Processes, events, and the imperfective paradox:
Ontological implications of a linguistic puzzle

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Reference to event(ualitie)s

Natural languages allow us to make reference to **situations** and/or **eventualities** with distinct characteristics:

- **Linguistically,** differences are legible as distinctions in **lexical aspect** (*Aktionsart*) (Vendler 1957, Kenny 1963, Krifka 1989, a.o.): eventualities can be inherently *bounded (telic), durative, dynamic*, ...
- A **metaphysical perspective** raises **ontological questions:** do aspectual/*Aktionsart* distinctions reflect contrasts in the nature of the referenced objects themselves?
- For instance, do (1a) and (1b) refer to ontologically distinct objects? (Steward 2013, a.o., drawing on Mouratelos 1978)

(1) a. Henrietta was crossing the street.
process: *describes a continuant lacking proper temporal parts, fully present at every moment of its existence*

b. Henrietta crossed the street.
event: *describes a perdurant which exists as a complete whole and can have proper parts in evidence at different times/places*

Reference to event(ualitie)s: semantic consequences

Treating **processes** and **events** as ontologically distinct simplifies certain aspectual puzzles, such as non-entailment in (1) (Kenny 1963, Dowty 1979) . . .

(1) Henrietta was crossing the street. $\not\rightarrow$ Henrietta crossed the street.

. . . but introduces others:

(2) While the wedding was happening, I felt nervous, but I was overjoyed when it had finally happened.

> *"[. . .] the simplest way to understand the cross-reference . . . to the first ('it') [. . .] is to suppose that [. . .] it is the same thing that was happening as eventually happened."* Steward (2013, p.786)

Linguistically: model-theoretic semantics privileges a **reductionist** approach

- What is the simplest set of model entities that can capture the truth conditions of natural language propositions?
- Ontological commitments should be **methodologically motivated**: they need not coincide with, nor aspire to settle, the kinds of questions that arise in broader metaphysical debates (e.g., about what "really" exists).

In focus: progression and completion

Durative telic predicates (accomplishments) are associated with:

- **culmination (conditions):** object creation/destruction (*bake/eat a cookie*), terminus (*run a marathon*), state transition (*open a door*)
- **culmination assumption**: telic *P*s *only denote culminated events*

Observation: we can refer to **non-culminated stages** of telic events

(3) Henny wrote a symphony. → *He completed it.*

a. Henny began to write a symphony (but gave up right away).

b. Henny stopped writing a symphony (and never began again).

Questions:

1. What governs truth, felicity of nonculminated (processual) uses?
2. What (**conceptually, lexically, semantically**) links predicate-relevant processes and culmination conditions?
3. Can we capture **processes** in an event-based reductionist approach, or must they represent an independent type of entity?

Outline of the talk

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The imperfective (progressive) paradox

Perfectives describe completed events, often licensing **culmination entailments** when they modify a telic predicate:

(4) Maya wrote a book. → *A complete book came into being.*

Prevalent explanation:

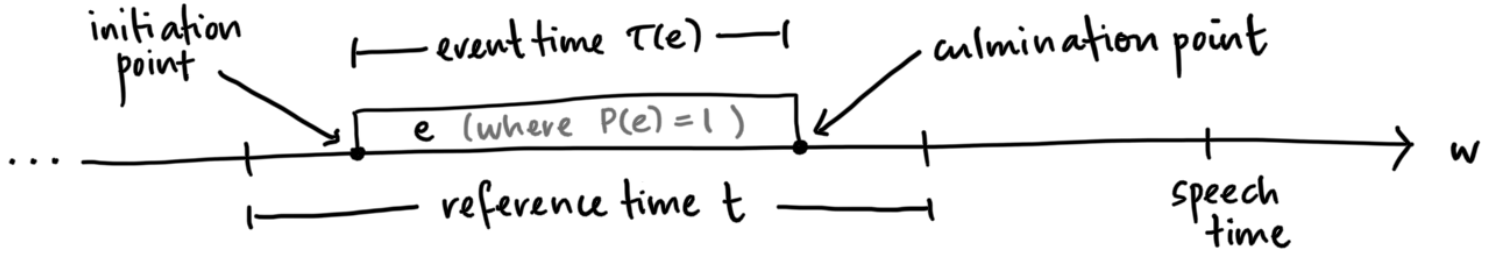
(i) **Culmination assumption:** $e \in [\![P_{\text{tel}}]\!]$ contains process + culmination

(ii) **Aspects instantiate P-eventualities** relative to reference time t

(5) $[\![\text{PFV}]\!] := \lambda w \lambda t \lambda P\,.\,\exists e[\tau(e) \subseteq t \wedge P(e)(w)]$

(cf. Klein 1994, Kratzer 1998, Bhatt & Pancheva 2005, a.o.)

Result: $e \in [\![P]\!]$ culminates, so t includes **culmination** . . .



. . . leading to **culmination entailment**

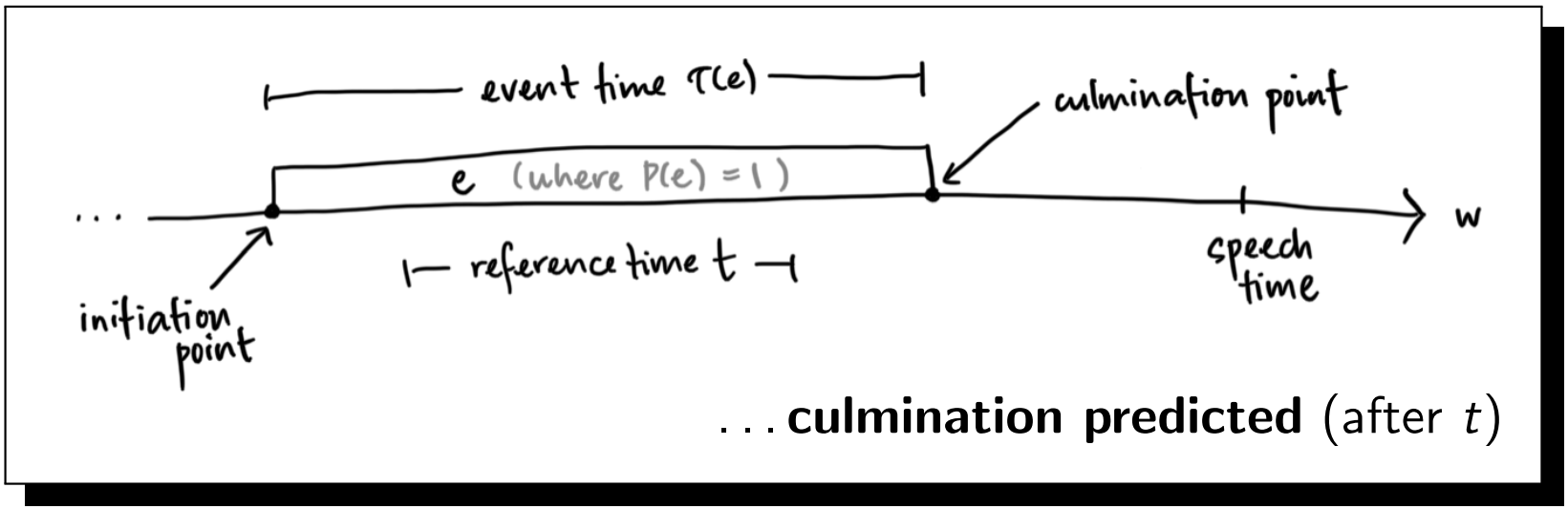
The imperfective (progressive) paradox

Wrong predictions for telic **progressives**:

If PROG instantiates $e \in [\![P]\!]$ as **ongoing** at t . . .

$$[\![\text{PROG}]\!] := \lambda w \lambda t \lambda P \,.\, \exists e[\tau(e) \supset t \wedge P(e)(w)]$$

. . . **culmination assumption** requires culmination in w^*



Contradicts empirical data, leading to 'paradox':

(1a) Henrietta was crossing the street (when she was hit by a truck).
no entailment: $\not\rightarrow$ *Henrietta reached the opposite side.*

The imperfective (progressive) paradox: puzzles

- **Practically:** when P is a telic predicate, $\textsc{prog}(P)$ refers to situations that fail to maximally instantiate P

  Question: why/when does $\textsc{prog}(P)$ apply to *partial* realizations of P?

- **Metaphysically:** if telic predicates describe events that are unified wholes individuated by completion, how can they be linked to actual occurrences in the absence of completion?

- A **telic perfective** entails the (prior) truth of a **telic progressive**, even though the reverse entailment fails (Kenny 1963)

  Question: do the two modes pick out (parts of) the same thing? If so, how?

(6) a. Henrietta crossed the street. → Henrietta was crossing the street.

b. Henrietta was crossing the street. → Henrietta crossed the street.

Existing approaches

From the linguistic standpoint, two assumptions suggest two solutions:

(I) **Intensional** approaches: intensionalize PROG so that **culmination** takes place in alternative worlds

(Dowty 1979, Landman 1992, Asher 1992, Bonomi 1997, a.o.)

- maintain **culmination assumption**, but allow PROG to **introduce modal alternatives**
- **analytical challenge:** constrain the modal relationship so that some *P*-**eventuality 'begins' in** w^*

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(P) **Partitive** approaches: an (extensional) partitive PROG instantiates **non-culminated** *P*-eventualities (e.g., Bach 1986, Parsons 1990, Szabó 2008)

- maintain **extensional** PROG, but **revise the culmination assumption**
- **analytical challenge:** what properties **qualify a partial ('process') eventuality** as *the same sort of thing as a culminated one*
  (i.e., what tells us that a non-culminated eventuality is something that aims at/makes progress towards culmination?)

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The philosophical literature offers a third route:

(O) **Ontological** approaches: PROGs, PFVs pick out distinct ontological objects

- processes and events are different kinds of things (Stout 1997, 2003).
- **analytical challenge:** what are the **verification conditions** for processes, events related to the same underlying predicate? How do we capture the sense of metaphysical identity between process and event (cf. Haase 2022)?

Existing approaches

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(O) **Ontological** approaches: PROGs, PFVs pick out **distinct ontological objects**

Our claim: combining insights from the intensional and partitive perspectives obviates the need to enrich the ontology

- Perfectives and progressives pick out different things, but . . . these things are parts of the same conceptual whole
- **part-whole relations** belong to a generalized *event type* (cf. Thompson 2008).
- processes, events are differentiated in terms of verification with respect to the (intensional) whole

Outline of the talk

Culmination, expectation on the intensional view

Intensional PROG: (Dowty 1979, Asher 1992, a.o.)
A P-eventuality is ongoing if reference time facts predict culmination

- $\text{PROG}(P) = 1$ iff events at t develop to culmination in **all normal/ inertial alternatives** to w^*

  Inertial alternatives $\sim$ ongoing processes continue uninterrupted

- alternatives are projected from circumscribed **perspectives** (Asher)

  (1a) Henrietta was crossing the street (when the truck hit her).

  A set of facts including Henrietta, the truck, & their physical properties predicts collision as 'inertial' outcome

Upshot: truth of telic PROG is tied to likelihood, expectation (necessity) of culmination in relevant alternatives

Culmination, expectation on the intensional view

Intensional PROG:
$\text{PROG}(P) = 1$ iff ref time events develop into culminated P-eventualities in **all normal alternatives***

Impossible event (IE) progressives are out:

(7) **Context.** Meena's 5 year old daughter Maya wrongly believes that the earth is made entirely of sand and soil. She is digging a hole (with the intention of tunnelling all the way through).

Meena: **?/✗** Maya is digging a hole to China.

- **false**: no (objective) perspective has normal culmination alternatives

*In Asher's terms: default/typicality inference is licensed (∼ completion occurs in the normal course of events based on state with the reference-time characteristics)

Culmination and expectation on the intensional view

Local culmination accessibility is a problem for **unlikely events (UEs):**

(8) Henrietta was crossing a minefield

(9) **The sailing competition** (*contra* 'defaults'; Bonomi 1997)
An international association organizes a sailing competition to circumnavigate the globe. 100 boats take part, and they all set sail from the same point. A few days later, a spokesman says:

✓ 100 boats are circumnavigating the globe. Most will fail.

- **intensional** PROG requires all normal continuations to culminate
  (or for each instance to license a default inference to completion)
- **so:** (8)-(9) are predicted to be **false**
- **because:** 'typical' attempts will not end successfully (failure is normal)

Empirically: (8)-(9) are both acceptable and **true**

Culmination, expectation on the intensional view

Even **existential intensional** PROG is too strong for **out of reach (OOR)** contexts:

(10) **The un(der)trained runner** (cf. Szabó 2008, Varasdi 2014)

Benny began an ultramarathon for which he (knowingly) undertrained; it was certain before the start that he lacked the stamina to complete the run, but he meant go as far as he could.

a. *Friend/observer:* ✓Benny was running an ultramarathon (when he collapsed from exhaustion).

b. *Benny:* ✓I was running an ultramarathon (when I collapsed).

- predicted **false**: no situation containing Benny (+ relevant properties) is expected to continue to culmination

> **Empirically:** (10)a-b are both acceptable and **true** in context

Similar example from Szabó (2004):

(i) As the architect was building the cathedral, he knew that, although he would be building it for another year or so, he couldn't possibly complete it.

The partitive perspective

Acceptability of **UE, OOR** progs suggests that telic PROGs don't need locally-accessible culmination alternatives, instead: "...it is the present activities that are the whole story." (Parsons 1989)

(11) **The part-of-proposal** (adapted from Landman 1992).
PROG(P) is true iff some actual event realizes **sufficiently much** of the type of events of P

The partitive concept implies a means of **measuring** the extent of a (partial) P-eventuality against some whole:

- a parallel between nominal and eventive *parts*: measurable features of the part allow comparison to the conceptual whole (Bach 1986, Parsons 1990)
- (*contra* Parsons) event partitivity cannot reduce to nominal partitivity: partial events can lack tangible correlates
- **intuition:** complex events involve organized/ordered stages ('steps' in a recipe), providing a conceptual standard of measure

Measuring accomplishments

Culmination procedures distinguish between **IE** vs. **UE, OOR** progressives:

Type	*Empirically*	*Intensional* PROG
IE	#	✗
UE	✓	✗
OOR	✓	✗

- **UEs, OOR** progs *can be true* if ref-time activities correspond to steps in a culmination 'recipe' for culmination (agent intentions can be evidence for a culmination procedure)
- **IE** progs are infelicitous: impossibility → no conceptual whole for comparison

Felicity, truth for telic progs (descriptive):

1. the existence of a realistic strategy/process for realizing culmination (per speaker's epistemic state)
2. actual events match (parts of) the culmination strategy, thus *making progress towards culmination*

Outline of the talk

Modeling progress: preview

Goal: combine intensionality, partitivity in the structure of telic predicates

- process-culmination relationship is **modal** in nature
  process leads to culmination in some *normative* sense
- actual events constitute **part of a P-eventuality**
  (but without local culmination expectation)

Idea: telic Ps invoke knowledge about necessary, sufficient conditions for initiating, developing, completing culmination processes

- a **type-level causal model** for culmination condition C_P provides 'recipe(s)' for realizing C_P
  + relevant preconditions (properties, facts, events) and relationships
- model induces a **(causal) mereological structure,** mediated through the relationship between process and C_P
- actual eventualities *partially realize* P if they conform to a causal pathway ($\sim$ normative/teleologically-optimal process) for C_P

Overview: structural equation models (Pearl 2000)

Causal information is represented by a **directed acyclic graph** D:

- **nodes** (finite set Σ): salient prop. variables (can be valued $u, 0, 1$)
- **edges:** atomic relations of **causal relevance** ($P \xrightarrow{\text{c-influences}} Q$)
- **structural equations:** specify how nodes' values are determined from their ancestors'

  Function Θ_D assigns to each $X \in \Sigma$ a pair $\langle Z_X, \theta_X \rangle$ where Z_X is the set X's immediate ancestors, $\theta_X : \{0,1\}^{|Z_X|} \rightarrow \{0,1\}$
- **causal consequences:** of a *situation s* (3-way valuation of Σ) are calculated using D and Θ_D

In lexical semantics:

Causal language refers to (predicates, presupposes) particular structural configurations as different causal dependency types

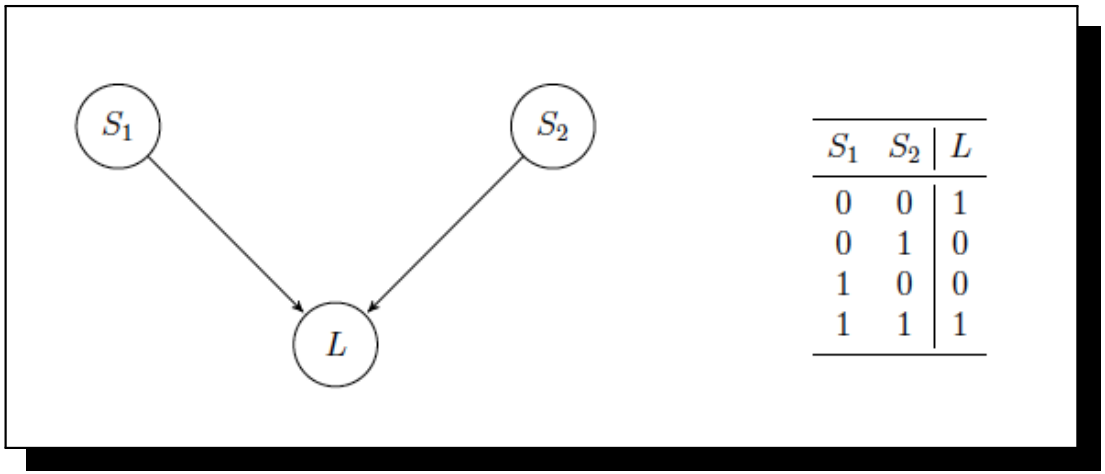
(cf. Nadathur & Lauer 2020, Baglini & Bar-Asher Siegal 2025)

Illustration: the Lifschitz circuit

(12) **The circuit example:** (Lifschitz 1990)

a. Suppose there is a circuit with two switches and one light, such that the light is on (L) exactly when both switches are in the same position (up or not up).

b. At the moment switch 1 is down, and switch 2 is up.



S_1	S_2	L
0	0	1
0	1	0
1	0	0
1	1	1

- (a) states the causal laws
- (b) gives us an initial setting (background situation)
- given (b), we expect the **causal consequences** to include that the light is off ($L = 0$)

Causal relationships in a model

Model structure allows us to define different causal relations:
(Nadathur & Lauer 2020, Baglini & Bar-Asher Siegal 2025)

- **background:** causation is a property of sets; effects are realized as the result of collections of conditions acting together
- causative predicates pick out causes with particular (binary) relationships to an effect *within a set of causes acting together*

Relations of interest (informally): (cf. Mackie 1965)

- **Causal necessity:**
  Within a situation s with both C and E, fact C is causally necessary for fact E iff changing C changes E
- **Causal sufficiency (of sets):** $\text{SUFF}^M(s, E)$
  A set s is sufficient for E iff E is true in s and s otherwise comprises necessary causes for E.

Causal necessity and causal sufficiency, formally

Let $M = \langle D, \Theta_D \rangle$ be a causal model over Σ, s a situation (3-way valuation of Σ)

(13) a. **Causal ancestors:** For $X \in \Sigma$, the set A_X of **causal ancestors** of X is given by $A_X = \{Y \in \Sigma | R^T_{\Theta_D}(X, Y)\}$ (w/ $R^T_{\Theta_D}$ the trans. closure of direct ancestry)

b. **Domain:** For s a situation, let $\textsc{dom}(s) = \{X \in \Sigma | \langle X, 1 \rangle \in s \vee \langle X, 0 \rangle \in s\}$

c. **Facts.** A fact is a tuple $\langle X, x \rangle$ where $X \in \Sigma$ and $x \in \{0, 1\}$.

d. **Causal consistency:** Situation s is **causally consistent** iff, $\forall X \in \textsc{dom}(s)$, $s(X) = f_X(s(Z_X))$

(14) **Causal necessity.**
Given a consistent situation s, a fact $\langle X, x \rangle \in s$ is **causally necessary** for fact $\langle Y, y \rangle \in s$ iff $X \in A_Y$ and for any consistent s' s.t. $\textsc{dom}(s) = \textsc{dom}(s')$, $s(X) \neq s'(X) \rightarrow s - s' = \{\langle X, x \rangle, \langle Y, y \rangle\}$

(15) **Causal sufficiency (of sets).** $\boxed{\textsc{suff}^M(s, \langle Y, y \rangle)}$

A consistent situation s is a **sufficient set** for a fact $\langle Y, y \rangle \in s$ iff:
$\forall X \in \{Z | Z \in A_Y \cap \textsc{dom}(s))\}, \langle X, s(X) \rangle$ is causally necessary for $\langle Y, y \rangle$

Causal models: from the specific to the general

Past work: (Bar-Asher Siegal & Boneh 2020, Baglini & Bar-Asher Siegal 2025, Nadathur & Lauer 2020, a.o.)

- **statements of singular causation** (causative claims): about **token instances** of causation (actual relations between specific events)
- **observation:** singular causal claims depend in part on unobservables

(16) Ria broke the vase.

a. *Ria did something* (e_1)

b. *The vase broke* (e_2)

c. e_1 *(is part of what) brought about* e_2

- (16c): Ria is the agent/causer of some event which stands in a **recognized causal relationship** to a state transition involving the salient vase
- (16) is licensed by a **type-level** model of certain local relationships; its truth depends on actualization of e_1, e_2 and their temporospatial configuration w.r.t. the causal generalizations in a contextually-relevant model

Causal models: from the specific to the general

Telic predicates introduce type-causal information:

- accomplishments aren't **causative** (can hold where actual causation fails)
- but they can license singular causal claims (cf. Szabó 2004)

(17) Ria baked a cake

a. Ria engaged in some activity/series thereof (e_1) (✓PROG(P))

b. A cake came into being (e_2)

c. e_1 *is part of what brought about* e_2

Our claim:

- the truth of a telic perfective is not constituted by the causal relationship between a (prior) progressive and the associated result
- **but:** the predicate must provide information which *can* validate an actual causal relation between (prior) progressive and result (where both are realized)
- *ergo:* telic predicates provide the **same kind of information** that licenses token causal claims

Motivating causal complexity in event types

Claim: type-level models underlie lexicalization, use of complex predicates

- models capture generalizations/idealizations (causal regularities): *how things work* and/or *how to do things*
- type models support specific (token) expectations, but are not *about* singular instances (actual causation)

Accomplishments (durative telic predicates): **today**

- *bake a cake* ∼ perform a series of actions which, taken together, bring a cake into being
- felicitous use *presupposes* model; truth depends on match between model-actuality match
- type vs. token: possible to engage in an appropriate process *without realizing the type-level result* . . . resulting (for instance) in imperfective paradox effects

NB: The model is *not* a linguistic object (it has a language-independent existence), but it is the object which constitutes and supplies the "real" facts for linguistic, truth-conditional evaluation

Imperfective paradox: the view from causal models

Causal models: a framework for modeling progress that combines intensional, partitive perspectives on paradox effects

An **accomplishment event type** is a causal model M_P for predicate P:

- culmination condition C_P occurs in M_P as a dependent variable
- M_P links certain conditions/steps to one another and to C_P
- a **process** for P (a **causal pathway** S for C_P) is a set of jointly sufficient conditions for C_P $(\text{SUFF}^{M_P}(S, C_P))$
- the model also specifies sufficient sets for **non-culmination** $(\neg C_P)$

Beyond progressives: M_P induces a **mereological structure** where $[\![P]\!]$ contains (non-)culminated eventualities; e_1, e_2 are comparable as subsets if they belong to the same causal pathway for C_P

Analytic truth conditions for $\textsc{prog}(P_{\text{tel}})$

Informally:
Given a model M_P for telic P with culmination condition C_P, the progressive is true at time t iff the situation s at t is a **possible cross-section of a non-culminated P-eventuality:**

(a) s realizes some part (condition Q) of a causal pathway for C_P (initiation)
(b) s does not realize a complete pathway for C_P (non-maximal)
(c) s does not realize a sufficient set for non-culmination ($\neg C_P$) (non-terminated)

Formally:
For telic predicate P with culmination condition C_P:

(18) $\textsc{prog}(P, t) = 1$ iff

$\exists s[\tau(s) \circ t \wedge [\exists Q \exists S : Q \in S \wedge \textsc{suff}^{M_P}(S, C_P) \wedge Q(s)]$ (a)

$\wedge [(\forall S' : \textsc{suff}^{M_P}(S', C_P)[\exists Q' \in S' : Q'(s) \rightarrow \exists Q'' \in S' : \neg Q''(s)]]$ (b)

$\wedge [\forall \Omega : \textsc{suff}^{M_P}(\Omega, \neg C_P)[\exists \omega \in \Omega : \neg \omega(s)]]]$ (c)

(based on submitted work)

Towards a compositional picture

Division of labour:

- The model provides conditions of **initiation**, **culmination**, **termination** (part-whole structure of sufficient sets)
- A **partitive** approach to grammatical aspects (Filip & Rothstein 2005, Altshuler 2014, a.o.): aspectual operator evaluates a(n actual) situation w.r.t. the appropriate event type model (how much / what sort of piece is instantiated)

The reductionist view:

(19) $\text{PROG}(P, t) := \exists s[\tau(s) \circ t \wedge \texttt{INIT}(s, M_P) \wedge \neg\texttt{END}(s, M_P)]$
where

a. $\texttt{INIT}(s, M_P) = \exists Q \exists S : Q \in S \wedge \text{SUFF}^{M_P}(S, C_P) \wedge Q(s)]$

b. $\texttt{END}(s, M_P) = \texttt{CUL}(s, M_P) \vee \texttt{TERM}(s, M_P)$

i. $\texttt{CUL}(s, M_P) = \texttt{SUFF}^{M_P}(s, C_P)$

ii. $\texttt{TERM}(s, M_P) = \texttt{SUFF}^{M_P}(s, \neg C_P)$

Culmination puzzles from a causal perspective

Big picture: causal models connect ✨world knowledge✨ to model/set-theoretic, truth conditional semantics

- this lets us write fairly intuitive truth conditions for (e.g.) progressives

Intensional PROG accounts cannot differentiate between **IE, UE**, and **OOR** PROGs, but the causal approach does:

1. **IE** PROGs are **infelicitous** (not false): event model does not exist
   - e.g., no set of conditions sufficient for digging a hole to China
2. **UEs, OORs** have models: truth thus depends on actual events
   - to complete an ultramarathon, one must show up at the start, take steps along the path, . . .
   - even though Benny's properties ensure eventual failure, PROG holds because his actions up to collapse match a culmination pathway
   - **upshot:** it's predictable that his endurance will fail, but Benny's actions until then can *make progress towards culmination*

Outline of the talk

Conceptualizing *process*

Observation:
Instantiations of durative telic predicates involve processes that lead to their culmination points, i.e. the *télos* of these processes.

- **Empirically:** Realization of the culmination point is not a prerequisite for truthful (and felicitous) use of telic *P*
- **Key question:** What exactly (formally, model-theoretically) constitutes a process that is directed toward a culmination point?
- What are the ontological commitments made by each approach (intensional, partitive, ontological)?

Conceptualizing *process:* Type I approaches

Recall: Type I (intensional) approaches advocate a local assessment of future developments

- $\textsc{prog}(P)$ is true iff local events are expected to develop to the point of culmination

(20) $[\![\textsc{prog}(P)]\!]^{w^*,t^*} = 1$ iff $\exists e_v[e \text{ in } w^* \,\&\, \tau(e) = t^* \,\&\, \forall w \in \textsc{inr}(w^*, P, e)[\exists t[t^* \subset_{\text{nf}} t \,\&\, P(t, w)]]$ (based on Portner 1998)

- Type I approaches assume a temporally extended event whose temporal subparts need not be homogeneous (e.g., in the telic case)

- **Result:** There is nothing ontologically special about telic progressives. They instantiate the same thing as telic perfectives (but change the intensional context of realization)

An alternative perspective: a mereological (part–whole) relation sub-events and events (Landman (1992), Bonomi (1997).

Conceptualizing *process*: Type P, O approaches

Recall: Non-intensional approaches postulate that the process leading to a particular result can be identified independently of the result.

- Two different ways of conceptualizing process correspond to the Type P and O approaches (Haase 2022)

Type P (partitive): Two-properties approach

- A single event can instantiate two distinct properties, HOLD (in progress) and CUL (culminated) (e.g., Parsons 1989, 1990).

(21) a. Mahler wrote a symphony. $\sim \text{PST}(\text{PFV}(\surd M \textit{ write a symphony}))$
$\exists e[\text{writing}(e) \wedge \text{AG}(e, \text{m}) \wedge \text{TH}(e, \text{a symphony}) \wedge \text{CUL}(e, t\{\prec_i \text{now}\})]$

b. Mahler was writing a symphony $\sim \text{PST}(\text{PROG}(\surd M \textit{ write a symphony}))$
$\exists e[\text{writing}(e) \wedge \text{AG}(e, \text{m}) \wedge \text{TH}(e, \text{a symphony}) \wedge \text{HOLD}(e, t\{\prec_i \text{now}\})]$

Type O (ontological): Two-entities approach

- The process is, ontologically, a distinct kind of entity, often taken to be what is denoted by the imperfective aspect (Stout 1997).

Conceptualizing *process*: our analysis

The causal-model approach:

- Causal models offer a robust framework for understanding how eventualities can figure as members of sufficient sets that lead to a culmination.
- On our approach, causal models are used to explain the truth conditions of progressives by focusing on the causal pathways that connect sets of eventualities to their potential culminations.

On this view, a **process** consists of a set of events (states, state transitions) that collectively form a "complete event" (sufficient set) as denoted by the predicate.

Conceptualizing *process*: the causal model approach

Certain conceptual elements are frequently highlighted in treating the relationship between process and culmination:

- **Causality** (Vlach 1981 and Szabó 2004): either by conceptualizing the process as a causal chain or by invoking the logical notion of necessity, where a particular state of affairs is deemed necessary for the occurrence of a specific event (Varasdi 2014).
  Problematic when the outcome has not yet materialized

- **Event-type:** various analyses often shift the focus from specific instances of events to types of events (Landman 1992, Bonomi 1997; Thompson (2008) characterizes the progressive as denoting a "type" or "general rather than an individuated event token.

Haase's (2022) challenge:
A precise formal account is required to show how progression could, in principle, suffice for culmination.

Conceptualizing *process*: the causal model approach

Causal models provide a framework to capture the relationship between a process and its result in a straightforward manner.

- **Crucially:** A process is neither regarded as a distinct ontological type of entity nor as a mere partial stage in the development of an event.
- **Instead:** A *process* is a collection of states and events that collectively bring about (are jointly sufficient for) the resulting event, which is conceived as the culmination point of the process. Each condition within this set is necessary in the context of the whole to bring about the result.

(19) $\text{PROG}(P, t) := \exists s[\tau(s) \circ t \wedge \texttt{INIT}(s, M_P) \wedge \neg\texttt{END}(s, M_P)]$, where

a. $\texttt{INIT}(s, M_P) = \exists Q \exists S : Q \in S \wedge \text{SUFF}^{M_P}(S, C_P) \wedge Q(s)]$

b. $\texttt{END}(s, M_P) = \texttt{CUL}(s, M_P) \vee \texttt{TERM}(s, M_P)$

i. $\texttt{CUL}(s, M_P) = \texttt{SUFF}^{M_P}(s, C_P)$

ii. $\texttt{TERM}(s, M_P) = \texttt{SUFF}^{M_P}(s, \neg C_P)$

NB: Parsons treats HOLD and CUL as 'primitive' properties of events, but we offer formal definitions which are well-defined with respect to the event type causal model

Outline of the talk

Summary: causal models for telic progressives

Imperfective paradox needs a combined intensional, mereological view:

- (locally-assessed) **culmination potential** cannot be the whole story
- the model provides a structure against which to measure the conditions under which a **token qualifies as partial realization (of type-defined whole)**
- **uninflected telic predicates** are 'responsible' for paradox effects (cf. Zucchi 1999, a.o.)

Progressives of accomplishments require causal knowledge but are **not themselves causal statements**:

- we need a (plausible) causal model to license PROG(P)
- use of PROG(P) indirectly (via presupposition) conveys a speaker's belief in a causal model for P's culmination (a belief that there is a way to do P)
- **but:** asserted content only reports a match between actual events and the structure of the type-level model

Outlook: ontology and aspect

Our view: aspectual distinctions are not about discrete ontological objects, but about different ways in which a complex intensional object can be realized in an evaluation context

- The **event type** associated with a predicate is crucial (cf. Landman 1992, Bonomi 1997, Thompson 2008 Varasdi 2014), but is not itself what is instantiated in the evaluation world
- Different aspectual contexts map the event type (model) to different concrete sets of events, allowing actual (in-progress) *processes* and (culminated) events to be linked to the same conceptual whole

Looking ahead:

- Dowty's (1979) **aspect calculus:** aims to derive *Aktionsarten* from a small set of decompositional lexical atoms (`CAUSE`, `BECOME`, `DO`, ...)
- **Causal models are the right tool for this project,** allowing us to map world knowledge about (causal) interrelationships between 'conditions' to set-theoretic objects

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