Causal dependence in actuality inferences:
enough and *too* predicates as a case study

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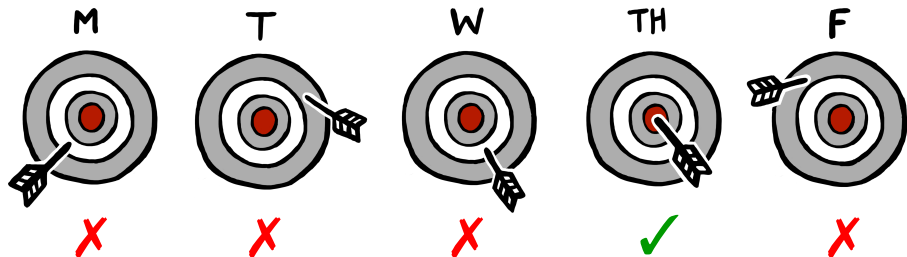
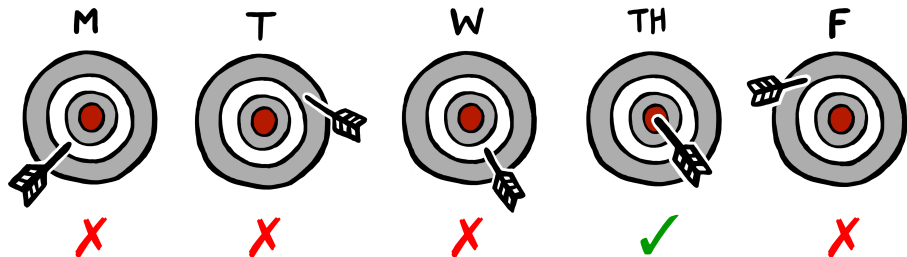(1)   In college, Tara **was able** to hit the bullseye.

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-yii.
       air-ship   sometime NEG fly-PFV.F

       '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-yii.
       air-ship   NEG fly-PFV.F

       'Yusuf could fly the plane, #but he didn't fly the plane.'

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

The problem of actuality

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

❷ The problem of modality
Actuality seems to erase the modality (possibility) of ability readings

❸ 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 uɽaa **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 uṛaa **sak-aa**,   #lekin us-ne   havaii-jahaaz
      Yusuf air-ship   fly   **can-PFV.M**, #but   3SG-ERG air-ship
      nahĩĩ uṛaa-yii.
      NEG   fly-PFV.F

      '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.

   ⤳ *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.

   ⤳ *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

❶ Introduction

❷ Implicatives and causal inference

❸ From implicativity to actuality inferences: the case of *enough* (and *too*)

❹ Aspect and actuality inferences

❺ Summary and conclusions

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The facts about *manage*

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

    (14)   a. Eman **managed** to solve the riddle. $\rightarrow$ *Eman solved the riddle*
            b. Eman **did** **not** **manage** to solve the riddle.
                                          $\rightarrow$ *Eman did not solve the riddle*

(B) **Projective inference:**

    (14a-b) $\rightsquigarrow$ *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 [. . .]
          ↛ intention, ↛ difficulty, ↝ unlikelihood

      b. By 1998, [. . .] gun manufacturers had **easily managed** to bypass the laws
          by making small alterations [. . .]
          ↝ intention, ↛ difficulty, ? ↝ unlikelihood

      c. The Socialdemokratiet **managed** to strengthen their position as Denmark's
          strongest political force **as expected** [. . .]
          ↝ intention, ? ↝ difficulty, ↛ 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

❶ Prerequisite relevance is presupposed (projective, not at issue)

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

❷ Assertion resolves prerequisite status (at issue)

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

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

❸ Complement entailments are derived as causal consequences

(18a) ∼ *Ria's bravery resulted in her opening the door* sufficiency

(18b) ∼ *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
  - $\leadsto$ *Finding/making time was required*   (Finnish *joutaa*)
  - (19) $\rightarrow$ Nur made the time (and consequently meditated)

- **similarly:** patience (Finnish *malttaa*), strength (*mahtua*), warmth (*tarjeta*)
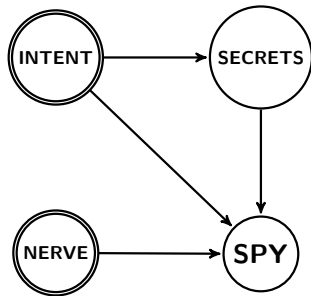
Causal network models (Pearl 2000)

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

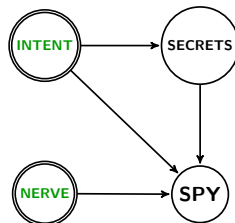**A causal model for the Dreyfus affair:** (finite graph + structural equations)

1. **SECRETS := INTENT**
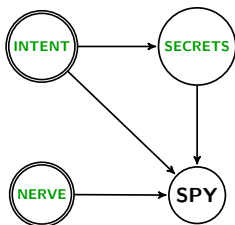2. **SPY := INTENT ∧ SECRETS ∧ NERVE**

Reasoning with causal models

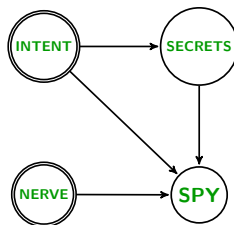Use background information to reason out causal consequences:

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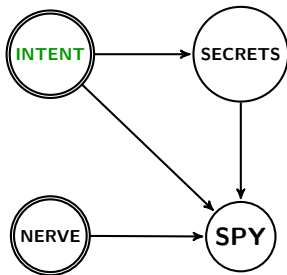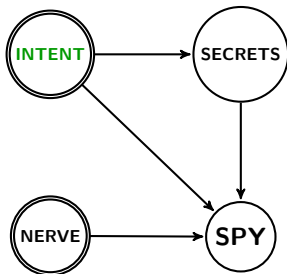**2** SPY := INTENT $\wedge$ SECRETS $\wedge$ NERVE

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 ∧ SECRETS ∧ 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

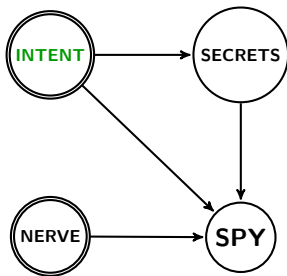If **INTENT** is **on**,
NERVE is **sufficient** for **SPY**

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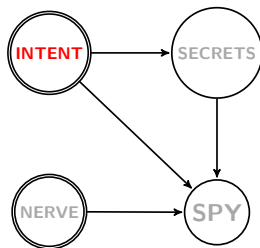
(20) ??Dreyfus **dared** to spy.

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:**

❶ presupposition:
the existence of an unresolved **jointly necessary & sufficient condition** (or set thereof) for the complement

❷ assertion:
determines the truth value of the **necessary & sufficient condition**

❸ 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

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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.

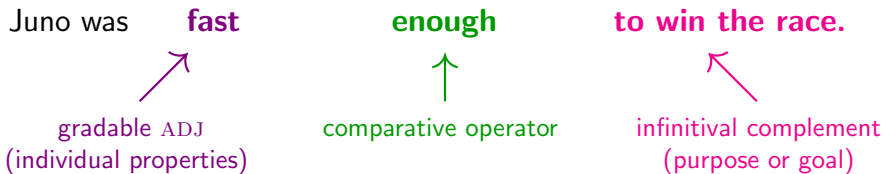(compare with French ability modal *pouvoir* under aspectual modification)

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   comparative operator   infinitival complement
(individual properties)   (purpose or goal)

Paraphrase:

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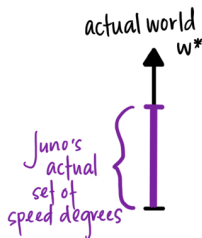 $\sim$ *Juno's actual speed makes it possible that she wins the race*

Composition: (modalized) degree comparison

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

  (28) Juno is *d*-fast
        ∼ *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*
        ∼ *Juno's actual* ADJ *allocation is at least as big as the smallest allocation compatible with P*

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

Composition

$[\![\text{Juno is fast enough to win the race}]\!]^{w^*} =$
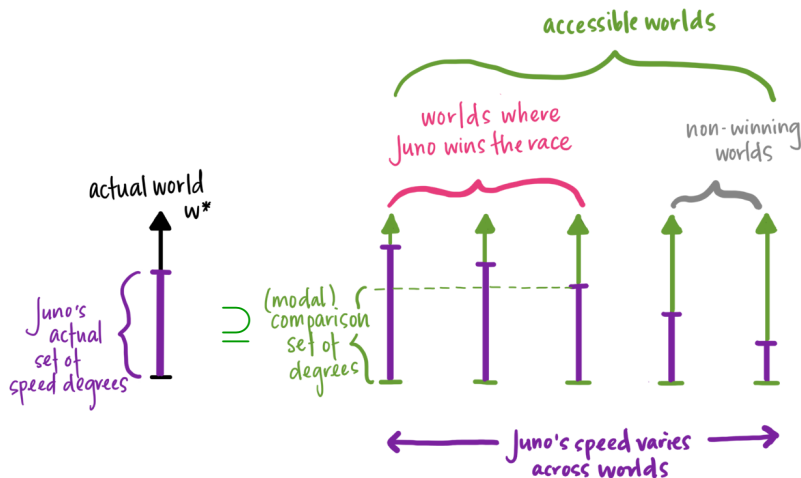
$$\{d : \text{speed}(J)(w^*) \geq d\} \quad \supseteq \quad \{d : \forall w \in \text{ACC}(w^*)\,[\text{win}(J)(w) \rightarrow \text{speed}(J)(w) \geq d]\}$$

Enough and necessity

(27)   Juno is fast enough to win the race.
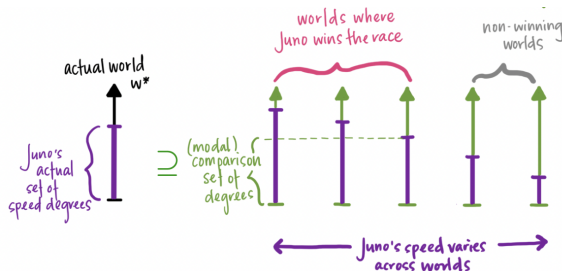
- **result:** Juno's actual (max) speed $\geq$ Juno's max speed in slowest win world

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

(27) $\equiv$ Juno's actual speed $\geq d_n$

where d_n is the **minimum speed required for Juno to win the race**

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

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

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.   ⤳ *Juno won the race.*

b. Juno **was not fast enough** to win the race.   → *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

  $$[\![\text{PFV}]\!] = \lambda w \lambda t \lambda P_\epsilon . \exists e[\tau(e) \subseteq t \wedge P(e)(w)] \qquad \text{(Kratzer 1998, a.o.)}$$
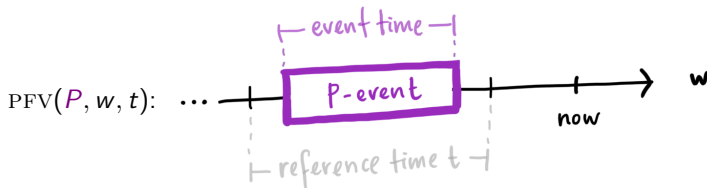
- **expect:** Juno was-PFV fast enough to win the race

  ⤳ *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**

  Juno is *d* fast $\sim$ *Juno is capable of instantiating speed d*
  $\text{speed}(J)(w^*) \geq d \sim \exists w \in \text{CIRC}(w^*)[\text{INST}(\text{speed}(J)(w^*) \geq d)]$

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

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

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)

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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$_{\text{ability}}$ 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.* $\rightarrow$ Anne *became* sad suddenly.
       'Suddenly, Anne was-PFV sad.' $+$ INCH

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

  (2) *Marie a été belle.* $\rightsquigarrow$ 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)

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

- the specific choice of $C_{\text{stative}\rightarrow\text{eventive}}$ 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 ($C_{\text{stative} \to \text{eventive}}$) 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.* $\rightarrow$ The house was bought.
       'The house cost-PFV 100,000 euro.'

   b. *La maison coûtait 100,000 euro.* $\not\rightarrow$ 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