

Causality, aspect, and modality in actuality inferences

Handout (supplement to slides)

Perna Nadathur

perna.nadathur@phil.hhu.de

Institut für Sprache und Information, Heinrich Heine Universität

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1 Aspect and actuality inferences: the basic patterns

Three constructions license actuality inferences:

(I) **implicative verbs entail** the realization of their complements (Karttunen, 1971):

(1) Solomon **managed** to build a temple. \vdash *Solomon built a temple.*

(II) **enough and too constructions implicate** the realization of their complements (Karttunen, 1971; Meier, 2003; Hacquard, 2005):

(2) Juno **was fast enough** to win the race. \rightsquigarrow *Juno won the race.*

(III) **ability modals and *be able*** – past-tense *be able* **implicates** the realization of its complement (Bhatt, 1999):

(3) (Yesterday,) Marja **was able** to swim across Lake Harriet. \rightsquigarrow *Marja swam across Lake Harriet.*

Actuality entailments are a special case:

- in aspect-marking languages like French¹, **perfectively-marked** ability modals and E&T constructions also **entail**:

(4) *Marja a pu traverser le lac à la nage, #mais elle ne l'a pas traversé.*
'Marja can-PFV swim across the lake, #but she didn't cross it.'

(5) *Juno a été assez rapide pour gagner la course, #mais elle n'a pas gagné.*
'Juno was-PFV fast enough to win the race, #but she did not win.'

- **proposal:** explain the convergence in entailments by assigning E&T constructions (Hacquard, 2005) and ability modals (Bhatt, 1999) the same complement-entailing lexical semantics as implicatives

¹The perfective is represented here by the French *passé composé*.

Problem: the inference patterns of constructions (I)-(III) only match under perfective marking

- E&T constructions, ability modals do not entail in the imperfective
 - (6) *Juno était assez rapide pour gagner la course, mais elle n'a jamais gagné.*
'Juno was-IMPF fast enough to win the race, but she never won.'
 - (7) *Marja pouvait traverser le lac à la nage, mais elle ne l'a jamais traversé.*
'Marja can-IMPF swim across the lake, but she never crossed it.'
- implicative entailments are unaffected by aspect
 - (8) *Juno a réussi à gagner la course, #mais elle n'a pas gagné.*
'Juno manage-PFV to win the race, #but she did not win.'
 - (9) *Juno réussissait à gagner la course, #mais elle n'a jamais gagné.*
'Juno manage-IMPF to win the race, #but she never won.'

	PFV	IMPF	Engl.
implicatives	⊢	⊢	⊢
E&T	⊢	↗	↗
ability modals	⊢	↗	↗

Table 1: Actuality inference patterns by aspect

2 Causal semantics for implicative verbs

Implicatives are characterized by their complement entailment pattern (Karttunen, 1971):

- (10) a. Solomon managed to build a temple. ⊢ *Solomon built a temple.*
- b. Solomon did not manage to build a temple. ⊢ *Solomon did not build a temple.*

The logical problem of implicatives: agent S , 1-place predicate A

- $manage(S, A)$ entails $A(S)$
- $\neg manage(S, A)$ entails $\neg A(S)$
- **but:** $manage(S, A)$ and $A(S)$ are not equivalent assertions

Basic solution: implicatives are associated with presuppositional content

- consequently, $manage(S, A)$ gives rise to implications that do not follow from $A(S)$ alone
 - (11) Solomon managed to build a temple.
 - a. \rightsquigarrow Solomon intended to build a temple.
 - b. \rightsquigarrow It was difficult/effortful for Solomon to build a temple.
 - c. \rightsquigarrow It was unlikely that Solomon would build a temple.

Necessary and sufficient conditions

- difficult to pin down *manage*'s presupposition (Coleman 1975, Karttunen & Peters 1979)
 - *intention, difficulty, unlikelihood* are candidates, but not universal (Baglini & Francez, 2016):
- (12)
- a. \neg Without intending to, Ms. Streisand actually managed to synthesize the problem of diversity mania. $\not\sim$ intention, $\not\sim$ difficulty, \sim unlikelihood
 - b. \neg By 1998, [...] gun manufacturers had easily managed to bypass the laws ... \sim intention, $\not\sim$ difficulty, ? \sim unlikelihood
 - c. \neg The Socialdemokratiet managed to strengthen their position as Denmark's strongest political force as expected ... \sim intention, ? \sim difficulty, $\not\sim$ unlikelihood
- however, English and Finnish have lexically-specific implicatives:
 - **dare**: the implicative complement required courage
- (13)
- a. She dared to open the door. \vdash *She opened the door.*
 - b. She did not dare to open the door. \vdash *She did not open the door.*
- Finnish **hennoa**(=*have.the.heart*): the complement required 'heart'
- (14)
- a. *Hän henno-i tappa-a kissa-n*
he.NOM have.the.heart-PST.3SG kill-INF cat-GEN/ACC
'He had the heart to kill the cat' \vdash *He killed the cat.*
 - b. *Hän e-i henno-nut tappa-a kissa-a.*
he.NOM NEG-3SG have.the.heart-PP.SG kill-INF cat-PART
'He did not have the heart to kill the cat.' \vdash *He did not kill the cat.*

Karttunen's proposal (1971; p.352):^a

"[L]et us ignore the individual differences among implicative verbs and try to state more precisely in what respect they are all alike. Let v stand for any implicative verb and S for the ... complement ... [I]n the representation of the main clause, $v(S)$ constitutes the central part of the proposition ... the semantic analysis of the whole sentence can be represented by the following schema."

(15) **Schema:**

- a. *presupposition*: $v(S)$ is a necessary and sufficient condition for S
- b. *proposition*: $v(S)$

^aThis proposal has largely been obscured due to the later Karttunen and Peters (1979) account on which *manage* provides no assertive content beyond that of its complement

Question: what constitutes the "central part of the proposition," $v(S)$?

- *dare, hennoa*: $v(S) \sim$ the lexically-specified prerequisite was met (Nadathur, 2016)
- (16)
- a. She dared to open the door, #but she didn't have the courage.
 - b. She didn't dare to open the door, #but she had the courage.

- *manage* is bleached by comparison, but the type of necessity/sufficiency is constrained:
 - e.g., backgrounding a deontically necessary/sufficient condition doesn't license *manage*

(17) a. *Context:* being 21 is legally necessary and legally sufficient for drinking alcohol in the United States. Amira turned 21 yesterday.

 b. ?Amira managed to drink alcohol.
 - we infer **circumstantial** conditions: e.g., that Amira has to overcome her aversion to alcohol, figure out where to buy it, ...
- **Baglini and Francez (2016)'s insight:** the relationship between *manage*'s presupposition and complement is about **causal dependence**

Proposal (Nadathur, 2019):

- (18) For implicative I , agent S , 1-place predicate A , and context c , the proposition $I(S, A)$:
- Presupposes:* The existence of a predicate H such that $H(S)$ is **causally necessary** for $A(S)$ in the utterance context. $H(S) \blacktriangleleft_c A(S)$
 - Asserts:* $H(S)$
 - Presupposes:* $H(S)$ is the only unmet causally necessary condition for $A(S)$ in context (so $H(S)$ is **causally sufficient** for $A(S)$ relative to c) $H(S) \blacktriangleright_c A(S)$

- causal dependencies are defined via Schulz (2011)'s **dynamics** for causal entailment
 - a dynamics D represents causal information in a discourse context, encodes which propositions are causally linked to others, and in what way
 - D can be updated, referenced, and manipulated by both at-issue and not-at-issue content

Implicatives unpacked:

- implicative entailments have **3 key components**
 - existence of a necessary and sufficient condition for the complement
 - the causal interpretation of necessity/sufficiency
 - an assertion that resolves the truth status of the necessary/sufficient condition

construction	semantic component			inference	
	<i>mod. flavour</i>	<i>presuppose</i>	<i>assert</i>	<i>pos</i>	<i>neg</i>
implicative	causal, circumstantial	$H(S) \blacktriangleleft_c A(S)$ $H(S) \blacktriangleright_c A(S)$	$H(S)$	$\vdash A(S)$	$\vdash \neg A(S)$

Table 2: The semantic components of polarity-preserving two-way implicativity

- **prediction:** E&T constructions will be implicative (complement-entailing) just in case all three conditions are met

Illustration: the modified Dreyfus scenario

(adapted from Baglini and Francez)

Suppose Dreyfus intends (INT) to spy for Germany:

- | | |
|--|--|
| (a) then he will collect secrets about the French army (SEC) | SEC = INT |
| (b) if he has the nerve (NRV) as well as the intention to spy, he will send out a message (MSG) to make contact | MSG = INT \wedge NRV |
| (c) if it so happens that a German is listening on that frequency (LST), and the message is not intercepted (BRK), he will establish a communications line (COM) | COM = MSG \wedge LST \wedge \neg BRK |
| (d) he will use this line to pass information to the Germans, thereby spying (SPY) | SPY = SEC \wedge COM |

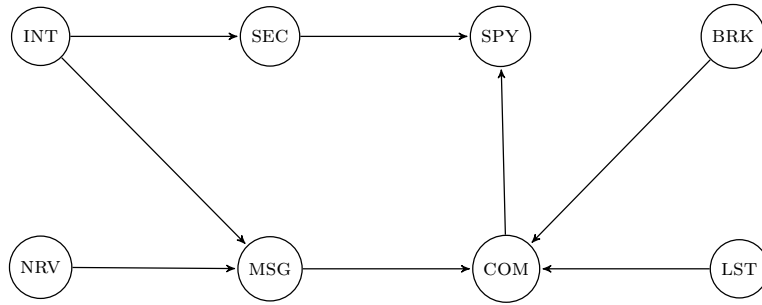


Figure 1: A dynamics for the Dreyfus example

Context 1: Dreyfus intends to spy, and has collected info INT = SEC = 1

- | | |
|---|--|
| (19) a. Dreyfus dared to send a message to the Germans. | \checkmark [NRV is nec, suff] |
| b. ?/#Dreyfus dared to make contact with the Germans. | \times [BRK, LST unresolved] |
| c. ?/#Dreyfus dared to spy for the Germans. | \times [BRK, LST, COM unresolved] |
| (20) a. Dreyfus managed to send a message to the Germans. | \checkmark [\sim NRV = 1] |
| b. Dreyfus managed to make contact with the Germans. | \checkmark [\sim NRV = 1, MSG = 1, LST = 1, BRK = 0] |
| c. Dreyfus managed to spy for the Germans. | \checkmark [\sim NRV = 1, MSG = 1, LST = 1, BRK = 0, COM = 1] |

Context 2: Dreyfus is very daring, but does not intend to spy. INT = 0, NRV = 1

- *dare* (19a-19c) is infelicitous; NRV is not sufficient in context
- *manage* (20a-20c) is infelicitous; given INT = 0, there can be no necessary/sufficient condition for MSG, COM, SPY

3 Variable implicativity in *enough* and *too* constructions

3.1 The semantic components of *enough* and *too* constructions

E&T constructions are modalized degree comparatives (Bierwisch, 1987; Meier, 2003; von Stechow et al., 2004; Schwarzschild, 2008):

- a real degree (e.g., Juno’s speed in the actual world) attributed to the subject (e.g., Juno) is measured against a modally-determined degree (e.g., the speed needed to win a salient race)
- components of the construction:
 - (a) gradable adjective (of variable type)
 - individual-level: *tall*; stage-level: *hungry*; actionable: *fast*
 - (b) complement proposition (for degree measurement/comparison)
 - (c) a comparative (and modal) operator: *enough*, *too*

The truth conditions we want can be paraphrased as follows:

- (21) a. Juno is fast enough to win the race.
Juno is as fast as she must be to make winning the race possible.
- b. Juno is too slow to win the race.
Juno is slower than she can be for winning the race to be possible.

Composition (see also von Stechow et al., 2004):

- gradable adjectives relate individuals to (downward-closed) sets of degrees on a scale

$$(22) \quad \llbracket \text{fast} \rrbracket^w := \lambda d \lambda x. \text{SPEED}(x)(w) \geq d$$

where $\text{ACT-}d = \{d : \text{SPEED}(x)(w) \geq d\}$

- *enough* is an equative (*as* ADJ *as*) with a universal modal:² it takes three arguments (an individual x , a predicate of individuals Q , and a gradable adjective P)

$$(23) \quad \llbracket \text{enough} \rrbracket^w := \lambda Q_{est} \lambda P_{dest} \lambda x_e$$

$$\quad \quad \quad \{ \{ d : \forall w' \in \text{ACC}(w) [Q(x)(w') \rightarrow P(d)(x)(w')] \} \subseteq \{ d : P(d)(x)(w) \} \}$$

- *true* if the set of degrees d s.t. x is at least d -ADJ in every $Q(x)$ -world is a subset of the set of degrees d s.t. x is at least d -ADJ in the evaluation world

Derivation: let w^* be the world of evaluation

- (24) a. $\llbracket \text{Juno be fast enough to win the race} \rrbracket^{w^*}$
 b. $\{ d : \forall w \in \text{ACC}(w^*) [\text{win}(j)(w) \rightarrow \text{SPEED}(j)(w) \geq d] \} \subseteq \{ d : \text{SPEED}(j)(w^*) \geq d \}$

²Its dual, *too*, is a comparative (*more* ADJ *than*) with an existential modal (von Stechow et al., 2004).

- the set MOD- d of degrees d s.t. Juno is at least d -fast in every world in $\text{ACC}(w^*)$ where she wins the race is a subset of the set ACT- d of degrees d s.t. Juno is at least d -fast in w^* .

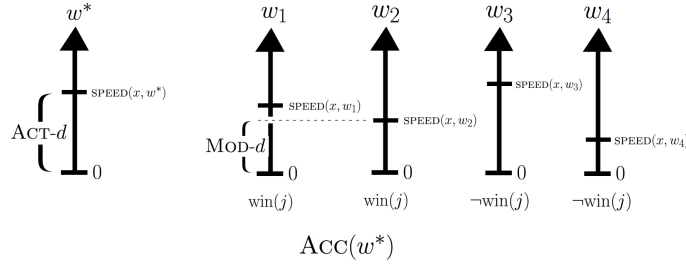


Figure 2: Representation of (24)

- equivalently: Juno's maximum degree of speed in w^* is greater than her maximum degree of speed in the slowest world where she wins the race (w_2)
- so: (24) is *true* if Juno's actual speed makes it possible for her to win (i.e., there is an accessible world where she wins with that speed or less)

This leads to a **necessity condition**:

- *enough* is infelicitous if its complement is impossible
- presuppose: there is at least one world in which, e.g., Juno wins the race

$$(25) \quad \exists w' \in \text{ACC}(w) : Q(x)(w') \quad [w_1, w_2 \text{ in Figure 2}]$$

- since she has a speed in every world, it follows that the set of degrees of Juno's speed in every world where she wins is not empty ...

$$(26) \quad \text{MOD-}d = \{d : \forall w' \in \text{ACC}(w)[Q(x)(w') \rightarrow (\text{ADJ}(x)(w') \geq d)]\} \neq \emptyset$$

- ... and that there is a minimum degree d_{nec} which makes Juno's win possible:

$$(27) \quad \exists d_{\text{nec}} : \forall w' \in \text{ACC}(w)[\neg(\text{ADJ}(x)(w') \geq d_{\text{nec}}) \rightarrow \neg Q(x)(w')]$$

On these semantics:

- like implicatives, E&T constructions:
 - presuppose a **necessary condition** (27) for their complements
 - assert that this **condition was satisfied**
- unlike implicatives, E&T constructions:
 - can vary in **modal flavour** (of the predicate-complement relationship)

(28) Amira was old enough to drink.

deontic

(29) Juno was tall enough to reach the branch.

circumstantial

(2) Juno was fast enough to win the race.

circumstantial

- **do not presuppose a sufficiency condition**

construction	semantic component			inference	
	<i>mod. flavour</i>	<i>presuppose</i>	<i>assert</i>	<i>pos</i>	<i>neg</i>
implicative	causal, circumstantial	$H(S) \triangleleft_c A(S)$ $H(S) \triangleright_c A(S)$	$H(S)$	$\vdash A(S)$	$\vdash \neg A(S)$
be ADJ enough	deontic	$d\text{-ADJ}(S) \triangleleft A(S)$	$d\text{-ADJ}(S)$	$\nVdash A(S)$	$\nVdash \neg A(S)$
	circumstantial	$d\text{-ADJ}(S) \triangleleft A(S)$	$d\text{-ADJ}(S)$	$\nVdash A(S)$	$\vdash \neg A(S)$

Table 3: Current predictions for E&T inferences

- **deontic E&T constructions:** Table 3 predictions upheld (no entailments)

- (30) a. Amira was old enough to drink, but she was a teetotaler.
 b. Amira was not old enough to drink, but she drank anyway.

– in the negative case (30b), a legally-necessary condition is not met, but the real world need not be one in which laws are obeyed

- **circumstantial E&T constructions:** predictions are not sufficiently fine-grained!

– when ADJ is a **static** property (e.g., *tall*), we only get a negative entailment, verifying the Table 3 predictions:

- (31) a. Nima was tall enough to reach the branch but he didn't even try.
 b. Nima was not tall enough to reach the branch, ?#but he reached it.

– when ADJ is **dynamic** (representing an actionable capacity; e.g., *fast*), neither positive or negative (English) E&T statements entail:

- (32) a. Juno was fast enough to win the race, but she didn't participate.
 b. Juno was not (really) fast enough to win the race, but the leader tripped on the last lap, making Juno the unexpected winner.

Two questions:

1. what is the (inference-relevant) difference between static properties and actionable capacities?
2. how do we avoid the unwanted negative entailment, but *only* for dynamic E&T constructions?

3.2 The sufficiency problem

Hacquard's generalization: perfective E&T constructions **entail** their complements

- (33) a. *Juno a été assez rapide pour gagner la course, #mais elle n'a pas gagné.*
 'Juno was-PFV fast enough to win the race, #but she did not win.'
 b. *Juno n'a été pas assez rapide pour gagner la course, #mais elle a gagné.*
 'Juno was-PFV not fast enough to win the race, #but she won.'

Contra Hacquard (2005), we **do not want to presuppose sufficiency** across the board:

(34) **Sufficiency condition** (for E&T constructions): (Hacquard, 2005)

$$\exists d_{\text{suff}} : \forall w' \in \text{ACC}(w)[(\text{ADJ}(x)(w') \geq d_{\text{suff}}) \rightarrow Q(x)(w')]$$

- setting $d_{\text{suff}} = d_{\text{nec}}$ to match the implicative presupposition, we get:

(35) **‘Implicative’ presupposition** (for E&T constructions):

$$id_{\text{NS}} : \forall w' \in \text{ACC}(w)[Q(x)(w') \leftrightarrow (\text{ADJ}(x)(w') \geq d_{\text{NS}})]$$

There is a unique degree d_{NS} of ADJ such that x is d_{NS} -ADJ in a world w if and only if x realizes Q in w

The implicative-style presupposition (35) is too strong:

- for circumstantial E&T constructions with static properties, it predicts a positive entailment: this prediction is not upheld even in the perfective

(36) *??Nima a été assez grand pour atteindre la branche, mais il ne l'a pas touché.*

‘Nima was-PFV tall enough to touch the branch, but he did not touch it.’

- (this is a new qualification to Hacquard’s generalization about perfective E&T)

- we get the right result (positive and negative entailments) for perfectly-marked E&T constructions with dynamic capacities, but in an **intuitively wrong** way:

(37) *Juno a été assez rapide pour gagner la course.*

⊢ Juno won the race.

‘Juno was-PFV fast enough to win the race.’

paraphrase, given (35): *Juno’s actual speed was at least as great as the speed that guarantees race-winning in all circumstantially-accessible worlds.*

- since the real world is circumstantially accessible to itself, Juno’s win is guaranteed by her speed in (37)

However ...

- *being d-fast* \sim having the *latent capacity* to do things at speed d
- the relationship between *being fast* and winning the race **is causal**, but only when the ‘fastness’ is **manifested in an action** (e.g., running)
- the ‘implicative’ presupposition (35) does not capture this

Making sense of these facts:

- static E&T and dynamic E&T constructions are differentiated **causally**
 - some causing action must take place in order for the complement to be realized
 - **dynamic capacities** (e.g., *be fast*) characterize the causing action: acting on the capacity brings about the E&T complement

- there is a sufficiency relationship between dynamic properties and E&T complements
 - then: agent S **instantiating** $d_{\text{nec}}\text{-ADJ}$ is *causally sufficient* for realizing $A(S)$
- (38) **Dynamic-capacity sufficiency:** $\text{INST}(\text{ADJ}(S)(d_{\text{nec}})) \blacktriangleright_c A(S)$

E&T assertions differ from implicative assertions even when ADJ is dynamic:

- implicatives assert the satisfaction of a necessary/sufficient condition
 - dynamic E&T constructions instead at-base assert only the *possibility* of satisfaction
- (39) $\text{ADJ}(S)(d_{\text{nec}})(w) \sim \diamond[\text{INST}(\text{ADJ}(S)(d_{\text{nec}})(w))]$

construction	<i>mod. flavour</i>	semantic component		inference	
		<i>presuppose</i>	<i>assert</i>	<i>pos</i>	<i>neg</i>
implicative	causal, circ.	$H(S) \blacktriangleleft_c A(S)$ $H(S) \blacktriangleright_c A(S)$	$H(S)$	$\vdash A(S)$	$\vdash \neg A(S)$
	deontic	$d\text{-ADJ}(S) \triangleleft A(S)$	$d\text{-ADJ}(S)$	$\nabla A(S)$	$\nabla \neg A(S)$
be ADJ enough	circ. static	$d\text{-ADJ}(S) \triangleleft A(S)$	$d\text{-ADJ}(S)$	$\nabla A(S)$	$\vdash \neg A(S)$
	circ. dynamic	$d\text{-ADJ}(S) \triangleleft A(S)$ $\text{INST}(d\text{-ADJ}(S)) \blacktriangleright_c A(S)$	$\diamond[\text{INST}(d\text{-ADJ}(S))]$?	?

Table 4: Updated predictions for E&T inferences

Given the components of actionable-capacity E&T inferences, we predict actuality inferences/entailments just in case instantiation of the dynamic property is implied/entailed.

- we need the perfective aspect to do this work
- to replace the question marks in Table 4 with the right aspect-governed facts:
 - we don’t need the perfective to *introduce* a sufficiency condition, since this is built into the structure of dynamic property E&T constructions
 - instead, perfective ‘peels off’ the possibility operator by forcing instantiation

Additional points:

- there are some additional conditions for ‘implicative’ readings of E&T constructions
 - e.g., there is a requirement of temporal overlap in the specification of the matrix attribution and the complement clause (Marques, 2012)
- these features support the claim that dynamic capacities and E&T complements have a causal relationship rather than a purely circumstantial one
- NB: the non-causal necessity relationship in Table 4 can be equivalently framed as causal necessity between an instantiation of the dynamic capacity and the realization of the E&T complement

4 Actuality inferences in E&T constructions

Proposal: implicative semantics of *enough* constructions

Let P be a proposition of the form $P = S$ be ADJ *enough* to A , where S is an agent, ADJ a relation between individuals and sets of degrees, and A a property of individuals. Evaluated with respect to a world w and context c :

- i. P presupposes the existence of a degree d_{nec} that is necessary for $A(S)$:
$$\exists d_{\text{nec}} : \forall w' \in \text{ACC}(w) [\neg(\text{ADJ}(S)(d_{\text{nec}})(w') \rightarrow \neg A(S)(w'))]$$
- ii. P asserts that S is/has d_{nec} -ADJ in w : $\text{ADJ}(S)(d_{\text{nec}})(w)$
- iii. In case ADJ is dynamic, P additionally presupposes the contextual causal sufficiency of an instantiation of d_{nec} -ADJ for $A(S)$: $\text{INST}(\text{ADJ}(S)(d_{\text{nec}})) \blacktriangleright_c A(S)$

4.1 Aspect-governed actuality inferences

Dynamic E&T constructions align almost exactly with implicatives:

- presuppose the existence of a causally necessary/sufficient condition for their complements
- however, they at-base assert only the possibility that this condition will be satisfied:
 - if the assertion is interpreted eventively, as an instantiation, actuality inferences arise
 - if it is interpreted statively, as a (latent) capacity attribution, no actuality inferences

English E&T actuality inferences:

- English actionable-capacity attributions are **systematically ambiguous**:
 - (40) Juno was loud.
 - a. *eventive*: Juno did (something) loud/loudly.
 - b. *stative*: Juno had the capacity do (something) loud/loudly.
 - (41) Juno was fast enough to win the race.
 - a. *eventive*: Juno ran at a speed of at least d_{nec}
 - b. *stative*: Juno can run at a speed of at least d_{nec}

- contexts that privilege eventive readings activate sufficiency, producing actuality inferences:
 - (42) I didn't know Juno was a runner, but I saw her at the 5K yesterday! She was fast enough to win! \rightsquigarrow *Juno won the race.*

- English actuality inferences are defeasible because nothing fixes/entails eventive interpretation

French actuality entailments:

- aspectual marking forces a choice between eventive and stative readings, perfective aspect (in general) selects for eventive predicates (Dowty, 1986)
- PFV combines with statives via **aspectual coercion** (Moens & Steedman 1988, de Swart 1998)

- dynamic capacities lend themselves to **instantiative** coercion (cf. Homer, 2011):³

(43) *Juno a été rapide.* → *Juno did something quickly.*
‘Juno was-PFV fast.’
- **instantiative coercion** picks out predicates whose stative interpretation is inherently action-oriented or action-characterizing (also applies under progressive marking)

(44) Nima was being funny. → *Nima was doing something funny*
- **as a result**, perfectly-marked dynamic E&T assertions are effectively implicative:
 - PFV entails satisfaction of the causally-sufficient condition for the E&T complement

(33) *Juno a été assez rapide pour gagner la course.* ⊢ *Juno won the race.*
‘Juno was-PFV fast enough to win the race.’

a. *entails*: INST(SPEED(*j*)(*d*_{nec})) sufficient for win
b. *interpretation*: Juno ran at a speed of at least *d*_{nec} (and that caused her to win the race).
- **by contrast**: IMPF selects for the stative interpretation, so we correctly predict no entailment

(45) *Juno était assez rapide pour gagner la course ...*
‘Juno was-IMPF fast enough to win the race, ...’ ...but she did not participate.
...but something unexpected always happened, and she never won.

Getting around necessity:

- due to the across-the-board necessity presupposition, we predict entailments in the negative direction for *all* circumstantial E&T constructions
- negated dynamic E&T constructions **do not entail** under the imperfective:

(46) *Juno n’était pas assez rapide pour gagner la course, mais elle a gagné.*
‘Juno was-IMPF not fast enough to win the race, but she won.’
- following Bhatt (1999), Hacquard (2005): the imperfective is associated with a genericity operator,⁴ which quantifies only over *normal* worlds:

(47) a. $\llbracket \text{GEN} \rrbracket^w := \lambda Q_{st} [\forall w' \in \text{NORM}(w) [Q(w')]]$
b. GEN(Juno not be fast enough to win the race)
 $\forall w \in \text{NORM}(w^*) [(\exists d_{nec} : \neg(\text{SPEED}(j)(w) \geq d_{nec}) \rightarrow \neg \text{win}(j)(w)) [\text{SPEED}(j)(w) < d_{nec}]$
In all normal worlds where there is a necessary speed for winning the race, Juno does not have this speed.
- the real world need not be normal:

(48) *Juno n’était pas assez rapide pour gagner la course, ...*
‘Juno was-IMPF not fast enough to win the race, ...’
...but the leader tripped on the last lap, leaving Juno in first place.

³Homer (2011) proposes an operation of ‘actualistic’ coercion, which he uses to directly instantiate the complements of ability modals in perfective; I believe the relevant coercion operation is more constrained in output than Homer’s.

⁴Alternatively, we can appeal to an independently-motivated **habitual** coercion operator, and avoid introducing an additional layer of quantification: see Nadathur (2019).

construction	mod. flavour	semantic component		inference	
		presuppose	assert	pos	neg
implicative	causal, circ.	$H(S) \triangleleft_c A(S)$ $H(S) \triangleright_c A(S)$	$H(S)$	$\vdash A(S)$	$\vdash \neg A(S)$
be ADJ enough	deontic	$d\text{-ADJ}(S) \triangleleft A(S)$	$d\text{-ADJ}(S)$	$\nabla A(S)$	$\nabla \neg A(S)$
	circ. static	$d\text{-ADJ}(S) \triangleleft A(S)$	$d\text{-ADJ}(S)$	$\nabla A(S)$	$\vdash \neg A(S)$
	circ. dynamic	$d\text{-ADJ}(S) \triangleleft A(S)$ $\text{INST}(d\text{-ADJ}(S)) \triangleright_c A(S)$	$\diamond[\text{INST}(d\text{-ADJ}(S))]$ $\text{INST}(d\text{-ADJ}(S))$	Eng/IMPF $\rightsquigarrow A(S)$ PFV $\vdash A(S)$	Eng/IMPF $\rightsquigarrow \neg A(S)$ PFV $\vdash \neg A(S)$

Table 5: Semantic components of implicativity

4.2 Differences between implicatives and E&T inferences

Question: Why do the inference patterns of implicatives and E&T constructions differ?

- implicative entailments are built into implicative lexical semantics
- E&T entailments arise compositionally, from a combination of aspect and ADJ type

- generally, E&T constructions presuppose only a necessary condition for their complements
- in the special case of dynamic E&T constructions, which involve causality, necessity, and sufficiency, implicatives and E&T constructions differ in asserted content:
 - implicatives always assert that their preconditions are satisfied (eventive)
 - E&T constructions only assert the possibility of satisfaction (at base stative)

The differences show up in inference patterns under imperfective aspect (and in English):

- in the imperfective, a generic interpretation of an eventive implicative assertion yields regular instances of a particular event, repeated over a period of time:

(49) *Juno réussissait à gagner la course.*
‘Juno managed-IMPF to win the race.’
Over some past time period, Juno habitually/regularly managed to win a (salient) race.

- this requires actual events in which *managing* took place, therefore requiring actual events in which Juno won the relevant race.

(9) *Juno réussissait à gagner la course, #mais elle n’a jamais gagné.*
‘Juno managed-IMPF to win the race, #but she never won.’

- on the other hand, the generic interpretation of an actionable-capacity E&T construction is simply interpreted as the attribution of a latent capacity:

(45) *Juno était assez rapide pour gagner la course, mais elle n’a jamais gagné.*
‘Juno was-IMPF fast enough to win the race, but she never won.’

- no event of being $d_{\text{nec-fast}}$ (at race time) is entailed; her speed might have been measured or evidenced another way

5 Summary and consequences for ability predicates

Recap: E&T complement inferences are sensitive to aspect; implicative entailments are not

- the lexical semantics of implicatives establishes three components for entailment:
 - (a) a presupposed necessary and sufficient condition for the complement
 - (b) causal dependence of the complement on this condition
 - (c) the assertion that the condition was met (eventive)
- across the board, E&T constructions presuppose a necessary condition for their complements
 - the asserted content and inference patterns vary according to modal flavour, ADJ type
 - the representation of dynamic capacities incorporates causal sufficiency
 - dynamic capacity attributions are at base stative, but can be coerced (by PFV) into eventive readings

Big picture: ability modals pattern with dynamic capacity E&T constructions

- (4) *Marja a pu traverser le lac à la nage, #mais elle ne l'a pas traverse.*
'Marja can-PFV swim across the lake, #but she didn't cross it.'
- (7) *Marja pouvait traverser le lac à la nage, mais elle ne l'a jamais traverse.*
'Marja can-IMPF swim across the lake, but she never crossed it.'

- Bhatt (1999)'s original proposal was to treat ability modals as implicatives (as *manage*)
- we have seen why the 'full' implicative route will not work
- understanding the components of implicativity helps make sense of the E&T patterns
- **next step:** represent abilities in the same way – as potentials for a causing action with the result specified in the modal complement (or, as **hypothetical guarantees**)

Proposal (Nadathur, 2019): the 'implicative' account of ABLE.

Let P be a proposition of the form $P = S \text{ ABLE } A$, where S is an individual, A a 1-place predicate. Evaluated with respect to a world w , context c , dynamics \mathcal{D} :

- i. P presupposes the existence of an action H for S such that $H(S)$ is **causally necessary** for $A(S)$: $\exists H(S) : H(S) \blacktriangleleft_c A(S)$
- ii. P asserts that S has the capacity for H in w : $\diamond H(S)(w)$
- iii. P presupposes the **causal sufficiency** of $H(S)$ for $A(S)$: $H(S) \blacktriangleright_c A(S)$

- based on their logical properties, there are independent reasons to believe that ability modals have internal structure that pure circumstantial modals lack (Kenny, 1976, a.o.)

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