Sufficiency causatives

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The basic puzzle

Languages use a range of non-interchangeable **periphrastic causatives**:

(1) a. Gurung **caused** the children to dance.
  b. Gurung **made** the children dance.
  c. Gurung **had** the children dance.
  d. Gurung **got** the children to dance.

- ▶ each example describes a causal situation/chain of events:
  - ▶ some action by or involving Gurung causally *brought about* an event in which the children danced
- ▶ but (1a)-(1d) don't describe the same situations
  - ▶ (1b): force/coercion
  - ▶ (1c): causer authority (no resistance)
  - ▶ (1d): manipulation or bribery
  - ▶ (1a): indirectness

The basic puzzle

Languages use a range of non-interchangeable **periphrastic causatives**:

(1)
  a. Gurung **caused** the children to dance.　　　　　[indirectness]
  b. Gurung **made** the children dance.　　　　　　　　[coercion]
  c. Gurung **had** the children dance.　　　　　　　　　[authority]
  d. Gurung **got** the children to dance.　　　　　[manipulation]

Two questions:

1. **What's shared** (semantically) between periphrastic causatives? What produces the common causal meaning?

2. **What's different?** What makes them sensitive to different features of causal scenarios (volition, resistance, authority, etc)?

Today: we'll focus on **make**, comparing it to **cause**

A first hypothesis

Causative verbs share a common causal core of meaning, call it CAUSE (Dowty 1979)

- CAUSE ≈ *cause*
- CAUSE is a basic semantic atom
  - might be definable (e.g. in terms of counterfactuals or necessity; Lewis 1973)
  - doesn't break down into further cause-related components
- to this core, different periphrastic verbs add different non-causal entailments

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make = CAUSE + coercive implication

(2) X **make** Y do Z :=   X **cause** Y to Z
                                  + Y did not want to do Z

A first hypothesis

> X **make** Y do Z := X **cause** Y to Z
> $+$ Y did not want to do Z

Problems:

- **make** is fine when the causee plausibly wants the outcome:
  - (3) "Then a surprise surgery and hospital stay at the age of 13 brought Albert in contact with nurses who made her feel happy and important during a stressful situation."

- so, revise the coercive implication?
  ...if Y had not wanted $Z(Y)$ to occur, it still would have

- **but:** **make** is also felicitous with non-volitional causees:
  - (4) "Too much water made the plant die..."
  - (5) "Mussolini made the trains run on time."

A first hypothesis

On the CAUSE-as-core approach for **make**:

- ▶ we want to derive the coercive implication for **make**-causatives
- ▶ but we can't make reference in the semantic representation to the volitional state of the causee

One way out: causative **make** is polysemous (Wierzbicka 1998)

- ▶ the coercive implication is specified for *interpersonal* **make**
  - (6) "[Anand's mother] made Anand pump the tires [of the bicycle] every morning."   [Naipaul, *A House for Mr. Biswas*]

- ▶ but not for the *impersonal* **make** *of surprise*:
  - (7) The wind made the door slam shut.

- ▶ or the **make** *of subjective necessity*:
  - (8) "A sharp hiss made Alice draw back in a hurry."
            [Carroll, *Alice's Adventures in Wonderland*]

An alternative route?

The many **make**s route isn't very satisfying:

- ▶ intuitively, **make**-sentences have something in common
- ▶ replacing **make** with other causatives produces changes in meaning and felicity conditions:

  (9) ...brought Albert in contact with nurses who **made** her feel happy ...
  $\neq$ ...brought Albert in contact with nurses who **got** her to feel happy ...

  (10) Mussolini **made** the trains run on time.
  $\neq$ Mussolini **had** the trains run on time.

Today:

- ▶ set aside the CAUSE-as-core hypothesis
- ▶ **central claim:** causatives share causal meaning, but express different types of causal dependencies
- ▶ specific implications (e.g. coercion) follow from the type of dependency asserted

Sufficiency causatives

> **Sufficiency thesis:**
> **make** is a **sufficiency causative**, expressing that a causing event made its effect *inevitable*

- ▶ **make** is neither a hyponym nor a hypernym of **cause**, but expresses a different type of dependence
- ▶ causal dependence relations can be defined in a unified way, as configurations in a causal network (Pearl 2000, Schulz 2011)
- ▶ the consequences of a sufficiency analysis for **make**: the coercive implication

Cause, make, and counterfactual necessity

Cause plausibly predicates a counterfactual relationship between cause and effect (Lewis 1973):

(11) "In total, the fires **caused** the transit system to lose $68,000..."
→ *If the Napa fires had not occurred, the transit system would not have lost $68,000*

While a counterfactual is often pragmatically plausible for **make**:

(7) The wind **made** the door slam shut.
⤳ *The door would not have slammed were it not for the wind.*

...there are felicitous uses which explicitly deny necessity:

(12) I usually go to soccer camp in the summer. Last year I was thinking about going to band camp instead, and I could not make up my mind. Then I broke my ankle, which settled things. I am so happy the injury **made** me skip soccer camp. I had the best summer ever!
↛ *I would have gone to soccer if I hadn't broken my ankle.*

Cause, make, and counterfactual necessity

Make is not a hyponym of **cause**:

- ▶ **cause** is bad in the soccer-camp scenario
  - (13) I usually go to soccer camp in the summer. Last year I was thinking about going to band camp instead, and I could not make up my mind. Then I broke my ankle, which settled things. ??I am so happy the injury **caused** me to skip soccer camp. I had the best summer ever!
- ▶ this suggests: **cause** is associated with (counterfactual) necessity, while **make** is not

Pursuing the **sufficiency thesis:**

- ▶ **make** is good in the soccer camp scenario because the injury "settles" things.

Make, cause, and causal sufficiency

We can test this intuition with a slightly different scenario:

(14) Several things happened last summer which led me to skip tennis camp. First, I broke my ankle in the spring, and since it was taking a long time to heal, I started thinking about band camp for the first time. Then I got into an argument with my doubles partner, so even with my ankle getting better, I wasn't sure I wanted to go to tennis. Finally, my parents said they'd get me a trombone if I went to band camp, which was pretty tempting!

  a. ?I am so happy the injury **made** me go to band camp! I had the best summer ever.

  b. I am so happy the injury **caused** me to go to band camp! I had the best summer ever.

  c. $\not\to$ *Breaking my ankle made it inevitable that I would go to band camp.*   [sufficiency not supported]

Causal sufficiency: positive consequences

> **Sufficiency thesis:**
> **make** asserts that the indicated cause was **causally sufficient** for the effect: given the cause, the effect was guaranteed.
>
> X **make** Y do $Z := X$ ensured that Y Zed

We do not directly encode the coercive implication:

- ▶ but, the sufficiency analysis should produce it naturally when the embedded VP is a volitional action

  (1b) Gurung **made** the children dance.
    $\rightarrow$ Gurung's action guaranteed that the children danced.

- ▶ if the children acted freely in dancing, then Gurung's action couldn't have made the dancing *inevitable* (they could have changed their minds and not danced)

A bonus: necessity, pragmatically

> **Sufficiency thesis:**
> X **make** Y do Z := X ensured that Y Zed

Question: why is the idea that **make** predicates necessity so prevalent?

- there is a well-known tendency for sufficiency statements to be interpreted as conveying necessity
- **conditional perfection:** *if P, then Q* is often interpreted as *if and only if P, then Q* (Geis & Zwicky 1971)
  - (15) If you study for the exam, you'll get an A.
    ⤳ *If you don't study, you won't get an A*
- but conditional perfection is *defeasible* (cancellable):
  - (16) If you study for the exam, you'll get an A. Actually, you might get an A even if you don't study.

A bonus: causal perfection

Claim: if **make** predicates sufficiency, then necessity implications can arise pragmatically as **causal perfection** implicatures

- ▶ if so, we expect:

(a) contexts where necessity arises as part of the speaker's intended meaning: 'exculpatory' uses of **make**

    (17) The devil made me do it.
        → *I had no choice but to do it*   [coercion/sufficiency]
        ⤳ *I would not have done it else*   [perfection/necessity]

(b) contexts that cancel necessity inferences

    (18) My husband's arrest (finally) made me get a divorce. . . .
        Even if his arrest had not made me do it, I might have gotten
        a divorce anyway, given the way he treated me.

Interim summary

Causative verbs differ in the *type* of causal dependence they assert:

- ▶ **make** is a sufficiency causative
- ▶ . . . allows us to capture the coercive implication without hard-coding it
- ▶ . . . gives us a handle on apparent necessity inferences
- ▶ . . . explains why **make** and **cause** contrast

- ▶ because **cause** asserts (causal) necessity (and maybe some other stuff, but crucially not sufficiency)

Causal dynamics and causal dependency relations

We cash out causal dependencies in a **causal model** (Schulz 2011, Pearl 2000)

- a **dynamics** is a graphical model:
  - nodes are events or propositions, and can take on truth values (0, 1, undetermined)
  - arrows represent causal relevance links ($P \rightarrow Q$ if P is a causal influencer of Q)
- it comes along with a set of equations defining the causal links
  - given an initial setting for the nodes, we can use these equations to calculate *causal consequences* (**normal causal developments**)
- **main idea:** causal dependence relations (necessity, sufficiency) are labels for certain structural configurations in a dynamics
  - these labels appear as atoms in the semantics of causative verbs

The Lifschitz example (1990)

(19) **The circuit example:**

    a. Suppose there is a circuit with two switches and one light, such that the light is on (L) exactly when both switches are in the same position (up or not up).

   b. At the moment switch 1 is down, and switch 2 is up.

S_1	S_2	L
0	0	1
0	1	0
1	0	0
1	1	1
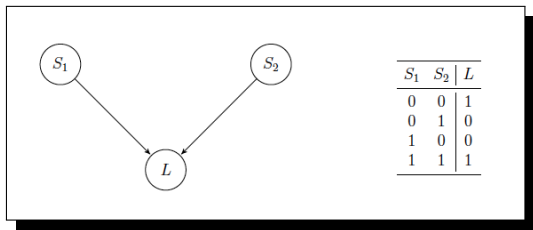
- ▶ (a) states the causal laws (dynamics)
- ▶ (b) gives us an initial setting (background situation)
- ▶ given (b), a **normal causal development** will be a situation in which the light is off ($L = 0$)

Causal necessity and causal sufficiency

Given two events C and E, and a background situation s which does not fix the occurrence of C ...

(20) C is **causally sufficient** for E relative to s if

    a. s does not produce E as a normal causal development

        the effect wasn't already inevitable

    b. $s' = s + C$ does produce E as a normal causal development

        the cause guarantees the effect

(21) C is **causally necessary** for E relative to s if

    a. s does not guarantee E

    b. $s' = s + C$ has a supersituation s'' which does not fix E, but has it as a normal causal development

        the cause makes the effect possible

    c. there is no supersituation s'' of s' which makes (b) true but does not have C as a normal causal development

        the effect was not possible without the cause

The Lifschitz example again
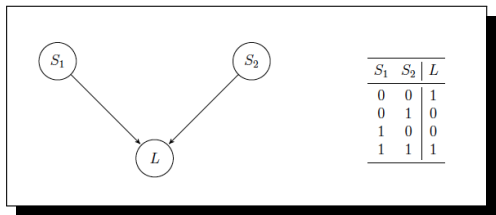
Suppose switch 1 is fixed up ($S_1 = 1$). In this background situation, flipping switch 2 up is both necessary and sufficient for the light to come on.

- if **make** predicates sufficiency and **cause** predicates necessity, we correctly predict that ...

(22) a. Turning the second switch on **made** the light go on.
  b. Turning the second switch on **caused** the light to go on.

... are both acceptable

A necessary but insufficient condition

The fire scenario
A fire burned a field outside town, starting immediately after the electric company restored power to a line that ran through the field, and which had previously been shut off. Due to a long drought, the grass was unusually dry, and thus more susceptible to burning. We assume that a power line can spark a fire only if electricity is flowing and the line comes into contact with something grounded and inflammable. Unfortunately, there had not been an inspection of the area for several months, and so the condition of the line is unknown, and cannot be determined by direct evidence in the aftermath of the fire.
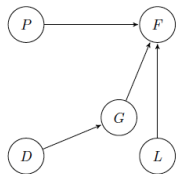
$P=$ power restored in line
$D =$ drought conditions
$G =$ dry/inflammable grass
$L =$ downed line
$F =$ fire

$$f_G = \begin{array}{c|c} D & G \\ \hline 0 & 0 \\ 1 & 1 \end{array}$$

$$f_F = \begin{array}{ccc|c} P & G & L & F \\ \hline 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 \end{array}$$
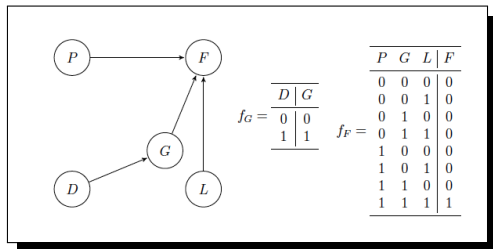
A necessary but insufficient condition: the fire scenario

(23)   a. #Restoring power **made** the field catch fire.
       b. Restoring power **caused** the field to catch fire.

We capture these judgements:

- background situation: drought, dry grass ($D = G = 1$)
- P is a necessary but insufficient condition for F
  - necessity: there's no route from the background to the fire without P
  - sufficiency: we don't guarantee F until we know L

$P=$ power restored in line
$D =$ drought conditions
$G =$ dry/inflammable grass
$L =$ downed line
$F =$ fire

$$f_G = \begin{array}{c|c} D & G \\ \hline 0 & 0 \\ 1 & 1 \end{array}$$

$$f_F = \begin{array}{ccc|c} P & G & L & F \\ \hline 0 & 0 & 0 & 0 \\ 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 \\ 0 & 1 & 1 & 0 \\ 1 & 0 & 0 & 0 \\ 1 & 0 & 1 & 0 \\ 1 & 1 & 0 & 0 \\ 1 & 1 & 1 & 1 \end{array}$$

A sufficient but unnecessary condition

The bus scenario
Lia has a high-end triathlon bike, which she rides to work almost every day. She takes the bus when rain is predicted for the evening, because it gets too cold to bike home in the rain. Occasionally, Lia's friend Ava visits her. Ava is a pro cyclist. She gets up early and borrows Lia's bike for training when she has a race coming up.
At the moment, Ava is visiting. She has a race coming up in two weeks, and is in the middle of training. Rain is predicted for the evening.
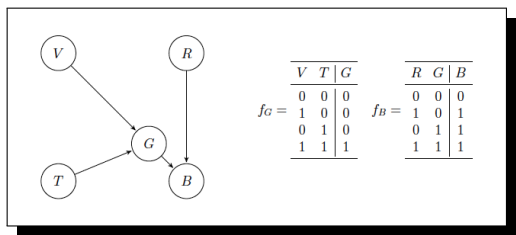
V = Ava visiting
T = Ava training
G = bike is gone
R = rain is forecast
B = Lia takes the bus

$$f_G = \begin{array}{cc|c} V & T & G \\ \hline 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 1 & 1 \end{array} \qquad f_B = \begin{array}{cc|c} R & G & B \\ \hline 0 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{array}$$

A sufficient but unnecessary condition: the bus scenario

(24) a. Ava's training **made** Lia take the bus to work.
      b. #Ava's training **caused** Lia to take the bus to work.

- ▶ background situation: Ava is visiting, rain is forecast
  ($V = R = 1$)
- ▶ T is sufficient but unnecessary for B:
  - ▶ since rain is forecast, we can get $B = 1$ with $G = 0$ and
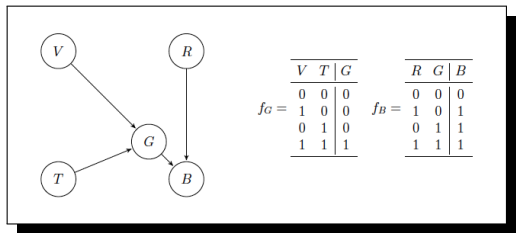   without $T = 1$ (unnecessary)
  - ▶ T guarantees B

$V =$ Ava visiting
$T =$ Ava training
$G =$ bike is gone
$R =$ rain is forecast
$B =$ Lia takes the bus

$$f_G = \begin{array}{cc|c} V & T & G \\ \hline 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 1 & 1 \end{array} \qquad f_B = \begin{array}{cc|c} R & G & B \\ \hline 0 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{array}$$

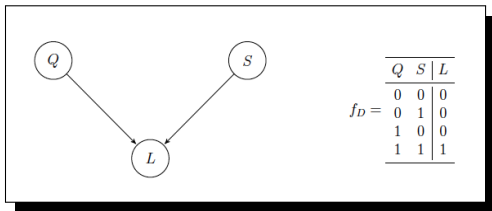# Refining the account: temporal considerations

The lighthouse scenario
The lighthouse was built with a very sturdy foundation, designed to withstand high winds at the tower top, but the foundation sustained structural damage in an earthquake about ten years ago. Even that would have been fine, but this year, there were record-setting winds and the worst hurricane season anyone can remember, and given the prior damage, it could not take the extra strain.
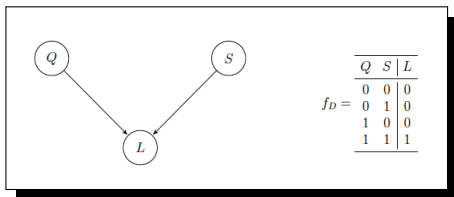
$Q=$ earthquake
$S =$ storms
$L =$ tower collapses

$$f_D = \begin{array}{cc|c} Q & S & L \\ \hline 0 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \\ 1 & 1 & 1 \end{array}$$

Refining the account: temporal considerations

Q = earthquake
S = storms
L = tower collapses

(25) a. The earthquake **caused** the tower to collapse.
      b. The storms **caused** the tower to collapse.
      c. #The earthquake **made** the tower collapse.
      d. The storms **made** the tower collapse.

. . . we can't rule out (25c) right now!

▶ intuitively: the earthquake isn't sufficient because things might still have gone another way

(26) **Temporal constraint on background situations.** In evaluating causal claims, the background situation cannot contain facts that were not fixed at the time of the purported cause.

# Other constraints: revisiting the coercive implication

Sufficiency intuitively captures the coercive implication:

X **make** Y do $Z \rightsquigarrow Y$ did not make a free decision to do Z

- but, consider the following:

  (27) The children are eager to dance. Gurung is their (strict) instructor, and they are only allowed to dance if he gives his explicit permission. Finally he does so, and they dance happily.

    a. ??Gurung **made** the children dance.
    b. Gurung **let** the children dance.

W_D	G	D
0	0	0
1	0	0
0	1	0
1	1	1

$f_D =$
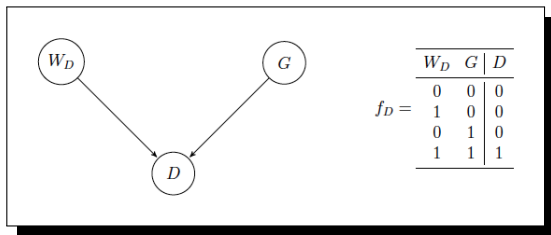
- the coercive implication doesn't follow, because nothing stops the children from changing their minds

Sufficiency and volition: command scenarios

$$f_D = \begin{array}{cc|c} W_D & G & D \\ \hline 0 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{array}$$
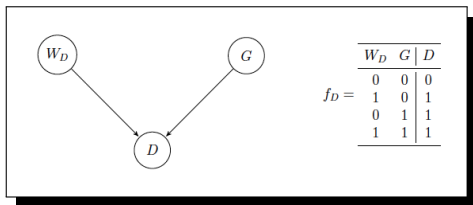
(28) The children are tired, and are not looking forward to dancing in their dance class. Gurung is their strict instructor, and they are required to obey any commands he gives them. As soon as they arrive in class, he tells them to dance. They start dancing.

    a. Gurung **made** the children dance.
    b. ??Gurung **let** the children dance.

The judgements are the same *even if the children want to dance*:

(29) The children have been feeling eager to dance all afternoon, looking forward to their lesson. Gurung is their strict instructor, and they are required to obey any commands he gives them. As soon as they arrive, he tells them to dance. They immediately start dancing.

Sufficiency and volition: presupposition

Make is sensitive to the relationship between the volition of an agent (when there is one), and the stated cause:

- ▶ it picks out contexts where the will of the agent is irrelevant
  - ▶ either because the agent does not have control (manipulation, trickery, persuasion)
  - ▶ or where the cause renders the agent's will irrelevant (command)
- ▶ but rules out contexts where a cause is sufficient only in view of the agent's own goals (permission)

(30) **Constraint on volitional actions**.
In evaluating a **make**-causative with background situation s, causing event C, and caused event E, a proposition W_E representing the agent's intention to perform E can either be determinative of E relative to $s + C$ or fixed by s/C, but not both.
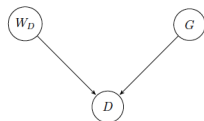
Sufficiency and volition
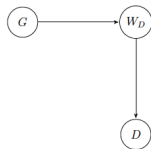
Constraint on volitional actions.
In evaluating a **make**-causative with background situation s, causing event C, and volitional caused event E, W_E can either be determinative of E relative to $s + C$ or fixed by s/C, but not both.
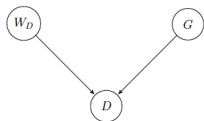
$$f_D = \begin{array}{cc|c} W_D & G & D \\ \hline 0 & 0 & 0 \\ 1 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 1 & 1 \end{array}$$ ✗

$$f_D = \begin{array}{cc|c} W_D & G & D \\ \hline 0 & 0 & 0 \\ 1 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 1 & 1 \end{array}$$ ✓

$$f_{W_D} = \begin{array}{c|c} G & W_D \\ \hline 0 & 0 \\ 1 & 1 \end{array} \quad f_D = \begin{array}{c|c} W_D & D \\ \hline 0 & 0 \\ 1 & 1 \end{array}$$ ✓

- this captures coercion
- hypothesis: **let** is a sufficiency causatives which picks out complementary configurations
- intuitively, **force**, **enable**, **permit** are sensitive to similar constraints

Summary

- we can maintain a common notion of causation without CAUSE as the only causal semantics atom
- **claim:** causatives predicate different dependencies
- preliminary account of **make** as a sufficiency causative
  - a formal way to cash this out
  - positive consequences for specific implications
- looking ahead: finer-grained distinctions between causatives on the basis of what kinds of background constraints (presuppositions)
  - e.g., permissive causations (**enable, let, permit**) care about configuration of volition and cause
  - coercive causatives (**make, force**) are complementary
  - languages will differ: German *lassen* is a 'pure' sufficiency causative, with both **let** and **make** meanings (Lauer & Nadathur 2018)
- causal models give us a way of capturing these distinctions while developing unified accounts of periphrastic causatives

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