Causal dependence in actuality inferences: the implicativity of *enough/too* predicates

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Causal reasoning and causal language

'Practical' causal intuitions vs. linguistic causation

- causal reasoning draws on complex networks of relationships: **causal models**
- linguistic causation: typically binary *cause-effect* relations

An alternative: causal models as discourse parameters

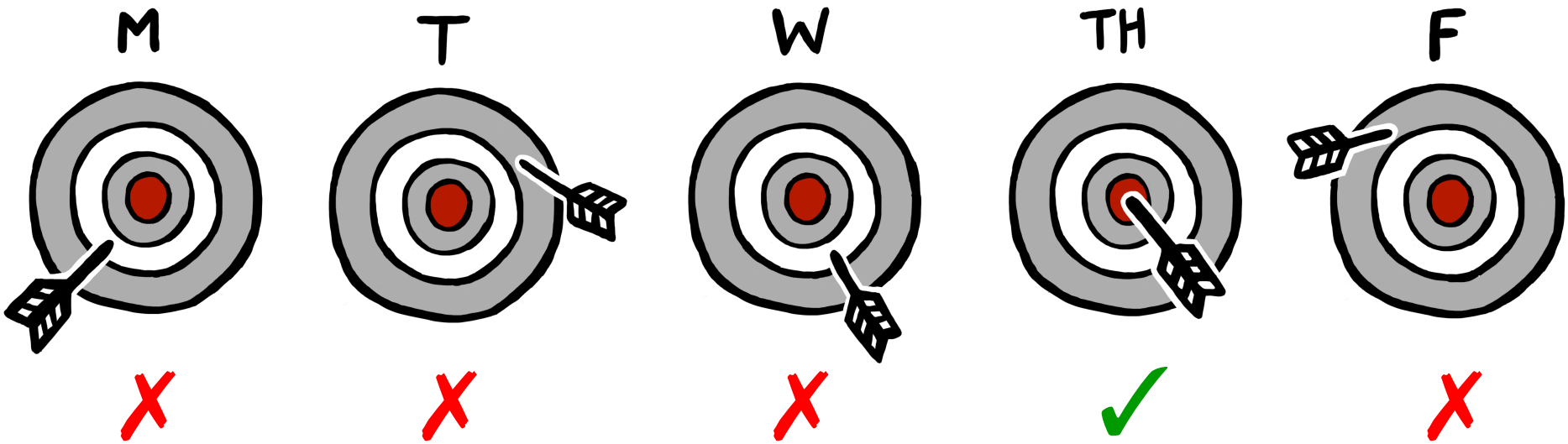
- causal language describes structures in an online language-independent representation
- discourse contributions interact (in familiar ways) with such representations
- model relationships can explicate linguistic effects

(Nadathur & Lauer 2020, Baglini & Bar-Asher Siegal 2021, a.o.)

Today: use this approach to shed light on a longstanding semantic puzzle

A longstanding puzzle: two kinds of ability?

Tara's typical college week at the dartboard:



(1) In college, Tara **was able** to hit the bullseye.

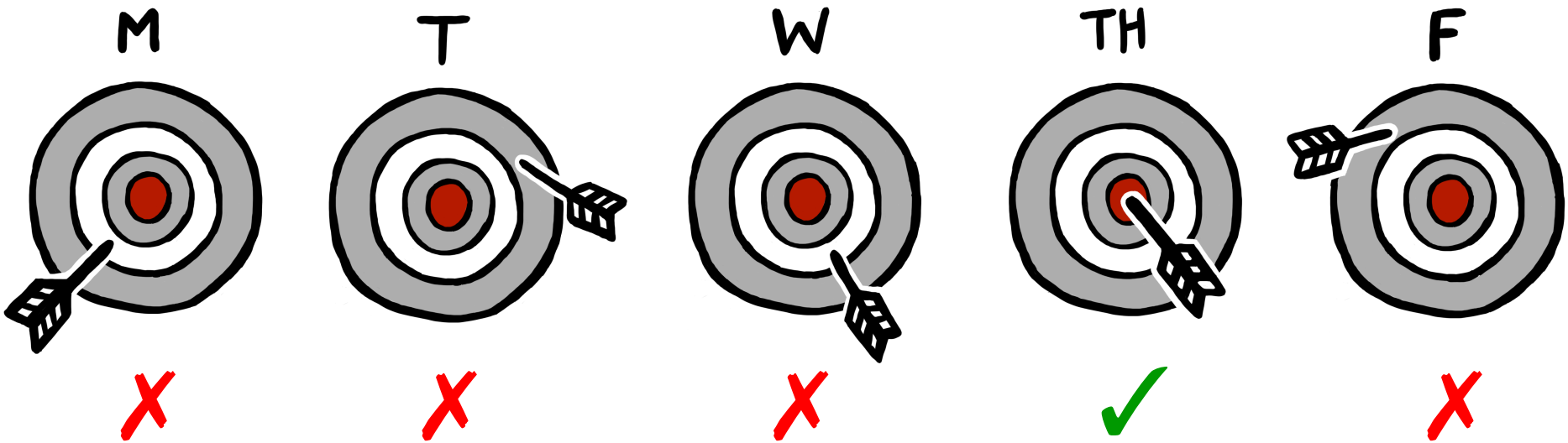
FALSE

She might do it once in a while, but she doesn't really *have this ability*

(loosely based on Thalberg 1972)

A longstanding puzzle: two kinds of ability?

Tara's last week at the dartboard:



(2) On Thursday, Tara **was able** to hit the bullseye.

TRUE

She doesn't do it regularly, but she *actually did* it on Thursday.

(loosely based on Thalberg 1972)

Actuality inferences: two kinds of ability?

Ability modals (e.g., Hindi *saknaa*) in aspect-marking languages: (Bhatt 1999)

- **imperfective** aspect has the **pure ability** reading

(3) Yusuf havaii-jahaaz uɽaa **sak-taa** thaa, lekin us-ne
Yusuf air-ship fly can-IMPF.M PST, but 3SG-ERG
havaii-jahaaz kabhii nahĩĩ uɽaa-yaa.
air-ship sometime NEG fly-PFV.M
'Yusuf could fly planes, but he never flew a plane.'

- **perfective** aspect gives rise to an **actuality entailment**

(4) Yusuf havaii-jahaaz uɽaa **sak-aa**, #lekin us-ne
Yusuf air-ship fly can-PFV.M, #but 3SG-ERG
havaii-jahaaz nahĩĩ uɽaa-yaa.
air-ship NEG fly-PFV.M
'Yusuf could fly the plane, #but he didn't fly the plane.'

(also in French, Greek, Russian, . . .)

The problem of actuality

1. **The problem of ability**
   'Ambiguity' is systematic across languages, ability predicates (ability modals, English *be able*, Spanish *ser capaz*, . . .)

2. **The problem of modality**
   Actuality seems to erase the modality (possibility) of ability readings

3. **The problem of aspect**
   No obvious reason why temporal information or 'viewpoint' aspect should have an actualizing effect

Goal: A univocal treatment of ability attributions that derives the distribution of pure ability and actuality

A starting point: implicative *manage*

Observation: **actualized ability** is closer to **managed** than to *did* (Bhatt 1999)

(5) Yusuf havaii-jahaaz uṛaa **sak-aa**.
Yusuf air-ship fly can-PFV.M
'Yusuf could fly the plane.'
≡ Yusuf **managed** to fly the plane.

Actualized ability in French (*pouvoir*) is the same: (Hacquard 2006)

(6) Marja **a pu** traverser le lac à la nage.
'Marja could-PFV swim across the lake.'
≡ Marja **managed** to swim across the lake.

A starting point: implicative *manage*

Manage shares complement entailments with **actualized ability**

Hindi:

(3) Yusuf havaii-jahaaz uɽaa **sak-aa**, #lekin us-ne havaii-jahaaz
Yusuf air-ship fly can-PFV.M, #but 3SG-ERG air-ship
nahĩĩ uɽaa-yaa.
NEG fly-PFV.M
'Yusuf could fly the plane, #but he didn't fly the plane.'

(7) Yusuf **managed** to fly the plane, #but he didn't fly the plane.

French:

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

(9) Marja **managed** to swim across the lake, #but she did not cross it.

A starting point: implicative *manage*

Manage and **actualized ability** share something more:

(10) a. Mika **was able** to breathe normally.
b. Mika **managed** to breathe normally.

$\rightsquigarrow$ *breathing normally was . . . unexpected? abnormal? unlikely?*

Something more **projects** through negation:

(11) a. Mika **was not able** to breathe normally.
b. Mika **did not manage** to breathe normally.

$\rightsquigarrow$ *breathing normally was . . . unexpected? abnormal? unlikely?*

Actuality as implicativity?

Bhatt's hypothesis: ABLE ≡ *manage*

- **but:** no **pure ability** reading for **manage**

  (12) In college, Tara **managed** to hit the bullseye. ∼ *did* + non-triviality

- even with aspectual modification (French *réussir*)

  (13) Marja **{réussissait / a réussi}** à traverser le lac à la nage,
  #mais elle n'a pas traversé.
  'Marja {managed-IMPF / managed-PFV} to swim across the lake,
  #but she did not cross it.'

If actuality entailments are implicative entailments:
the equivalence is analytical, not lexical (ABLE ≢ *manage*)

From implicativity to actuality: overview

New goal: a unified semantic treatment of implicative and actuality inferences

What we need to get there:

- an account of the (lexical) semantic basis of implicative inferences
- a way to take apart and identify the same components (+ sources of variability!) in the ability-aspect interaction

Key addition: a role for **causal reasoning**

- *manage*, ability make reference to the *causal background*

(on which their complements depend)

Outline of the talk

1. Introduction
2. Implicatives and causal inference
3. From implicativity to actuality inferences: the case of *enough* (and *too*)
4. Aspect and actuality inferences
5. Summary and conclusions

Outline of the talk

The facts about *manage*

(A) Two-way pattern of **complement entailment:**

(14) a. Eman **managed** to solve the riddle. → *Eman solved the riddle*

b. Eman **did not manage** to solve the riddle.
→ *Eman did not solve the riddle*

(B) **Projective inference:**

(14a-b) ⇝ *Solving the riddle was (somehow) non-trivial*

(15) Eman solved the riddle. *(no inference)*

What semantic components produce this inference pattern?

(**assumption:** shared with actualized ability)

The presupposition(s) of *manage*

What **manage** projects is surprisingly **hard to pin down:**

(Coleman 1975, Karttunen & Peters 1979, Baglini & Francez 2016, a.o.)

- common proposals like *intention, difficulty, unlikeliness* aren't universal

(16) a. **Without intending to,** Ms. Streisand [. . .] **managed** to synthesize the problem [. . .]
$\not\rightsquigarrow$ intention, $\not\rightsquigarrow$ difficulty, $\rightsquigarrow$ unlikelihood

b. By 1998, [. . .] gun manufacturers had **easily managed** to bypass the laws by making small alterations [. . .]
$\rightsquigarrow$ intention, $\not\rightsquigarrow$ difficulty, ? $\rightsquigarrow$ unlikelihood

c. The Socialdemokratiet **managed** to strengthen their position as Denmark's strongest political force **as expected** [. . .]
$\rightsquigarrow$ intention, ? $\rightsquigarrow$ difficulty, $\not\rightsquigarrow$ unlikelihood

What do these inferences have in common?

Managing and *doing*

What do *intention, difficulty, unlikeliness* **inferences share?**

Reasoning about **non-triviality:**

- P is non-trivial if you can't **just** do P
- something additional (and prior) is **required** in order to do P
  (alternatively: some obstacle must be overcome *en route* to P) (Karttunen 2014)

Manage to P presupposes the existence of a **causal prerequisite** for P

Implicative presuppositions

Most implicatives characterize their prerequisites:

(18) **English dare:** *boldness, courage*

a. Ria dared to open the door. → *Ria opened the door*

b. Ria did not dare to open the door. → *Ria did not open the door*

↝ *Opening the door required Ria to act bravely*

(19) **Finnish hennoa:** *emotional fortitude, hard-heartedness, ruthlessness*

a. Sampo henno-i tappa-a kissa-n.
Sampo have.heart-PST.3SG kill-INF cat-GEN/ACC
'Sampo had the heart to kill the cat. → *Sampo killed the cat*

b. Sampo e-i henno-nut tappa-a kissa-a.
Sampo NEG-3SG have.heart-PP.SG kill-INF cat-PART
'Sampo didn't have the heart to kill the cat.'
→ *Sampo didn't kill the cat*

↝ *Killing the cat required Sampo to be ruthless*

The implicative semantic template

1. **Prerequisite relevance is presupposed** (projective, not at issue)

   (18) Ria { dared / did not dare } to open the door.
   $\rightsquigarrow$ *Opening the door required Ria to act bravely*

2. **Assertion resolves prerequisite status** (at issue)

   (18) a. Ria dared to open the door. $\rightarrow$ *Ria acted bravely*
   b. Ria did not dare to open the door. $\rightarrow$ *Ria did not act bravely*

3. **Complement entailments are derived as causal consequences**

   (18a) $\sim$ *Ria's bravery resulted in her opening the door* sufficiency
   (18b) $\sim$ *Ria's lack of bravery stopped her opening the door* necessity

The implications of *manage*

Manage follows the same template:

- **causal necessity** and **causal sufficiency** derive complement entailments
- underspecification of the **causal prerequisite** captures **non-triviality**

Causal background knowledge fills in details:

(19) Nur **managed** to meditate yesterday.

- *Context.* Nur is extremely busy with work lately
  $\rightsquigarrow$ *Finding/making time was required* (Finnish *joutaa*)
  (19) $\rightarrow$ Nur made the time (and consequently meditated)

- **similarly:** patience (Finnish *malttaa*), strength (*mahtua*), warmth (*tarjeta*)

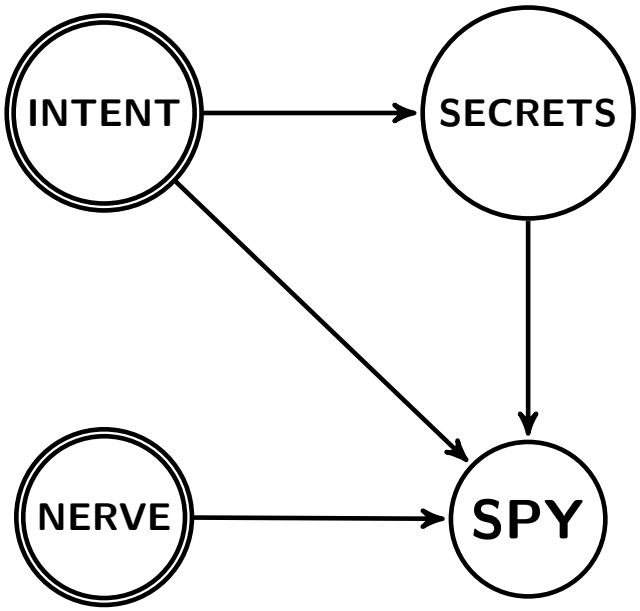
Causal network models (Pearl 2000)

Background. Captain Dreyfus was wrongly accused of spying for the Germans.

Relevant causal dependencies:

1. Collecting secrets requires treasonous intent
2. Spying (sharing secrets) requires treasonous intent, secret collection, risk-taking

A causal model for the Dreyfus affair: (finite graph + structural equations)

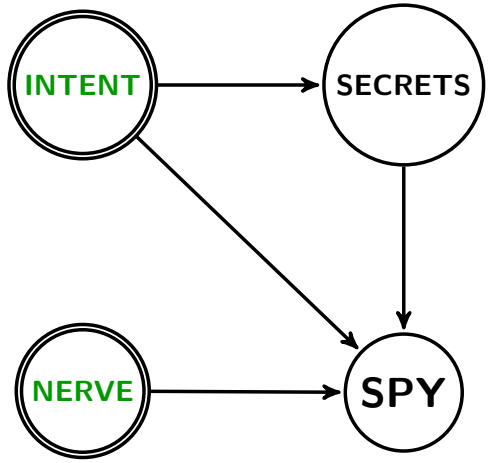


1. **SECRETS** := **INTENT**
2. **SPY** := **INTENT** $\wedge$ **SECRETS** $\wedge$ **NERVE**

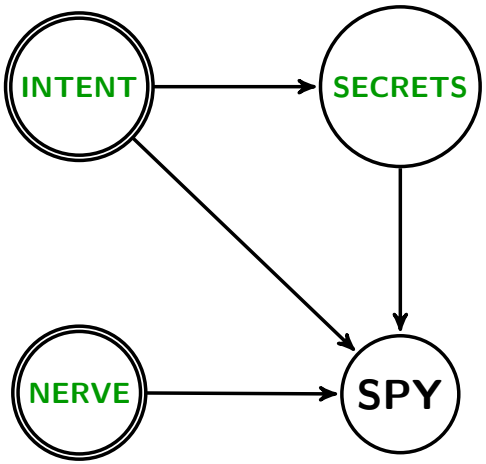
Reasoning with causal models

Use background information to reason out causal consequences:

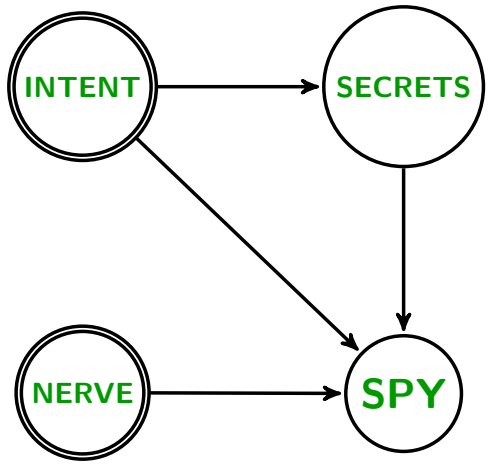
If **INTENT**, **NERVE** are **on**:



INTENT turns **SECRETS** **on**:



Which turns **SPY** **on** in turn:

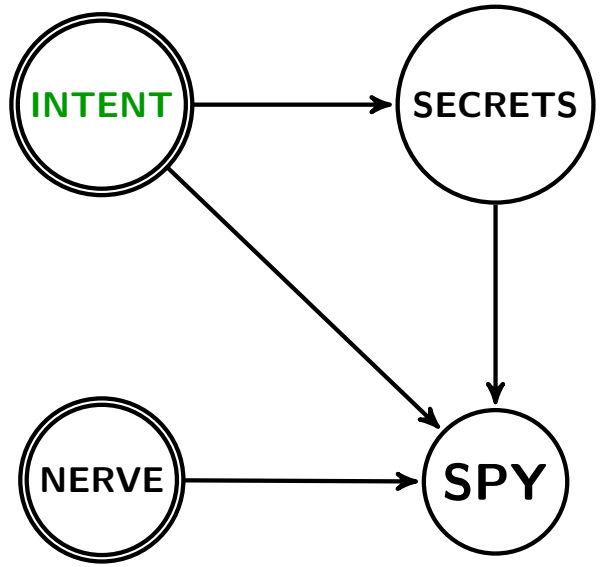


Causal dependence relations

Causal necessity, sufficiency are labels for different structural configurations:

- given a background situation s, a cause C is **causally necessary** for an effect E iff there's no (consistent) path from s to E which does not flip C

If we know that **INTENT** is **on**,
NERVE is **necessary** for **SPY**



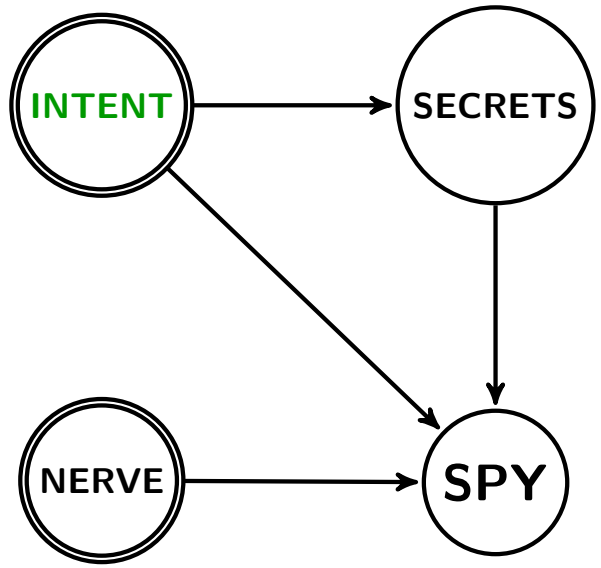
1. **SECRETS** := **INTENT**
2. **SPY** := **INTENT** $\wedge$ **SECRETS** $\wedge$ **NERVE**

Causal dependence relations

Causal necessity, sufficiency are labels for different structural configurations:

- given a background situation s, a cause C is **causally sufficient** for an effect E iff adding C to s guarantees E

If **INTENT** is **on**,
NERVE is **sufficient** for **SPY**



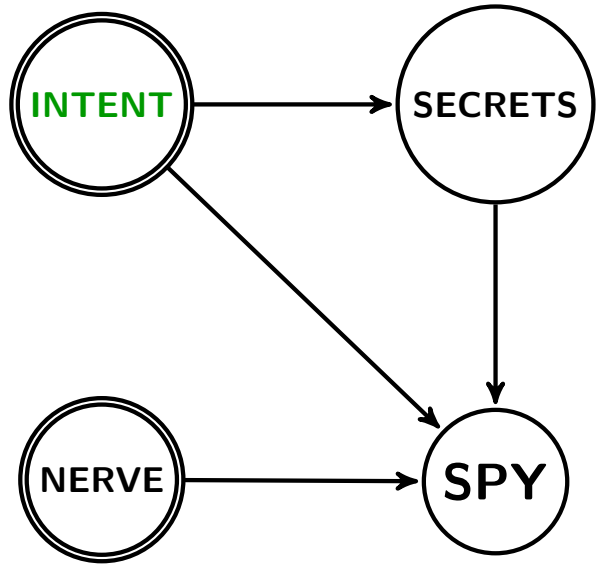
1. **SECRETS** := **INTENT**
2. **SPY** := **INTENT** $\wedge$ **SECRETS** $\wedge$ **NERVE**

Causal dependence relations

Causal necessity, sufficiency are labels for different structural configurations:

- given a background situation c, a cause C is **causally sufficient** for an effect E iff adding C to c guarantees E

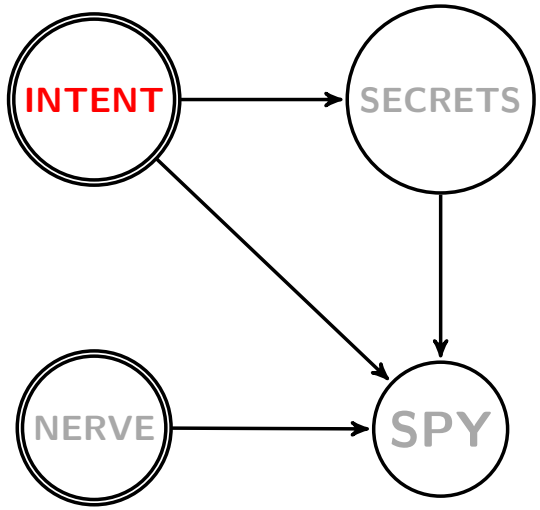
If **INTENT** is **on**,
NERVE is **sufficient** for **SPY**



This is the right kind of context for **dare**:

(20) a. Dreyfus **dared** to spy for the Germans.
b. Dreyfus did not **dare** to spy for the Germans.

Implicatives and causal dependence



In actuality, Dreyfus was loyal to France:

(20) ??Dreyfus **dared** to spy.

requires: **NERVE** is causally necessary, sufficient for **SPY**

in context: NERVE is insufficient

(21) ??Dreyfus **managed** to spy.

requires: condition/s jointly causally necessary, sufficient for **SPY**

in context: no set of sufficient conditions

Interim summary: unpacking implicativity

Three key components work together to derive **implicative inferences:**

1. **presupposition:**
   the existence of an unresolved **jointly necessary & sufficient condition** (or set thereof) for the complement
2. **assertion:**
   determines the truth value of the **necessary & sufficient condition**
3. **modal flavour:**
   necessity & sufficiency are **causal**

If actuality entailments are (analytically) implicative:

- the components emerge compositionally for **actualized ability**

$$\text{ABLE} + \text{PFV} \equiv \textbf{manage}$$

- we need a way to look 'inside' ability: *enough/too* constructions

Outline of the talk

Enough predicates

Enough (and *too*) constructions **license inferences in the implicative pattern:**

(22) a. Juno **was fast enough** to win the race. $\rightsquigarrow$ *Juno won the race.*

b. Juno **was not fast enough** to win the race.
$\rightarrow$ *Juno did not win the race.*

(23) a. Ria **was brave enough** to open the door. $\rightsquigarrow$ *Ria opened the door*

b. Ria **was not brave enough** to open the door.
$\rightarrow$ *Ria did not open the door*

Compare **be brave enough** to **dare**

(24) a. Ria **dared** to open the door. $\rightarrow$ *Ria opened the door*

b. Ria **did not dare** to open the door. $\rightarrow$ *Ria did not open the door*

Enough and actuality

Enough actuality inferences are **aspect sensitive** (Hacquard 2005)

- **actuality entailments** with perfective:

  (25) 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 didn't win.'

- **ability/capacity** reading with imperfective

  (26) 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.

(compare with French ability modal *pouvoir* under aspectual modification)

Enough/too predicates: the basics

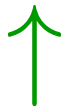
Enough constructions attribute **specific abilities:**

(27) Juno **is fast enough** to win the race.
$\sim$ *Juno can win the race, in view of her speed*

The ability attribution breaks into (variable) components:

Juno was **fast** **enough** **to win the race.**

gradable ADJ
(individual properties)



comparative operator

infinitival complement
(purpose or goal)

Paraphrase:

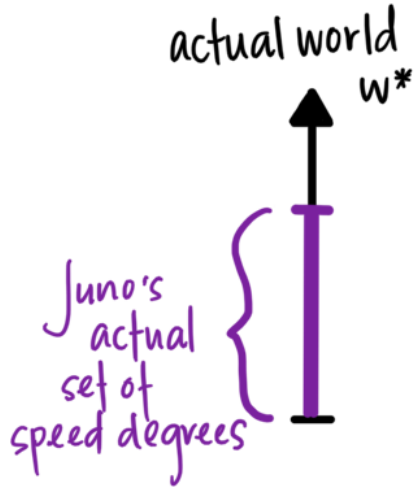
Juno's actual speed is as great as it needs to be in order for her to win the race
$\sim$ *Juno's actual speed makes it possible that she wins the race*

Composition: (modalized) degree comparison

- **matrix adjective** picks out an individual's allotment of some property (in sets of degrees)

(28) Juno is *d*-fast
$\sim$ *Juno has at least degree d of speed*

$[\![\text{fast}]\!] := \lambda w \lambda d \lambda x.\text{speed}(x)(w) \geq d$



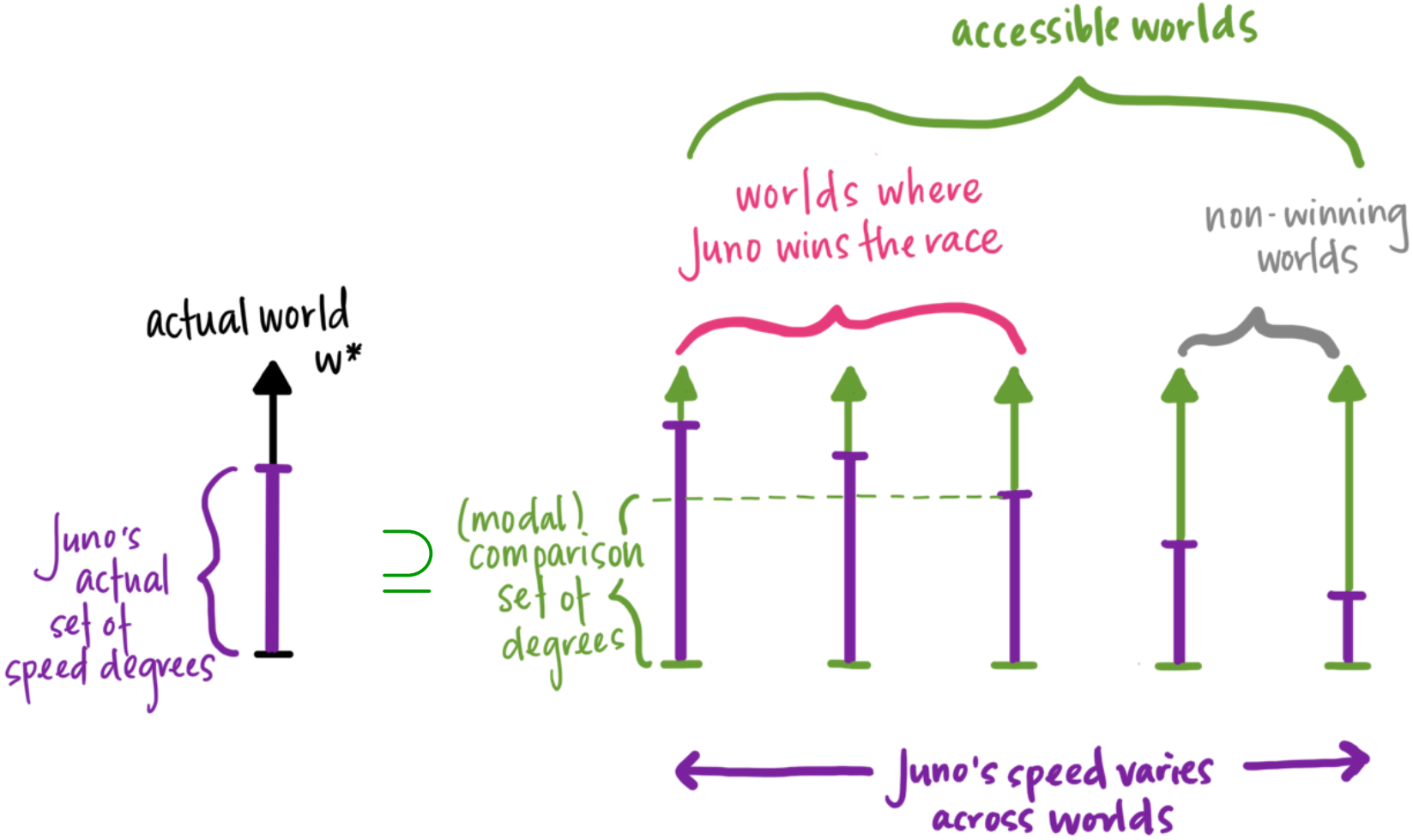
- **enough** compares an actual degree allocation to the allocation in worlds where the complement is realized (von Stechow et al 2004)

(29) Juno is ADJ enough to *P*
$\sim$ *Juno's actual* ADJ *allocation is at least as big as the smallest allocation compatible with P*

$[\![\text{enough}]\!] := \lambda w \lambda P \lambda A \lambda x.$
$\{d : A(d)(x)(w)\} \supseteq \{d : \forall w' \in \text{ACC}(w)[P(x)(w') \rightarrow A(d)(x)(w')]\}$

Composition

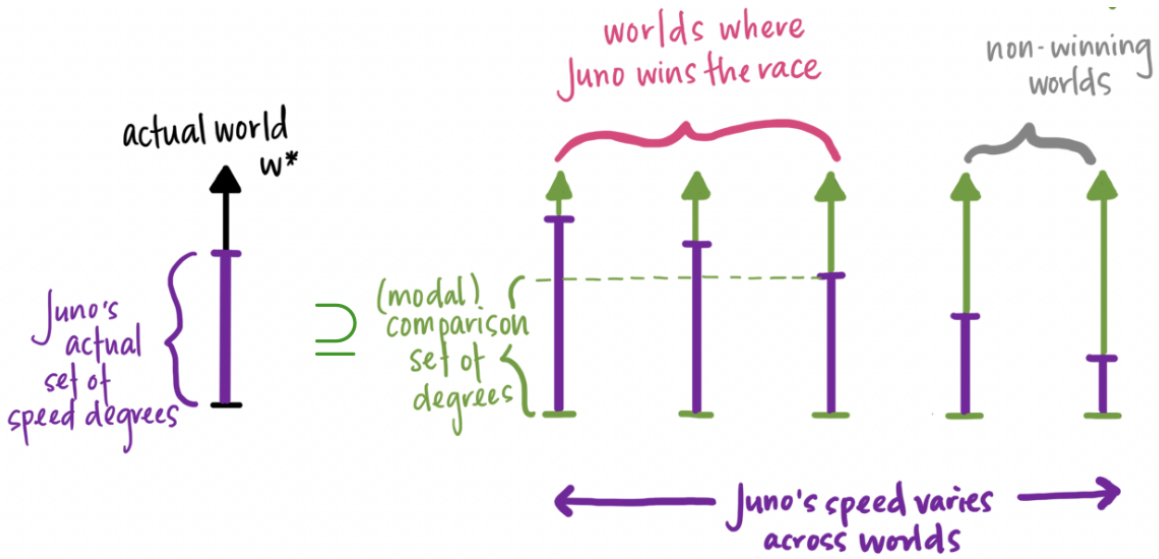
$[\![\text{Juno is fast enough to win the race}]\!]^{w^*} =$



$$\{d : \text{speed}(J)(w^*) \geq d\} \quad \supseteq \quad \{d : \forall w \in \text{ACC}(w^*)\,[\text{win}(J)(w) \rightarrow \text{speed}(J)(w) \geq d]\}$$

Enough and necessity

(27) Juno is fast enough to win the race.



- **result:** Juno's actual (max) speed $\geq$ Juno's max speed in slowest win world

Main takeaway: *enough* builds in a **necessity condition**

(27) $\equiv$ Juno's actual speed $\geq d_{\text{n}}$

where d_{n} is the **minimum speed required for Juno to win the race**

$$\iota d_{\text{n}} : \forall w \in \text{ACC}(w^*)[\text{speed}(J)(w) < d_{\text{n}} \rightarrow \neg\text{win}(J)(w)]$$

Enough predicates in the implicative perspective

Like lexical implicatives (e.g., *dare*):

1. (a) *Enough* predicates **presuppose necessity**

   a minimum degree d_n of ADJ is required to realize the complement

   $$\iota d_n : \forall w \in \text{ACC}(w^*)[\text{ADJ}(x)(w) < d_n \rightarrow \neg P(x)(w)]$$

2. *Enough* predicates **assert satisfaction of the prerequisite**

   the sentence subject actually has at least degree d_n of ADJ

   $$\text{ADJ}(x)(w^*) \geq d_n$$

Table: Components of implicativity

	presupposition	*assertion*	*modal flavour*
dare	bravery nec & suff	✓bravery	causal

Enough predicates in the implicative perspective

Unlike lexical implicatives:

1. (b) *Enough* predicates **don't presuppose sufficiency**

   missing: having degree d_n of ADJ guarantees the complement

   $$\forall w \in \text{ACC}(w^*)[\text{ADJ}(x)(w) \geq d_n \rightarrow P(x)(w)]$$

3. *Enough* constructions **vary the modal flavour** of necessity

   (22a) Juno was fast enough to win the race **circumstantial** necessity

   Calculate d_n using worlds where most circumstances are the same and Juno wins the race

   (30) Amira was old enough to drink alcohol. **deontic** necessity

   Calculate d_n using worlds where Amira drinks legally

Correct prediction: no implicative inferences in cases like (30)

Circumstantial *enough* and actuality inferences

Actuality inferences arise with circumstantial *enough*:

(22) a. Juno **was fast enough** to win the race. $\rightsquigarrow$ *Juno won the race.*

b. Juno **was not fast enough** to win the race. $\rightarrow$ *Juno did not win the race.*

- we predict the **necessity-based inference** in (22b) ✓
- **absent sufficiency,** no **actuality entailment** for (22a)
  ✓ for English, under imperfective in French
- **but:** perfective *enough* has an **actuality entailment** ✗

(25) 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 didn't win.'

⚠ **Implicative approach:** we need **perfective** to **introduce sufficiency**

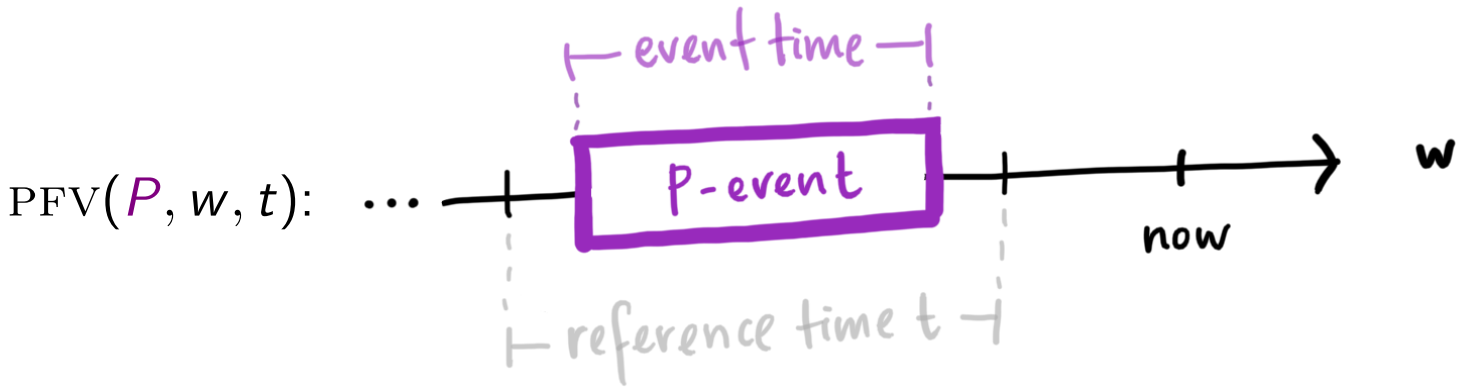
Sufficiency and perfective aspect?

⚠ **Implicative approach:** we need **perfective** to **introduce sufficiency**

This isn't *a priori* plausible:

- **'Viewpoint' aspect:** PFV yields complete events by containing runtime

$$[\![\text{PFV}]\!] = \lambda w \lambda t \lambda P_{\epsilon}.\exists e[\tau(e) \subseteq t \wedge P(e)(w)] \qquad \text{(Kratzer 1998, a.o.)}$$



- **expect:** Juno was-PFV fast enough to win the race

  $\rightsquigarrow$ *bounds time at which Juno had (at least) the necessary speed* d_n

Two kinds of circumstantial *enough*

Actuality entailments are also sensitive to the **matrix adjective:**

- circumstantial *enough* with **static adjectives** **lack actuality inferences**

  (31) Nima **was tall enough** to touch the branch, but he didn't even reach for it.

- so far as **be tall** + PFV is acceptable, **aspect makes no difference**

  (32) ??Nima **a été assez grand** pour toucher la branche, mais il ne l'a pas touché.
  'Nima was-PFV tall enough to touch the branch, but he did not touch it.'

Generalization: *enough* **actuality entailments** also require **dynamic adjectives** (e.g., *fast*)

(25) 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 didn't win.'

Causal reasoning again

Static and **dynamic** *enough* constructions are **causally differentiated:**

- calculate necessary degree d_n by looking at worlds where Nima touches the branch, Juno wins the race, ...
- **implicitly:** circumstantial modality limits attention to worlds where complement is realized in a normal way
- **no magic:** an event P is realized in a normal world if its enabling and causing conditions are satisfied

Static *enough*: height is **not the proximate cause** of reaching the branch

(31) Nima was tall enough to touch the branch, but he **didn't even reach for it.**

- having height d_n works in tandem with a causally sufficient and necessary action, but **no inherent connection**

Causal reasoning again

Static and **dynamic** *enough* constructions are **causally differentiated:**

- calculate necessary degree d_n by looking at worlds where Nima touches the branch, Juno wins the race, . . .
- **implicitly:** circumstantial modality limits attention to worlds where complement is realized in a normal way
- **no magic:** an event P is realized in a normal world if its enabling and causing conditions are satisfied

Dynamic *enough*: speed **characterizes the proximate cause** of race-winning

(22a) Juno was fast enough to win the race

- speed only matters after other conditions are satisfied (registered, at start, . . .)
- **then:** running at speed d_n is **causally sufficient** (and necessary) for winning

Dynamic *enough* in the implicative perspective

1. (a) Dynamic, circumstantial *enough* **presuppose necessity**

   a minimum degree d_n of ADJ is required to realize the complement

   $$\iota d_n : \forall w \in \text{CIRC}(w^*)[\text{ADJ}(x)(w) < d_n \rightarrow \neg P(x)(w)]$$

   (b) and background **contingent sufficiency**

   instantiating degree d_n of ADJ is causally sufficient for complement

   $$\forall w \in \text{CIRC}(w^*)[\text{INST}(\text{ADJ}(x)(w) \geq d_n) \xrightarrow{\text{causal}} P(x)(w)]$$

2. *Enough* predicates **assert satisfaction of the (necessary) prerequisite** ⚠

   the sentence subject actually has at least degree d_n of ADJ

   $$\text{ADJ}(x)(w^*) \geq d_n$$

3. **Causal modal flavour** is embedded via 'hidden' sufficiency condition, operative with instantiation

Dynamic *enough* and actuality inferences

Dynamic circumstantial *enough* **differs minimally from implicative assertions:**

- implicatives assert that their prerequisites were satisfied

  (18a) Ria dared to open the door. → *Ria acted bravely*

- dynamic *enough* **instead establish the possibility of satisfaction**

$$\text{Juno is } d \text{ fast} \sim \textit{Juno is capable of instantiating speed } d$$

$$\text{speed}(J)(w^*) \geq d \sim \exists w \in \textsc{circ}(w^*)[\textsc{inst}(\text{speed}(J)(w^*) \geq d)]$$

Dynamic *enough* and actuality inferences

Dynamic circumstantial *enough* **differs minimally from implicative assertions:**

- Latent attribution is good enough for English (and French imperfective)

(22a) Juno is fast enough to win the race.
$\sim$ *Juno can instantiate (run at) the race-winning speed*

- **to get actuality entailments,** we need the instantiation

(25) 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 didn't win.'

Implicative approach: we need **perfective** to activate **causal sufficiency** by **forcing instantiation**

Outline of the talk

Dynamic properties and aspect

In English, dynamic capacity attributions are **systematically ambiguous:**

(32) Juno **was loud.**

a. **stative:** Juno had the capacity to do loud things.

b. **eventive:** Juno did something loud(ly).

(22) Juno **was fast enough** to win the race.

a. **stative:** Juno could (had the capacity to) run at speed d_n

b. **eventive:** Juno ran at a speed of at least d_n
thereby bringing it about that she won the race

- episodic contexts privilege **eventive** and thus **actualized** interpretation
- **actuality** is defeasible because nothing fixes the **eventive** interpretation

Dynamic properties and aspect

Overt aspect forces a choice between readings:

- PFV selects for **eventives**, can compose with **statives** via **aspectual coercion**

(Moens & Steedman 1988, de Swart 1998)

(33) Jupiter **a aimé** Europa.
'Jupiter loved-PFV Europa.'

Interpretation: Jupiter fell in love with Europa

stative *love* + PFV $\xrightarrow{\text{coercion}}$ eventive INCHOATIVE

Instantiation is the natural reinterpretation for **dynamic capacity attributions:**

(34) Juno **a été rapide.**
'Juno was-PFV fast.'

Interpretation: Juno did something fast

stative *be fast* + PFV $\xrightarrow{\text{coercion}}$ eventive INSTANTIATIVE

- coercion operator INST provides a 'witnessing' event(ive) for the capacity

Dynamic properties and aspect

Aspect-governed actuality inferences for French dynamic *enough*:

- IMPF composes with the **stative**: ability, not actuality

  (26) Juno **était assez rapide** pour gagner la course . . .
  'Juno was-IMPF fast enough to win the race, . . .'

  ✓. . . but she did not participate.

  ✓. . . but something always went wrong.

- **instantiative coercion** with PFV makes dynamic *enough* **implicative**

  (25) Juno **a été assez rapide** pour gagner la course.
  'Juno was-PFV fast enough to win the race.'

  a. *asserts:* Juno **instantiated** speed d_n sufficiency condition

  b. *causal consequence:* Juno won the race
  (because she ran at speed d_n)

Outline of the talk

Summary

Semantic components of implicativity:

1. implicatives **presuppose** the existence of a **necessary and sufficient condition** A for their complements
2. implicatives **assert** that **condition** A **is satisfied**
3. implicatives invoke **causal reasoning** via **modal flavour** of necessity and sufficiency

Implicative entailments are derived as **causal consequences** when presupposition and assertion are taken together

Summary

Enough **predicates** have **actuality entailments only** where the **same components arise compositionally:**

- baseline semantics for *enough* encode a **necessity presupposition,** but **modal flavour** varies
- we get sufficiency only with **dynamic adjectives,** which **characterize the proximate (sufficient) cause** of the *enough* complement
- with necessity and contingent **causal sufficiency**, **perfective aspect** is needed to produce an **implicative assertion**

  . . . forcing **instantiation** of the **causally sufficient condition**

  . . . and deriving **actuality entailments** as **causal consequences**

Conclusion: *enough* predicates' **actuality entailments** are **implicative**

A unified account of actuality inferences

Ability modals pattern with **dynamic adjective** *enough* **constructions:**

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

b. Marja **pouvait** traverser le lac à la nage, mais elle ne l'a jamais traversé.
'Marja could-IMPF swim across the lake, but she never crossed it.'

Towards a unified implicative analysis: (Nadathur 2019, 2021)

ABLE : manage :: be brave enough : dare

- **ability as hypothetical guarantee:**
  x can_{ability} P $\sim$ x has the capacity to realize **proximate cause** of $P(x)$
- PFV activates implicative structure: ABLE is subject to **instantiative coercion**
- **key ingredient:** background **causal reasoning**

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Appendix: Instantiative coercion

Aspectual coercion theories propose **formal coercion operators:** (Bary 2009)

- **inchoative coercion:** from a stative to its initiation (transition) point, often lexically triggered

  (1) *Soudain, Anne a été triste.* → Anne *became* sad suddenly.
  'Suddenly, Anne was-PFV sad.' + INCH

- **maximal coercion:** a maximal instance of states (cessation inferences)

  (2) *Marie a été belle.* ⇝ Marie is no longer beautiful.
  '[In those days], Marie was-PFV beautiful.' + MAX

- **type mismatch** between input predicate and PFV's selectional restrictions inserts coercion (repair) operator (de Swart 1998)

$$\mathrm{PFV}(P_{\text{stative}}) \xrightarrow{\text{mismatch!}} \mathrm{PFV}(C_{\text{stative}\to\text{eventive}}(P_{\text{stative}}))$$

- the specific choice of $C_{\text{stative}\to\text{eventive}}$ depends on context, predicate properties

Appendix: Instantiative coercion

Instantiative coercion is novel: (but see Goldsmith & Woisetschlaeger 1982, de Swart)

- **here:** applies only to predicates that hold of individuals *in view of* capacity for action characterized by a particular property
- **one option:** meaning postulate establishes 'witness' relationship

(3) $[\![\text{fast}_{\text{stative}}]\!] := \lambda w \lambda e \lambda x.$
$[\Diamond \exists e' [e' \sqsubseteq e \wedge \text{fast}_{\text{eventive}}(w)(e') \wedge \text{AGENT}(e') = \text{THEME}(e) = x]]$

- INST ($C_{\text{stative}\rightarrow\text{eventive}}$) introduces a witness event (underspecified)

(4) $[\![\text{INST}]\!] := \lambda w \lambda S \lambda R \lambda e.$
$[\exists e' [e \sqsubseteq e' \wedge R(e)(w) \wedge \text{QUANT}(R) \wedge S(e')(w) \wedge \text{WITNESS}(R, S)]]$

- if we privilege a different coercion operator, actuality entailment goes away:

(5) *Olga* **a** *soudain* **pu** *soulever un frigo, mais elle ne l'a pas fait.*
'Olga could-PFV suddenly lift a fridge, but she did not do it.'

(5) not possible in Hindi!

Appendix: Instantiative vs. actualistic coercion

Homer (2011, 2021) suggests a (related) **actualistic** coercion operator:

(6) a. *La maison a coûté 100,000 euro.* → The house was bought.
'The house cost-PFV 100,000 euro.'

b. *La maison coûtait 100,000 euro.* ↛ The house was bought.
'The house cost-IMPF 100,000 euro.'

- ACT is less restricted than INST, no meaning postulate required
- **Homer:** ACT directly realizes ability modals' complements, by selecting a (salient) eventive which temporally overlaps the stative possibility
- **but:** this incorrectly predicts actuality entailments from perfective **static-adjective** *enough* constructions (ACT can select the *enough* complement to realize)
- INST avoids this because actuality entailments are (causal) consequences of coerced events