# 'repurposed' past and (un)certainty in counterfactuals

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## This Talk: What's in the past?

- Contribution of past tense
- Past has a meaningful contribution
- Pastness, Counterfactuality, Uncertainty

## This Talk: The past is unequal

- Everybody agrees that the past is unequal
- But, disagree w.r.t. its index
- Times? Worlds? Times and worlds?
- Branching timers are right: we need branching times.
- Possible worlders are right: we need possible worlds.
- They can both be right here: a fusion of both accounts.

# At the beginning: Linear Time

On a Reichenbachian model, time is linear.



Figure: Linear time.

#### Linear Time

Taking the index of past morphology to be only a time has the effect that the *unequal* on the time line will naturally get you either:

- the *before-now* past
- or the after-now future
- with "now" being (equal to) the utterance time, or the time of the context of use  $(t_C)$ .

### Abandoning Linear Time

On a Priorian model, the model is branching. The past and the present are tenses, while the future is a tense and a modal.

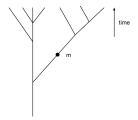


Figure: Branching time.

## Branching Time

The argument then goes: if the past is *unequal* on the timeline, then

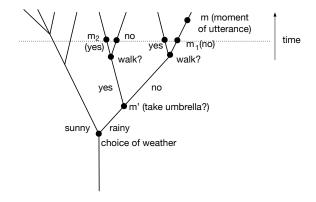
- it must be in the before-now realm
- as the realm of the future is inherently modal,
- while the past is purely temporal.

- the actual past
- the open future
- a representation of real, in the world, possibility

- In a unified manner, BT can account for the real, historical, past.
  - (1) I had coffee for breakfast.
- And also counterfactuals involving real past choices, a.k.a historical counterfactuals.
  - (2) I had coffee for breakfast, if I had had tea, it would have been better.
  - $\longrightarrow$  historical connectedness assumption is a virtue here because, the examples involve before now choices or events.

After all, a counterfactual past could be something that was possible (open) in the real past, but did not actualise.

A tree-like representation of counterfactuals, supports the view that the past is fixed (and hence linear) while the future may be open (branching into multiple possible futures).



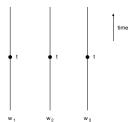
(3) If I had an umbrella yesterday, I would have gone for a walk in the rain.

- non-real epistemic possibilities (real counterfactuals, counterlegals, ...)
  - (4) If kangaroos had no tails, they would topple over. (Lewis 1973)
  - (5) If water froze at 7 degrees, we would have had more snow.
- Try to consider these examples, in light of the rationale above: "There is a line that takes one back ..., there is an alternative branch that would then be taken ...." You can't, can you?

The problem here is that there is <u>no reaching back</u> in the linear past where it was possible that kangaroos had no tails, i.e. the issue whether there was a past choice does not arise.

→ BT fails because it relies on a notion of historical connectedness – i.e., historical connectedness is a vice here.

 To account for counterfactual conditionals that appeal to possibilities that were never open in the real world, the PW is the right way to go – as it goes against having one connected set of temporal courses of events (and in favor of several linear time lines).



- atemporal counterfactuals
- the kangaroo
- counterlegals
  - $\longrightarrow$  You can always hop to a different world, and say of that one that so and so is (would have been) the case.

(6) Humphrey cares about whether he could have won the elections. (Kripke 1980)

→ Spatio-temporal separation gets the wrong results.

- The example is not about a counterpart of Humphrey he couldn't care less about other guys who look like him.
- Humphrey; in world w<sub>1</sub> cares that he; could have won the elections, really. It is about Humphrey himself, his feelings, and the fact that an emotional reaction is warranted for what would have been the case for him in case he had won.
- This is not understandable on this model, in which a Humphrey-look alike wins the elections in the completely separate world  $w_2$ .

- It helps to think of this example within a connected past framework with an element of reality.
- The branching account does that well, because it helps here that the histories are predicted to intersect.
  - → Distinct linear lines is not always justified, because it means that one would be losing the real possibilities in their specificity.
  - Another problem is the appeal to miracles (when intuitively we can appeal to choices).

- The open future: worlds contain full histories that reach well into the future – making each worlds individually deterministic.
- The branching account does that well after all, this is what it was designed to do.

- (7) FNVs (non "subjunctive"): If they invade Laos tomorrow, they will ...
- (8) FLVs (singly marked "subjunctive"): If they **were** to invade Laos tomorrow, they would ...
- (9) FCF (doubly marked "subjunctive"): If they had invaded Laos tomorrow, instead of yesterday/ some other country, they would've ...

- Lewis's theory has a 50% chance of getting the FCF correctly:
  - Correct if it is read akin to the kangaroo example;
  - Incorrect if the possibility is real in the model.
- Lewisian view gets both FLVs and FNV conditionals wrong: FLVs are categorised together with FNVs.
- Might be OK for a philosopher for whom matters of form do not arise; for linguists it would be absurd to assume that both forms are equivalent.

- The PW framework fails, even on accounts that take the contribution of past tense seriously (getting rid of miracles and defining similarity locally): (Arregui 2009)
- Relying on past similarity misses the counterfactuality inference of FLVs: since there are no de re facts about a future event, identifying the actual-world facts that matter is not possible.
- So here the possible worlds account mistakes what the future will be: disregarding a prominent reading of such examples where the speaker expresses something about self location with respect to a set of possible worlds.

- It is fair to say, that the differentiation also fails on the branching times account, since the future is inherently open;
- especially on a temporal past interpretation as the event is in the future altogether and there is no going back in time.
- Taking an epistemic stance (following Ippolito 2002, Kaufmann 2005) has the potential to save the day.
- Kaufmann's (2005) observation that certainty is lifted in conditionals.

- Problem: relying on past epistemic accessibility results in taking their counterfactuality to be merely a pragmatic inference (Ippolito 2002 et seq.; Leahy 2011).
- According to Ippolito (2002), past morphology in counterfactuals contributes to the epistemic evaluation time of the antecedent: a present tense epistemic modal, a past tense epistemic modal, and or a past tense epistemic modal that is further in the past.
- Nevertheless, there is no axiom that says that the further you go in the past the more a possibility should be excluded. The assumption is only that the model will be more diverse Condoravdi 2002).

- (10) (Maybe they will, maybe they won't.) If they invade Laos tomorrow, . . . .
- (11) (It doesn't look like they will invade.) If they invaded Laos tomorrow, ...
- (12) (They failed to get congress to approve the strike.) If they had invaded Laos tomorrow, . . .
- $\longrightarrow$  Future oriented counterfactuals cannot be accounted for without some extra notion of epistemic settledness: one that takes the moment of speech  $m_C$  into consideration.
- In this respect, an obvious advantage of the past as modal account is that it can deal with examples that cannot work without an additional notion of exclusion.

# Which way to go?

What would it take for the Ockhamist model to also be able to help visualize

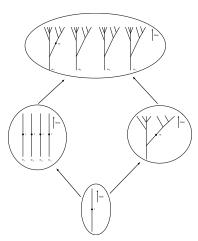
- the real past
- future contingents
- conditionals
  - open conditionals,
  - metaphysically closed counterfactual pasts and presents,
  - and metaphysically open future counterfactuals?

# Which way to go?

- Neither the "past as past" camp trying to emulate possible worlds in a branching framework, nor the "past as modal" camp trying to emulate branching in a possible worlds framework — can do full justice to the richness of proper uses of past morphology.
- What we propose to do is actually simpler than taking sides and trying to emulate: our irenic proposal is to fuse both accounts.
- This means that we take the notion of possible worlds seriously (they are clearly needed, e.g., for epistemic alternatives and unreal possibilities, such as counterlegals). But we also take the notion of branching seriously (the future is really open, not just epistemically uncertain).

#### Enter the forest

From linear time to the modal forest, in two steps: a commuting diagram.



#### Enter the forest

No matter whether one considers multiple possible worlds or branching histories to be the first step, one ends up with the same framework: a modal forest of trees of branching histories.

#### Enter the forest

- W is a set of possible worlds,
- the worlds each have a tree-like structure of possible histories, so that for each  $w \in W$ ,  $\mathcal{M}$  contains a partial ordering  $\langle M_w, <_w \rangle$  that is like a whole branching time model (left-linear and connected), and
- T is a set of clock times, which (for simplicity) we assume to be isomorphic for all histories in all worlds (usually, e.g., isomorphic to the real line).
- A context of use then specifies a world  $w_C \in W$  and a moment  $m_C \in M_{w_C}$  and, accordingly, a time  $t_C$ ; but again, there is no "history of the context", as the future is open.

Let me illustrate the modal forest by a series of examples that pose problems for both PW and the BT frameworks, as neither can, in isolation, do full justice to the way in which we can now easily evaluate the example sentences in a single coherent discourse.

The first setting is familiar from historical "past choice" examples above. You are in a boring meeting, which you went to instead of staying home. In fact you had to run to the bus to campus in order to catch it, and you feel remorse:

(13) If I hadn't rushed for the bus, I wouldn't be in this boring meeting.

Out of boredom, you play with the plastic spoon that comes with the meeting coffee. It breaks and hurts your finger. Here you can utter the two counterfactuals:

- (14) If I hadn't played with that spoon out of boredom, I wouldn't have hurt myself.
- (15) If that spoon had been made out of metal, I wouldn't have hurt myself.
- These counterfactual sentences are based on very different facts.
- They can also be uttered in one breath; they can be connected by "and" into a single sentence.
- So for semantic evaluation one should expect a single semantic model to do the job.

- The metal sentence shows that the "past as past" approach fails
  for obvious reasons: never was there a moment at which the
  antecedent could have been true—you can trace the spoon
  through its whole history and it's always made from plastic, no
  matter what happens to it (basically this is like the kangaroo case);
- while the "past as modal" approach cannot capture the fact that
  the broken plastic spoon sentence expresses that you feel remorse
  for what you did (basically, this is the point of the Humphrey
  example).

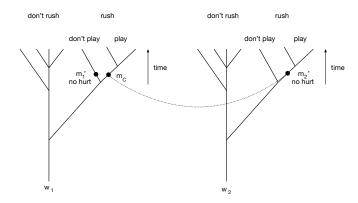


Figure: A tale of two spoons. The dotted line indicates "tree-hopping" accessibility from the actual moment of the context of utterance,  $m_C$ , in tree (world)  $w_1$ , to a corresponding moment  $m'_2$  in world  $w_2$ . In  $w_2$ , the spoon is made of metal, which is not a real possibility given that it is actually made of plastic.

## The past is unequal in the modal forest

The unequal index of the past (which allows <u>hopping</u> to a different moment or a different tree) is

- neither the  $\langle w,t \rangle$  pair of the "worlds imes times" possible worlds approach,
- nor an m/h index of a single branching tree —
- rather, it is a triple \( \lambda w, m, h \rangle \),
- which we also write  $\langle w, m/h \rangle$  to indicate the presupposition  $m \in h$ . (It is also presupposed that  $h \subseteq w$  is a history in w; thus,  $m \in w$ .)

## The past is unequal in the modal forest

The tripartite index allows for three different ways of anchoring inequality:

- given that two indexes  $\langle w, m, h \rangle$  and  $\langle w', m', h' \rangle$  are different, it can be that  $m \neq m'$ , that  $h \neq h'$ , or that  $w \neq w'$ , where the "or" is inclusive.
- In case  $m \neq m'$  but h = h' and w = w', we can derive a past semantics as in the purely temporal case: the minimal change in the index is non-modal, and so it should be that m' < m, i.e., that the altered index contains a moment in the real past of m (note that  $m' \in h$  follows directly from the definition of a history as a maximal linear chain).

- 1 There is a way to allow that the history could have been otherwise ... ("I know which moment it is, but here's this other real possibility")
- 2 There is a way to allow that the *world* could have been otherwise ... ("I know which moment it is, but here's this unreal possibility")
- There is a way to allow for uncertainty w.r.t. self location ("I don't know, or I'm simply uncertain, which moment it is" – thereby also, most likely, which history it is, and possibly also which tree, i.e. world, it is).
- There is also uncertainty with respect to an open future (for when the speaker does not know which history, for there is nothing (yet) to be known, even though she may be completely certain about which moment it is and which world it is).

- Two types of certainty that not:
  - The model allows the speaker to express her epistemic stance towards a given proposition: taking the proposition to be excluded, from the perspective of m<sub>C</sub>, but still on the home tree,
  - or even excluded from the home tree.
- Two types of uncertainty:
  - Epistemic indistinguishability of the context of use a self location problem: "Tell me more" type.
  - Uncertainty with respect to an open future: "Wait and see" type.

(16) If I were in Mallorca now, ...

Three readings:

- I know I'm not in Mallorca, but was this ever a real possibility?
  - (a) Maybe it was a real possibility. Say I had the ticket, but decided to visit grandma at the hospital (in which case we are dealing with a different history, same world, i.e. same tree): here,  $m_C \in h_1$  and  $h_1 \neq h_2$ .
  - (b) It was never a real possibility. I'm with grandma at the hospital (in world w<sub>1</sub>) and Grandma and I are day dreaming (about a different world, i.e. different tree, say w<sub>2</sub>): here m<sub>C</sub> ∈ w<sub>1</sub> and w<sub>1</sub> ≠ w<sub>2</sub>.
- (c) I do not know whether that shore is Mallorca or Ibiza. Say my boat got lost in Mar Balear; it finally made it to a shore; I don't know which.

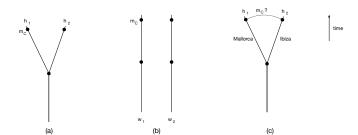


Figure: Three different models for being in Mallorca. (a) a real possibility; (b) in a different world; (c) uncertainty of self-location.

What's noticeable in the above is that the speaker has access to the actual moment  $(m_C)$  in the first two readings, (a) and (b), but not in the third, (c), which expresses epistemic indistinguishability. Indeed, she knows she is at one specific moment. She just doesn't know which one it is. She therefore considers a set of options for  $m_C$ . These options correspond to moments on different histories, or even in different trees.

Note that what the speaker takes to be the set of options for  $m_C$  could also include an unreal possibility. She will be mistaken, a case of false belief, but from her epistemic standpoint, for example, she could think that she landed in Ibiza, Mallorca, or even Hawaii, which is not a real possibility!

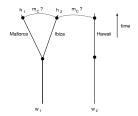


Figure: Mallorca, Ibiza or Hawaii?

This illustrates that the speaker does not always have access to  $m_C$ , that is when she lacks information, but can still allow for certain possibilities that would be compatible with what she knows, or at least what she thinks she knows.

crucially, it also allows the speaker to express uncertainty with respect to a possibility without saying something counterfactual at all: but, simply I don't know  $m_C$ .

Similar examples are known in the literature under the label conditionals as tests:

(17) I don't know if this pen is made of metal, but if it were, it would transmit heat. So, let's test.

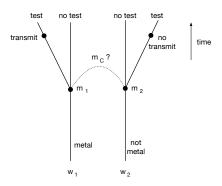


Figure: Is the pen made of metal? In  $w_1$  it is, in  $w_2$  it isn't, and the speaker is unsure which tree is actual one (she cannot distinguish between moments  $m_1$  and  $m_2$ , as indicated by the curved dotted line). Conducting the test reveals which it is: if the pen transmits heat,  $w_1$  is actual; if not,  $w_2$ . before testing the trees are indistinguishable

In terms of self location in a forest of trees: here the speaker considers the possibility of the pen being made of metal as epistemically indistinguishable from the possibility of the pen being not made of metal (equally likely, therefore also as equally unlikely).

- That the phenomenon conditionals as tests fits well with the self-location representation that we can offer in our model is an advantage of the model showing its versatility.
- The speaker standing in the modal forest faces not just real possibilities in one tree, but more than one possible tree.
- The past indicates that the speaker lacks access to  $m_C$ .

The problem of self location can extend to the past as well. There are things in the past that are objectively and metaphysically settled, but the speaker may simply not know how they turned out.

(18) I bought a lottery ticket last week. The numbers were drawn yesterday. I haven't checked, yet. I don't know how they turned out.

Once these numbers are drawn (whatever they are) the matter is closed – it can only be epistemically open for me: I may simply not know it. (Metaphysically settled, epistemically open)

Or, the speaker does not know as there is nothing yet to be known. (Metaphysically and epistemically open)

(19) I bought a lottery ticket last week. The drawing is tonight. I am excited how it will turn out.

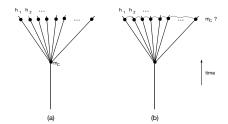


Figure: Two different lottery scenarios: **before the lottery**: different outcomes are possible; one has to **wait and see** which one is realised and **after the lottery**, the numbers are settled, but unaware of the real outcome, the different moments in the histories corresponding to the different possible outcomes are epistemically indistinguishable (indicated by curved dotted lines), but one of them is the actual one. Somebody else who has that information could **tell the speaker more** and help solve this problem of self-location.

- Before the drawing, there is no uncertainty of self-location, only an open future – genuinely so.
- This type of uncertainty is a wait-and-see type: epistemic uncertainty w.r.t. a metaphysically unsettled possibility.

What about the future?

- Isn't the fact that it is genuinely open enough to say that one would always speak of it with uncertainty?
- Fact is that for the purpose of living, language allows us to talk about the future (say when we make plans or predictions) with certainty.

We now want to discuss what it means to be certain that the (metaphysically open) future is (epistemically) one way or another — genuine cases of open future: an open future from a metaphysical perspective.

But first, note that metaphysically settled futures exist:

- (20) Said in Paris: (I know) there is no (real) future for me to physically make it to Berlin (through the available means of transport) in one hour.
- (21) We will all be dead in 200 years.
- (22) The moment a coin is tossed, it is metaphysically (mathematically) settled which way it will land, but most of us won't be able to tell until the outcome is visible.

There are states of affairs that are <u>really open</u>, but are, nonetheless, subjectively taken to be one way or another. We can choose to talk about them <u>as if they are not</u> (from an epistemic perspective). (Copley 2002 et seq., Kaufmann 2005, Karawani and Zeijlstra 2013)

- (23) (I'm certain) John will come to dinner at 8 pm.
- (24) (I'm certain) John is going to come to dinner at 8 pm.
- (25) (I'm certain) John comes at 8 pm.
- We speak with certainty of an open future.

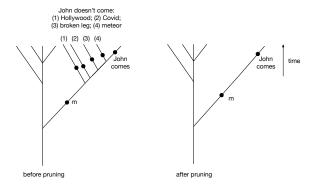


Figure: Illustrating pruning with respect to "John will come to dinner." He still might not come of course, and we know this, but we have reason to disregard all unlikely possibilities that may intervene: e.g., Hollywood calling for an audition, catching Covid, breaking a leg, a meteor hitting, ... The tree on the right shows the effect of pruning: the only live possibility we consider is the one in which John comes.

## The epistemic dimension: pruning

An operation we call pruning

- Pruning allows the speaker to make a claim about the history, by disregarding the complement possibility and pretending as if the outcome p is settled.
- Pruning allows the speaker to disregard certain possibilities to make a (really open) future event epistemically salient

## The epistemic dimension: pruning

Formally, we can define pruning of a world (i.e., a branching tree) as the deletion of moments from the top (if you prune one moment, you have to prune all later moments as well, exactly as in pruning a real tree).

#### Definition (Pruning).

Let two worlds  $w = \langle M, < \rangle$  and  $w = \langle M', <' \rangle$  be given. We say that w' is a pruning of w iff (i)  $M' \subseteq M$  and (ii) for all  $m \in M \setminus M'$ , if  $m' \in M$  and m < m', then  $m' \notin M'$ , and (iii) <' is the restriction of < on M'. If additionally  $M \neq M'$ , we say that w' is a proper pruning of w.

Having introduced this tool, we can now also explain the use of past morphology as means to bring about the unlikelihood inference in conditionals: as in FIVs.

- (26) Candidate to journalist: I'm not going to lose, but if I were to lose, ... (Karawani 2014)
- (27) If he took this syrup, he would get better, but I am certain that he will refuse to drink it when we ask him to do so.

(latridou 2000)

The example illustrates epistemic distancing via pruning a genuinely open future. The candidate has pruned the real possibility that he loses, but can still talk about what would be the case on that pruned branch. Same goes for the speaker in the syrup example, the speaker has pruned the real possibility that the sick person takes the syrup, but can still talk about what would be the case on that branch.

## The epistemic dimension: unified via pruning

Futurates and FLVs receive a unified treatment. In both cases, the speaker has an opinion. In both cases, the unlikely branches are pruned. Futurates talk about the unpruned branch (just made salient) and express likelihood (or certainty). The past in FLVs refers to the pruned branch and express unlikelihood.

The inventory we have allows us to distinguish what has been called the contrast between a future reading of *will* and an epistemic reading *will* without abandoning the future semantics for *will* altogether. (contra, e.g., Klecha 2013, Giannakidou 2018).

- (28) It will be sunny tomorrow.
- (29) It will be the postman at the door.

On our account, however, we can distinguish them by saying that *It will be sunny* involves a pruned diagram making a history salient, *will* w.r.t. an open future makes a claim about the future; while *will* w.r.t. a settled present indicates the time when the uncertainty will be lifted.

- (30) That will be the postman at the door.
- (31) That would be the postman at the door.
- (32) That would have been the postman at the door.

If I hear the door bell ring and I don't know who it is, but I'm quite sure, I say: "This will be the postman – he always rings twice." With one layer of past, I can say: "This would be the postman, but it is not 12 yet" – expressing more uncertainty.

With two layers of past, I can say something stronger: "This would have been the postman, but I know he's ill; I wonder who rang the bell."

 $\longrightarrow$  The main observation is that epistemic uncertainty (w.r.t. it being the postman) is no longer possible with two layers of past.

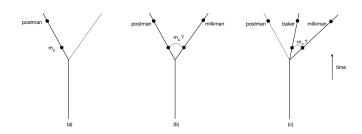


Figure: In (a), we have an interaction with the future (when will the uncertainty be resolved? I'm betting on  $m_C$  being "the postman is at the door"), the time of the discovery is in the realm of  $m > m_C$ . In (b), with one layer of past,  $m_C$  is still compatible with "the postman is at the door" but it is indistinguishable from other options in the realm of  $m > m_C$  given my uncertainty; and in (c), with yet another layer of past (excluding "it is the postman" from the history — "it is the postman" is in the realm of  $m > m_C$  but on a different history, one that is no longer accessible from  $m_C$ ).

The same observation can be made about conditionals: conditionals about the future with two layers of past can no longer express uncertainty.

- (33) (Maybe they will, maybe they won't.) If they invade Laos tomorrow,
- (34) (It doesn't look like they will invade.) If they invaded Laos tomorrow, ...
- (35) (They failed to get congress to approve the strike.) If they had invaded Laos tomorrow, . . .

In the indicative, the future is left unpruned, but the speaker picks out one of the possibilities; whereas in the FLV case, the pruned possibility is what the speaker is talking about. A FCF would then indicate that the possibility is counterfactual: as such, the FCF conditional refers to a different history, one that is not accessible from the perspective of  $m_C$ .

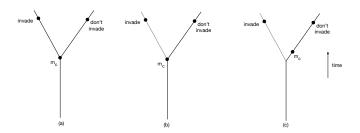


Figure: In (a), we have an indicative conditional, where both branches, "invade" and "not invade", are compatible with  $m_{C}$  / open in the realm of  $m > m_{C}$ . In (b), with one layer of past, both "invade" and "not invade" are open on  $m_{C}$ , but from the perspective of the speaker, the "invasion" branch has been pruned. In (c), with yet another layer of past, from the perspective of the speaker, the "invasion" branch is excluded from the history – the possibility is at a time after the time of  $m_{C}$ , but on a different history, one that is no longer accessible from  $m_{C}$ .

## What the fusion gets us?

- not just one tree, but a forest of trees, where each tree represents a world with real possibilities
- no historical connectedness; spatio temporal disconnect is allowed.
- no determinism
- represent "real" in-the-world possibility.
- A treatment for epistemic issues (e.g. uncertainty, epistemic indistinguishably, and the open future)
- An account of past stacking as a function of distance from  $m_C$ .

#### This Talk: A real fusion of both accounts

- One can emulate the possible world via branching which is what proponents of the past as tense camp do – "a history is a world"
- One can emulate the branching via possible worlds which is what the proponents of the past as modal camp do – "bundling"
- But, that ends up mixing virtues with vice.
- A real fusion which introduces a forest of branching trees, getting rid of historical connectedness and allowing for the representation of real in-the-world possibility.

