# Causal necessity and sufficiency in implicative inferences

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# Introduction: implicative inferences

**Implicative verbs** like *manage* are characterized by the inferences they generate over the truth of their complement propositions (Karttunen 1971):

(1)  Morgan **managed** to solve the riddle.

$\rightarrow$ *Morgan solved the riddle*

These inferences are **non-defeasible** and **reverse in polarity** under upstairs negation:

(2)  a.  Morgan **managed** to solve the riddle, #but she did not solve it.

  b.  Morgan did not **manage** to solve the riddle, #but she solved it.

. . . leading to the conclusion that implicative verbs **entail** the truth of their complements

# The logical problem of implicatives

*Manage* is one of many verbs with this inferential profile:

- ▶ English implicatives: *manage, dare, condescend, bother,* . . .
- ▶ Finnish implicatives: *onnistua* ('succeed'), *uskaltaa* ('dare'), *ehtiä* ('have time (to)'), *maltaa* ('have patience (to)'), . . .

**This sets up a puzzle:**

1. For an individual $x$, a one-place predicate $P$, and an implicative $I$, we have the following relationships:

$$\text{(i) } I(x, P) \vdash P(x) \qquad\qquad \text{(ii) } \neg I(x, P) \vdash \neg P(x)$$

2. (i) and (ii) are logical converses, leading us to expect (iii):

$$\text{(iii) } I(x, P) \equiv P(x)$$

**The problem:** (iii) is obviously wrong

(3) Solomon **managed** to build the temple

$$\not\equiv \text{Solomon built the temple}$$

(4) Juno **dared** to enter the cave $\not\equiv$ Juno entered the cave.

# The logical problem of implicatives

**The logical problem:**
(i) $I(x, P) \vdash P(x)$
(ii) $\neg I(x, P) \vdash \neg P(x)$
(iii) **but:** $I(x, P) \not\equiv P(x)$

**The analytical challenge:** capture (i)-(ii) compositionally, while avoiding the "intuitively unacceptable conclusion" that an implicative assertion is indistinguishable from the complement assertion (Karttunen 1971, p.343).

**Basic solution:** the unwanted equivalence is blocked by presuppositional content associated with the implicative verb

- ▶ an implicative is felicitous only when its presuppositions are met
- ▶ the complement remains assertable in contexts where the presuppositions fail
- ▶ we infer more from the use of an implicative than from its bare complement: $I(x, P)$ and $P(x)$ have different effects

# Implicatives and their presuppositions

The approach from presupposition is promising:

- Karttunen & Peters (1979):

    - (3)  Solomon **managed** to build the temple.
        - a. *Entails:* Solomon built the temple.
        - b. *Presupposes:* It required effort for Solomon to build the temple.

- Similar 'requirement' inferences are licensed by other verbs:

| Language | Verb | Complement requires |
|----------|------|---------------------|
| English | **dare** | courage, daring |
| | **condescend** | suppressing disdain |
| Finnish | **hennoa** | fortitude, 'heart' |
| | **ehtiä** | time |
| | **iljetä** | suppressing aversion |

# Implicatives and their presuppositions

Requirement inferences pass standard presupposition tests (Chierchia & McConnell-Ginet 1990, Tonhauser et al 2013), for instance **projecting through negation:**

(5) Solomon did not **manage** to build the temple.

$\rightarrow$ *Building the temple required effort*

| Lang | Verb | Requirement |
|------|------|-------------|
| Engl | **dare** | courage, daring |
| Finn | **hennoa** | fortitude, 'heart' |
| | **iljetä** | suppress aversion |

(6) Juno did not **dare** to enter the cave.
   $\rightarrow$ *Entering required courage*

The same is true for Finnish *hennoa* and *iljetä*:

(7) Hän    e-i **henno-nut** noust-a.
   he.NOM NEG-3SG    have.heart-PP.SG rise-INF

   'He didn't have the heart to get up.   $\rightarrow$ *Getting up took 'heart'*

(8) Marja e-i    **iljen-nyt**    katso-a.
   Marja NEG-3SG bring.self-PP.SG look-INF

   'Marja couldn't bring herself to look.'

   $\rightarrow$ *Looking required overcoming aversion*

# The ingredients of an analysis

Generalizing across Finnish and English data:

- ▶ implicatives presuppose conditions for their complements
- ▶ these conditions represent **potential obstacles** to complement realization (cf. Karttunen 2014)
- ▶ bare complement assertions do not invoke potential obstacles

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**The central explananda:**

(A) an implicative assertion $I(x, P)$ entails $P(x)$; its negation $\neg I(x, P)$ entails $\neg P(x)$

(B) $I(x, P)$ conditions $P(x)$ on $x$ overcoming a potential obstacle, ultimately blocking $I(x, P) \equiv P(x)$

(C) Given the entailments in (A), overcoming the obstacle is **both necessary and sufficient** for $P(x)$

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The task is to determine the correct division of labour between **at-issue** (asserted) and **not-at-issue** (presupposed, backgrounded) content which will capture (A)-(C).

# Road map

1. The **direct assertion** account of *manage*
2. Challenges to the standard account
   - Baglini & Francez (2016): *manage* and causal dependence
3. A closer look at causal dependence in implicatives
4. **Proposal:** causal necessity and causal sufficiency in implicativity
5. Conclusions, consequences, and outlook

# The implications of *manage*

Most work on implicatives focuses on *manage* (Coleman 1975, Karttunen & Peters 1979, Bhatt 1999, Baglini & Francez 2016):

- Karttunen & Peters (1979) capture **Fact A** (two-way implicative entailments) by proposing that implicatives contribute *only* their complements to asserted content

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**The 'direct assertion' account**       (Karttunen & Peters)
For an agent $x$, and one-place predicate $P$, *manage*$(x, P)$:
 (i) *Asserts:* $P(x)$                                      ($x$ *did* $P$)
 (ii) *Presupposes:* $P(x)$ was effortful for $x$

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- as anticipated, presuppositional content blocks assertoric equivalence between *manage*$(x, P)$ and $P(x)$        (Fact B)
- **question:** what is the relationship between effort and the necessity and sufficiency of overcoming a potential obstacle?
                                                              (Fact C)

# The direct assertion account of *manage*

**Question:** what is the relationship between effort and the necessity and sufficiency of overcoming a potential obstacle?    (Fact C)

- ▶ **a first attempt:** putting in effort is necessary and sufficient for realizing *manage*'s complement (potential lack of effort ∼ obstacle)
- ▶ with effort, the complement is realized:

    (4)   Solomon **managed** to build the temple.

    ⊢ *Solomon built the temple*

    - ▶ we know $x$ did $P$, and we know effort is necessary for $P(x)$, so we conclude that Solomon put in effort

- ▶ when the complement fails, can we conclude effort was absent?

    (5)   Solomon did not **manage** to build the temple.

    ⊢ *Solomon did not build the temple.*

    - ▶ if effort suffices for $P(x)$, (5) should indicate its absence, **but:**

        (9)   Even though he tried hard, Solomon did not **manage** to build the temple.

The first attempt is too blunt.

# The case of the vanishing presupposition

It's not clear that all uses of *manage* presuppose effort:

- ▶ others suggest *manage* presupposes trying ("active attempt"; Givón 1973), intention, or even unlikelihood

(10) Solomon **managed** to build the temple.

    a. → *Solomon tried to build the temple.*

    b. → *Solomon intended to build the temple.*

    c. → *It was unlikely that Solomon would build the temple.*

- ▶ (10a)-(10c) all plausibly project though matrix negation

**The problem:** *manage*'s presuppositions seem malleable

- ▶ Coleman (1975): there are perfectly acceptable uses of *manage* which fail to presuppose either effort or intention

(11) a. Harry **managed** to insult Ursula without even trying.

    b. My neighbors **managed** to schedule their one wild party of the year on the night before my German exam.

# The case of the vanishing presupposition

Coleman proposes that *manage* has strength-ranked presuppositions:

intention > effort/difficulty > unlikelihood

▶ in any given context, the strongest tenable presupposition must be satisfied (cf. *strongest meaning hypothesis*; Dalrymple et al 1998)

**This won't work either:** there are acceptable uses of *manage* where any one of the three presuppositions is supported, but the others are precluded (compare Baglini & Francez 2016)

(12) $^\gamma$Without intending to, Ms. Streisand **managed** to synthesize the problem of diversity mania.

$\not\to$ *intention, ?$\to$ difficulty, $\to$ unlikelihood*

(13) $^\gamma$By 1998, gun manufacturers easily **managed** to bypass the laws. $\to$ *intention, $\not\to$ difficulty, ?$\to$ unlikelihood*

(14) $^\gamma$The social democrats **managed** to strengthen their position, as expected. $\to$ *intention, ?$\to$ difficulty, $\not\to$ unlikelihood*

# The presuppositions of *manage*

Baglini & Francez (2016):

- ▶ to explain the 'vanishing' presuppositions, we need to adopt an alternative approach
- ▶ *manage* must have weak (non-specific) presuppositional content
- ▶ ...which can be realized, given context, as any one of intention, effort, or unlikelihood

> **Baglini & Francez's insight:**
> The presuppositional content of *manage* has to do with causal dependence: specifically, with the causal conditions under which the *manage*-complement is realized

# A causal approach to *manage*

> **The catalyst account of manage** (Baglini & Francez)
> For an agent $x$ and one-place predicate $P$, *manage*$(x, P)$:
>   (i) *Presupposes:* The familiarity (salience and truth) of a
>        **catalyst**, or *causally necessary but causally insufficient
>        situation* for the realization of $P(x)$
>  (ii) *Asserts:* The catalyst **actually caused** $P(x)$

This differs from the direct-assertion account in two key ways:

1. the presupposition is couched in terms of causal dependence
    - it informs us about conditions for $P(x)$ but does not
      specify a requirement
2. *manage* contributes non-trivially to asserted content
    - the assertion is also about a causal relationship

The real work lies in how **causal necessity, sufficiency,** and
**actual cause** are formalized.

# A positive consequence of non-trivial assertion

The catalyst proposal aims at capturing the presuppositional behaviour of *manage*, but the move away from direct assertion also has positive consequences:

- *because*-clauses are interpreted differently when modifying *manage*$(x, P)$ and $P(x)$:

(15)   a. John **managed** to buy the ring because it was cheap.

$\rightsquigarrow$ *cost as enabler*

   b. John bought the ring because it was cheap.

$\rightsquigarrow$ *cost as motivator*

   (contrasts with the interpretation of temporal and locative adverbials; Karttunen 1971, 346–347)

- we can't explain (15) with direct assertion; the *because*-clause should be modifying the same (asserted) content

- on the catalyst proposal, the *because*-clause in (15)a modifies the assertion of **actual cause** – the causal chain leading to $P(x)$, rather than $P(x)$ itself

# A causal approach to *manage*

Baglini & Francez cash out the key causal dependence relationships in terms of Schulz's (2011) notion of **causal entailment:**

- a **catalyst** is a situation (three-way valuation of relevant propositional variables)
- we are interested in relations of necessity and sufficiency between situations and propositions

  (16) A situation $s$ **causally entails** a proposition $\phi$ iff $\phi$ is true at the least fixed point $s^*$ of the causal consequence operator $\mathcal{T}_D$ relative to $s$:

  $$s \models_D \phi \text{ iff } s^*(\phi) = 1$$

- informally, a situation $s$ will be **causally sufficient** for $\phi$ if $s$ has $\phi$ as a guaranteed causal consequence
- $s$ is **causally necessary** for a proposition if all causal 'pathways' to $\phi$ go through $s$

# Causal necessity and sufficiency of situations

More formally, let the tuple $\langle Y, y \rangle$ represent an assignment of truth to a variable $Y$, $y \in \{0, 1\}$

(17) For $D$ a dynamics, $s$ a situation, and $\langle Y, y \rangle$ a **fact** (proposition)
  a. $s$ is **causally sufficient** for $\langle Y, y \rangle$ iff $s$ causally entails $\langle Y, y \rangle$
  b. $s$ is **causally necessary** for $\langle Y, y \rangle$ iff, for all situations $s'$ such that (i)-(iii) hold:
    i. the set of $Y$'s causal ancestors determined by $s$ are a subset of the ancestors determined by $s'$
    ii. $s$ and $s'$ disagree on the determination of at least one causal ancestor of $Y$
    iii. $s'(Y) \neq y$

    we have that $s'$ does not causally entail $\langle Y, y \rangle$

Baglini & Francez additionally define a relation of **actual cause**:

(18) A situation $s$ **actually causes** $\langle Y, y \rangle$ in a world $w$ iff $s(Y) = u$, $w(Y) = y$, and $w$ is consistent with $s^*$ (the least fixed point of $s$)

## The catalyst account: how it works

> **The catalyst account of manage** (Baglini & Francez)
> For an agent $x$ and one-place predicate $P$, $manage(x, P)$:
> (i) *Presupposes:* The familiarity (salience and truth) of a **catalyst**, or *causally necessary but causally insufficient situation* for the realization of $P(x)$
> (ii) *Asserts:* The catalyst **actually caused** $P(x)$

On this account, $manage(x, P)$ is assertable in contexts where:

- $P(x)$ is possible (consistently causally realizable), based on the current situation, but not guaranteed
- some additional causal condition needs to be realized for $P(x)$

This additional condition is not settled by the catalyst, but its truth is ensured by the asserted content, since **actual cause** requires that actual world has $P(x) = 1$ and is consistent with the catalyst

# Illustration: the Dreyfus scenario

(19) *Context:* Dreyfus was wrongfully convincted of treason; he never had any intention of spying for Germany, or made any attempt to do so.

    a. ??Dreyfus didn't **manage** to spy for Germany.

**The problem with using manage:**

- ▸ (19) requires that there was a point at which the world could have developed *in a causally normal fashion* into one in which Dreyfus did spy

- ▸ no such point existed: not only did Dreyfus not take the actions for spying, but he never intended to spy, and there was no causal pathway to his spying

**For Baglini & Francez:** (19) is bad because there's no causally necessary but causally insufficient catalyst for Dreyfus to spy

$\rightarrow$ presupposition failure!

# The catalyst account of *manage*

**Recall:**

> **The central explananda:**
> (A) an implicative assertion $I(x, P)$ entails $P(x)$; its negation $\neg I(x, P)$ entails $\neg P(x)$
> (B) $I(x, P)$ conditions $P(x)$ on $x$ overcoming a potential obstacle, ultimately blocking $I(x, P) \equiv P(x)$
> (C) Given the entailments in (A), overcoming the obstacle is **both necessary and sufficient** for $P(x)$

**Fact A:** The catalyst proposal captures the characteristic entailments of *manage*

- *manage*$(x, P)$ presupposes the truth of a catalyst $s$, and asserts that $s$ **actually caused** $P(x)$: this forces $P(x) = 1$
- $\neg$*manage*$(x, P)$ presupposes the truth of $s$, and asserts that $s$ **did not actually cause** $P(x)$: by the definition of actual cause, this forces $P(x) = 0$

# The catalyst account of *manage*

> **Facts B and C:**
> (B) $I(x, P)$ conditions $P(x)$ on $x$ overcoming a potential obstacle, ultimately blocking $I(x, P) \equiv P(x)$
> (C) Given the entailments in (A), overcoming the obstacle is **both necessary and sufficient** for $P(x)$

- **Fact B:** in the catalyst framework, it is the **causal insufficiency** of the catalyst which is associated with the potential obstacle for $P(x)$
  - since the catalyst situation $s$ does not guarantee $P(x)$, some other causal condition for $P(x)$ remains open
  - this solves Coleman's 'vanishing presupposition' problem: we know that a causally-necessary condition for $P(x)$ must be left unresolved by the catalyst, but the nature of this condition can be fixed contextually

# The catalyst account of *manage*

> **Fact C:**
> (C) Given the entailments in (A), overcoming the obstacle is **both necessary and sufficient** for $P(x)$

- for a causally-insufficient catalyst to **actually cause** $P(x)$, any other causally-necessary conditions for $P(x)$ must be satisfied in context
- if the catalyst does not actually cause $P(x)$, at least one catalyst-external necessary condition must remain unsatisfied
- thus, the presupposed insufficiency of the catalyst, combined with the assertion of actual cause, leads to the conclusion that some catalyst-external condition(s) for $P(x)$ are both necessary and sufficient in context

# Complicating the catalyst proposal

**Upshot:** Baglini & Francez's proposal mandates that **some causal condition external to the catalyst is determinative for** $P(x)$

- this breaks down as soon as we look beyond *manage*

(20) a. He **dared** to kill the cat.       ⊢ *He killed the cat*

    b. He did not **dare** to kill the cat.     ⊢ *He did not kill the cat*

(21) a. Hän    **henno-i**       tappa-a kissa-n
      he.NOM have.heart-PST.3SG kill-INF cat-GEN/ACC
      'He had the heart to kill the cat'     ⊢ *He killed the cat*

    b. Hän   e-i     **henno-nut**      tappa-a kissa-a
      he.NOM neg-3sg have.heart-PP.SG kill-INF cat-PART
      'He did not have the heart to kill the cat'

                                       ⊢ *He did not kill the cat*

- the (a) sentences suggest that a particular attribute (courage, 'heart') is present; the (b) sentences suggest its absence
- ideally, the necessary/sufficient condition named by the implicative verb should also be the thing targeted by presuppositional content

# Complicating the proposal: one-way implicatives

A second problem for the catalyst account is the existence of
**one-way implicative verbs:**

(22) a. Hän **jakso-i** noust-a.
he.NOM have.strength-PST.3SG rise-INF
'He had the strength to rise.'  ⤳ **He rose.**

b. Hän e-i **jaksa-nut** noust-a.
he.NOM NEG-3SG have.strength-PP.SG rise-INF
'He did not have the strength to rise.'  ⊢ *He did not rise.*

▶ the catalyst account doesn't give us a way to relax positive entailments

▶ the only way to weaken the presupposed content is by weakening
the necessity assumption: this will weaken the negative entailment!

▶ we can't modify the asserted content without either making it
vacuous or breaking the relationship of negation between a positive
and negative implicative claim

▶ moreover, the positive assertion in (22a) **suggests the presence of
strength,** just as the positive assertion of *dare* suggests the
presence of courage

# Causal necessity and sufficiency in implicativity

**Desiderata for a revised causal-dependence analysis:**

1. an implicative assertion should highlight a **causal prerequisite** that is *in question* (potentially an obstacle) for the realization of the implicative complement
2. from implicatives like *dare* and *hennoa*, we see that the absence of a presupposed requirement should force the negation of the complement, and its presence should force the realization of the complement
3. in other words, the truth-value of the complement is computed from **the joint contribution of backgrounded causal dependence and an assertion that resolves the prerequisite's status**
4. one-way implicatives should be captured by **a minimal change to presupposed content** (not assertion)

# Causal necessity and sufficiency in implicativity

> **The prerequisite account of implicatives** (Nadathur 2019)
> For a two-way implicative verb $I$, an agent $x$, and a one-place
> predicate $P$, the proposition $I(x, P)$:
>   i. *Presupposes:* the existence of a one-place predicate $H$
>      such that $H(x)$ is **causally necessary** for $P(x)$ in context
>  ii. *Asserts:* $H(x)$
> iii. *Presupposes:* the **causal sufficiency** of $H(x)$ for $P(x)$

Implicative verbs vary with respect to the nature of the prerequisite $H$,
and in their degree of specificity:

▶ verbs like *dare, condescend*, and Finnish *hennoa* ('have.heart')
  name specific causal conditions for $P(x)$

▶ *manage* simply presupposes that there are contextual causal
  conditions for $P(x)$, allowing context to resolve this as effort,
  difficult, unlikelihood, and so on

▶ we maintain the benefits of the Baglini & Francez proposal

# Causal necessity and sufficiency of facts

We now evaluate the causal dependence of one fact on another *relative* to a given context (implicitly a 'catalyst'):

(23) For $D$ a dynamics, $s$ a situation, and $\langle X, x \rangle, \langle Y, y \rangle$ facts with $s \not\models_D \langle X, x \rangle, s \not\models_D \langle Y, y \rangle$:

    a. $\langle X, x \rangle$ is **causally sufficient** for $\langle Y, y \rangle$ **relative to $s$** iff $s[X \to x] \models_D \langle Y, y \rangle$

    b. $\langle X, x \rangle$ is **causally necessary** for $\langle Y, y \rangle$ **relative to $s$** iff:

       i. there is a consistent supersituation $s'$ of $s[X \to x]$ such that $Y$ is not determined by $s'$ and $s' \models_D \langle Y, y \rangle$

      ii. there is no consistent supersituation $s'$ of $s$ such that $Y$ is not determined by $s'$ and $s' \models_D \langle Y, y \rangle$ but $s' \not\models_D \langle X, x \rangle$

*Note:* for situation $s$, fact $\langle X, x \rangle$, $s[X \to x]$ is the update of $s$ with $X = x$ setting the value of $X$ to $x$ but otherwise preserving assignments from $s$

# Supporting evidence for the prerequisite account

To see that $H(x)$ must be both necessary and sufficient in context, we look at contexts which deliberately leave open a variable other than the one specified by the implicative:

(24) *Context:* A hunter in the forest lost count of the number of times he had fired his gun and was not sure if he had used all of the bullets or not. He decided to check the gun after eating something, and put it down to get some food from his pack. While he had both hands in the bag, he caught sight of a bear coming towards him. We are wondering if he shot it.

$\#$Hän **eht-i** ampu-a karhu-n
he.NOM have.time-PST.3SG shoot-INF bear-GEN/ACC
'He had enough time to shoot the bear'

- ▶ two-way implicatives are correctly predicted to be infelicitous
- ▶ *ehtiä* remains infelicitous under matrix negation
- ▶ informant comment: "you cannot use *ehtiä*, because if he didn't have any bullets, he could not have shot the bear"

# Supporting evidence for the prerequisite account

The prerequisite account is a **precisification** of Karttunen's original schema (which was obscured by the Karttunen & Peters direct assertion analysis)

**Karttunen (1971, p.352):**

In the following, let 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 sentence that manifests itself as the infinitival complement of that verb in the surface structure. I assume that, in the representation of the main clause, $v(S)$ constitutes the central part of the proposition to which negation, modals, and time and locative references are attached. Leaving out these other details, the semantic analysis of the whole sentence can be represented by the following schema:

(37) PRESUPPOSITION: $v(S)$ is a necessary and sufficient condition for $S$.
PROPOSITION: $v(S)$.

# Supporting evidence for the prerequisite account

> In the following, let 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 sentence that manifests itself as the infinitival complement of that verb in the surface structure. I assume that, in the representation of the main clause, $v(S)$ constitutes the central part of the proposition to which negation, modals, and time and locative references are attached. Leaving out these other details, the semantic analysis of the whole sentence can be represented by the following schema:
>
> (37) PRESUPPOSITION: $v(S)$ is a necessary and sufficient condition for $S$.
> PROPOSITION:     $v(S)$.

**Question 1:** What is "the central part of the proposition?"

▶ *Answer:* on the current account, it's the assertion that the prerequisite was resolved ($H(x) = 1$)

▶ This fits both Karttunen's presupposition and proposition: $H(x)$ is necessary and sufficient for $P(x)$ ($= S$), and the content of an implicative assertion is $H(x)$

# Supporting evidence for the prerequisite account

**Question 2:** Karttunen's schema already incorporates necessity/sufficiency; is causal dependence doing any real work?

- ▶ it still helps explain the facts about *because*-clause interpretation (in ex. 15, as compared to temporal/locative adverbials which have the same effect on an implicative assertion and its bare complement)

**Non-causal necessity/sufficiency don't license implicatives:**

(25) *Context:* In the U.S., being 21 is necessary and sufficient for the legal consumption of alcoholic beverages. Amira has been eager to try a glass of wine for a long time, but has refrained because she is too law-abiding. She turned 21 yesterday.
    ??Yesterday, Amira **managed** to drink a glass of wine.

- ▶ (25) backgrounds a deontically necessary/sufficient condition
- ▶ to rationalize the use of *manage*, we draw inferences about non-legal conditions (the difficulty of obtaining wine, Amira's potential distaste for it)
- ▶ these inferences are about potential causal obstacles for $P(x)$

# Extending the account: one-way implicatives

We get a natural account of one-way implicatives:

(22) a. Hän **jakso-i** noust-a.
he.NOM have.strength-PST.3SG rise-INF
'He had the strength to rise.' $\leadsto$ **He rose.**

b. Hän e-i **jaksa-nut** noust-a.
he.NOM NEG-3SG have.strength-PP.SG rise-INF
'He did not have the strength to rise.' $\vdash$ *He did not rise.*

▶ we want to **relax the positive entailment without affecting the assertion** (in this case that strength was present)

▶ this is now straightforward: where two-way implicatives presuppose the necessity and sufficiency of their prerequisites, **one-way verbs like jaksaa presuppose only the prerequisite's necessity**

▶ in both cases, the implicative **asserts the satisfaction of the prerequisite**

▶ when a necessary condition fails, we **get a negative entailment**

▶ but meeting a necessary condition does not guarantee the complement, so we **get at best implicature in the positive case**

# Extending the account: one-way implicatives

We also predict the implicature in (22a):

(22)  a.  Hän **jakso-i** noust-a.
          he.NOM have.strength-PST.3SG rise-INF
          'He had the strength to rise.'                 ⤳ **He rose.**

- ▶ two-way implicatives background contextual causal necessity and sufficiency of their prerequisites, making it **determinative**
- ▶ a necessary condition is sufficient in context if it is the **only unresolved necessary condition**

  → the sufficiency presupposition is **circumscriptive**

- ▶ the implicature results from **circumscriptive pragmatic reasoning**
  ("what you see is all there is"; Kahneman 2011):

  - ▶ because only one causally-necessary condition is highlighted (mentioned), we infer that it is the **only relevant such condition**, making it contextually sufficient
  - ▶ similar reasoning may explain *conditional perfection* (which goes from sufficiency to necessity; Geis & Zwicky 1971)

# A final extension: polarity-reversing implicatives

We can also handle **polarity-reversing** implicative verbs:

(26)  a.  Juri **failed** to open the door.  ⊢ *Juri did not open the door.*
      b.  Juri did not **fail** to open the door.  ⊢ *Juri opened the door.*

(27)  a.  Hän   **laiminlö-i**      korjat-a   virhee-n
          he.NOM neglect-PST.3SG repair-INF error-GEN/ACC
          'He neglected to correct the error'   ⊢ *He did not correct it*

      b.  Hän   e-i        **laiminlyö-nyt** korjat-a   virhe-ttä
          he.NOM NEG-3SG neglect-PP.SG repair-INF error-PART
          'He didn't neglect to correct the error'   ⊢ *He corrected it*

- for two-way polarity-reversing implicatives, the prerequisite $H(x)$ is causally necessary/sufficient for **the failure of the complement**
- a positive assertion enforces a sufficient condition for $\neg P(x)$; a necessary condition or $\neg P(x)$ fails under matrix negation ($\vdash P(x)$)
- one-way polarity-reversers (*hesitate*, *ujostella*/'be.shy') drop sufficiency:

  (28)  Juri **hesitated** to ask for help.   ⇝ *She didn't ask for help*

# Summary

We began with a logical puzzle for implicative lexical semantics:

- despite the two-way entailment pattern, **implicatives and their complements have different discourse effects**

The difference is attributed to presupposition, but it has been hard to pin down the precise nature of the not-at-issue content:

- following Baglini & Francez, we explain the malleability of *manage*'s presuppositions in terms of **causal dependence**
- we focused on determinative conditions: implicatives **background causal prerequisites that are necessary & sufficient** for their complements
  - *manage* turns out to be a special (semantically bleached) case
- simple modifications of B&F's proposal extend a causal analysis from *manage* to: **lexically-specific** verbs (*dare*, *hennoa*/'have.heart'), **one-way** verbs (*jaksaa*/'have. strength'), and **polarity-reversers** (*fail*, *neglect, hesitate*)

# Outlook

We identify the following three semantic components of
**implicativity:**

(i) the existence of a condition which is presupposed to be necessary
and sufficient for the realization of the implicative complement

(ii) a causal interpretation of the prerequisite-complement relationship

(iii) an assertion which resolves the status of the prerequisite, thus
licensing conclusions about the complement

Looking ahead, this structure has consequences for the analysis of
a range of related inferential phenomena:

▶ Karttunen (1971) suggests that English semi-modal *be able* is a
one-way implicative

(29)  a. Eman **was able** to go to the party.      ⤳ *She went.*

   b. Eman **was** not **able** to go to the party.

                                                ⊢ *She did not go.*

# Outlook: actuality entailments

This is related to the interpretation of **ability modals** in languages that mark **aspect** (Thalberg 1972, Bhatt 1999, Hacquard 2006):

- ▶ **perfective** French **pouvoir** ('can') **entails its complement**:
- (30) *Mara **a pu** traverser le lac à la nage, #mais elle ne l'a pas traversé.*
  'Mara could-PFV swim across the lake, #but she did not cross it.'
- ▶ **but not under imperfective marking:**
- (31) *Mara **pouvait** traverser le lac à la nage, mais elle ne l'a pas traversé.*
  'Mara could-IMPF swim across the lake, but she did not cross it.'

**Actuality entailments** involve modality-aspect interactions, but have yet to receive a satisfactory compositional explanation:

- ▶ suppose actuality entailments are cases of **implicative behaviour**
- ▶ we'd like to explain them as resulting from the three semantic components of implicativity
- ▶ these components occur together lexically for implicative verbs
- ▶ here, they come together in the **composition of ability and perfective aspect** (crucially, how?)
- ▶ **starting point:** a causal component in ability (Nadathur 2019)

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