Causality, aspect, and modality in actuality inferences[*]

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1   Introduction

1.1   Actuality entailments

(Bhatt, 1999) famously observes that certain past-tense uses of ability modals give rise to **actuality entailments** which force the realization of the modal complement.

(1)   *Olga a pu   soulever un frigo, #mais elle ne   l'a   pas fait.*
      Olga can.PFV lift   a   fridge, #but   she NEG it-has NEG do.PP

      'Rebecca was able to lift a fridge, #but she didn't do it.'

(2)   *Rebecca jheel ke paar tair   sak-ii,   #lekin woh paar   nahiin gay-ii.*
      Rebecca lake across swim can-PFV, #but   she across NEG   go-PFV.

      'Rebecca was able to swim across the lake, #but she didn't go across.'

Actuality is governed by aspect: the perfectively-marked French and Hindi modals in (1) and (2) entail, but their imperfectively-marked counterparts (3) and (4) do not.

(3)   *Olga pouvait   soulever un frigo, mais elle ne   l'a   jamais fait.*
      Olga can.IMPF lift   a   fridge, but   she NEG it-has never   do.PP.

      'Olga was able to lift a fridge, but she never did it.'

(4)   *Rebecca jheel ke paar tair   sak-tii   thii, lekin woh paar   kabhii-nahiin gay-ii.*
      Rebecca lake across swim can-IMPF PST, but   she across never   go-PFV.

      'Rebecca was able to swim across the lake, but she never went across.'

The extensive literature on actuality entailments features a wide variety of approaches:

- scopal/structural: Hacquard (2006, 2009); Piñón (2003)
- aktionsart, aspect, and ontology: Mari and Martin (2007, 2009); Homer (2011)
- 'prospective' aspect: Kratzer (2011); Matthewson (2012); Mari (2015)
- other/pragmatic: Portner (2009); Piñón (2009, 2011)

But these all work with the same basic ingredients: a Kratzerian modal semantics, and the contribution or selection restriction of various aspectual specifications.

1.2   Back to Bhatt (1999)

Bhatt's original account is an outlier:

- instead of a standard modal semantics, *be able, pouvoir, saknaa* share the semantics of **implicative** *manage*, which always entails its complement (Karttunen, 1971):

  (5)   Solomon managed to build the temple.
        ⊢ *Solomon built the temple.*

- non-entailment for imperfective *be able/can* is due to the presence of a covert generic operator, which is realized as imperfective when combined with the past tense.

This doesn't quite work, because implicative verbs entail even in the imperfective:

(6)   *Jean réussissait   à parler à Marie, #mais il n'a   jamais parlé   à son.*
      Jean managed.IMPF to speak to Marie, #but   he NEG-has never   speak.PP to her.

      'Jean (habitually) managed to speak to Marie, #but he never spoke to her.'

To take seriously the idea that **perfective actuality entailments represent *implicative behaviour***, we need first to understand implicatives:

- recent treatments of implicatives (Baglini and Francez, 2016; Nadathur, 2016) argue for a semantics grounded in *causal dependence* (Schulz, 2011, a.o.)

- causal dependence between an initiating factor and a potential result is a new ingredient in the actuality entailment mix

- linking implicativity/complement entailment to an initiator-result structure opens the door to a wider class of constructions:

  - 'periphrastic modal constructions (Hacquard, 2009): *have the ability to X, have the possibility to X, avoir la capacité to X, avoir la possibilité to X*
  - *too* and *enough* constructions (Karttunen, 1971; Meier, 2003; Hacquard, 2005): *be clever enough to X, be too young to X*

- ‘defeasible’ causatives (Martin and Schäfer, 2012, 2015): *offer/offrir*, *provoke/provoquer*, *suggest/suggérer*

- the top-level aim of the current project is to develop a unified account of constructions with this conceptual structure, which can derive the distribution of complement entailments and (vs) implicatures

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Today:

1. Mostly: a causal account of implicative verbs (Nadathur, 2016)

2. The outlook for actuality entailments:

   - English *be able* as a one-way implicative
   - Insights from *too* and *enough* constructions
   - A sketch of the way forward
   - More data, more problems

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2   Implicative verbs: causal necessity and sufficiency

2.1   Implicative entailments

Implicative verbs in English and Finnish entail truth values for their infinitival complements (Karttunen, 1971); implication polarity reverses with upstairs negation.

(7)   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.

(8)   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 logical problem: explain what blocks the “intuitively unacceptable conclusion” that implicative sentences are logically equivalent to assertions of their complements.

2.2 The role of presupposition

For an implicative I, and a (downstairs) event X, the following relationships hold:

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

Karttunen's suggestion: the blocked entailment (9c) follows from the fact that implicatives have presuppositional content.

- (10a) presupposes (at least one of) (10c)-(10e), but (10b) does not (Coleman, 1975; Karttunen and Peters, 1979; Bhatt, 1999)

  (10) 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.*

Other Finnish and English implicatives:

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'

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

Key point: I conditions the accomplishment of X on overcoming the 'potential obstacle' specified by its presupposed content (cf. Karttunen, 2014). Both necessity and sufficiency are involved.

2.3 *Manage* and causal dependence

Baglini and Francez (2016)'s insight: the relationship between an implicative's presupposition and its complement is one of **causal dependence.**

(11) **Proposal.** A statement *manage to X*:

     a. presupposes the occurrence of a *causally necessary but causally insufficient* "catalyst" C for the realization of X[a]

     b. asserts that the catalyst *actually caused X*

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

Causal dependence. Causal necessity and sufficiency are defined via Schulz (2011)'s **causal entailment**, determined on the basis of:

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

  (12) 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)[1] 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 $\{u, 0, 1\}$

- 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.

  (13) 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

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

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 $\mathcal{T}_D(s)(p) = s(p)$

Causal entailment, necessity, and sufficiency

A set Σ of literals **causally entails** a proposition ϕ in a dynamics D ($\Sigma \models_D \phi$) if $\phi = 1$ is a consequence of iterative applications $\mathcal{T}_D$ to the situation s_Σ that validates the propositions in Σ and leaves all others undetermined.[a]

- variable Y is **causally necessary**[b] for variable X iff $\neg Y \models_D \neg X$
- variable Y is **causally sufficient** for variable X iff $Y \models_D X$

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

[b]I treat catalysts as single variables here for ease of presentation. We are really interested in relations between a situation and a proposition; the extended definitions are given in Baglini and Francez (2016) and Nadathur (2016) (in slightly different, but equivalent, forms).

Finally, Baglini and Francez define:

(14)   A proposition C **actually causes** X in a world[2] w iff $C \in Z_X$ and $C, X = 1$ in w.

Upshot: catalyst C gets us the logical relationships (9a)-(9c)

(15)   a. *manage(X)* presupposes that $C = 1$, and asserts actual cause, so $C = X = 1$: *manage(X)* $\vdash X$

     b. $\neg$*manage(X)* also presupposes $C = 1$, but denies actual cause, so $X = 0$: $\neg$*manage(X)* $\vdash \neg X$

     c. X alone says nothing about C, so we can't conclude *manage(X)*

More positive results:

- the presupposition is bleached, allowing context to specify between the potential presuppositions (10c)-(10e)

- a causal assertion accounts for Karttunen (1971)'s observations about *because*-clauses

  (16)   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 (16a) and the proposition X itself in (16b)

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

2.4 Some complications

Catalysts and actual causes:

- 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 $\neg Y \models_D \neg X$)[3]

- 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:

(17) 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*

(18) 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'   ⊢ *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'   ⊢ *He did not kill the cat*

(17a) and (18a) suggest that 'heart" is present; (17b) and (18b) suggest its absence.

- Baglini and Francez's proposal places this attribute outside C, so an implicative's lexical presupposition must be distinct from its catalyst.

One-way implicatives:

- (19) weakens the complement entailment to an implicature under one matrix polarity:

(19) a. *Hän*   **jakso-i**   *noust-a*
 he.NOM have.strength-PST.3sg rise-INF

 'He had sufficient strength to rise'   ⊬ *He rose.*

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

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.*

- no minimal change will account for this:

  – weakening the presupposition means dropping causal necessity: this loses the entailment $\neg I(X) \vdash \neg X$, and validates the bad $X \vdash I(X)$.
  – reducing the assertion to the trivial case (X) doesn't work

  – reduction to assertion of the catalyst is vacuous, given the presupposition, and moreover breaks the logical relationship of negation between $I(X)$ and $\neg I(X)$.

2.5   The new (revised) proposal

Desiderata:

- an implicative assertion highlights a causal prerequisite that is *in question* (potentially obstructive) for the accomplishment of X

- attribute-specific implicatives suggest that Xs truth value is "calculated" on the basis of a positive or negative assertion of $I(X)$.

- this calculation should fail for positive assertions of one-way implicatives.

Proposal (Nadathur, 2016)

Given dynamics D, an implicative utterance $I(X)$:

  i. presupposes the existence of a causal factor (ancestor or set thereof) A for X, where A is *causally necessary* for X in the utterance context

  ii. asserts A in the evaluation world. $\neg I(X)$ asserts $\neg A$.

  iii. if I is a two-way implicative, $I(X)$ also presupposes that A is the only unresolved prerequisite (A-independent ancestors are presumed resolved in the X-conducive way)

An implicature utterance therefore:

- highlights the fact that causal ancestor Y is unresolved in the discourse context

- resolves Y as at-issue content

- determines X as a logical consequence of at-issue content

- backgrounds the necessity and sufficiency relationship

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We get the desired relationships: (9a)-(9c) for two-way implicatives, (9b)-(9c) for one-way

(20) a. $I(X)$ sets $A = 1$:
- if I is one-way, nothing more
- if I is two-way, we have $A \models_D X$, so $X = 1$ and $I(X) \vdash X$

  b. $\neg I(X)$ sets $A = 0$, and $\neg A \models_D \neg X$ gives us $X = 0$ and $\neg I(X) \vdash \neg X$

  c. X alone does not involve A, so $X \nvdash I(X)$

Implicative verbs vary as to the nature of A, 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)

2.5.1 Supporting evidence

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

(21) 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'

(22) 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.[4] No such infelicity occurs for one-way verbs:

(23) *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.'

2.5.2   Implicatures and one-way predicates

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

(24)   a. John **was able** to solve the problem. $\nvdash$ *John solved the problem.*
       b. $\rightsquigarrow$ John solved the problem.

(25)   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.' $\nvdash$ *He went through the door.*
       b. $\rightsquigarrow$ He went through the door.

This is predictable!

- reasoning about speaker choice may implicate that the necessary condition Y is the *only* prerequisite (in context), yielding sufficiency
- this reasoning recalls *conditional perfection* (Geis and Zwicky, 1971), and 'anti-perfection' may also arise with periphrastic causatives (Lauer, 2010, and current joint work)

2.5.3   Polarity-reversing implicatives

Polarity-reversing implicatives flip the truth value of the complement entailment:

(26)   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*

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

One of two minimal adjustments to the proposal will capture polarity reversal:

(i) Let A be necessary $\neg X$: the negative entailments follow directly, while the positive ones result from a sufficiency presupposition

(ii) Alternatively, let $\neg A$ be necessary for X; positive entailments follow directly, and the negative ones from circumscription

There are arguments for either approach, and perhaps both are valid:

- One-way polarity reversing implicatives come two types:

  (27) 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 $\nvdash$ *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 $\vdash$ *He took part in the race*

  (28) Option (ii):

      a. John **was too shy** to speak up in class. $\vdash$ *John did not speak up in class.*

      b. John **was** not **too shy** to speak up in class. $\nvdash$ *John spoke up in class.*

  Finnish only uses the implicative construction for class (i), so perhaps these are 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).

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

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

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

  (30) *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.[5]

      a. *Factive-type:* $\rightsquigarrow$ He showed me the picture (reluctantly).

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

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

3 Taking implicativity to actuality entailments

3.1 *Being able* vs *doing*

The connection between implicatives and ability modals:

- Karttunen (1971) classes *be able* as a one-way implicative

- English *be able* shares the implicature pattern:

  (31)   a. Rebecca **was able** to swim across Lake Balaton.
  $$\rightsquigarrow (\nvdash) \; \textit{Rebecca swam across Lake Balaton.}$$
            b. Rebecca **was** not **able** to swim across Lake Balaton.
  $$\vdash \textit{Rebecca did not swim across Lake Balaton.}$$

- on the implicative view, *be able* (*can, pouvoir, saknaa*) lexically invoke a necessary *ability* (unanalyzed)

On the implicative account

An utterance of *be able*(X):

  i. presupposes the existence of an *ability* A that is causally necessary for X in the utterance context

  ii. asserts that A is present; $\neg be\ able(X)$ asserts the absence of ability

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So far, so good: the presence of ability A doesn't guarantee that it is exercised, but its absence should preclude X

But, we can't account for perfective entailments for *pouvoir, saknaa*, etc:

- some pragmatic mileage?

  - since statives and activities have the subinterval property, imperfective entails perfective:

    (32)   a. $[\![\text{IMPF}]\!] = \lambda P \lambda t. \exists e[t \subset \tau(e) \; \& \; P(e)]$
             b. $[\![\text{PFV}]\!] = \lambda P \lambda t. \exists e[t \supseteq \tau(e) \; \& \; P(e)]$

    (33)   a. *Rebecca run*.IMPF $= \exists e[t \subset \tau(e) \; \& \; \text{run}(R)(e)]$
             b. *Rebecca run*.PFV $= \exists e[t \supseteq \tau(e) \; \& \; \text{run}(R)(e)]$

    (34) (33a) $\vdash$ (33b)
          Rebecca ran (habitually,continuously) $\vdash$ Rebecca ran (on some occasion, for some amount of time)

- – (34) produces a scalar strength relationship, so PFV $\leadsto \neg$ IMPF: i.e., that the state or activity no longer holds

- for some predicates, like *have the opportunity* or *avoir la possibilité*, this is what we want:

  - – Hacquard (2006): a possibility/opportunity stops being one when either the circumstances change, or the possibility is realized
  - – at best implicates complement realization

- it doesn't help us with *be able/pouvoir*:

  - – exercising an ability does not (typically) eliminate it
  - – contexts where the ability's persistence is established should cease to have actuality entailments, but this is not the case:

    (35) *Pendant l'entraînement, Jane a soulevé des poids de 200kg pluseirs fois d'affilée sans aucun problème et donc lors de la compétition, elle a pu soulever un poids de 150kg, #mais elle n'a soulevé que le poids de 100kg.*
    'During training, Jane lift.PFV 200kg weight several times in a row without any problem, thus during the competition, she can.PFV lift a 150kg weight, #but she only lift.PFV a 100kg weight.'

A bigger problem for the one-way implicative story:

- *being able* doesn't necessarily presuppose ability

  (36) (Thalberg, 1972) Consider the case of Brown, who is well-known as a terrible marksman. During a particular shooting session, he hit three bullseyes in a row. Prior to hitting the bullseye, he fired 600 rounds, without coming anywhere close, and his later tries were equally random.

  - – (36) licenses the claim that 'Brown was able to hit three bullseyes in a row,' but we certainly do not attribute to him any ability to shoot bullseyes in general

- it seems like there are two ways to *be able*: "*was able* sometimes means *had the ability* and sometimes means *did*" (Thalberg, 1972)

- why would the perfective only select for the latter meaning?

3.2 What is an ability?

From the philosophical literature: an ability (modal) is not just a possibility (Austin, 1961; Kenny, 1976):

- *be able* and *can* don't behave like possibility modals

- if S *can* $\phi = \Diamond_{\mathrm{circ}}\phi(S)$, we expect: $\phi(S) \vdash S$ *can* ϕ

  - but a single observation of Brown hitting the bullseye does not justify the assertion *Brown can hit the bullseye*

- we also expect S *can* $\phi \vee \psi \vdash S$ can $\phi \vee S$ *can* ψ

  - given a randomly shuffled deck of cards (each of which is either black or red), *Brown can draw a red card or a white card* $\nvdash$ *Brown can draw a red car* $\vee$ *Brown can draw a black card.*

- these inferences become good in the perfective; the asymmetry needs to be explained

Mari and Martin (2007, 2009): bite the bullet and enrich the ontology

- there are two kinds of ability: *generic abilities* (the traditional, persistent kind), and *action-dependent abilities* which "ontologically" depend on their corresponding actions for existence

- the perfective aspect has a 'boundedness constraint,' which selects the action-dependent meaning in the absence of some other bounded eventuality

- support: the entailment is absent when the ability is explicitly bounded:

  (37) *Notre nouveau robot a même pu repasser les chemises à un stade bien précis de son développement. Mais on a supprimé cette fonction (qui n'a jamais été testée) pour des raisons de rentabilité.*
  'Our new robot can.PFV even iron shirts at a particular stage of its development. But we suppressed this function (which was never tested) for reasons of cost.'

- Hacquard (to appear): (37) is a present perfect use of the *passé composé*

A more promising approach: a complex view of abilitative and agentive modal claims

- agentive *can* is stronger than $\Diamond$, but weaker than $\Box$: it represents a potential guarantee

- the basic idea: S *can* ϕ means that S has some available choice or action which will determine whether or not ϕ

- Belnap and Perloff (1988); Horty and Belnap (1995): *S can* ϕ means $\Diamond[S$ *determines* $\phi]$
- Maier (to appear); Mandelkern et al. (to appear): S has a practically available action A *option* such that if S tries to do A, S does ϕ

- this accounts for the present/past asymmetry:

  - present tense *can* relies on knowing what A and its result are
  - past tense *can* has the benefit of hindsight: it's enough to see that a particular action A did result in ϕ
  - past tense *can* can therefore be used in situations where, at the reference time, the speaker would not have asserted *can*

A rough proposal

- ability modals are structured as 'hypothetical guarantees': S *can* $X :=$ S has a possible action A such that $A(S)$ causes $X(S)$
- if S does A, then X is realized
- causal sufficiency – key to the positive implicative entailments – is 'under' the possibility modal
- causal necessity is presupposed: S *can* X is infelicitous if X will independently be realized

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If this can be cashed out:

- one-way implicative behaviour follows from the necessity presupposition

- the positive entailment $able(X) \vdash X$ is blocked by the presence of the possibility operator

  - the action available to an agent need not be taken
  - S *can* X is not a prediction that S *will* X

- if action A is realized, its causal sufficiency for X will produce $able(X) \vdash X$

- on this view, we need the perfective to do the work of peeling off the possibility modal

Historical possibility? (Piñón, 2003; Mari, 2015)

- in a **branching time framework** (Thomason, 1984; Belnap, 1991; Condoravdi, 2002)

  - the past is determinate, the future branches
  - the set of instants t, t' is partially ordered by temporal precedence $\prec$

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- *histories h* are maximal sets of linearly ordered instants
- propositions are evaluated at $\langle t, h \rangle$ pairs

- historical possibility and past have a scope interaction: possible pasts are just pasts

(38) $\llbracket \Diamond_h \rrbracket := \lambda P \lambda \langle t, h \rangle . \exists h'[P(\langle t, h \rangle) \,\&\, t \in h']$

(39) $\llbracket \text{PAST} \rrbracket := \lambda P \lambda \langle t, h \rangle . \exists t'[P(\langle t', \rangle) \,\&\, t' \in h \,\&\, t' \prec t]$

(40) $\forall \langle t, h \rangle \forall P[\Diamond_h(\langle t, h \rangle, \text{PAST}(P)) \rightarrow \text{PAST}(\langle t, h \rangle, P)]$

- this will do what we need, but there's no obvious *a priori* reason why the perfective should represent $\Diamond > \text{PAST}$ and the imperfective $\text{PAST} > \Diamond$

- Mari (2015) uses (40) differently: ability modals are just $\Diamond_h$, and the entailment results from the presence of a perfective (past) in the modal complement

  - perfective in French, e.g., must block future reference in the modal complement; imperfective allows this (or brings in a generic)
  - Matthewson (2012) on Gitksan: future reference in the complement blocks actuality entailments
  - this view would be bolstered by evidence from a language with optional future reference in circumstantial modal complements, and associated optional actuality entailments:
    * English is argued to be such a language, but that predicts: a felicitous reading of *I can/am able to speak French* in a situation where I am taking a class now that will have me speaking French at the end of next year.

3.3   Insights from *too* and *enough* constructions

Karttunen (1971) points out that *too* and *enough* constructions are optionally implicative:

(41)   a.   Bertha was fast enough to win the race. $\rightsquigarrow$ *Bertha won the race.*
        b.   Bertha wasn't fast enough to win the race. $\rightsquigarrow$ *Bertha didn't win the race.*

Hacquard (2005): T&E constructions pattern with ability modals

(42)   a.   *Bertha a été assez rapide pour gagner la course, #mais elle n'a pas gagné.*
            'Bertha was-PFV fast enough to win the race, #but she didn't win.'
        b.   *Bertha était assez rapide pour gagner la course, mais elle n'a pas gagné.*
            'Bertha was-IMPF fast enough to win the race, but she didn't win.'

As with *be able, pouvoir*, an at-base implicative story (cf. Hacquard, 2005) won't work, because *manage* still entails under imperfective

Proposal:

- (circumstantial) E&T constructions have the structure proposed for ability modals, but are specific about the type of action involved

- *be fast enough to X/être assez rapide pour X* presuppose the existence of a certain degree of fastness d, the deployment of which will cause X (cf. also Schwarzschild, 2008)

  (43) Bertha was fast enough to win the race $\sim$ Bertha was able to win the race (because she was d-fast)

- E&T constructions presuppose the necessity of d-adj for complement actualization, and assert a causal sufficiency relationship between a demonstration of the relevant property and actualization of the complement.

  - *be fast enough to win the race* presupposes: there is a certain degree d of speed necessary for winning the race
  - *S be fast enough to win the race* asserts: S is such that her demonstration of d-fastness (at the appropriate time, see below) will cause her to win the race

- perfective E&T constructions force a demonstration of the property in question:

  - this is supported by plain adjective-possession claims:

  (44) *Bertha a été   rapide.*
        Bertha was.PFV fast.
        'Bertha was (did something) fast.'

  - in the context of an E&T construction, instantiation of the property 'unlocks' the implicative entailment

- imperfective does not require instantiation (but also does not block it).

3.4   Looking forward

E&T claims require more than just perfective to entail

- the modal flavour of the complement must be circumstantial (Meier, 2003)

- the (potential) time of the complement, or goal, must be at the same time as the demonstration (Marques, 2012, for Portugese):

  (45) *No último encontro, ele foi humilhado o suficiente para agora recusar o convite para um novo encontro (mas parece que já se esqueceu, porque está a pensar aceitar).*

'In the last meeting, he was-PFV humiliated enough to now refuse the invitation for a new meeting (but it seems he already forgot), since he is thinking of accepting.'

This suggests the following:

- actuality entailments are linked to circumstantial, goal-oriented modalities (Mari, 2015)

- there is some reality to the action-dependent ability claim: the goals of ability modals cannot be temporally separated from the ability-time

- abilities are, at some conceptual level *beings*, not *havings*: the perfective consequently instantiates a demonstration instead of a time of possession

Another puzzle:

- ability modals in Spanish and Brazilian Portugese are fully ambiguous between an actual and a counterfactual reading (Borgonovo and Cummins, 2007; Vallejo, 2017):

  (46) *Jean pudo   coger el   bus . . . pero no quiso/   y   tuvo un*
        Juan can.pstpfv take   the bus . . . but   not want/and had a   trip
        viaje   fantástico.
        wonderful.

        'Juan was able to take the bus . . . but he didn't want to/and he had a wonderful trip.'

- a situation where the speaker doesn't know what happened requires imperfective

- can this be reconciled with the view of ability/goal-oriented modality put forward here?

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