] \)

For some \( x \), where \( P(x) \), then there is a proper part of \( x \), \( y \), where \( P(y) \)

→ This correlates to being **NON-QUANTIZED**
(ii) **Weakly Homogenous:** \( \forall P(x) \rightarrow \exists y [x \sqsubseteq x \land \neg y = x \land P(y)] \)

All x-es such that P(x) have a proper part, y, where P(y)

*eg., run to Vienna*

\[
\text{London} \quad \text{Paris} \quad \text{Rome} \quad \text{Vienna}
\]

(iii) **Strongly Homogenous:** \( \forall x [P(x) \rightarrow \forall y [y \sqsubseteq x \land \neg y = x \land P(y)]] \)

If P(x), then all proper parts of x, y, are such that P(y)

*eg., run, love flowers*

- Note that mass predicates are **Strongly Homogeneous**, but plural predicates are not.

### 3.3 The Dynamic/Non-Dynamic Distinction

- **Homogeneity** can be defined down to different part
  - the previous definition talks about minimal subevents defined by the **PART-OF** relation \( \sqsubseteq \)
  - We can also talk about **Homogeneity** down to minimal times
    - i.e., **instants**

- Rothstein 2004 uses this difference to distinguish (non-dynamic) **States** from (dynamic) **Activities**
  - **Activities** like *run* are homogenous down to minimal events, but not to instants
  - **States** like *be happy* are homogenous down to instants

- **Idea:** Being **Dynamic**, by definition, involves **change over time**

  → Change over time can only be evaluated (i.e., judged as true or false), if there are distinct times to evaluate some property

  *eg., P'(t_1) = 1, P'(t_2) = 0*

  where P’ could be something like ‘right leg off the ground’

- **Recall Kratzer 1996:** Event Identification can apply if
  - The VP (g(e) is stative, and the Voice head f(e,x) is stative - *eg., holder(e,x)*)
  - The VP (g(e) is eventive, and the Voice head f(e,x) is eventive - *eg., agent(e,x)*)

- **Idea:** The relation **agent(e,x)** is semantically defined as true, only if the truth of some property, P’, changes over the event’s run-time

---

**My Belnap-inspired version: Agentivity OP ‘STIT’**

"x sees to it that P": There is an action such that

(i) **Positive Condition:** All of the worlds compatible with x taking that action are P-worlds

(ii) **Negative Condition:** There is a world w where x doesn’t take that action, which is a \( \neg P \) world

---

\(^7\text{if you assume that plural predicates are (the characteristic function of) sets of sums which do not contain atoms. Of course, many people believe that plural predicates also contain the atoms (eg., Chierchia 1998).}\)
\[ \forall w' \neg P \quad \exists w'' \neg P \]

- Essentially: The agent, \( x \), takes an action, \( a \), which (non-vacuously) guarantees the truth of \( P \).

- Alternative Formalizations of the Stative/Eventive Distinction:

  1. Katz 1996: Eventives and statives differ in argument structure
     - Eventives (dynamic predicates) are predicates of events
       i.e., have an event argument
     - Statives (non-dynamic predicates) are predicates of times
       i.e., don’t have an event argument

  2. Kratzer 1995: Some statives have event arguments
     - stage-level predicates (temporary properties) ✓
       eg., be hungry,
     - individual-level predicates (enduring properties) ×
       eg., have brown hair

4 The Locus of Lexical Aspect

- We have proposed distinct semantic features categories of VPs

- Q: How should we encode these semantic difference?
  (i) in their lexical entries?
  (ii) with functional projections in the syntax?

4.1 A Lexicalist Approach

- Dowty 1979 Each verb class has a particular lexical template:

\[
\begin{align*}
&\lambda e.P(e) \quad \text{States} \\
&\lambda e.[DO(P)](e) \quad \text{Activities} \\
&\lambda e.[BECOME(P)](e) \quad \text{Achievements} \\
&\lambda e.\exists e_1 \exists e_2[e =^s (e_1 \oplus e_2) \land [DO(P)](e_1 \land Cul(e) = e_2)] \quad \text{Accomplishments}^8
\end{align*}
\]

- DO, BECOME and Cul(minate) are defined so that they encode or entail the semantic properties discussed in the previous section
  - DO is common to activities and accomplishments
    it’s definition entails duration
  - BECOME encodes dynamicity
    (i.e., a change from \( \neg P \) to \( P \))
  - Cul encodes telicity/quantization and entails dynamicity

4.2 A Syntactic Approach

- Recall Borer 2005a? She proposes mass/count is constructed in the syntax

- Borer 2005b: The telic/atelic distinction is constructed in the syntax

\(^8\)The superscript \( ^s \) is to indicate that the sum operation here, unlike the previous \( \oplus \), combines to subevents into a single event, as opposed to combining two distinct events into a plural event.

\(^9\)Sorry! Last time I accidentally cited Borer 2005a as Borer 2005b. Both are cited in the references of this handout.
4.3 Borer (2005b)’s Basic Framework

- Borer (2005a,b) proposes a spine of functional phrases where the head of a functional phrase, $F^0$, can be valued by two methods:
  1. By an independent lexical item that merges in its specifier
  2. By a head-feature on a moved lexical (or functional) stem

$\text{FP} \xrightarrow{\text{spec}} F' \xrightarrow{X.(F)} F' \xrightarrow{\text{FP}} F^0 \xrightarrow{X}$

- The presence/absence of functional phrases correlates with whether the syntactic phrase has specific semantic properties

- In the nominal domain, she proposes:
  1. The nominal root $N$ (mass stuff)
  2. The functional phrase, $\text{DivP}$, which acts to “portion” the mass into countable individuals
  3. A functional phrase $\#P$, which holds numbers and quantifiers, then acts to “counts” these portions
  4. The DP shell, which acts to assign a referential index to the individual (in the discourse)

- The semantic consequences of the presence/absence of nominal FPs:
  - Lack of $\text{DivP}$ yields a non-count (mass) interpretation
  - Lack of $\#P$ yields a non-quantity interpretation (i.e., unbounded/atelic)$^{11}$
  - Lack of D yields a non-referential interpretation

- In the functional domain, she proposes:
  1. The verbal root, $V$, (event stuff)
  2. An Aspectual Quantity Phrase, $\text{AspQP}$
      - semantically, this is the verbal equivalent of $\#P$; it makes verbs telic the same way $\#P$ makes nouns count
      - This can take a subject-of-quantity (better known as the internal argument) in its specifier
      - The subject-of-quantity must have a count interpretation to value the head of this phrase$^{12}$
      - If the nominal lacks a count interpretation, the head cannot be valued as Quantity, and this phrase projects a semantically vacuous shell phrase $F^P$
  3. TP (Tense Phrase), which assigns nominative case$^{13}$
  4. An Event Phrase, $\text{EP}$, which binds the event variable, and sometimes holds an originator in its specifier

- The telicity of the extended verbal projection depends on whether or not $\text{AspQP}$ is present or not
- If it is not there, and the shell projection $F^P$ projects instead, we derive an atelic interpretation

$^{10}$She also actually has a MP “Massifier Phrase,” to deal with Cheng & Sybesma 1998’s evidence of a mass/count distinction in Chinese.

$^{11}$More on this later! This relates more to the semantics of the VP - whether or not the VP describes an event with an inherent endpoint or not.

$^{12}$This is a simplification; she allows many other ways for this head to be valued, eg., via head-features and movement, via indirect range assigners, head-specifier (as opposed to specifier-head) agreement, where the heads are valued by particles or bound morphemes.

$^{13}$And I assume, other tense-like things, like situating reference times with respect to utterance times.
Next Week: MIDTERM!

1. Propositional Logic
2. Predicate Logic
3. Type-Driven Compositionality
4. Topics at the Syntax-Semantics Interface

References


