conditional sentences and causal reasoning

tutorial 1: challenges for the similarity approach

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COURSE PLAN

GENERAL INTRODUCTION

Lecture 1: The logic of conditionals: The standard view

Tutorial 1: Challenges for the similarity approach

Lecture 2: Bayes Nets and Causal Bayes Nets

Tutorial 2: Counterfactuals as Interventions

SPECIFIC TOPICS

Seminar 1 (Practicum, part 1): 3 challenges for the framework
(I will first introduce the challenges individually, then you can choose and work in groups on one of them for 40 minutes)

Seminar 2: The relation between the similarity approach and the causal approach

Seminar 3: Using Logic Programming to model causal inferences

Seminar 4 (Practicum, part 2): presentations and discussion
(each group will shortly present their ideas, we will discuss them and I will comment on the state of the arts on each of the challenges)
SIMILARITY APPROACH
Truth conditions:

\[ M,w_0 \models A > C \text{ iff } \text{Min}(\leq_{M,w_0}, [A]^M) \subseteq [C]^M \]
“The counterfactual

(1) If Nixon had pressed the button there would have been a nuclear holocaust.

is true or can be imagined to be so. Now suppose that there never will be a nuclear holocaust. Then that counterfactual is, on Lewis' analysis, very likely false. For given any world in which the antecedent and consequent are both true it will be easy to imagine a closer world in which the antecedent is true and the consequent false. For we need only imagine a change that prevents the holocaust but that does not require such a great divergence from reality." (Fine 1975: 452)
Stalnaker:

“...the relevant conception of minimal difference needs to be spelled out with care."
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A coin is going to be flipped and you bet on tails. Unfortunately, heads comes up and you lose. Now you can say:

(1) If I had bet on heads, I would have won.
1. It is of the first importance to avoid big, widespread, diverse violations of law.

2. It is of the second importance to maximise the spatiotemporal region throughout which perfect match of particular fact prevails.

3. It is of the third importance to avoid even small, localised, simple violations of law.

4. It is of little or no importance to secure approximate similarity of particular fact, even in matters that concern us greatly.

LEWIS’ SOLUTION
“Consider a man - call him Jones who is possessed of the following disposition as regards wearing his hat. If the man on the news predicts bad weather, Mr Jones invariably wears his hat the next day. A weather forecast in favour of fine weather, on the other hand, affects him neither way: in this case he puts his hat on or leaves it on the peg, completely at random.

Suppose, moreover, that yesterday bad weather was prognosed, so Jones is wearing his hat. In this case, ... .

(1) *If the weather forecast had been in favour of fine weather, Jones would have been wearing his hat.* [Tichy (1976)]
Suppose that Jones always flips a coin before he opens the curtains to see what the weather is like. `Heads' means he is going to wear his hat in case the weather is fine, whereas `tails' means he is not going to wear his hat in that case. Like before, bad weather invariably makes him wear his hat.

Now suppose that today heads came up when he flipped the coin, and that it is raining. So, again, Jones is wearing his hat.

Would you accept the statement:

(4) If the weather had been fine, Jones would have been wearing his hat.
ANOTHER APPROACH: PREMISE SEMANTICS

A conditional sentence ‘If A then C’ is true iff:

\[
\begin{array}{ccc}
A & \Rightarrow & C \\
\end{array}
\]
A conditional sentence ‘If A then C’ is true iff:

\[
\begin{array}{cccc}
A & + & \text{Facts of } w_0 & \Rightarrow_L & C \\
\text{maximal} & \text{consistent} & \text{premise} & \text{general} & \text{subset} \\
\text{set } P(w_0) & \text{laws} & \\
\end{array}
\]

special case of the similarity approach (Lewis 81):

\[
w_1 \leq w_2 \text{ iff } \{p \in P(w_0) \mid w_1 \models p\} \supseteq \{p \in P(w_0) \mid w_2 \models p\}
\]
back to cognition

- Children observed a puppet named Carol making dirty footprints on a clean floor. They were asked, “What if Carol had taken her dirty shoes off — would the floor be clean or dirty?”
- 75% of the 3-year-old and 87% of 4-year olds answered that the floor would be clean.
Marie is walking to the swimming pool in her swimsuit. On her way to the pool she is caught in a rainstorm and gets soaked. Then she gets to the pool and jumps in. Now she is all wet.

(1) If it hadn’t rained, would Marie be wet or dry?
ANOTHER APPROACH: PREMISE SEMANTICS

A conditional sentence ‘If A then C’ is true iff:

\[
\begin{align*}
A & + \text{ Facts of } w_0 \quad \Rightarrow_L \quad C \\
\text{maximal consistent subset} & \quad \text{premise set } P(w_0) \quad \text{general laws}
\end{align*}
\]

special case of the similarity approach (Lewis 81):

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A conditional sentence ‘If $A$ then $C$’ is true iff:

\[
\begin{array}{cccc}
A & + & \text{Facts of } w_0 & \Rightarrow_L & C \\
\text{maximal} & \text{consistent} & \text{premise} & \text{general} & \text{subset} \\
\text{set } P(w_0) & \text{laws}
\end{array}
\]

Problem:
- what are the laws $L$?
- what are the premises $P(w_0)$?

✓ The premises can’t be all true statements about $w_0$ (Veltman ‘76).
A conditional sentence ‘If A then C’ is true iff:

\[ A \quad + \quad \text{Facts of } w_0 \quad \Rightarrow_L \quad C \]

- maximal consistent subset
- premise set \( P(w_0) \)
- general laws
A conditional sentence ‘If A then C’ is true iff:

\[ A + \text{Facts of } w_0 \Rightarrow_L C \]

\[ \text{Basis}(w_0) = \text{minimal set of primitive facts of } w_0 \text{ from which, given } L, \text{ all other facts of } w_0 \text{ can be derived.} \]

\[ \rightarrow \text{Particular variant of Premise Semantics} \]
“Consider a man - call him Jones who is possessed of the following disposition as regards wearing his hat. If the man on the news predicts bad weather, Mr Jones invariably wears his hat the next day. A weather forecast in favor of fine weather, on the other hand, affects him neither way: in this case he puts his hat on or leaves it on the peg, completely at random.

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There are three lights called S1, S2 and L. The lights regularly change from on to off and back again. After observing the lights for a while you realize that there is a certain pattern in the way they are lit: either all lamps are on or only one of the lamps is on. At the moment S1 is off, S2 is on and L is off.

(5) If S1 had been on, L would have been on. (S1 > L)
Suppose there is a circuit such that the light is on (L) exactly when both switches are in the same position (up or down). At the moment switch one is down (¬S1), switch two is up (S2) and the lamp is off (L).

(4) If switch one had been up, the lamp would have been on. (S1 > L)
A coin is going to be flipped and you bet on tails. Unfortunately, heads comes up and you lose. Now you can say:

(1) If I had bet on heads, I would have won.
REFERENCES

a nice overview article with challenges for the similarity approach:

premise semantics:

the famous Fine example:

answers to Fine’s challenge:
  • Lewis, D.: 1979, ‘Counterfactual dependence and time's arrow’. NOUS 13, 455-476.