Attention to facts: counterfactuals, the progressive, and 'before'

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Goals of this talk:
– Take a close look at the relationship between non-veridical (esp. “counterfactual”) uses of 'before'-sentences, the progressive and counterfactual conditionals
– Characterize and compare the notions of “likelihood” involved in the interpretation of non-veridical 'before'-sentences and counterfactuals
– Connect the interpretation of the progressive to the interpretation of (non-veridical) before

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1 'Before'

Topics for this talk:
– The interpretation of '[before B]' in '[A [before B]]', where 'B' is a clause.
– The modal dimension of the meaning of 'A before B' and its relation to the counterfactual 'if had been ¬A, would have been B'

Not in this talk:
– Before' as a preposition with a DP complement.
– The fine details of its temporal semantics. See Beaver and Condoravdi (2003) and references therein.

1.1 Entailments of 'before'- and 'after'-sentences

The clausal complement of 'before' is not entailed by the whole sentence. In contrast, the complement of 'after' is entailed. The matrix clause is always entailed:

(1) a. A before B ⇒ B
    b. B after A ⇒ B

A 'before B' entails A but not B¹
(2) I left the party before I got sick.
    a. ⇒ I left the party.
    b. ⇒ I got sick.

'B after A' entails both A and B
(4) I got sick after I left the party.
    a. ⇒ I got sick.
    b. ⇒ I left the party.

Assymetry between 'before'- and 'after'-sentences: 'A before B' does not entail 'B after A', whereas 'B after A' entails 'A before B'.²
(6) a. A before B ⇒ B after A
    b. B after A ⇒ A before B

'A before B' does not entail 'B after A'
(7) I left the party before I got sick.
    ⇒ I got sick after I left the party.

'B after A' entails 'A before B'
(9) I got sick after I left the party.
    ⇒ I left the party before I got sick.

Mozart died before he finished the Requiem.
(3) a. Mozart died.
    b. Mozart finished the Requiem.
(5) Mozart finished the Requiem after he died.
    a. Mozart died.
    b. Mozart finished the Requiem.

Mozart died before he finished the Requiem.
(8) Mozart died before he finished the Requiem.
(10) Mozart finished the Requiem after he died.

¹What is entailed is of course not merely the truth of the matrix clause, but its truth at a time whose location is restricted by the temporal clause.
²The difference in veridicality is one of several well-documented asymmetries between 'before' and 'after' (Anscombe, 1964; Hoimiński, 1972, 1974; Valencia et al., 1992; Olphara, 1993, among others). Beaver and Condoravdi (2003) argue that while these asymmetries hold between sentences involving 'before' and 'after', the two lexical items themselves are nevertheless converses.
**1.2 (Non-)veridical uses of ‘before’ and their modal implications**

**Veridical:** B is implied to be true.

- ‘A before B’ has no relevant modal implications.

- The police evacuated the airport before the bomb exploded.
  \[ \sim \text{The bomb exploded.} \]

**Non-committal:** B is neither implied to be true nor implied to be false.

- B may be false, but if it is, it was at least reasonably probable (Beaver and Condoravdi, 2003).

- Having seen several suspicious pieces of luggage, I left the the airport before any of them exploded.
  \[ \sim \text{An explosion seemed likely and may or may not have occurred.} \]

- I left Trafalgar Square about half an hour ago and it started to look scary. The happy crowd that had made its way towards the square for some reason got cut off by the police and the Trade Union Congress march was prevented from getting in for their planned meeting. I gather that McDonalds has been trashed. Tourists seemed to be mingling curiously with the demonstrators in the square, but there was no violence at that time. Yet the police seem to be blocking off all the exits. I decided to leave before there was any trouble. [Google]
  \[ \sim \text{Trouble looked likely before I left and may or may not have come about.} \]

**Counterfactual:** B is implied to be false.

- B was reasonably probable (Beaver and Condoravdi, 2003).

- The police defused the bomb before it exploded. And a good thing too, because they saved the lives of a trainful of commuters.
  \[ \sim \text{There was no explosion.} \]

**Under what circumstances is ‘A before B’ true when B is false?**

- The truth of B (jointly with A) is not necessary for the truth of ‘A before B’.
- BUT nor is the falsehood of B (jointly with the truth of A) sufficient for the truth of ‘A before B’, even when the temporal relationship is right.

\[ (11) \ A, \sim B \Rightarrow 'A \ before \ B' \]

Beaver and Condoravdi (2003):

- David never won a gold medal at anything, but he once ate lots of ketchup.
  \[ \Rightarrow \text{David ate lots of ketchup before he won all the gold medals in the Sydney Olympics.} \]

**Analysis of non-veridical readings**

In the analysis of Beaver and Condoravdi (2003), the time contributed by the temporal clause is specified in terms of an earlist operator applied to the denotation of the temporal clause. When earlist is undefined at the world w of evaluation, it is relativized to a set of alternative worlds:

- Trace w back to the reference time t_A of ‘A’ (when ‘not A’ was still possible)
- Look at those courses of events that were reasonably probable at w, t_A
- Check whether B is consistent with those courses of events
- If consistent, then earlist is defined at w
  (as the earliest occurrence of ‘B’ among the courses of events that were reasonably probable at w, t_A)

**Non-veridical implications as contextual entailments**

- The definedness of earlist is not a pragmatic presupposition
  (i.e., need not be satisfied at all worlds in the context set in order for the interpretation to succeed).

- Point-wise evaluation at worlds in the context set; those where earlist is undefined are discarded
  (i.e., where B did not happen and was unlikely at the relevant time).

- ‘before/after’-clauses can be informative.
  - Only those worlds survive the update at which B either happened or was reasonably probable.
    - Note that if B happened, it need not have been likely!
    - For consistent update, it is sufficient that there be some such worlds in the context set.

- Veridical and non-veridical readings are contextual entailments
  (i.e., they result from updating particular types of context with a ‘before/after’ sentence).

**Most important for our purposes:**

- “For the counterfactual reading, the input context has to entail that A’s occurrence makes B’s later occurrence impossible and that prior to A’s occurrence there was a process that made B’s occurrence at least reasonably probable.” (Beaver & Condoravdi 2003:51)
- Facts at times later than the reference time of ‘A’ are given up in the process of “renumbering history.”
- An intuitively plausible and often observed parallelism links the truth of “counterfactual” “A before B” with that of the corresponding counterfactual conditional If had not been A, would have been B.

**Questions:**

- What does “reasonably probable” mean?
- What is the relationship between (17a) and (17b)?
- Are posterior facts (later than the reference time of A) ignored in both?
2 Counterfactual conditionals

A first hypothesis based on the preceding section:
- Counterfactual ‘A before B’ and the counterfactual conditional ‘not-A ∨ B’ go hand in hand.
  I.e., whatever makes one true (false) also makes the other true (false).
- Likelihood at the relevant past time is crucially involved in both.

2.1 ‘Before’-sentences and counterfactuals

Problem for the first hypothesis: While ‘A before B’ on its counterfactual reading implies that B was/is likely, counterfactual conditionals do not generally imply this.
(18) ‘A before B’ ⊃ ‘If had been ~A, would have been B’
(19) ‘A’, ‘If had been ~A, would have later been B’ ⊃ ‘A before B’

Scenario 1
You are on the bus from San Francisco to Los Angeles. You get off at Santa Barbara; the bus travels on. The next day you hear that the bus had an accident and everyone on board was injured or killed. Consider now the following sentences:
(20) If I hadn’t gotten off the bus, I would have been injured. [true]
(21) I got off the bus before I got injured. [infelicitous/false]
  - Intuitively, (21) is false because the accident was not foreseeable at the time I got off – i.e., likelihood.
  - But (20) is true even though the accident was unlikely!

Main difference: The truth of the counterfactual depends on ‘posterior’ developments (i.e., ones after the reference time of ‘A’ whereas the ‘before’-sentence does not.

2.2 Posterior counterfactuals and prior indicatives

The difference between counterfactuals and ‘before’-sentences is reminiscent of their relation to their indicative counterparts. Counterfactuals are not generally associated with likelihood, whereas indicatives are.

Pro equivalence
(22a) is false (unlikely) now because (22b) was false (unlikely) then.
(22a) If Oswald had not killed Kennedy, someone else would have.
(22b) If Oswald does not kill Kennedy, someone else will.

Examples like (22a,b) have led many authors to the believe that counterfactuals are basically past-tense indicatives.

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Contra equivalence
In the above scenario, (23a) is true, but (23b) is false.
(23) a. If I hadn’t gotten off the bus, I would have been injured. [is true now]
  b. If I don’t get off the bus, I will get injured. [was false then]

Scenario 2
I was on my way to the airport this morning when my car broke down. Now I am back home, upset because I believe:
(24) If I had not missed my plane, I would be on my way to Vancouver now.
The next morning, however, it turns out that the plane crashed and everyone on board was killed. So I was lucky, for
(25) If I had not missed my plane, I would be dead now.
Q: But maybe what matters is that the plane crash was likely, not from the speaker’s subjective perspective, but somehow ‘objectively’ i.e., with respect to facts that held at the time unknownst to the speaker?
A: Not likely. Very similar effects are observed with posterior facts that happen purely by chance, and therefore cannot have been predictable. Here’s another example from the philosophical literature on the counterfactuals:

Scenario 3
Time 1: A fair coin is about to be tossed, and you are asked to make a bet. Since the coin is fair, (26) is false.
(26) If I bet on tails, I will lose. [was false then]
Time 2: You bet on heads. The coin is tossed and comes up heads. You win. Now (27) is true:
(27) If I had bet on tails, I would have lost. [is true now]
The counterfactual (27) is now true. But there was no earlier time at which the indicative (26) was true.

\[\text{Examples like these suggest that the ‘before’-sentence is more closely related to the past indicative than to the present counterfactual.} \]
- ‘A before B’:
  B was predictable/likely at the time of A;
  If not-A then B’ was true at the time.
- ‘If had been not-A, would have been B’:
  B may have been very unlikely at the time of A;
  Does not imply that ‘if not-A then B’ was true at the time.

\[\text{\textsuperscript{1This scenario is due to Edgington (2003))} \]

\[\text{\textsuperscript{2This example was attributed to Sidney Morgenbesser by Slotz (1978) and was also discussed by Bennett (1984, 2003), Edgington (1995), Barker (1998), Kaufmann (2005) and others.}} \]
2.3 Consequences for the analysis of counterfactuals: Holding on to the facts

**Naive strategy**

To evaluate a counterfactual 'If had been A, would have been B', where 'A' is false and the reference time of 'A' precedes that of 'B'.

- Hypothetically "rerun history" from a past time at which 'A' was still a "live possibility"
- Restrict this hypothetical exploration to those courses of events in which 'A' does occur.
- The counterfactual is true iff all of those courses of events lead to 'B'.
- Modify the preceding clause if some weaker notion of necessity is called for (e.g., Kratzer's "human necessity" relative to an ordering source).

**Proper strategy**

Make reference to a relation of causal (in)dependence. Hold on to facts that are causally independent of the antecedent.

- **Bus example**: Whether the accident occurs does not causally depend on my presence or absence on the bus.
- **Coin example**: Whether the coin lands heads or tails does not causally depend on the bet.

### Counterfactuals vs. 'before':

- Posterior facts that are causally independent of 'A' are held constant in the interpretation of the counterfactual 'if had been ~A, would have been B'.
- Such posterior facts are given up in the interpretation of 'A before B'.

3 'Before' again

**A second hypothesis** in contrast to the findings on counterfactuals:

- What matters for the question whether 'A' happened "before B" or not is whether 'B' was likely at the time.
- Ignore everything that came after 'A'.
- Consider all and only the facts of the world at the reference time of 'A'.

But this is still not enough: Certain facts about the state of the world at the reference time of 'A' must be given up as well.

3.1 Likelihood and 'before'

#### Problem for the second hypothesis: Counterfactual 'A before B' does not always imply that 'B' is (was) probable at the time in question.

In (28) the use of before is felicitous even though the meteor was unlikely to reach the ground.

(28) a. As meteors usually do, as scientists expected, the meteor burned up before it hit the ground.
   b. If the meteor had not burned up, it would have hit the ground.
   - The context given in (28) explicitly denies that the meteor was likely to hit the ground. Still, there is no problem with (28a).
   - Notice that the counterfactual (28b) is true as well. This is for a somewhat different reason, though (see below).

Likewise, (29a) is felicitous even though Bill’s books were never likely to become overdue.

(29) a. As he always does, as people around here always do, Bill returned his books to the library before they became overdue.
   b. If Bill hadn’t returned his books to the library, they would have become overdue.

#### A still better strategy for interpreting 'before'-sentences

- Causally independent facts are not just "given up" in the interpretation of 'before'-sentences
  - Giving up facts means "opening up" the question of whether those facts were likely to hold.
  - The answer may well be affirmative.
  - That’s not what we want in cases like (28a), (29a).
- Rather, the very question of whether they occur or not is disregarded.
  - Intuitively, focus on a part of the world: the process that is (was) at the relevant time bound to bring about the truth of the 'before'-clause.
  - Don’t even think about things external to that process.

#### A potential objection

Q: But the counterfactuals in (28b) and (29b) are also true! Doesn’t that (somehow) explain the truth of the 'before'-sentences?

A: The counterfactuals are true because their antecedents are causally (though not logically) inconsistent with the events that interfered with the truth of B (the friction in the atmosphere; the books’ becoming overdue).
- Conditional antecedents "win" over unmentioned conflicting facts (see Hiddleston, 2005, for a theory which takes this into account)
- In 'before'-sentences, we want to know whether a given time lies "before B," regardless of what happens at that time.
- In 'before'-sentences, on the other hand, we want to know whether the reference time of A was "before B," regardless of what A is.
- In a fully compositional account, the interpretation of 'before B' should not even have access to A.
  - Our interpretation of 'before B' cannot make reference to (the negation of) A.
4 The Progressive

Topic for this talk:
- The modal dimension of the progressive on the ‘event in progress’ interpretation.

4.1 The Imperfective Paradox

- How to relate the meaning of the progressive to the meaning of the non-progressive
- Account for the entailment patterns of activity vs. accomplishment predicates

Activity predicates
(30) John was swimming in the lake.
\implies \text{John swam in the lake.}

Accomplishment predicates
(32) John was swimming across the lake.
\implies \text{John swam across the lake.}

Implications of continuation and (non-)completion
(34) Mozart was working on the Requiem when he died.
\sim \text{Had he not died when he did Mozart would have continued working on the Requiem.}

(35) Last time I saw her, she was writing her thesis.
\sim \text{She may or may not have finished.}

(36) Last time she was seen, she was crossing a minefield. She most likely never made it across.

(37) Last time she was seen, she was climbing the mountain in a blizzard. She most likely never made it all the way up.

Two views on the progressive

**Intensional view**: the progressive relates an event in progress and a corresponding complete event that may be non-actual (Dowty 1979, Landman 1992, Bonomi 1997, Portner 1998, Zucchi 1999, Higginbotham 2004, Fernando 2008 among others)

**Extensional view**: the progressive turns a complete event into an incomplete event, an event in progress (Parsons 1989, 1990, Van Geenhoven 2005, Szabó 2008, among others)

4.2 Normality

Dowty (1979):

\[ \text{Normality} \]

- For an accomplishment predicate like swim across the lake whether the sentence in the progressive entails the sentence in the perfective depends on whether \( w \in \text{Inr}(I, w) \).
- Activity predicates like swim in the lake satisfy the subinterval property so the sentence in the progressive entails the sentence in the perfective.
- For an activity predicate whether the sentence in the progressive entails that the described event went on past the reference time depends on whether \( w \in \text{Inr}(I, w) \).

Normality and Interruptions

\[ \text{Inr is too global:} \quad \text{all the facts of \( w \) at time \( I \) determine \( \text{Inr}(I, w) \)} \]

- Suppose that the most likely course of events given everything that holds true at the reference time is for the interruption to occur
- Suppose that if both Mary’s crossing and the truck moving follow their natural course, then collision is inevitable. Still (39) is judged to be true in that situation
- In a two truck scenario (40) and (41) both can be judged true.

(39) Mary was crossing the street when the truck hit her.

(40) Mary was crossing the street when the first truck hit her.

(41) If the first truck hadn’t hit her, the second truck would have.

4.3 Actual Facts and Reasonable Options

Landman 1992:

- “Thus, if an accomplishment manages to get completed, it is unproblematic to assume (in retrospect) that the progressive is true during the development stage. This is the case even if the event gets completed against all odds” (p. 14)
- Scenario 1: no miracle, Mary drowns. Scenario 2: miraculously, Mary swims across the Atlantic.
- (42) is false on Scenario 1 but true on Scenario 2.
- The fact that Mary actually manages to cross the Atlantic is taken into account in the evaluation of the progressive.
- Landman argues that some form of normality is necessary to distinguish between (39), on the hand, and (43), (42), on the other.
(42) Mary was crossing the Atlantic. \[\text{false on Scenario 1/true on Scenario 2}\]

(43) Mary was wiping out the Roman army.

**Landman’s Event Stages**

- An event \(e\) is a stage of another event \(e_1\) if \(e_1\) can be regarded as a more developed version of \(e\), that is, if \(e_1\) is the same event in a further stage of development.
- Let \(e\) be an event that goes on at \(i\) in \(w\). Let \(e_1\) be an event that goes on at \(j\) in \(w\) and \(i < j\).
  
  - \(e_1\) is a continuation of \(e\) iff \(e\) is a stage of \(e_1\).
  
  - Let \(j\) be a non-final interval [sic].
    
    - \(e_1\) stops at \(j\) in \(w\) iff no event of which \(e_1\) is a stage goes on beyond \(j\) in \(w\).
    
    - Let \(P\) be an activity or accomplishment predicate, where \(P(e_1)\), and \(e\) a stage of \(e_1\).
      
      - \(e\) is a process stage of \(e_1\) iff \(e\) has the same process characteristics as \(e_1\).

**Event Stages and Reasonable Options**

- The set of reasonable options for \(e\) in \(w\), \(R(e,w)\), is such that \(v \in R(e,w)\) iff there is a reasonable chance on the basis of what is internal to \(e\) in \(w\) that \(e\) continues in \(w\) as far as it does in \(v\).
- In determining what chance a stage has of continuing ignore facts about the world that are external to the stage.
- Within a world look just at what happens.
- Construct a continuation branch by considering continuation in a given world plus counterfactual reasoning.
- \(\text{PROG}(e, P)\) is true in \(w\) iff \(\exists e' : (e', v) \in \text{Cont}(e, w) \text{ and } P(e')\) true in \(v\).

**Issues with Landman’s analysis**

- The notions of stage and continuation/development are ultimately a primitive in the theory.
- The same event can be a stage of different types of possible developments in a way that is relevant to the meaning of the progressive (Bonomi 1997).
- Multiple Choice Paradox (Bonomi 1997)

**Incompatible developments**

Suppose that at 10am of June 21 I am on a boat that goes from the port of Rafina to the islands of Andros, Naxos, Paros with the intention of getting off at the Naxos port.

(45) \text{a. I am going to Naxos on the boat from Rafina. [true]}

\text{b. I am going to Paros on the boat from Rafina. [false]}

Now suppose that there was a problem at the port of Naxos so the boat couldn’t stop and, as a result, I ended up on Paros.

(46) \text{a. Yesterday at 10am I was going to Naxos on the boat from Rafina. [true]}

\text{b. Yesterday at 10am I was going to Paros on the boat from Rafina. [true]}

Suppose the same scenario as before except that at 10am I have not made up my mind yet which port to get off on.

(47) \text{a. I am going to a Cycladic island. [true]}

\text{\rightarrow There is no particular Cycladic island I am going to.}

(48) \text{a. I am going to Andros. [false]}

\text{b. I am going to Naxos. [false]}

\text{c. I am going to Paros.}

**Context sensitivity and perspectives**

Suppose I board a plane headed to NYC but which is hijacked and ends up in Washington: both (49a) and (49b) can be judged true.

(49) \text{a. I was flying to NYC. [true]}

\text{b. I was flying to Washington.}

**The set of reasonable options is too restrictive and absolute**

- The counterfactual alternatives in the continuation branch of a world \(w\) are determined based on a local/limited view of the facts in \(w\) at a given time.
  
  - But we need to allow for alternatives in which the ‘event in progress’ in \(w\) develops and culminates in different ways.
  
  - We also need to introduce context sensitivity in the semantics of the progressive.
5 Outline of a formal analysis

Goals of this section:
- Add a principled (and also off-the-shelf) way to deal with (many) counterfactual conditionals.
- Against this background, propose a principled way to deal with 'if' clauses and with the progressive which highlights the contrast.

5.1 Premise semantics, similarity, and human necessity

Main points (accepted here largely without argument):
- Counterfactuals and 'if'-sentences alike call for a modal interpretation in terms of what’s likely, necessary, etc.
- The standard interpretation of necessity as truth at all A-worlds is too strong for our purposes.
- For instance, if B was likely but did not happen, its likelihood cannot have been true at all possible courses of events. Similar arguments abound for conditionals.
- “Human necessity” is a weaker notion of truth, roughly speaking, that at all “relevant” worlds, e.g., all worlds following the “normal” course of events.
- Goal: Encode the difference between counterfactuals and 'if'-clauses in terms of different conditions on the “relevant” worlds to consider.

Some formal background

Let us adopt the formal tool of an ordering source imposing a relation of relative likelihood on the possible worlds (or states of affairs). For details, see Kratzer (1981).

- A proposition is a set of possible worlds.
- A modal base is a function f from worlds to sets of propositions. For concreteness, let f(w) be the set of those propositions that are contextually taken for granted. Their intersection, \( \bigcap f(w) \), is the set of those worlds which, are compatible with everything that is taken for granted.
- An ordering source is a function \( \sim \) from worlds to sets of propositions. Intuitively, in our case, \( \omega(w) \) is the set of those propositions that are “normally” true (or more likely to be true than not) given the facts at w.
- At each world w of evaluation, \( \omega(w) \) induces an order between worlds: world u is (at least) as relevant as world v iff all the propositions in \( \omega(w) \) that are true at v are also true at u.

\[
\forall u \in \bigcap f(w) \exists v \in \bigcap f(w) [\sim v \wedge v \subseteq f(w) \wedge u \subseteq f(w) \wedge v \subseteq f(w) \wedge u \subseteq f(w)]
\]

This offers a new notion of “human necessity” that is weaker than “simple” necessity. Simplifying, p is a human necessity at w relative to f and \( \omega \) iff those worlds in the modal base that are most likely under \( \omega(w) \) are p-worlds.

5.2 Counterfactuals

Main idea:
- In the evaluation of ‘If had been A, would have been B’ at world w, the “relevant” worlds are those which satisfy two conditions:
  - A is true at them; and
  - they are at least as similar to w as any other A-worlds.
- Roughly: The counterfactual is true at w iff among all A-worlds, those that are most similar to w are C-worlds (Stalnaker, 1968; Lewis, 1973).

\[
f(w) = 0 \text{ for all } w. \text{ Thus } \bigcap f(w) = W, \text{ the set of all worlds.}
\]

- Since the relevant ranking is based on relative similarity to w, \( \omega(w) \) contains propositions that are true at w.
- Q: Which true propositions?

How the relevant worlds are chosen (reconstruction of similarity)

Much recent work in philosophy, psychology, and artificial intelligence has explored the role of causal (in)dependencies in the interpretation of counterfactuals (Spirtes et al., 1993; Pearl, 2000; Hiddleston, 2005; Schulz, 2007, among many others)

\[(52) \text{I bet on heads, the coin came up heads, I won}\]

If I had bet on tails, I would have lost.

- True if the speaker’s bet has no (causal) influence on the outcome of the toss.
- False if it does (e.g., if a different fair coin is used depending on the bet).

\[(53) \text{If I got off the bus, the bus had an accident, I was uninjured}\]

If I hadn’t gotten off the bus, I would have been injured.

- True if the speaker’s presence or absence on the bus has no (causal) influence on the accident.
- False if it does.

\[&text{If a relation of causal dependence (or causal influence) is given as basic, then the interpretation of counterfactuals can be explained in terms of it.}\]

Lots of people nowadays think that this is a more fruitful approach than Lewis’s attempt to go the other way and reduce causality to counterfactual (in)dependence.

The above presupposes that there is a set of most similar A-worlds. In fact, neither Stalnaker nor Lewis make exactly that assumption. Stalnaker’s iff the most similar A-world (to w) is a C-world. Lewis: iff any sequence of A-worlds whose similarity to w grows monotonically, ends in a sequence of C-worlds.
Main idea reconstructed:

- In the evaluation of "If had been A, would have been B" at world w, the "relevant" worlds are those which satisfy two conditions:
  - A is true at them; and
  - True propositions at w that are causally independent of A are true at them.
- The counterfactual is true at w iff among all A-worlds, the most relevant ones are B-worlds.

This is a simplified picture. The causally most relevant worlds should be ranked further by likelihood or normalcy. We ignore this here.

Some formal background

- Causal dependence is a relation between variables (in the statistical sense).
- The relation is transitive and asymmetric (often given as a directed acyclic graph).
- In our framework, a "variable" is a partition of the set of all worlds (like a question denotation).
- For simplicity, assume that these variables are binary (i.e., yes-no questions): Each corresponds to a proposition and its negation.
- At each world, all relevant variables take some value or other.
- Let Xo be the cell in partition X that contains world w.
- Impose the following constraint on ordering sources for counterfactuals:
  - For all X, Y such that X → Y (i.e., X causally influences Y), and all w, o(w) contains only Yw ∩ Xo (not Yw).

Intuitively, the partition Y does not really play a role in the interpretation; only its refinement by X does.

Upshot:

- Suppose X, Y are both true at w.
- Without causal dependence: Among the worlds at which X is false, those at which Y is true are more similar to w than those at which Y is false.
- With causal dependence X → Y. Among the worlds at which X is false, Y does not count towards relevance at w.

We derive the following asymmetry:

- If Y were false, X would (still) be true.
- If X were false, Y might not be true.

Back to our examples

(57) If I had stayed on the bus, I would have been injured.

- Suppose my presence or absence on the bus had no causal bearing on whether there would be an accident.
(62) a. David ate lots of ketchup before he made a clean sweep of all the gold medals in the Sydney Olympics.
   b. Mozart, fatally ill, died before he finished the Requiem.

5.4 The Progressive
   - Similar idea as for before
   - Have a partition that tracks the development of an event of type P and disregard any causally independent issues.
   - Use Pfüon’s 2008 notion of the degree of realization of an event type.
   - The realization of P (realization of P to degree 1) is a human necessity relative to ordering sources of two different kinds:
     - ordering sources based on prior intentions, plans, schedules etc.
     - realistic ordering sources based on what actually happened
   - Thus, posterior facts need not be given up in the interpretation of the progressive; they would be relevant if the progressive is interpreted relative to a (totally) realistic ordering source

The Context Dependence of the Progressive
   - Make the interpretation of the progressive dependent on:
     - a contextually determined ordering source of the appropriate type
     - a contextually supplied standard for event type degree of realization

Pfüon’s aspectual composition with degrees

Pfüón 2008, p. 203:

what is measured by degree functions is the degree to which x qua type O is affected (or effected) in e with respect to the verbal property in question. Thus, the incremental degree function eat, does not measure the degree to which x as a ‘bare individual’ or quantity gets eaten in e but instead measures the degree to which x qua type ‘applesauce’ is eaten in e and so a sensible answer seems to be that if x qua type ‘applesauce’ is eaten at all in e, then the degree to which x qua type ‘applesauce’ is eaten in e is 1. Although, naturally, eating more of x would mean that a larger quantity of applesauce is eaten, it would not change the degree to which x qua type ‘applesauce’ is eaten. To harp on this point, we are not measuring quantities of applesauce that are eaten – we are measuring the degree to which the event type ‘eat applesauce’ is realized.

5.5 Conclusions
   - Causal (in)dependence is at work in ‘before’, the progressive, and counterfactuals.
   - Given a set of relevant variables, counterfactuals are interpreted rather differently from ‘before’ or the progressive. Hold independent facts constant for counterfactuals, give them up for ‘before’ and the progressive.
   - But the set of relevant variables is generally small (and likely subject to contextual and general cognitive factors), and variables that are not included are ignored.

Perspectives
   - In the hijacking scenario, (63a) is judged true if the ordering relative to which the realization of I fly to NYC is a human necessity is determined by e.g. the schedule of the flight.
   - (63a) is judged true if the ordering relative to which the realization of I fly to NYC is a human necessity is determined by the actual course of events

(63) a. I was flying to NYC.
   b. I was flying to Washington.

Activity predicates

Pfüón 2008, p. 205–206:

the incremental degree function eat, does not measure the degree to which x as a ‘bare individual’ or quantity is eaten in e. Instead, it measures the degree to which x qua type ‘applesauce’ is eaten in e. and so a sensible answer seems to be that if x qua type ‘applesauce’ is eaten at all in e, then the degree to which x qua type ‘applesauce’ is eaten in e is 1. Although, naturally, eating more of x would mean that a larger quantity of applesauce is eaten, it would not change the degree to which x qua type ‘applesauce’ is eaten. To harp on this point, we are not measuring quantities of applesauce that are eaten – we are measuring the degree to which the event type ‘eat applesauce’ is realized.

Conclusions
   - Causal (in)dependence is at work in ‘before’, the progressive, and counterfactuals.
   - Given a set of relevant variables, counterfactuals are interpreted rather differently from ‘before’ or the progressive. Hold independent facts constant for counterfactuals, give them up for ‘before’ and the progressive.
   - But the set of relevant variables is generally small (and likely subject to contextual and general cognitive factors), and variables that are not included are ignored.

This idea, as well as its implementation in terms of disregarding partitions, sounds a lot like awareness, though outside the epistemic realm we should probably prefer to call it attention (Franke and de Jager, 2008).