conditional sentences and causal reasoning

Seminar 4: Back to the challenges

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3 challenges

Plan today

- discuss the challenges
  - a linguistic challenge: fake tense
  - subjunctive vs. indicative conditionals
  - Simpson’s paradox

- Conclusions
a linguistic challenge: Fake Tense
Fake Tense
In English subjunctive conditionals the Simple Past, and also the Past Perfect appear not to be interpreted as semantic past tense or past perfect.

(6) If Peter left in time, he will be in Amsterdam this evening.
(7) If Peter left in time, he would be in Amsterdam this evening.
(8) If Peter had left in time, he would have been in Amsterdam this evening.
Fake Tense
In English subjunctive conditionals the Simple Past, and also the Past Perfect appear not to be interpreted as semantic past tense or past perfect.

Fake Tense occurs in other contexts as well

(9) I wished I owned a car.
(10) He behaves like he was sick.
(11) Suppose she failed the test.
(12) It’s time we left.
Fake Tense
In English subjunctive conditionals the Simple Past, and also the Past Perfect appear not to be interpreted as semantic past tense or past perfect.

- Fake Tense occurs in other contexts as well.
- It occurs in various languages from different language families.

English, French, Latin, Classic Greek, Russian, and Old Irish (Indo-European), Cree (Algonquian), Tonga and Haya (Bantu), Chipewyan (Athabascan), Garo (Tibeto Burman), Nitinaht (Wakashan), and Proto-Uto-Aztecan (in the reconstruction of Steele). [James 1982]
Fake Tense

In English subjunctive conditionals the Simple Past, and also the Past Perfect appear not to be interpreted as semantic past tense or past perfect.

- Fake Tense occurs in other contexts as well.
- It occurs in various languages from different language families.
- Fake Tense is something a tense language can develop diachronically.
related observations

Simple past subjunctives about the present CAN be counterfactual, but they don’t need to.

(13) If I were you, I wouldn’t do that.

Double past subjunctives about the present or the future MUST be counterfactual.

(14) I might have to cancel my trip to Paris, which is a pity, because *if I had been in Paris next week, we could have met.

In this case counterfactuality cannot be cancelled.
related observations
Double past subjunctives CAN have counterfactual presuppositions.

(15) Last year, John died. If he had run the Boston marathon next spring, he would have won.

Simple past subjunctives CAN’T.

(16) Last year, John died. *If he ran the Boston marathon next spring, he would win.
The Challenge:

Why should the semantics of subjunctive conditionals involve a Past Tense?

What’s its contribution?
2 The literature

**FAKE TENSE**

*past-as-past approaches*
- Tedeschi 1981
- Crouch 1992
- Condoravdi 2002
- Arregui 2007
- Romero 2014

*past-as-modal approaches*
- Palmer 1986
- Fleischmann 1989
- Dahl 1997
- Iatridou 2000
- Schulz 2014
The Past-as-Past approach

• Subjunctive conditionals explore historical alternatives (Thomason).
• The simple Past shifts the temporal variable of the accessibility relation into the past.

(1) If Sue hadn’t danced with Peter, she would have danced with Tom.
3 Fake Tense

Problems

- The temporal backshift is not always needed: what about subjunctive conditionals about the future? (Actually it’s even worse: backshift makes bad predictions in these case.)
- The temporal backshift is not always possible: what about generic counterfactuals/counterpossibles?
- We need additional similarity restrictions (Morgenbesser cases) …
- … and an answer to this problem might make the backshift superfluous.
Even then we need additional similarity restrictions (Morgenbesser cases) …
3 Fake Tense

Solution

Replace quantification over historical alternatives with intervention (in the antecedent).
3 Fake Tense

Solution

Replace quantification over historical alternatives with intervention (in the antecedent).
3 Fake Tense

Solution

Replace quantification over historical alternatives with intervention (in the antecedent).

- no need to refer to the past to make counterfactual statements about the utterance time true
- no need of temporal reference for generic/counterpossible conditionals
- the Morgenbesser cases come out nicely
- … but there might be a problem …
What if the intervention violates conceptual/metaphysical laws?

**Challenge**
- What if the intervention violates conceptual/metaphysical laws?

```
Support ¬Smoke
```

```
This is not a proper model!!!
```

```
alternative structure
event structure
```

```
3 Fake Tense
```

```
challenge
```

```
intervention
```

```
t0
```

```
smoking
Stop smoking
```

```
Stop smoking getting support
```

3 Fake Tense

Challenge

- What if the intervention violates conceptual/metaphysical laws?
3 Fake Tense

Challenge

What if the intervention violates conceptual/metaphysical laws?
3 Fake Tense

We do actually seem to care about these cases of model violations:

Observation (Ippolito 2013, p. 55)

“SPCs can in principle be counterfactual, but if the particular eventuality in the antecedent has already happened in the past or if any presupposition of the antecedent is inconsistent with the actual history at the utterance time, then a SPC is infelicitous.”

[... and a PPC needs to be used.]
3 Fake Tense

**Solution**

- Intervention doesn’t always happen in the antecedent.
- Sometimes we need to change the past (by intervention) to make the antecedent true (to avoid violations of conceptual/metaphysical laws).
- We use the Perfect in PPCs to express this past-shift of the intervention.
3 Fake Tense

The proposal

- Intervention can be restated in terms of a similarity relation.
- We can extend this order to indexes, consisting of an event structure and a time, and select for the minimal indices that make the antecedent true (with model restrictions on proper event structures).

\[
\text{Int}(i_0, A) = \{ i \mid i \models A \land \neg \exists i' (i' \models A \land i' < i) \}
\]

- The selected event structures will work with the latest possible intervention that makes the consequent true - as intended.
3 Fake Tense

Discussion

★ Past-as-Past for the Simple Past is out, but there are other options (Iatridou 2000, Schulz 2014)

★ The order on event-structures is difficult to define, because it involves answering questions involving the relation between causation, time and event-structures.
indicative vs. subjunctive
2 The Problem

Adam’s (1975) Kennedy example

(1) If Oswald did not kill Kennedy, then someone else did.
(2) If Oswald had not killed Kennedy, then someone else would have.
The Challenge:
What is the difference between indicative and subjunctive conditionals?

Why do we give up belief (in the death of Kennedy) in the subjunctive case, even though it is not necessary to make the antecedent possible?

Can you model both readings using Pearl’s approach to conditionals?
What about Pearl?

the indicative conditional

X: Oswald killed Kennedy.
Y: Sb. else killed Kennedy.
K: Kennedy was killed.
2 The Problem

What about Pearl?

the indicative conditional in terms of learning

X: Oswald killed Kennedy.
Y: Sb. else killed Kennedy.
K: Kennedy was killed.

\[ K \leftrightarrow (X \lor Y) \]
2 The Problem

What about Pearl?

the indicative conditional
in terms of learning

X: Oswald killed Kennedy.
Y: Sb. else killed Kennedy.
K: Kennedy was killed.

K $\leftrightarrow (X \lor Y)$
2 The Problem

What about Pearl?

the indicative conditional in terms of learning

K ⟷ (X ∨ Y)

X: Oswald killed Kennedy.
Y: Sb. else killed Kennedy.
K: Kennedy was killed.
What about Pearl?

the counterfactual conditional
in terms of intervention

K ⟷ (X ∨ Y)

X: Oswald killed Kennedy.
Y: Sb. else killed Kennedy.
K: Kennedy was killed.
2 The Problem

What about Pearl?

the counterfactual conditional in terms of intervention

K ⟷ (X ∨ Y)

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2 The Problem

What about Pearl?

the counterfactual conditional in terms of intervention

\[ K \iff (X \lor Y) \]

X: Oswald killed Kennedy.
Y: Sb. else killed Kennedy.
K: Kennedy was killed.
What about Pearl?

the counterfactual conditional in terms of intervention

$K \leftrightarrow (X \lor Y)$

X: Oswald killed Kennedy.
Y: Sb. else killed Kennedy.
K: Kennedy was killed.
Contra Lewis and Adams:

There is one underlying interpretation mechanism for both, indicative and subjunctive conditionals. This mechanism is based on intervention, but allows for backward reasoning in case of uncertainty. Differences in marking (Fake Tense) put additional constraints on this mechanism.
solution

indicative conditional $\neg X \leadsto (Y \lor Z)$

- retraction of X makes the conditional possible
- retraction is belief retraction
- dependent facts are retracted as well

X: Oswald killed Kennedy.
Y: Sb. else killed Kennedy.
K: Kennedy was killed.
indicative conditional $\neg X \leadsto (Y \lor Z)$

- retraction of $X$ makes the conditional possible
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$K \leftrightarrow (X \lor Y)$

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X: Oswald killed Kennedy.
Y: Sb. else killed Kennedy.
K: Kennedy was killed.
indicative conditional $\neg X \sim (Y \lor Z)$

- retraction of $X$ makes the conditional possible
- retraction is *belief* retraction
- dependent facts are retracted as well
- adding the antecedent will allow us to derive the consequent given the laws
- the conditional is predicted to be true

X: Oswald killed Kennedy.
Y: Sb. else killed Kennedy.
K: Kennedy was killed.
solution

subjunctive conditional $\neg X \leadsto (Y \lor Z)$

• retraction of $X$ makes the conditional possible
• retraction is *ontic* retraction
• dependent facts are retracted as well, but dependence means something else

X: Oswald killed Kennedy.
Y: Sb. else killed Kennedy.
K: Kennedy was killed.
solution

subjunctive conditional \( \neg X \leadsto (Y \lor Z) \)

- retraction of \( X \) makes the conditional possible
- retraction is *ontic* retraction
- dependent facts are retracted as well, but dependence means something else

\[
\text{X: Oswald killed Kennedy.} \\
\text{Y: Sb. else killed Kennedy.} \\
\text{K: Kennedy was killed.}
\]
solution

subjunctive conditional $\neg X \sim (Y \lor Z)$

- retraction of $X$ makes the conditional possible
- retraction is *ontic* retraction
- dependent facts are retracted as well, but dependence means something else

X: Oswald killed Kennedy.
Y: Sb. else killed Kennedy.
K: Kennedy was killed.
solution

subjunctive conditional $\neg X \sim (Y \lor Z)$

- retraction of $X$ makes the conditional possible
- retraction is *ontic* retraction
- dependent facts are retracted as well, but dependence means something else

- adding the antecedent will not allow us to derive the consequent
- the conditional is predicted to be false

X: Oswald killed Kennedy.
Y: Sb. else killed Kennedy.
K: Kennedy was killed.
You enter a town which you believe to have just two snackbars, A and B. There you see a man walking along the street with a hamburger, and you form the belief that at least one of the snackbars is open. At the same time you form the belief that if A is not open then B is. Now as you approach one of the snackbars, it happens to be A, you see that the lights are on there. As a result you form the belief that A is open. You also believe:

*If A had not been open, B would have been open.*
2 The Problem

What about the Hamburger case?

- no epistemic dependence: independent observations.

A: Snackbar A is open
B: Snackbar B is open.
H: There is a guy with a Hamburger.

\[ H \leftrightarrow (A \lor B) \]
2 The Problem

What about the Hamburger case?

- no epistemic dependence: independent observations.

A: Snackbar A is open
B: Snackbar B is open.
H: There is a guy with a Hamburger.

H \leftrightarrow (A \lor B)
What about the Hamburger case?

- no epistemic dependence: independent observations.

A: Snackbar A is open
B: Snackbar B is open.
H: There is a guy with a Hamburger.
Simpson's paradox
Simpson’s paradox

example
Data of patients’ gender and their status after taking or not taking the drug C is listed as follows

- Male patients take drug C: 30 in total; recovered 18
- Male patients do not take drug: 10 in total; recovered 7
- Female patients take drug C: 10 in total; recovered 2
- Female patients do not take drug C: 30 in total; recovered 9
Simpson’s paradox

The paradox
if some action is optimal in a number of particular cases, it should still be optimal if you generalise over the cases

- sure thing principle (Savage 1954)
- male patient: don’t give the treatment
- female patient: don’t give the treatment
- overall: give the treatment
Simpson’s paradox

The Challenge:
How can we explain the paradox (and the incorrect intuitions? 
What should be advised as best action in this case? 
What about the following variation?
Simpson’s paradox

data of patients’ blood pressure and their status after taking or not taking the drug C is listed as follows

- patients with low blood pressure take drug C: 30 in total; recovered 18
- patients with low blood pressure do not take drug: 10 in total; recovered 7
- patients with high blood pressure take drug C: 10 in total; recovered 2
- patients with high blood pressure do not take drug C: 30 in total; recovered 9
Simpson’s paradox - solution

**Sure thing principle** (Savage 1954)
if some action is optimal in a number of particular cases, it should still be optimal if you generalise over the cases

Pearl
The sure thing principle is valid, not for learning, but for doing.
Under the assumption that the critical factor Z is independent of doing X, one can prove the principle.
Simpson’s paradox - solution

**Sure thing principle** (Savage 1954)
if some action is optimal in a number of particular cases, it should still be optimal if you generalise over the cases

**Pearl**
An action $A$ that increases the probability of an event $B$ in each subpopulation (of $C$) must also increase the probability of $B$ in the population as a whole, provided that the action does not change the distribution of the subpopulations. [Pearl, 2009, p. 181]
Simpson’s paradox - solution

- Male patients take drug C: 30 in total; recovered 18
- Male patients do not take drug: 10 in total; recovered 7
- Female patients take drug C: 10 in total; recovered 2
- Female patients do not take drug C: 30 in total; recovered 9
Simpson’s paradox - solution

- patients with low blood pressure take drug C: 30 in total; recovered 18
- patients with low blood pressure do not take drug: 10 in total; recovered 7
- patients with high blood pressure take drug C: 10 in total; recovered 2
- patients with high blood pressure do not take drug C: 30 in total; recovered 9
Simpson’s paradox - solution

**Back-door criterion** (Pearl)

Conditioning on Z is required iff

1. Z is not a descendant of X, and
2. conditioning on Z blocks every path that ends with an arrow into X.

In these case the Z-specific data carries the correct information.

- criterion is purely graphical!
- stochastic information is not sufficient, we need to have qualitative information about causal dependence
Simpson’s paradox - solution

(a)  
(b)  
(c)  
(d)
Simpson’s paradox - solution
Fake Tense:


indicative vs. subjunctive conditionals (also relevant to the topic above,):


Simpson’s paradox: