Modality Disordered

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Plan

1. Reciprocity
   - Dynamic counterexamples to Reciprocity
   - Static counterexamples to Reciprocity
2. Substitution
   - *Infinitely many*
   - Comparatives
3. Conjunctive Sufficiency
   - Reciprocity implies Conjunctive Sufficiency
   - Evidence against Conjunctive Sufficiency in causal claims

Failures of antecedent strengthening (Goodman 1947)

(1) a. If this match had been scratched, it would have lit.
    b. If this match had been wet and scratched, it would have lit.

← *more similar* *less similar*

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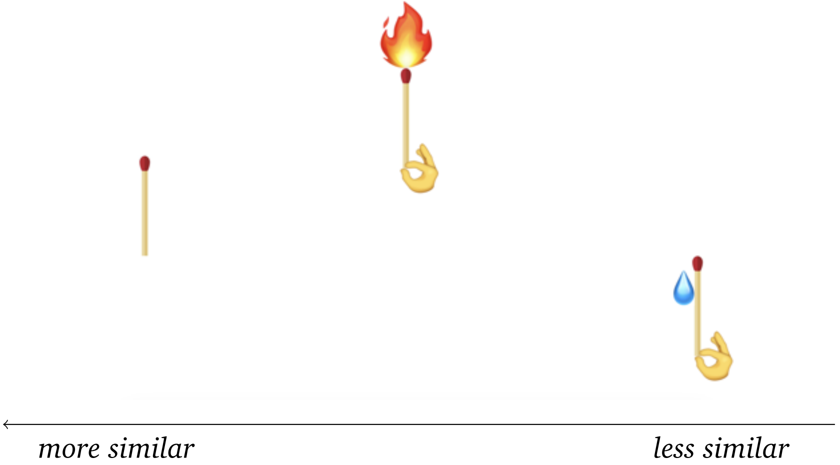
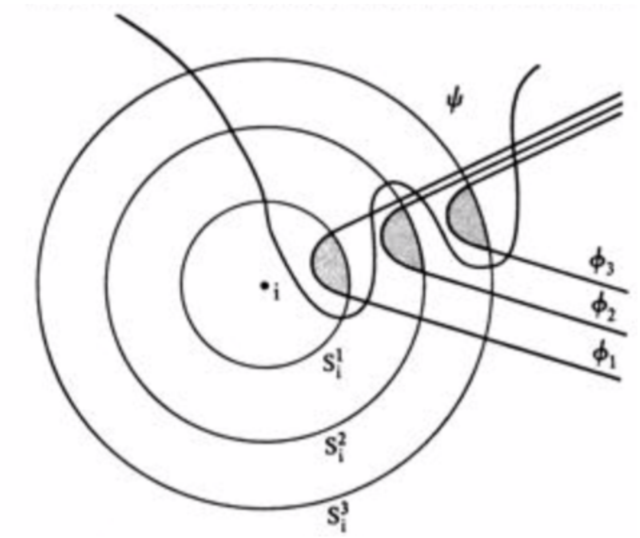


Lewis (1973), *Counterfactuals*



Deontic paradoxes (Kratzer 1981)

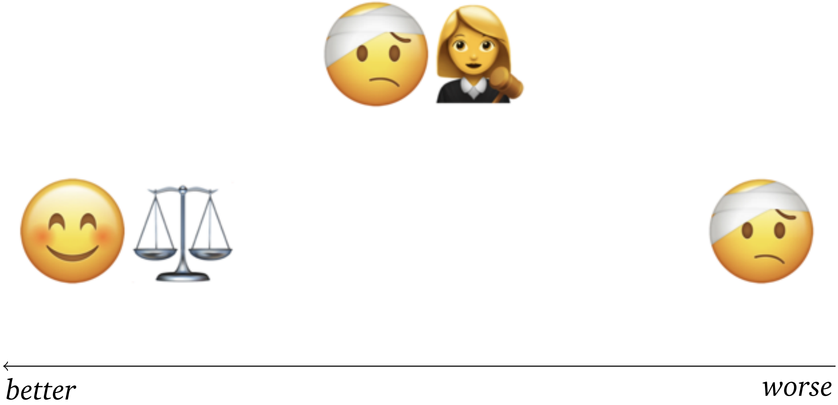
(2) a. Justice must be given to everyone.
b. If someone was unjustly treated, the injustice must be amended.
c. If someone was unjustly treated, the injustice must be rewarded.

Assumptions

1. $\Box A$ is true at w iff A is true at every v accessible from w (Kripke 1959)
2. v is accessible from w iff the rules of w are followed in v
3. *If A, must B* expresses $\Box(A \rightarrow B)$

Problem

$\Box A$ entails $\Box(\neg A \rightarrow B)$ and $\Box(\neg A \rightarrow \neg B)$ (Kratzer 1981:70)


better
worse

The ordering approach

Model

For each world w, let $\leq_w$ be (at least) a reflexive and transitive binary relation over the set of possible worlds.

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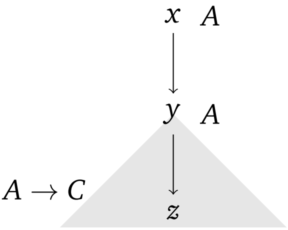
Truth conditions (Lewis 1981:230)
If A, would C is true at a world w

just in case

for every A-world x,
there is an A-world $y \leq_w x$ such that
for every world $z \leq_w y$,
if A is true at z then C is true at z.



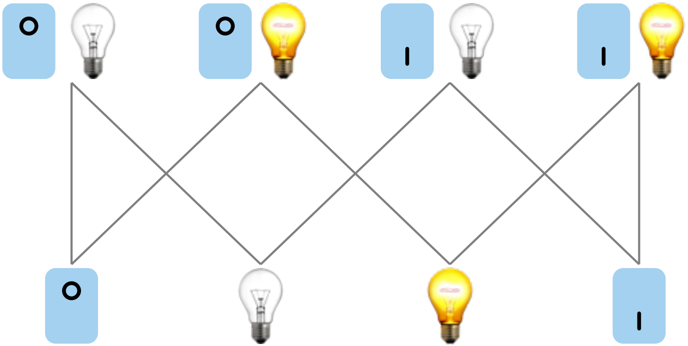


Figure: A state space of the switch and light.

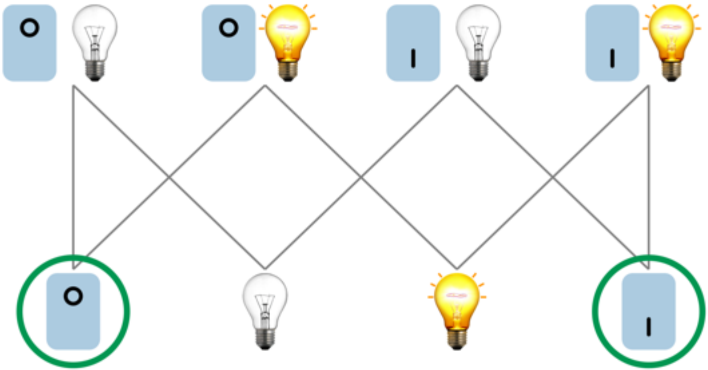
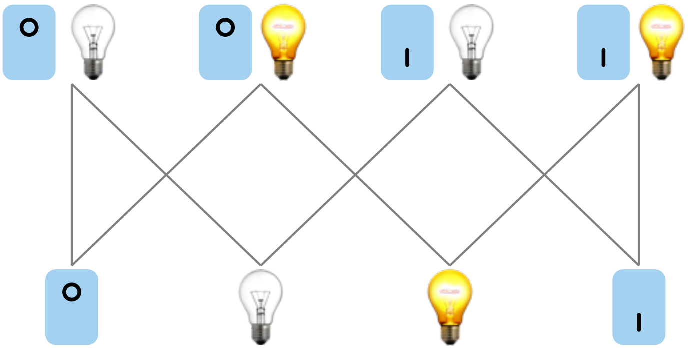


Figure: The states that “the switch is up” is about.



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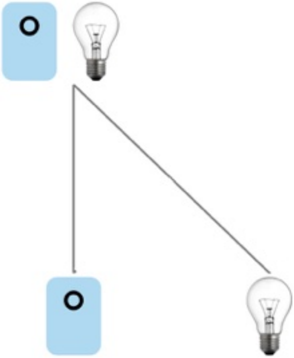

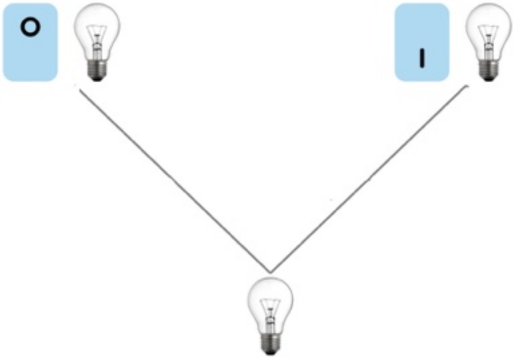
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Analysis of aboutness: a sentence is about the parts of the world that exactly determine its truth value (McHugh 2023:108).

- **The foreground:** the set of states A is about.
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Ceteris paribus

- The background is the *ceteris*, the ‘all else’ in ‘all else being equal’
- *Paribus* means having the *ceteris* as part

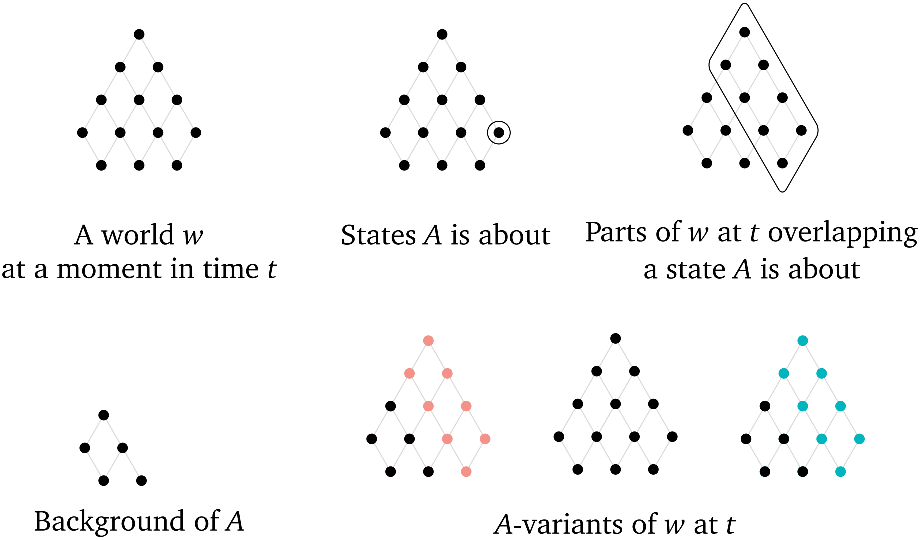

Figure: Steps to construct the A-variants of a world at a moment in time.

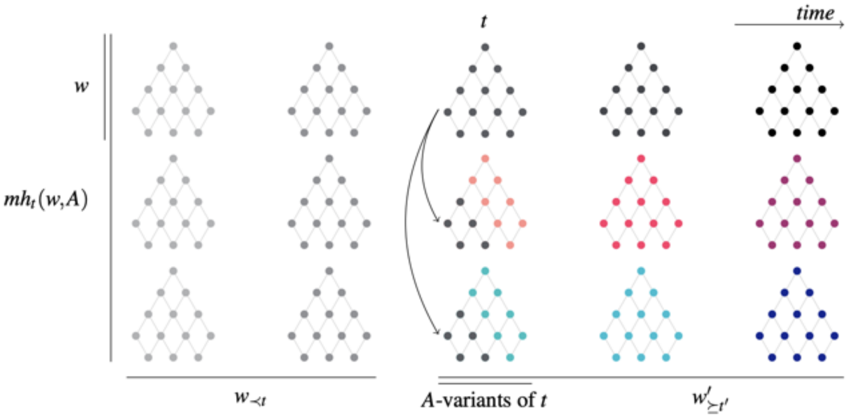

Figure: Constructing the modal horizon.

Definition (Nomic aboutness model)

Where S is a set and $\leq$ a binary relation on S, define

$$\begin{aligned} Sit &:= S \times I, \text{ where } I \text{ is an arbitrary label set,} \\ M &:= \{t_i \in Sit : t \leq u \text{ implies } t = u \text{ for all } u \in S\}, \\ W &:= \{(M', \preceq) : M' \subseteq M, \preceq \text{ is a linear order}\}. \end{aligned}$$

Definition (The modal horizon)

For any sentence A, moment $t \in M$ and world $w \in W$, define

$$mh_{P,t}(w, A) := \{w_{\prec t} \frown w'_{\succeq t'} : t' \text{ is an } A\text{-variant of } t, t' \in w' \text{ and } w' \in P\}.$$

(3) Where P is the set of nomically possible worlds, t the intervention time, and s the selection function,

$$\begin{array}{lll} A \gg C \text{ is true at } w & \text{iff} & mh_{P,t}(w, A) \cap |A| \subseteq |C| \\ A > C \text{ is true at } w & \text{iff} & s\big(w, mh_{P,t}(w, A) \cap |A|\big) \in |C| \end{array}$$

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Reciprocity

$$\frac{A > B \qquad B > A}{(A > C) \leftrightarrow (B > C)}$$

If A and B conditionally imply each other,
they are intersubstitutable salva veritate in conditional antecedents.

Reciprocity is valid according to the ordering approach

Proof.

Pick any $w \in W$ and suppose that $A > B$, $B > A$ and $B > C$ are true at w. To show that $A > C$ is true at w, pick any $x \models A$. We have to show that

$$\text{there is a } y \models A \text{ such that } y \leq_w x \text{ and for all } z \leq_w y,\ z \models A \rightarrow C.$$

Since $w \models A > B$ and $x \models A$, there is a $v \models A$ such that $v \leq_w x$ and (i) for all $v' \leq_w v$, $v' \models A \rightarrow B$. Since $\leq_w$ is reflexive, $v \leq_w v$, so $v \models A \rightarrow B$. Thus $v \models B$.

Since $w \models B > A$ and $v \models B$, there is a $u \models B$ such that $u \leq_w v$ and (ii) for all $u' \leq_w u$, $u' \models B \rightarrow A$.

Since $w \models B > C$ and $u \models B$, there is a $y \models B$ such that $y \leq_w u$ and (iii) for all $z \leq_w y$, $z \models B \rightarrow C$.

Since $y \leq_w u$, by (ii), $y \models B \rightarrow A$. Then as $y \models B$, $y \models A$.

And as $y \leq_w u \leq_w v \leq_w x$, by transitivity of $\leq_w$, $y \leq_w x$.

We show that for all $z \leq_w y$, $z \models A \rightarrow C$. Pick any $z \leq_w y$. Then $z \leq_w y \leq_w u \leq_w v$, so by transitivity of $\leq_w$, $z \leq_w v$. Then by (i), $z \models A \rightarrow B$. And since $z \leq_w y$, by (iii), $z \models B \rightarrow C$. Hence $z \models A \rightarrow C$. □

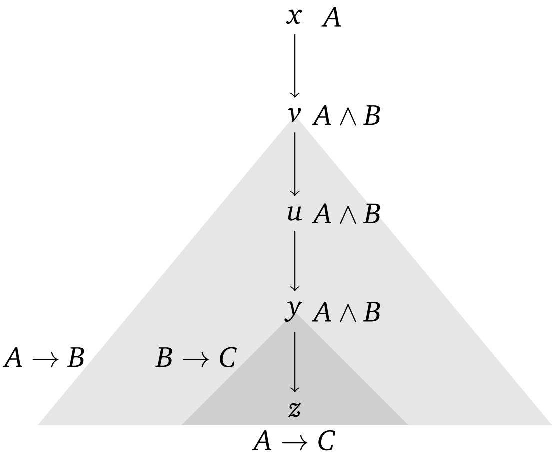

Figure: Illustrating the proof that reciprocity is valid on the ordering semantics.

The selection function approach validates reciprocity

> *Consider a possible world in which A is true, and which otherwise differs minimally from the actual world. 'If A, then B' is true (false) just in case B is true (false) in that possible world.*

Let W be the set of possible worlds, and $f : \wp(W) \times W \to W$ a function from propositions to worlds.

Proposal: $A > B$ is true at world w just in case B is true at $f(A, w)$.

Constraints on the selection function:

1. A is true at $f(A, w)$.
2. $f(A, w)$ is the absurd world λ (the world where every proposition is true) only if there is no possible world with respect to w in which A is true.
3. If A is true in w then $f(A, w) = w$.
4. If A is true in $f(B, w)$ and B is true in $f(A, w)$, then $f(A, w) = f(B, w)$.

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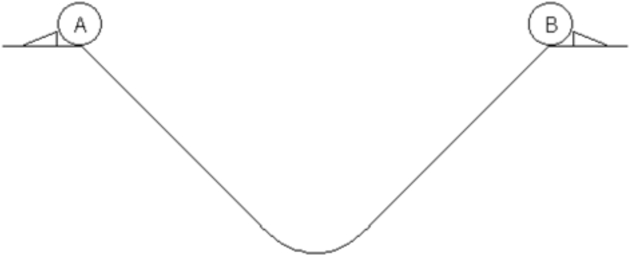
A counterexample to reciprocity (Bacon 2013)

If A falls, it knocks over B, and vice versa. The balls are on sensors. If A falls while B is stationary, the light turns green. If B falls while A is stationary it turns red.



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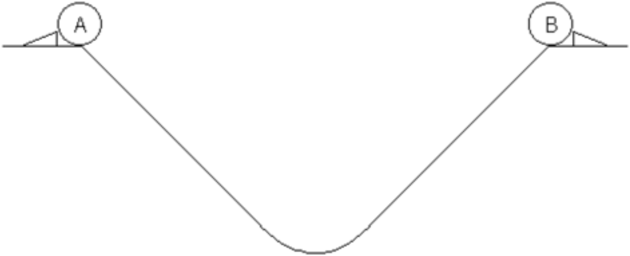

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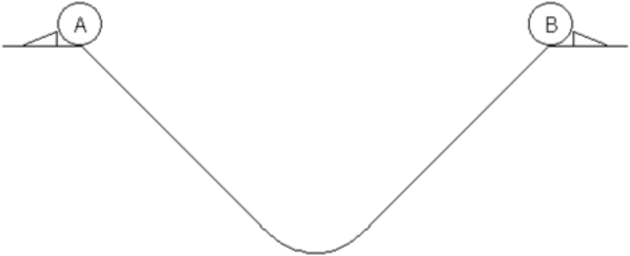

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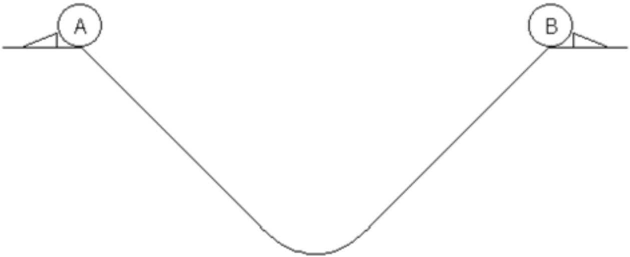

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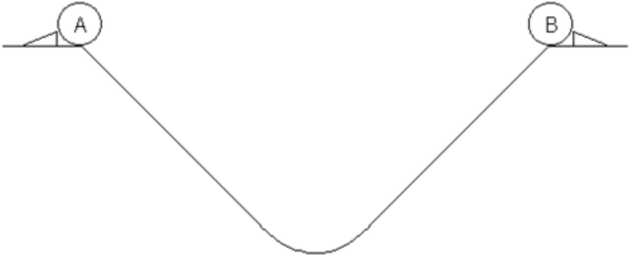

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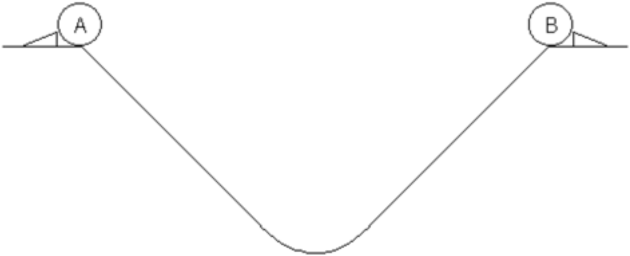
A counterexample to reciprocity (Bacon 2013)

If A falls, it knocks over B, and vice versa. The balls are on sensors. If A falls while B is stationary, the light turns green and stays green. If B falls while A is stationary it turns red and stays red.



(5)
a. If A had fallen, B would have fallen.
b. If B had fallen, A would have fallen.
c. If A had fallen, the light would have turned green.
d. If B had fallen, the light would have turned red.

The possibility of backtracking readings

I might say to you: 'look, when A topples because it's hit by B the green light will not come on ... So if A were to topple, the green light might not come on (because B toppled first).' ...

It must be stressed, however, that our case against [Reciprocity] does not depend on the possibility of contexts in which backtracking is legitimate. We only need 1-4 to be simultaneously true in one context to complete our case against [Reciprocity], which deems them jointly inconsistent. It does not matter if there are also contexts in which some or all of 1-4 are false.

(Bacon 2013:18)

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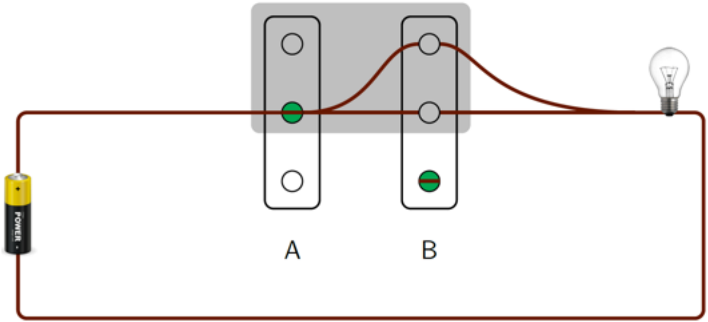
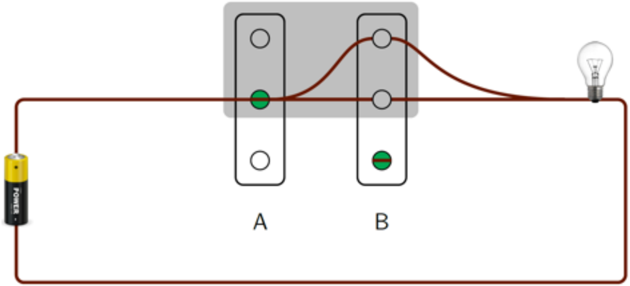
New experimental evidence against Reciprocity



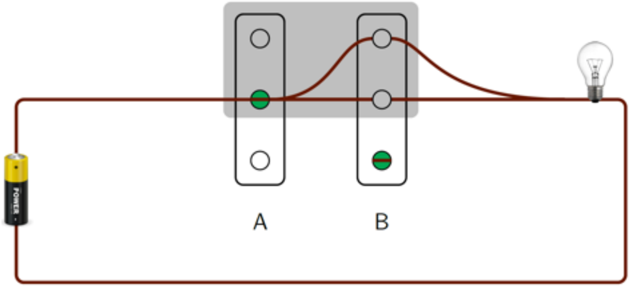
- There are two switches, A and B, are connected to a light.
- Each switch can be up, in the middle, or down.
- The light is on just in case A is in the middle and B is up or in the middle.
- A is in the middle and B is down, so the light is off.

Premise 1



If switch B were in the shaded area,
both switches would be in the shaded area.

Premise 2



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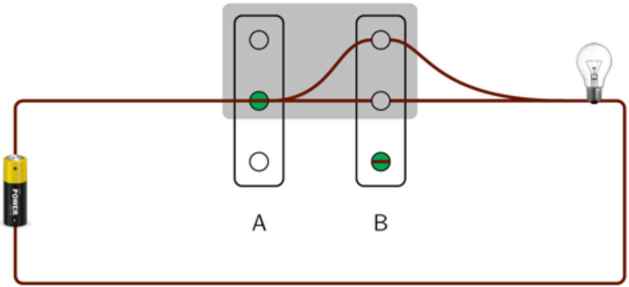
Premise 3



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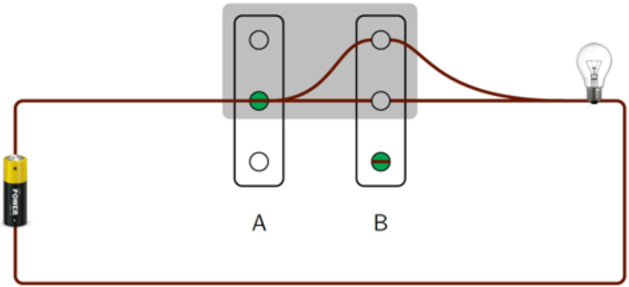
Conclusion



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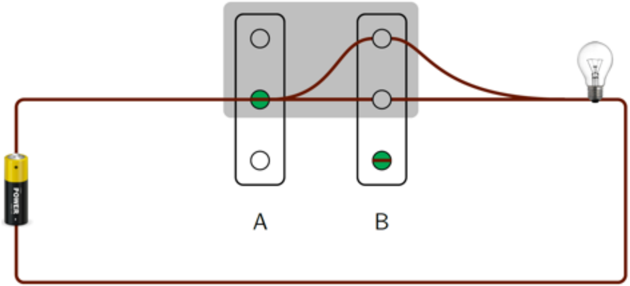
True control



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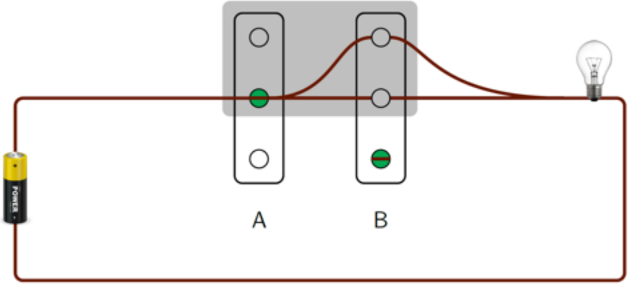
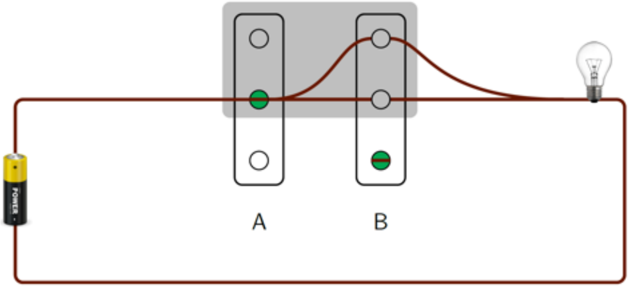
False control



If both switches were outside the shaded area, the light would be on.



T	If both switches were in the middle, the light would be on.	
P1	If switch B were in the shaded area, both switches would be in the shaded area.	$B > both$
P2	If both switches were in the shaded area, switch B would be in the shaded area.	$both > B$
P3	If switch B were in the shaded area, the light would be on.	$B > on$
C	If both switches were in the shaded area, the light would be on.	$both > on$
F	If both switches were outside the shaded area, the light would be on.	

Experimental design

- 80 native English speakers, recruited via Prolific
- Three sentence-picture verification tasks
- Following Romoli, Santorio, and Wittenberg (2022), for each sentence we asked whether it is true, false, or indeterminate.
  - If indeterminate: follow up whether they strongly feel that there is no correct answer or just do not know
  - We excluded the latter responses from the analysis.
- Participants understood the scenarios well
  - Mean accuracy of 89% on the filler items
  - Excluded from the statistical analysis two participants whose error rates on the fillers were above 30%.

Experiment available at
`https://www.tklochowicz.com/experiment_reciprocity`

Results

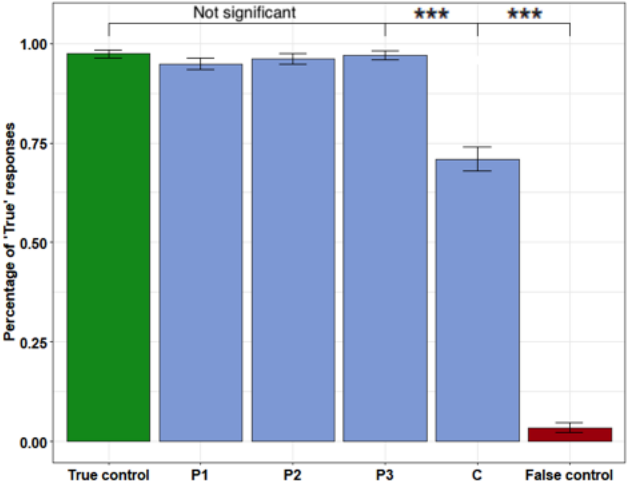


Figure: Percentage of ‘True’ responses. Error bars denote Standard Errors.

Sentence	True	Indeterminate	False	Not sure
True control	232	0	8	0
Premise 1	225	0	11	4
Premise 2	227	2	8	3
Premise 3	225	2	12	1
Conclusion	163	26	43	8
False control	9	0	229	2

Table: Responses from all three scenarios.

Candy scenario: conclusion

Alice likes strawberry-flavoured candy and does not like any other kind of candy. Bob likes all fruit-flavoured candy, but does not like any other kind of candy.

If both children's candy were fruit-flavoured, both children would be happy with their candy.

True | Indeterminate | False

Instance of reciprocity from the candy scenario

Context: Alice likes strawberry-flavoured candy and no other flavours, while Bob likes all fruit-flavoured candy and no other flavours. The teacher gave Alice got a strawberry-flavoured candy and Bob a mint. So Alice was happy with her candy and Bob was not.

(P1) If Bob's candy had been fruit-flavoured, both of the children would have been happy with their candy.

(P2) If Bob's candy had been fruit-flavoured, both of the children's candy would have been fruit-flavoured.

(P3) If both of the children's candy had been fruit-flavoured, Bob's candy would have been fruit-flavoured.

(C) If both of the children's candy had been fruit-flavoured, both of the children would have been happy with their candy.

Plan

1. Reciprocity
   - Dynamic counterexamples to Reciprocity
   - Static counterexamples to Reciprocity
2. Substitution
   - *Infinitely many*
   - Comparatives
3. Conjunctive Sufficiency
   - Reciprocity implies Conjunctive Sufficiency
   - Evidence against Conjunctive Sufficiency in causal claims

Substitution

$$\frac{A \models B \qquad B \models A}{(A > C) \leftrightarrow (B > C)} \text{ Substitution}$$

If A and B are logically equivalent, they are substitutable salva veritate in conditional antecedents.

Substitution

$$\frac{A \models B \qquad B \models A}{(A > C) \leftrightarrow (B > C)}\ \text{Substitution}$$

If A and B are logically equivalent, they are substitutable salva veritate in conditional antecedents.

$$\frac{A \models B}{A > B}\ \text{Entailment}$$

Given Entailment, Reciprocity implies Substitution.

$$\frac{\dfrac{A \models B}{A > B} \qquad \dfrac{B \models A}{B > A}}{(A > C) \leftrightarrow (B > C)}\ \text{Reciprocity}$$

Plan

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Infinitely many: a counterexample to Substitution

From Fine (2014:328): There is one poison apple and infinitely many safe apples.

$\cdots\ \infty$

Infinitely many: a counterexample to Substitution

From Fine (2014:328): There is one poison apple and infinitely many safe apples.

$\cdots \infty$

(6) If Eve ate infinitely many of the green apples,
she would be fine.

Infinitely many: a counterexample to Substitution

From Fine (2014:328): There is one poison apple and infinitely many safe apples.

 $\cdots\ \infty$

(6) If Eve ate infinitely many of the green apples,
she would be fine.

(7) If Eve ate infinitely many of the apples,
she would be fine.

Infinitely many: a counterexample to Substitution

From Fine (2014:328): There is one poison apple and infinitely many safe apples.

$\cdots \infty$

(6) If Eve ate infinitely many of the green apples,
she would be fine.

(7) If Eve ate infinitely many of the apples,
she would be fine.

The antecedents are logically equivalent.

Eve eats infinitely many of the green apples just in case she eats infinitely many of the apples.

Infinitely many: a counterexample to substitution

From Goodsell (2022):
There is a 1 Euro coin and infinitely many pennies, all facing tails.
The light is green just in case the 1 Euro coin is facing tails.

. . .

(8) If infinitely many of the coins were facing heads,
the light would still be green.

(9) If infinitely many of the pennies were facing heads,
the light would still be green.

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Figure/Ground relations in conditionals

(10) a. If Alice were near Bob, they would both be dry.

b. If Bob were near Alice, they would both be dry.

De re comparators?

A is near B

De dicto: $\lambda w'$. Location of A at w' is near the location of B at w'

De re: $\lambda w'$. Location of A at w' is near the location of B at w

De re comparators?

A is near B

De dicto: $\lambda w'$. Location of A at w' is near the location of B at w'

De re: $\lambda w'$. Location of A at w' is near the location of B at w

(11) a. Alice is near Bob
b. Bob is near Alice

Logically equivalent on the *de dicto* reading, but not on the *de re*:

(12) a. If Alice were near where Bob actually is, they would both be dry.
b. If Bob were near where Alice actually is, they would both be dry.

Lewis on *de re* anchors

We can explain the simultaneous truth of Goodman's sentences

(1) If New York City were in Georgia, New York City would be in the South.

and

(2) If Georgia included New York City, Georgia would not be entirely in the South.

by the hypothesis that both are de re *both with respect to 'New York City' and with respect to 'Georgia', and that a less stringent counterpart relation is summoned up by the subject terms 'New York City' in (1) and 'Georgia' in (2) than by the object terms 'Georgia' in (1) and 'New York City' in (2).*

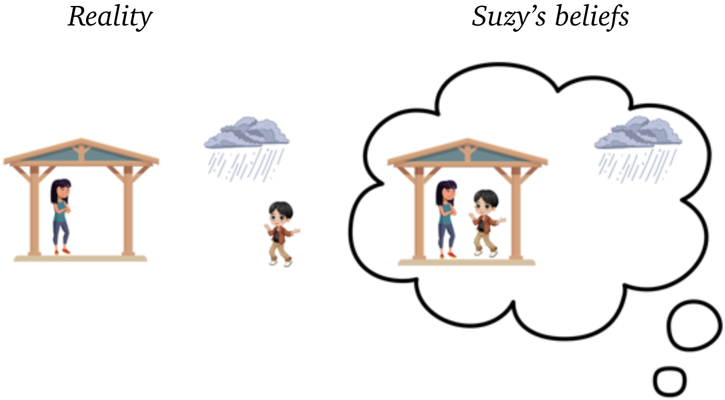
(Lewis 1973:43)

The *de re* reading appears to be available

Context: we know where the dog and rabbit are, but Suzy does not. She sees where the gold is.

(13) Suzy believes that the gold is near the dog.

Alice is under the shelter and Bob is in the rain.
Suzy believes that they are both under the shelter.



(14) Suzy believes that Alice is near Bob.

Alice is under the shelter and Bob is in the rain.
Suzy believes that they are both under the shelter.

Reality *Suzy's beliefs*

(14) Suzy believes that Alice is near Bob.

(15) Suzy believes that Alice is near where Bob actually is.

Alice is under the shelter and Bob is in the rain.
Suzy believes that they are both under the shelter.

Reality *Suzy's beliefs*

(14) Suzy believes that Alice is near Bob.

(15) Suzy believes that Alice is near where Bob actually is.

There is a clear preference for the *de dicto* reading.

Alice and Bob are under the shelter.
Suzy believes that Alice is under the shelter and Bob is in the rain.

Reality

Suzy's beliefs

(16) Suzy believes that Alice is near Bob.

(17) Suzy believes that Alice is near where Bob actually is.

Figure/Ground relations in conditionals

(18) a. If Alice were near Bob, they would both be dry.
b. If Bob were near Alice, they would both be dry

- Semantics of conditionals that validate Substitution can appeal to *de re* readings of the comparator.
- But then they must explain why the *de re* reading is the default reading in conditional antecedents, but not in other intensional contexts, such as belief reports.
- For approaches that invalidate Substitution, this problem does not arise.

Talmy (1975) on Figure and Ground

The terms have been taken from Gestalt psychology ...

The FIGURE object is a moving or conceptually movable point whose path or site is conceived as a variable the particular value of which is the salient issue.

The GROUND object is a reference-point, having a stationary setting within a reference-fram, with respect to which the FIGURE's path or site receives characterization.

(Talmy 1975:419)

Talmy (1975) on Figure and Ground

while one might expect to sentences like

(19) (a) The bike is near the house.
(b) The house is near the bike.

to be synonymous on the grounds that they simply represent the two inverse forms of a symmetric relation, they in fact do not mean the same thing. … (a) makes the non-symmetric speficiations that, of the two objects, one (the house) has a set location … and is to be used as a reference-point by which to characterize the other object's (the bike's) location, understood as a variable … whereas (b) makes all the reverse specifications.

(Talmy 1975:419–420)

Spatial terms

(20) If block A were below block C, block B would be on top.

(21) If block C were above block A, block B would be on top.

Spatial terms

(20) If block A were below block C, block B would be on top.

(21) If block C were above block A, block B would be on top.

The antecedents are logically equivalent.

Block A is below block C just in case C is above A.

A *de re* anchor?

X is above Y

- **De dicto:** $\lambda w'$. Location of X at w' is above location of Y at w'.
- **De re:** $\lambda w'$. Location of X at w' is above location of Y at w.

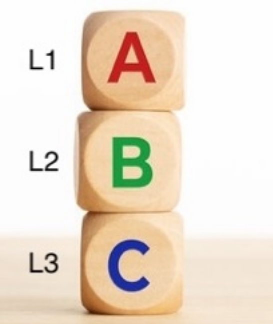
A *de re* anchor?

X is above Y

- **De dicto:** $\lambda w'$. Location of X at w' is above location of Y at w'.
- **De re:** $\lambda w'$. Location of X at w' is above location of Y at w.

(22) If block A were below the actual location of block C (L3), block B would be on top.

(23) If block C were above the actual location of block A (L1), block B would be on top.



A *de re* anchor?

(24) Ali believes that block A is above block C.

Ali's beliefs

Reality

A *de re* anchor?

(24) Ali believes that block A is above block C.

Ali's beliefs

Reality

(25) Ali believes that block A is above where block C actually is.

A difficulty for the *de re* anchor response

If the *de dicto* reading is ruled out in conditional antecedents, why it is so easy to access is other intensional contexts, such as belief reports?

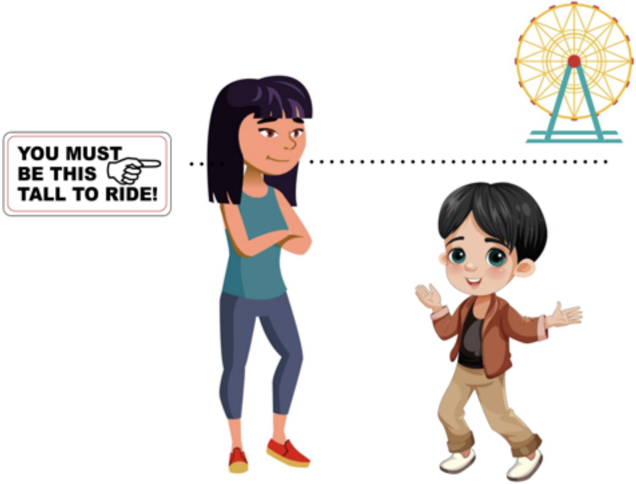
Alice is 25, Bob is 15. One must be over 18 to enter the nightclub.

(26) If Alice were younger than Bob,
they could both enter the nightclub.

(27) If Bob were older than Alice,
they could both enter the nightclub.

(28) If Alice were shorter than Bob,
they could ride the Ferris wheel together.

(29) If Bob were taller than Alice,
they could ride the Ferris wheel together



De re standards of comparison

(30) a. I thought your yacht was larger than it is. (Russell 1905)
b. If your yacht were larger than it is, it wouldn't fit in the marina.
c. John thinks that everyone in the room is outside the room.
d. If everyone in the room were outside the room, ...

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Reciprocity implies conjunctive sufficiency

$$\frac{A > B \qquad B > A \qquad B > C}{A > C}\ \text{Reciprocity}$$

$$\frac{A \wedge C}{A > C}\ \text{Conjunctive Sufficiency}$$

Walters and Williams (2013) show that, under mild assumptions, reciprocity also ensures that $A \wedge C$ implies $A > C$.

Consider any true A, C, and any B that is irrelevant to A and C, in the sense that $(B \vee \neg B) > A$ and $(B \vee \neg B) > C$ hold.

$$\frac{A > (B \vee \neg B) \qquad (B \vee \neg B) > A \qquad (B \vee \neg B) > C}{A > C}\ \text{Reciprocity}$$

Given the existence of such a B, Reciprocity tells us that $A \wedge C$ implies $A > C$.

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The need for sufficiency

(31) a. Ali has an Irish passport because he was born in Ireland.
b. Ali has an Irish passport because he was born in Europe.

The need for sufficiency

(31) a. Ali has an Irish passport because he was born in Ireland.
     b. Ali has an Irish passport because he was born in Europe.

(32) a. Being born in Ireland caused Ali to get an Irish passport.
     b. Being born in Europe caused Ali to get an Irish passport.

The need for sufficiency

(33) a. Sue was allowed into the bar because she's over 21.
b. Sue was allowed into the bar because she's over 16.

(34) a. The fact that Sue is over 21 caused the bouncer to let her in.
b. The fact that Sue is over 16 caused the bouncer to let her in.

The need for sufficiency

(35) *The radio spontaneously starts playing music.*

A: Why did the radio turn on?

B: I have no idea. I didn't touch it.

A: I see it's plugged in, and it needs to be plugged in to turn on.

B: Right, but I still have no idea why it started playing.

The need for sufficiency with reasons

Sami and Jan are fun on their own, but always fight when together. A heard that they are both attending a party and therefore decids to skip it.

(36) a. I'm skipping the party for two reasons: because Sami is going and because Jan is going.
b. I'm skipping the party for one reason: because Sami and Jan are going.

(37) a. The reasons why I'm skipping the party are that Sami is going and that Jan is going.
b. The reason why I'm skipping the party is that Sami and Jan are going.

The need for sufficiency with reasons

Sami and Jan are fun on their own, but always fight when together. A heard that they are both attending a party and therefore decids to skip it.

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(37) a. The reasons why I'm skipping the party are that Sami is going and that Jan is going.
b. The reason why I'm skipping the party is that Sami and Jan are going.

My intuitive judgement: the (a)-sentences are odd, the (b)-sentences are fine.

The need for sufficiency with reasons

Sami and Jan are each miserable people. Even one of them going to a party is enough to make it a dull event.

(38) a. I'm skipping the party for two reasons: because Sami is going and because Jan is going.
b. I'm skipping the party for one reason: because Sami and Jan are going.

(39) a. The reasons I'm skipping the party are that Sami is going and that Jan is going.
b. The reason I'm skipping the party is that Sami and Jan are going.

The need for sufficiency with reasons

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b. The reason I'm skipping the party is that Sami and Jan are going.

My intuitive judgement: the (a)- and (b)-sentences are both fine.

The sufficiency requirement

- E *because* $C \Rightarrow C$ is sufficient for E.
- C *cause* $E \quad \Rightarrow C$ is sufficient for E.

What does it mean for C to be sufficient for E?

Sufficiency is not logical entailment

(40) a. My laptop turned on because I pushed the power button.
b. Pushing the power button caused the laptop to turn on.

$\not\Rightarrow$ In every logically possible world where I push the power button, the laptop turns on.

These are assertable even though there is a logically possible world where the laptop's battery is empty.

Is C sufficient for E just in case *if C would E* is true?

Problem

Many existing semantics of conditionals validate conjunctive sufficiency, predicting that C and E together entail *if C would E*.

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Cautious monotonicity

$$\frac{A > B \qquad A > C}{(A \wedge B) > C}\ \text{Cautious monotonicity}$$

$$\frac{A \models C}{A > C}\ \text{Entailment} \qquad\qquad \frac{A > B \qquad A > C}{A > (B \wedge C)}\ \text{Conjunction}$$

Given Entailment and Conjunction,
Reciprocity implies Cautious Monotonicity.

Proof.

$$\dfrac{\dfrac{\dfrac{}{A > A}\ \text{Entail} \qquad A > B}{A > (A \wedge B)}\ \text{Conjunction} \qquad \dfrac{}{(A \wedge B) > B}\ \text{Entail.} \qquad A > C}{(A \wedge B) > C}\ \text{Reciprocity}$$

$\square$

Cautious monotonicity

$$\frac{(A \wedge B) > C \qquad B > A}{B > C} \text{ Cautious transitivity}$$

Given Cautious Transitivity, Cautious Monotonicity implies Reciprocity.

Proof.

$$\dfrac{\dfrac{A > B \qquad A > C}{(A \wedge B) > C} \text{ Cautious monotonicity} \qquad B > A}{B > C} \text{ Cautious transitivity}$$

□

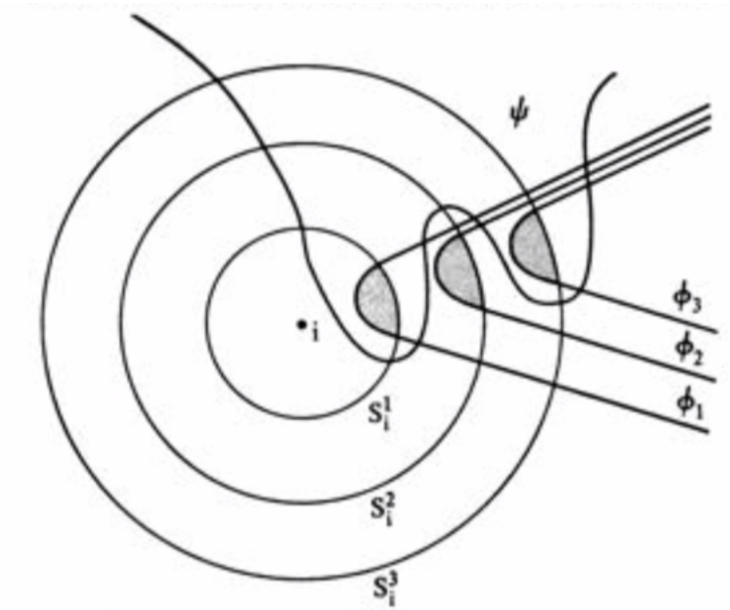
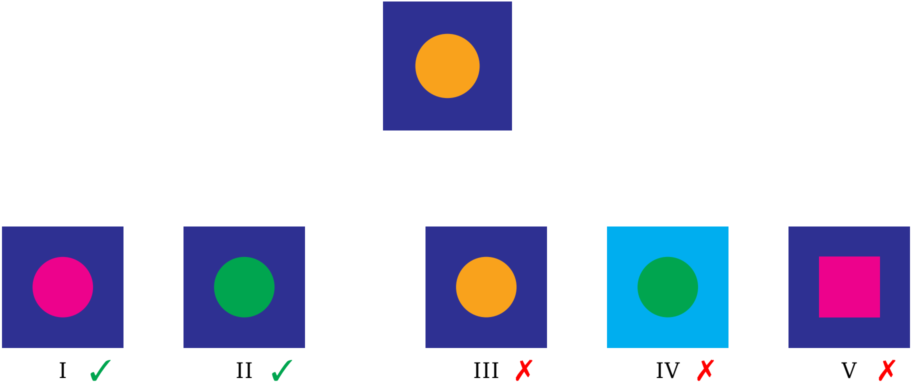


Figure: Lewis (1973) assumes strong centering: every world is more similar to itself than any other world is to it: $w \leq_w v$ and $\not(v \leq_w w)$ for all w, v where $w \neq v$.

A semantics of conditionals (McHugh 2022, 2023)

1. Pick a time at which to imagine the change.
   - This is the *intervention time* t.
2. Vary the part of the world the antecedent A is about at intervention time.
   - This gives us a set of time slices, called the *A-variants of w at t*.
3. Play the laws forward.
   - Find the lawful futures of the A-variants of w at t.
4. Stick on the actual past.
   - This gives us the *modal horizon of A at w*.
5. Restrict to those worlds where the antecedent is true.
6. Check whether the consequent is true at the resulting world(s).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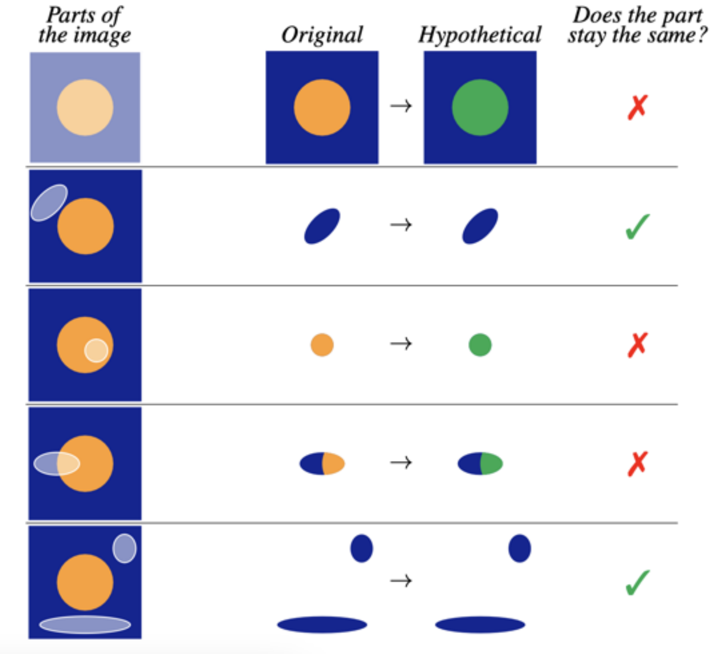

Figure: A part of the image stays the same just in case it does not overlap the

Some parts that change.

Some parts that stay the same.

Some parts that change.

Some parts that stay the same.

- We are asked to change the circle.

Some parts that change.

Some parts that stay the same.

- We are asked to change the circle.
- A part stays the same just in case it does not overlap the circle.

Some parts that change.

Some parts that stay the same.

- We are asked to change the circle.
- A part stays the same just in case it does not overlap the circle.
- Two parts overlap just in case they have a part in common.

If x and y are two individuals, then their mereological difference,

$$x - y$$

is the largest individual contained in x which has no part in common with y. (Simons 1987:14, going back to Leśniewski 1927–1931; see Sinisi 1983:29, Definition VII)

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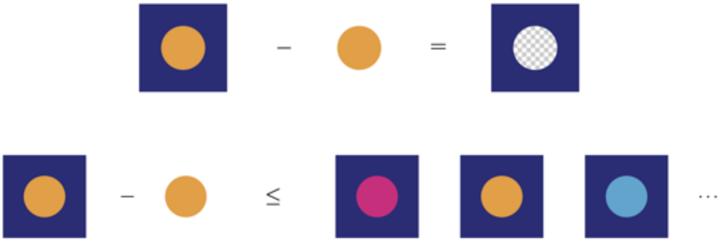

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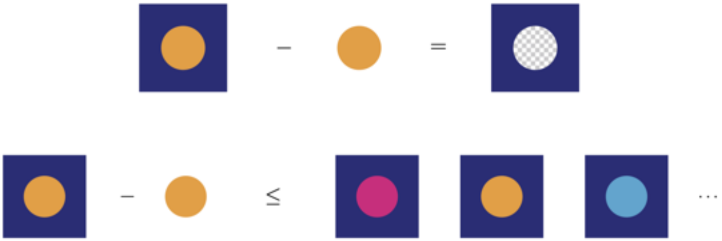
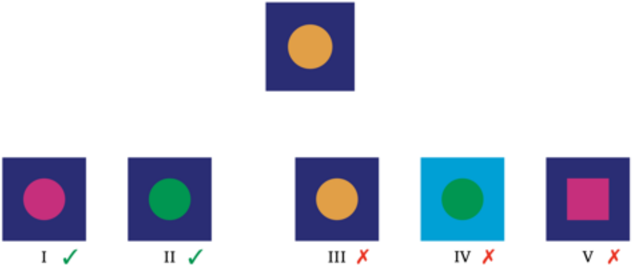


$$\underbrace{x - y}_{ceteris} \underbrace{\leq z}_{paribus}$$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II ✓
III ✗
IV ✗
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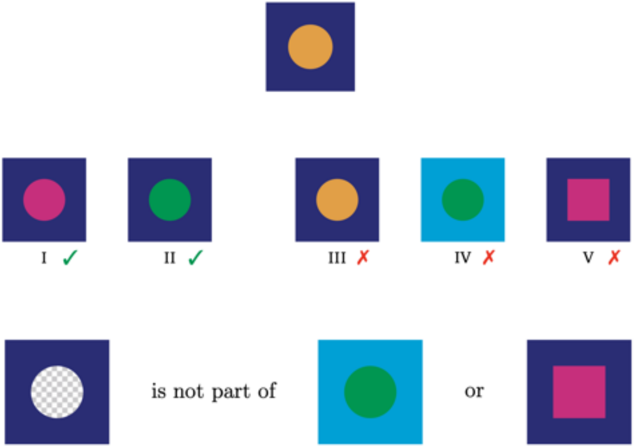
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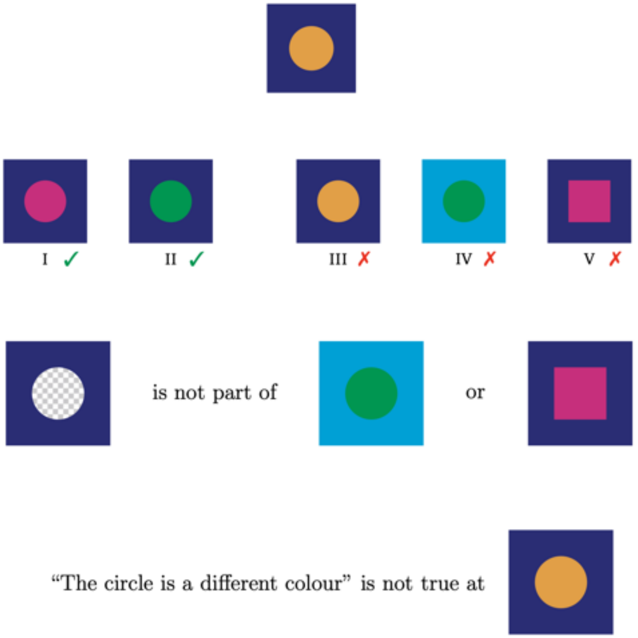
is not part of
or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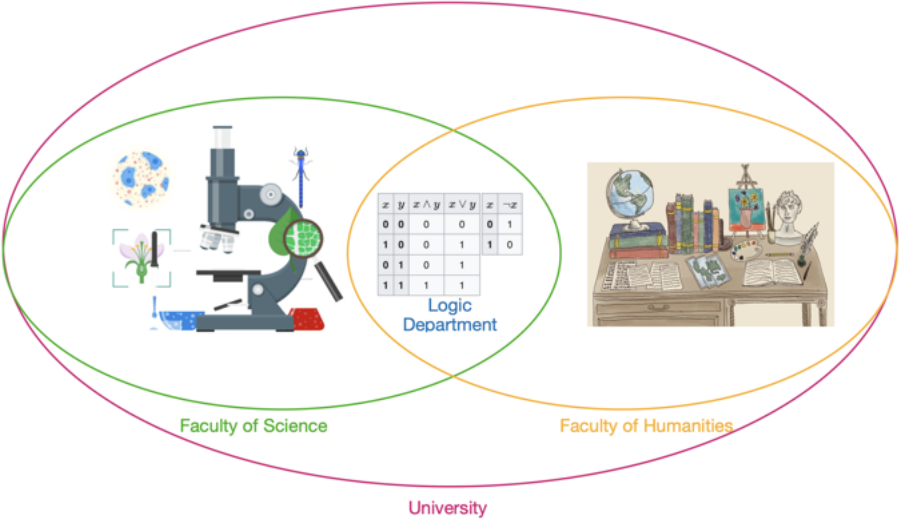
or
“The circle is a different colour” is not true at

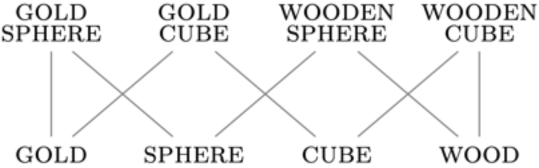
Parthood in conceptual space



Parthood in conceptual space

Parthood in conceptual space

Parthood in conceptual space



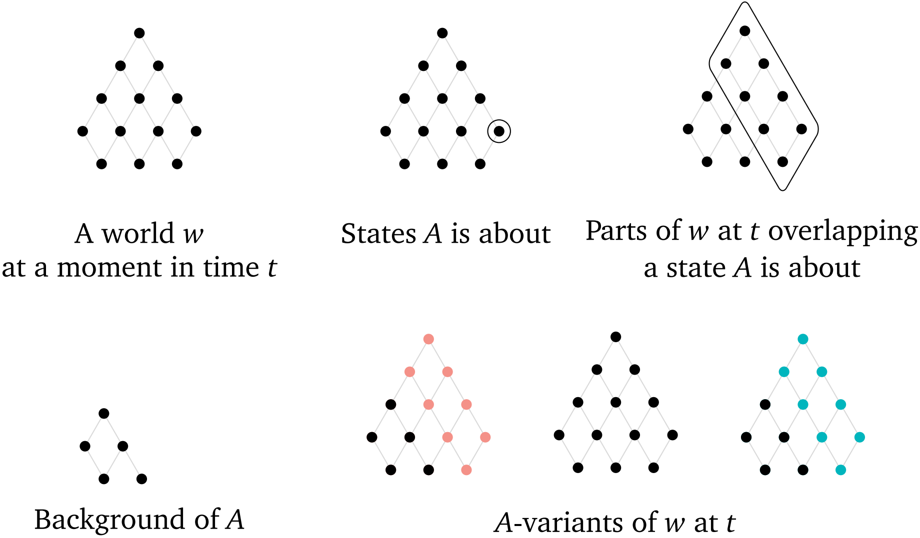


Figure: Steps to construct the A-variants of a world at a moment in time.

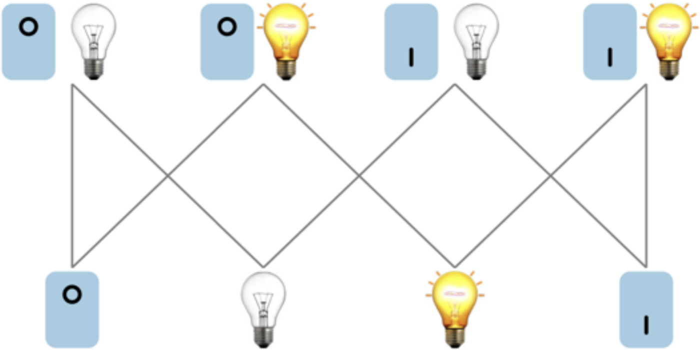


Figure: A state space of the switch and light.

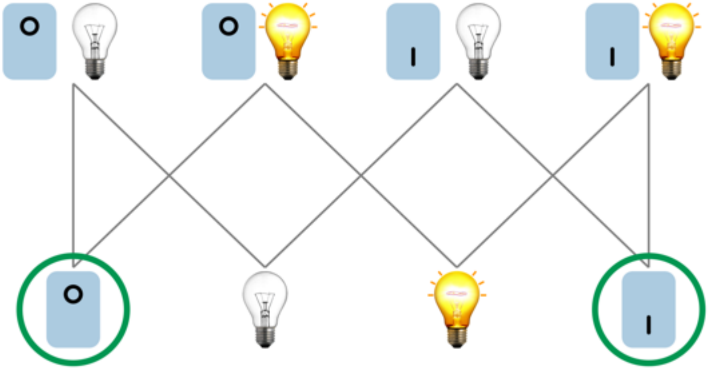


Figure: The states that “the switch is up” is about.

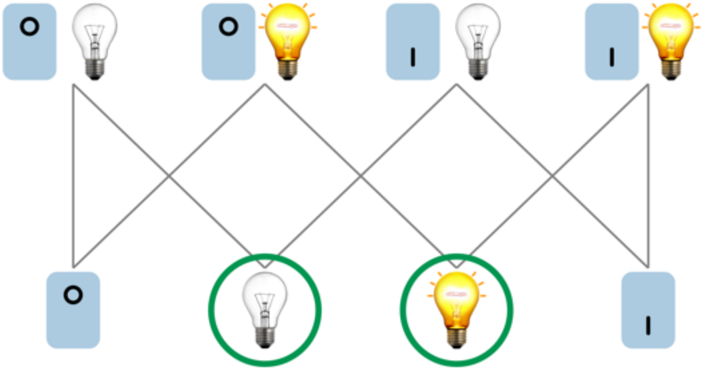


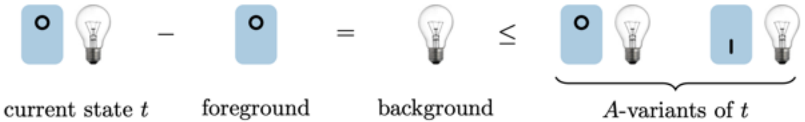
Figure: The states that “the light is off” is about.

(41) *Current state: the switch is up and the light off.*

a. If the switch were down, the light would be on.

b. The light is off because the switch is up.

"The switch is down" and "The switch is up" are about the state of the switch, and not about the state of the light.



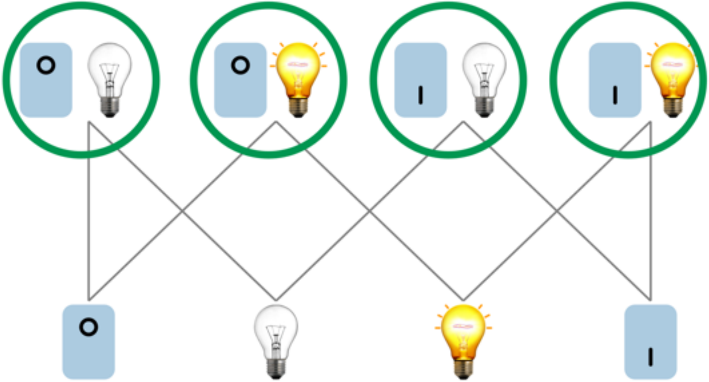
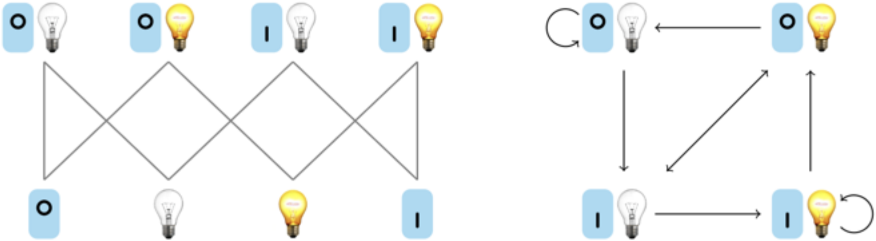


Figure: The states that “the switch is up and the light is off” is about.



(a) Mereological structure.

(b) Nomic possibilities.

Figure: Light switch example. Nomically possible worlds correspond to directed paths in (b).

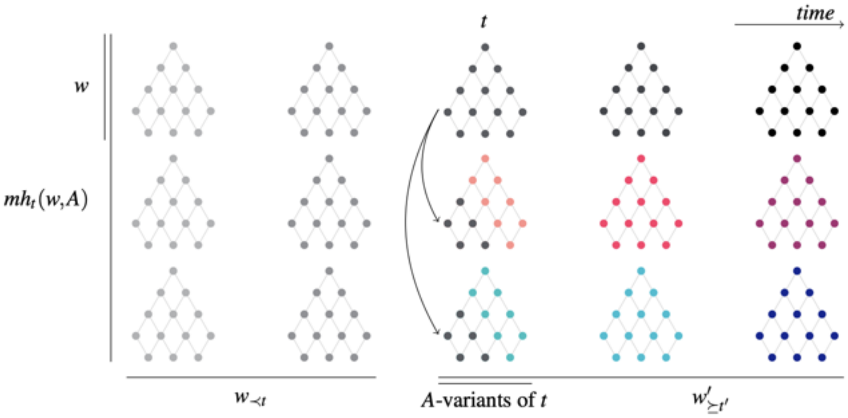


Figure: Constructing the modal horizon.

Definition (Nomic aboutness model)

Where S is a set and $\leq$ a binary relation on S, define

$$
\begin{aligned}
Sit &:= S \times I, \text{ where } I \text{ is an arbitrary label set,}\\
M &:= \{t_i \in Sit : t \leq u \textit{ implies } t = u \textit{ for all } u \in S\},\\
W &:= \{(M', \preceq) : M' \subseteq M, \ \preceq \text{ is a linear order}\}.
\end{aligned}
$$

Definition (The modal horizon)

For any sentence A, moment $t \in M$ and world $w \in W$, define

$$mh_{P,t}(w, A) := \{w_{\prec t} \frown w'_{\succeq t'} : t' \textit{ is an } A\textit{-variant of } t, t' \in w' \text{ and } w' \in P\}.$$

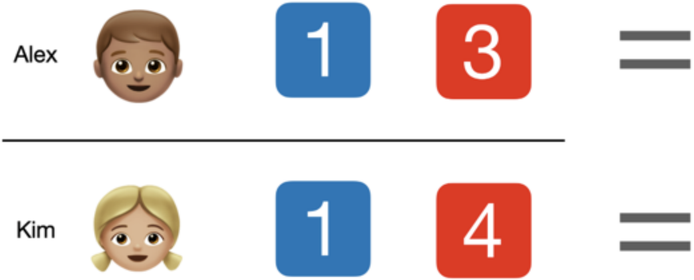
(42) Where P is the set of nomically possible worlds, t the intervention time, and s the selection function,

$$
\begin{array}{llr}
A \gg C \text{ is true at } w & \text{iff} & mh_{P,t}(w, A) \cap |A| \subseteq |C| \\
A > C \text{ is true at } w & \text{iff} & s\big(w, mh_{P,t}(w, A) \cap |A|\big) \in |C|
\end{array}
$$

Numbers scenario: conclusion

A player wins just in case their red number is higher than their opponent's red number and their blue number is higher than their opponent's blue number.

Otherwise the result is a draw.



If both of Kim's numbers were even, Kim would have a winning hand.

True | Indeterminate | False

Results per scenario