Necessity, sufficiency, and implicativity*

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1 Introduction

Two-way **implicative** verbs in English and Finnish entail truth values for their infinitival complements (Karttunen 1971). The polarity of the implication reverses with upstairs negation.

(1) a. Hän **onnistu-i** kuitenkin pakenema-an.
he-NOM succeed-PST.3sg however flee-3INF.ILL
'He succeeded in fleeing'
b. He **managed** to flee.
c. ⊢ He fled.

(2) a. Hän e-i **onnistu-nut** kuitenkaan pakenema-an.
he-NOM neg-3sg succeed-PP.sg however flee-3INF.ILL
'He didn't succeed in escaping'
b. He didn't **manage** to flee.
c. ⊢ He didn't flee.

The problem (cf. Karttunen) is to explain what blocks the "intuitively unacceptable conclusion" that the implicative sentences are logically equivalent to the assertion of their complements.

2 The contribution of the implicative verb

2.1 Presuppositions

Given an implicative I, and a downstairs event X, the following relationships hold:

(3) a. $I(X) \vdash X$
b. $\neg I(X) \vdash \neg X$
c. $X \nvdash I(X)$

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The "upwards" entailment (3a) is thought to be blocked by the presuppositional content of I (Karttunen 1971, Bhatt 1999): X need not validate the presuppositions of I. Thus (4a) presupposes (at least one of) (4c)-(4e), but (4b) does not.

(4) a. Solomon **managed** to build the temple.
b. $\vdash$ Solomon built the temple.
c. *Solomon made an attempt to build the temple.*
d. *Building a temple was difficult (for Solomon).*
e. *It was unlikely that Solomon would build a temple.*

The argument from presupposition is supported by other implicatives in both Finnish and English:

English	**Finnish**	**Examples**
dare	*uskaltaa*	*Hän* **uskals-i** *avat-a* *ove-n* he.NOM dare-PST.3sg open-INF door-GEN/ACC He **dared** to open the door
bother	*viitsiä*	*Hän* *e-i* **viitsi-nyt** *vastast-a* he.NOM neg-3sg bother-PP.sg answer-INF He didn't **bother** to answer
condescend	-	He **condescended** to meet the petitioners
-	*iljetä*	*Hän* *e-i* **iljen-nyt** *katso-a* he.NOM neg-3sg bring.self*-PP.sg look-INF 'He couldn't bring himself to look'

*this verb (*iljetä*) does not translate well: the sense of aversion is imported from the speaker's perspective, and does not necessarily reflect the attitude of the subject towards the complement X (Karttunen, p.c.)

- *dare (uskaltaa) to* X presupposes a need for courage in doing X
- *condescend to* X presupposes disdain for doing X (Karttunen 2012)
- *iljetä* presupposes (the speaker's opinion) that there should be aversion towards X

Crucially: for each verb, the presupposed content of I bears some relationship to the accomplishment of X.

2.2 The ingredients of an analysis

I assume:

- implicatives lexically encode presuppositions about mental attitudes or physical attributes
- these presuppositions represent potential "obstacles" for X (Karttunen 2014)

What are the necessary components of the utterance $I(X)$ (or $\neg I(X)$)?

(I) $I(X)$ *conditions* the accomplishment of X on the validity of the presupposition(s) of I: this blocks the upwards entailment (3c).

(II) This conditioning relationship involves both necessity and sufficiency, since both (3a) and (3b) hold

(III) An assertion of $I(X)$ informs us that X; $\neg I(X)$ tells us that $\neg X$

The task is to determine the correct "division of labour" between assertion and presupposition that will produce these relationships.

3 *Manage* and causal dependence

Departing from the traditional view (that the assertion of *manage to* X is just X; Karttunen & Peters 1979, Bhatt 1999), Baglini & Francez (2015) propose the following:

(5) A statement *manage to* X:
   a. presupposes the occurrence of a *causally necessary but causally insufficient* "catalyst" C for the realization of X[1]
   b. asserts that the catalyst *actually caused* X

Sufficiency (of C for X) follows only from positive assertion, which is therefore non-trivial.

3.1 Causal dependence (Schulz 2011)

Causal dependence is modeled using Schulz's (2011) **causal entailment**, which is determined on the basis of:

- a **dynamics**, a contextually-manipulated parameter which represents causal relationships between a set of relevant proposition symbols

  (6) A dynamics D over a set of propositions P contains:
     a. a set $B \subseteq P$ of background propositions (facts that are causally independent of others in P)
     b. the set $I = P - B$ of "inner" propositions (facts that causally depend on one another or on B)
     c. a function F (*rooted* in B)[2] sending any element $p \in I$ to a tuple (Z_p, f_p) where:
        i. Z_p is the set of propositions which p causally depends on
        ii. f_p, a two-valued function that tells us how to determine a truth value for p from the values for the propositions in Z_p

- a **situation**, an assignment of proposition symbols to values from the 3-way logic $\{u, 0, 1\}$

[1] Baglini & Francez provide arguments, cf. Coleman (1975), that the presupposition of *manage* must be less specific than either difficulty or unlikeliness, since it can be realized as either.

[2] Informally, "walking backwards" through the causal dependency network always terminates at an element of B.

- an **operator** $\mathcal{T}_D$ which calculates immediate causal effects (as per D), given a situations s. $\mathcal{T}_D$ updates the value assigned to a proposition $p \in I$ according to its function f_p iff $s(p) = u$ and f_p is defined on the settings for the relevant symbols in s.

(7) Given a dynamics D and a situation s, $\mathcal{T}_D(s)$ is defined, for all $p \in P$, as
   a. If $p \in B$, then $\mathcal{T}_D(s)(p) = s(p)$
   b. If $p \in I$ and $Z_p = \{q_1, \ldots, q_n\}$, then
      i. If $s(p) = u$ and $f_p(s(q_1), \ldots s(q_n))$ is defined (is 0 or 1), then $\mathcal{T}_D(s)(p) = f_p(s(q_1), \ldots, s(q_n))$
      ii. If $s(p) \neq u$ or $f_p(s(q_1), \ldots s(q_n))$ is undefined, then $\mathcal{T}_D(s)(p) = s(p)$

This gives us:

(8) **Causal entailment (informally):**
A set Σ of literals *causally entails* a proposition ϕ in a dynamics D ($\Sigma \models_D \phi$) if some number of iterations of applying $\mathcal{T}_D$ to the situation s_Σ (which validates the propositions in Σ and leaves all others undetermined) results in the assignment of ϕ to 1.[3]

Given D and an initial setting s we have the following:[4]

- C is **causally necessary** for X iff $\neg C \models_D \neg X$
- C is **causally sufficient** for X iff $C \models_D X$

3.2 How the account works

Baglini & Francez additionally define:

(9) A proposition C **actually causes** X in a world[5] w iff $C \in Z_X$ and $C, X = 1$ in w

Proposal (5) produces the desired inferential relationships:

- *manage to* X asserts that C *actually caused* X, so both $C = 1$ and $X = 1$. This is the positive entailment (3a).
- $\neg$(*manage to* X) asserts that C *did not actually cause* X; thus Since $C \in Z_X$ is presupposed to be 1, X must be 0 to falsify (9). This is the negative entailment (3b).
- the implicative I invokes the dynamics; assertion of $X/\neg X$ does need not communicate any causal background. This avoids the upwards entailment (3c)

More positive results:

- The catalyst presupposition is relatively bleached: context specifies between the potential presuppositions (4c)-(4e)

[3] This iterative process always has a fixed point, so causal entailment is well-defined.

[4] These define a relationship between two propositions. We are really interested in relations between a situation s and a proposition; I omit the details of extension here and treat the catalyst as a single variable. Baglini & Francez's formalizations (and an updated version of necessity) are presented in section 3.1 of the manuscript linked above.

[5] A world is a situation where all propositional variables are assigned to either 0 or 1

- The assertive content accounts for the interaction of *manage* with *because* (Karttunen 1971):

  (10) 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*

  In each case, *because* modifies the assertion; the causal chain leading to X in (10a) and the proposition X itself in (10b)

4 Some complications

4.1 Catalysts and actual causes

From the interaction of the causal presupposition and the relation of *actual cause* it follows:

- For a catalyst C, we have $\neg C \models_D \neg X$ (necessity) and $\neg(C \models_D X)$ (insufficiency)
- insufficiency requires that Z_X contains at least one variable that is neither C nor causally dependent on C.
- If Y is this variable, the truth conditions of $manage(X)$ mandate that Y is determined in such a way that $Y = 1$ and $C = 1$ causally entails $X = 1$ (that is, $C \neq Y$ and $\neg Y \models_D \neg X$)[6]
- The truth conditions of $\neg manage(X)$ give us that $Y = 0$ (since $C = 1$ and $X = 0$)

As a result, some factor *external to the catalyst* is crucial in determining X (a "potential obstacle").

For more specific verbs, (5) seems to put the obstacle on the "wrong side" of the catalyst partition:

(11) a. He **dared** to kill the cat. $\vdash$ *He killed the cat*
b. He **did** not **dare** to kill the cat. $\vdash$ *He did not kill the cat*

(12) a. Hän **henno-i** tappa-a kissa-n
he.NOM have.the.heart-PST.3sg kill-INF cat-GEN/ACC
'He had the heart to kill the cat' $\vdash$ *He killed the cat*
b. Hä e-i **henno-nut** tappa-a kissa-a
he.NOM neg-3sg have.the.heart-PP.sg kill-INF cat-PART
'He did not have the heart to kill the cat' $\vdash$ *He did not kill the cat*

(11a) and (12a) suggest that the presupposed attribute (gumption,"heart") is present; (11b) and (12b) suggest its absence. Proposal (5) places this attribute outside C, so an implicative's lexical presupposition must be distinct from its catalyst.

4.2 The existence of one-way implicatives

One-way implicatives (13)-(16) cannot be unified with two-way implicatives on schema (5).

(13) John **was able** to solve the problem. $\nvdash$ *John solved the problem.*
(14) John **was** not **able** to solve the problem. $\vdash$ *John did not solve the problem.*

[6]This is a simplification; there may in fact be a finite set of variables $\{Y_1, Y_2, \ldots, Y_m\}$.

(15) Hän **jakso-i** noust-a
he.NOM have.strength-PST.3sg rise-INF
'He had sufficient strength to rise' $\nvdash$ *He rose.*

(16) 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.*

The negative entailments can be derived as above, but the positive ones are also enforced. No minimal change fixes this problem:

- weakening the presupposition seems to force dropping causal necessity: this will both lose the negative entailment and validate the bad "upwards" one.
- it is not clear how to reduce the strength of assertion. Rduction to the trivial case (X) does not help; reduction to assertion of the catalyst is vacuous, given the presupposition, and breaks the relationship of negation between $I(X)$ and $\neg I(X)$.

5 The revised proposal

Our new desiderata:

- an implicative assertion should focus a causal prerequisite that is *in question* (potentially an obstacle) for the accomplishment of X
- 4.1 suggests that Xs truth value is "calculated" on the basis of a positive or negative assertion of $I(X)$.
- this calculation to fails for positive assertions of one-way implicatives.

5.1 The changes

I claim the following:

(17) a. **Claim 1:** Implicative I (one- or two-way) presupposes [7] the existence of a *discourse-unresolved* causal ancestor Y for its complement X .
b. **Claim 2:** Both implicative types take Y to be causally necessary for X.
c. **Claim 3:** The difference between one- and two-way verbs is whether or not Y is taken to be sufficient for X; two-way implicatives background sufficiency, and one-way implicatives do not.
d. **Claim 4:** The relationship between Y and X is backgrounded; the at-issue content of $I(X)$ is the resolution of Y.

Given this backbone:

(18) An implicative statement $I(X)$:
a. presupposes the existence of a causally necessary ancestor Y for X in the discourse context

[7] "Presuppose" is used loosely as a stand-in for not-at-issue projective content.

b. asserts that Y was met ($\neg I(X)$ asserts that Y was not met)

c. if I is a two-way implicative, a second presupposition gives us that Y is causally sufficient for X (sp. that all non-Y causal conditions for X were met in context)

An implicative utterance therefore:

- highlights the fact that Y is in question
- resolves the value of Y
- determines X as a logical consequence of asserted content
- necessity and sufficiency of Y are not at-issue

Implicative verbs vary as to the nature of Y, and its degree of specificity:

- *dare, bother,* and the Finnish *iljetä*(=bring.self*), *hennoa*(=have the heart), *jaksaa*(=have sufficient strength) are specific, compared to *manage* and *onnistua*(=succeed)
- *manage* (along with other bleached verbs) is represents the special case of a "default" two-way:
  - *manage* "bundles" conditions; it simply presupposes that X is not causally independent
  - the positive assertion sets any causally necessary condition in D to 1, licensing the conclusion that X (circumscription does not apply here)

5.2 Supporting evidence

(18) can be tested in which deliberately leave open a variable other than the implicative-specified one; we predict that two-way implicatives are infelicitous in such contexts:

(19) 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'

(20) Two versions of a survey were prepared for a policy consultant to take door to door. One version had an unusually detailed question about sexual preferences which was not on the other. The policy consultant was only given one version, but we don't know which. We are wondering whether he asked the personal question.

Hän **kehtas-i** kysy-ä niin henkilökohtais-i-a asio-i-ta
he.NOM unashamed-PST.3sg ask-INF such personal-PL-PART thing-PL-PART

'He was unashamed to ask something so personal'

These examples are infelicitous: D contains a non-Y necessary but unresolved condition for X.[8] No such infelicity occurs for one-way verbs:

[8]One informant said "I would not use *ehtiä* here because, if he didn't have bullets, he could not have shot the bear."

(21) Hän **jakso-i** tappelma-an, mutta päätt-i sitä
he.NOM have.strength-PST.3sg fight-INF but decide-PST.3sg he.PART
vastaan.
against.ILL
'He had the strength to fight, but chose not to.'

5.3 Implicatures and one-way predicates

One-way verbs may conversationally implicate X in the non-entailed direction (Karttunen 2012):

(22) a. John **was able** to solve the problem. $\not\vdash$ *John solved the problem.*
b. $\rightsquigarrow$ John solved the problem.

(23) a. Hän **mahtu-i** kulke-ma-an ove-sta
he.NOM fit-PST.3sg go-INF-ILL door-ELA
'He was small enough to go through the door.' $\not\vdash$ *He went through the door.*
b. $\rightsquigarrow$ He went through the door.

This is predictable! The inference that Y is the *only* necessary condition in question for X amounts to sufficiency, and is often contextually licensed (cf. *conditional perfection*; Geis & Zwicky 1971).

6 Polarity-reversing implicatives and other questions

There are also polarity-reversing implicatives:

(24) a. John **failed** to open the door. $\vdash$ *John did not open the door.*
b. John **did** not **fail** to open the door. $\vdash$ *John opened the door.*

(25) a. Hän **laiminlö-i** korjat-a virhee-n
he.NOM neglect-PST.3sg repair-INF error-GEN/ACC
He **neglected** to correct the error $\vdash$ *He did not correct the error*
b. Hän e-i **laiminlyö-nyt** korjat-a virhe-ttä
he.NOM neg-3sg neglect-PP.sg repair-INF error-PART
He did not **neglect** to correct the error $\vdash$ *He corrected the error*

(18) can be modified minimally in either of two ways to capture polarity reversal:

(i) if we take Y to be an ancestor for $\neg X$, we derive the negative entailments (27b) and (28b) directly; the positive entailments result (as before) from the sufficiency presupposition

(ii) alternative, we can take $\neg Y$ to be an ancestor for X; then the positive entailments results from necessity and the negative from circumscription/sufficiency

It is not clear which alternative is to be preferred.

One-way polarity reversing implicatives come in both types:

(26) Option (i):

a. Hän **epärö-i** otta-a osa-a kilpailu-n
he.NOM hesitate-PST.3sg take-INF part-PART race-ILL
He **hesitated** to take part in the race ⊬ *He didn't take part in the race*

b. Hän e-i **epäröi-nyt** otta-a osa-a kilpailu-n
he.NOM neg-3sg hesitate-PP.sg take-INF part-PART race-ILL
He did not **hesitate** to take part in the race ⊢ *He took part in the race*

(27) Option (ii):

a. John **was too shy** to speak up in class. ⊢ *John did not speak up in class.*

b. John **was** not **too shy** to speak up in class. ⊬ *John spoke up in class.*

I am informed that Finnish only uses the implicative construction for the *hesitate*-type of one-way polarity-reversing verbs, which suggests that these may be more basic.

On the other hand, this type seems to default towards a factive-type implicature pattern in the non-entailed direction (although context can push either (31a) or (31b).

(28) John **hesitated** to ask for help.

a. *Factive-type:* ⇝ John asked for help (after some time).

b. *Implicative-type:* ⇝ John did not ask for help (because hesitation cost him the opportunity).

(29) Hän **ujostel-i** näyttä-ä kuva-{a/n} minu-lle
he.NOM shy-PST.3sg show-INF picture-{PART/GEN} me-ILL
He was shy to show me the picture.[9]

a. *Factive-type:* ⇝ He showed me the picture (reluctantly).

b. *Implicative-type:* ⇝ He did not show me the picture (because of shyness).

What does this mean?

- Just as *able*-type implicatives are often about attributes or that must be present in sufficient quantity, *too shy*-type verbs describe attributes that must not exceed some quantity
- Circumscribing specifies that the only open question regarding X was whether or not the quantity of Y exceeded this limit (conceptually similar to the non-reversing cases)
- Is this a reasonable description of two-way polarity reversers like *neglect*? (*Fail* may be the converse of *manage* and a special case)

[9]There may be a correlation between the case difference and the preferred implication, with the partitive privileging the factive-type inference.

Relatedly, what is different about the *hesitate*-type implicatives?

- Finnish examples include *ujostella*(=be.shy), *häikäillä*(=have.scruples), and *empiä*(=be of two minds)
- These seem to be about attributes which *could* present an obstacle, but don't carry the notion of a threshold

The causal framework used here and in Baglini & Francez (2015) seems insufficiently fine-grained as formulated to capture these generalizations.

7 Conclusions and outlook

Summary:

- Some simple modifications of the basic proposal in Baglini & Francez allow us to capture non-reversing implicatives as a class: we produce the desired inference patterns, but do not enforce the undesirable $I(X) - X$ equivalence
- Due to the circumscriptive nature of the secondary two-way presupposition, I make room for an independently-motivated explanation for the implicatures that often accompany one-way implicative verbs
- The theoretical account is supported by presupposition-testing contexts in Finnish (as well as English)
- The framework presented here is promising with respect to capturing polarity-reversing implicatives as well

Questions:

- Polarity-reversing implicatives open up interesting questions about how specific we can be about the content of conditions (and the logical consequences of this specificity)
- Can we/ought we to include the details of these generalizations (once we are clear on them) in an account of implicatives as a whole?
- There seems to be a connection between implicative verbs and the actuality entailments associated with *ability modals* in certain languages (Bhatt 1999, Hacquard 2009, Piñón 2009); an account that makes good on this is desirable

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