Dowty's aspect hypothesis segmented

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Where are the events in Dowty's aspect calculus?

Word Meaning & Montague Grammar, 1979

statives $+$ DO, BECOME, CAUSE ...

A rough approximation from Rothstein 2004

activities	$\lambda e.(\mathrm{DO}(\varphi))(e)$
achievements	$\lambda e.(\mathrm{BECOME}(\varphi))(e)$
accomplishments	$\lambda e.\exists e'[(\mathrm{DO}(\varphi))(e') \wedge e = e' \sqcup_S \mathrm{Cul}(e)]$

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Interval world pairs

For stative φ,

$$\langle I, w\rangle \models \varphi \quad \text{iff} \quad (\forall t \in I)\ \langle \{t\}, w\rangle \models \varphi$$

contra φ for an event

$$\langle I, w\rangle \models \varphi \quad \text{iff} \quad I \text{ is the time of a } \varphi\text{-event in } w$$

Idea. Bring out events by segmenting I to track change in stative φ's

A *segmentation of* I is a sequence $I_1 I_2 \cdots I_n$ such that $I = \bigcup_{i=1}^{n} I_i$ and for $1 \leq i < n$, $I_i \prec I_{i+1}$ – i.e. $(\forall t \in I_i)(\forall t' \in I_{i+1})\ t \prec t'$.

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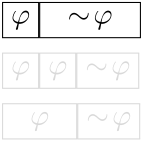

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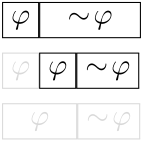

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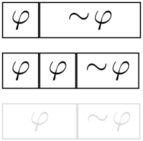

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Tracking φ

A segmentation $I_1 \cdots I_n$ of I *w-tracks* φ if for all subintervals I' of I,

$$\langle I', w \rangle \models \varphi \quad \text{iff} \quad I' \subseteq \bigcup \{ I_i \mid 1 \leq i \leq n \text{ and } \langle I_i, w \rangle \models \varphi \}.$$

A (φ, w, n)*-alternation in* I is a string $t_1 t_2 \cdots t_n \in I^n$ s.t. $t_i \prec t_{i+1}$ and $\langle \{t_i\}, w \rangle \models \varphi$ iff i is odd.

I is (φ, w)*-alternation bounded* (a.b.) if for some $n > 0$, no (φ, w, n)-alternation in I exists.

Fact. *For stative* φ*,*

some segmentation of I *w-tracks* φ *iff* I *is* (φ, w)*-a.b.*

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From segmentations to strings

$$I_1 I_2 \models_w \boxed{\psi}\boxed{\varphi, \psi} \quad \text{iff} \quad \langle I_1, w\rangle \models \psi \text{ and } \langle I_2, w\rangle \models \varphi \wedge \psi$$

$$I_1 \cdots I_n \models_w \alpha_1 \cdots \alpha_m \quad \text{iff} \quad n = m \text{ and for } 1 \leq i \leq n \text{ and } \varphi \in \alpha_i, \; \langle I_i, w\rangle \models \varphi$$

	non-durative	durative (length ≥ 3)
telic	achieve $\boxed{\sim\varphi}\boxed{\varphi}$	accomplish $\boxed{\sim\varphi}\left(\boxed{\sim\varphi, \psi}\boxed{\sim\varphi, \psi}\right)^{+}\boxed{\varphi}$
$-$tel	semelfactive $\boxed{}\boxed{\psi}$	activity $\boxed{}\left(\boxed{\psi}\boxed{\psi}\right)^{+}$

$\alpha_1 \cdots \alpha_n$ is *telic* if there is some φ in α_n such that the negation $\sim\varphi$ of φ appears in α_i for $1 \leq i < n$

Mary ran to post-office $\quad \varphi =$at(mary,post-office)
not quantized (Krifka) … "arrow of time" (Landman & R 2012)

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Moens & Steedman 1988 in strings

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(2) $s\beta \;;\; \alpha s' \;:=\; s(\beta \cup \alpha)s'$

(3) $L; L' \;:=\; \{s; s' \mid s \in L - \{\epsilon\}$ and $s' \in L' - \{\epsilon\}\}$

(4) iterate(L) $:=$ (least $Z \supseteq L; L$) $Z; L \subseteq Z$

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Comrie 1976

> *With a state, unless something happens to change that state, then the state will continue ...*
> *With a dynamic situation, on the other hand, the situation will only continue if it is continually subject to a new input of energy.*

$$\langle I, w\rangle \models \text{Prev}(\varphi) \quad \text{iff} \quad \langle I', w\rangle \models \varphi \text{ for some } I' \text{ abutting } I$$

$$\langle I, w\rangle \models \varphi \wedge \text{Prev}(\sim\varphi) \quad \text{iff} \quad I'I \models_w \boxed{\sim\varphi}\boxed{\varphi} \text{ for some } I'$$

For $\psi := \varphi \wedge \text{Prev}(\sim\varphi)$, *no* segmentation w-satisfies any string in

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Incremental change and grain

$$\langle I, w\rangle \models d < \varphi\text{-deg} \quad \text{iff} \quad (\forall t \in I)\ d < \deg^D_{\varphi,w}(t)$$

$$\langle I, w\rangle \models \varphi\text{-deg} \leq d \quad \text{iff} \quad (\forall t \in I)\ \deg^D_{\varphi,w}(t) \leq d$$

For $\psi \ := \ (\exists d \in D)\ (d < \varphi\text{-deg} \wedge \text{Prev}(\varphi\text{-deg} \leq d))$,

$$I_0 I_1 \cdots I_n \models_w \boxed{}\boxed{\psi}^n \quad \text{iff} \quad (\exists d_1, \ldots, d_n \in D)(\forall i \in [1, n])\ (\forall t \in I_{i-1})(\forall t' \in I_i)\ \deg^D_{\varphi,w}(t) \leq d_i < \deg^D_{\varphi,w}(t')$$

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The projections $bc_A(s) := bc(\rho_A(s))$

days in a year $\rightsquigarrow$ months in a year

$$\boxed{\text{Jan,d1}}\boxed{\text{Jan,d2}}\cdots\boxed{\text{Dec,d31}} \overset{\rho_{months}}{\rightsquigarrow} \boxed{\text{Jan}}^{31}\boxed{\text{Feb}}^{28}\cdots\boxed{\text{Dec}}^{31}$$

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ρ_A "see only A"

bc "no time without change" : compress α^+ to α

For infinite Φ, let $Fin(\Phi)$ be the set of finite subsets of Φ.

A Φ-*system* is a function $f : Fin(\Phi) \rightarrow (2^\Phi)^*$ such that

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$$f \prec_\Phi f' \quad \text{iff} \quad f \neq f' \text{ and } (\forall A \in Fin(\Phi))\ f(A) \text{ is a prefix of } f'(A)$$

where

$$s \text{ is a prefix of } s' \quad \text{iff} \quad (\exists s'')\ s' = ss''$$

Fact. *$\prec_\Phi$ is transitive and left linear: for all $f \in \mathbb{IL}(\Phi)$, and $f_1, f_2 \prec_\Phi f$,*

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From intensions to truthmaking & finite-state methods

An interval world pair $\langle I, w \rangle$ is Φ-*approximable* if every $\varphi \in \Phi$ is homogeneous and alternation-bounded in $\langle I, w \rangle$.

Fact. *Every Φ-approximable $\langle I, w \rangle$ is representable in $\mathbb{IL}(\Phi)$ by a unique system $\{f(A)\}_{A \in Fin(\Phi)}$ of approximations of $\langle I, w \rangle$ as $f(A) \in (2^A)^*$ at granularity A.*

DAH_s: At granularity A, events within $\langle I, w \rangle$ are representable as substrings of $f(A)$

an E-event occurs in $\langle I, w \rangle$ iff $(\exists s \in L_E)\ s \sqsubseteq f(A)$

relational intension: $s' \sqsupseteq_E s$ iff $s \in L_E$ and $s \sqsubseteq s'$

Construe strings as models/segmentations (for completeness)
- a poor man's IL amenable to finite-state methods

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