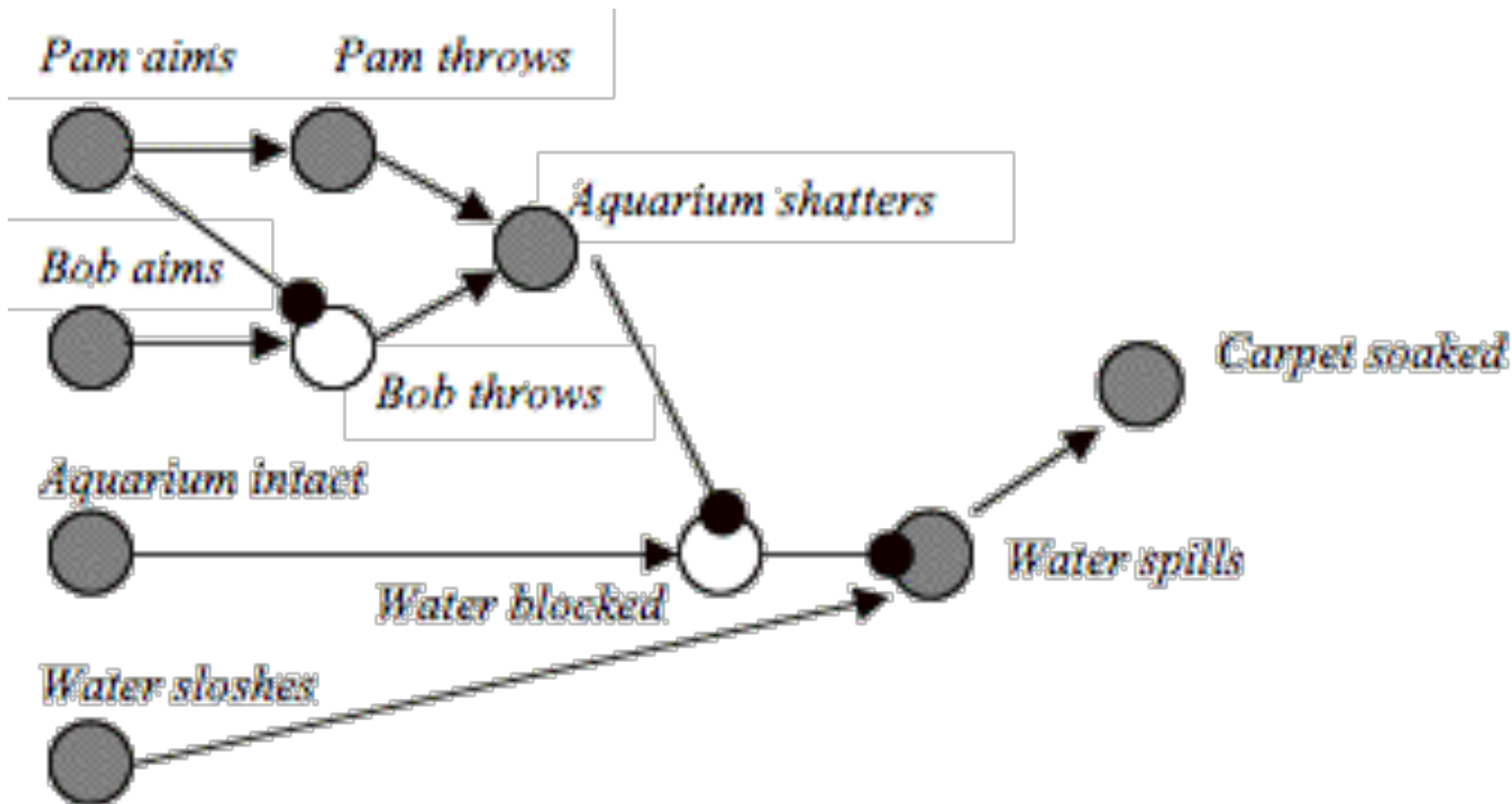


Causation I: Humean Approaches



How is the causal relation to be understood?

-> analysis of the concept of causation:

A is the cause of B, if and only if ...

How is the causal relation to be understood?

-> what sort of entities stand in the causal relation?
(what are the **relata** of the causal relation?)

-objects? 'the stone broke the window'

-BUT: the stone touching the window with a certain force,
is the cause

'the stone broke the window' -> 'The stone having such-and-such properties and being in so-and-so an environment caused the window to break'.

How is the causal relation to be understood?

-> **event**

-> events cause events

-> causal statements made in terms of objects can be rephrased in terms of events, but not vice versa.

Analysis of the causal relation

'event A causes event B -> analysandum

if and only if '...' -> analysans

-> analysis should not be **circular** (i.e. to use notions that depend on the analysandum)

Analysis of the causal relation

-pre-Humean analysis of causation: **production** accounts

-event A causes event B, if and only if,

the objects that constitute A **manifest some power** which consists in moving etc the objects that constitute B.

-> **necessary connection** between cause & effect

-> logical implication between cause & effect

Causation: the two traditions

- causation-as-dependence
- causation-as-production

On the **dependence approach**, to say that c causes e is to say that e suitably depends on c .

On the **production approach**, to say that c causes e is to say that something in the cause produces (brings about) the effect or that there is something (e.g., a mechanism) that links the cause and the effect.

Dependence vs Production

Different ways to cash out the relation of dependence:

nomological dependence (cause and effect fall under a law);

counterfactual dependence (if the cause hadn't happened, the effect wouldn't have happened);

probabilistic dependence (the cause raises the probability of the effect).

Different ways to cash out the concept of production

Something being **transferred** from the cause to the effect (e.g., a property, or some physical quantity—force, energy etc.).

Cause and effect are connected by means of a **local mechanism**.



David Hume
(1711 - 1776)

*A Treatise of
Nature (1738)*

*An Enquiry
Concerning
Human
Understanding
(1748)*

Treatise of Human Nature, I iii 1-6, 14-15.

Enquiry Concerning Human Understanding, Sections II, VII, VIII

The Humean analysis

-Hume's sceptical argument against necessary connection

'[...] we may define a cause to be an object followed by another, and where all the objects, similar to the first, are followed by objects similar to the second.

Or, in other words, where, if the first object had not been, the second never had existed'

(Hume, Enquiry, VII)

The Humean analysis

-regularity theory of causation

A causes B if and only if:

(i) A and B occur

(ii) A occurs before B

(iii) A is of **event-type A** and B is of **event-type B** and *all events of type A are followed by events of type B*

-> logical empiricists constant conjunction

-counterfactual theory of causation

A causes B if and only if:

(i) A and B occur

(ii) A occurs before B

(iii) if A had not occurred, B would have not occurred

-> David Lewis

Problems for the regularity account

'event A causes event B' -> analysandum

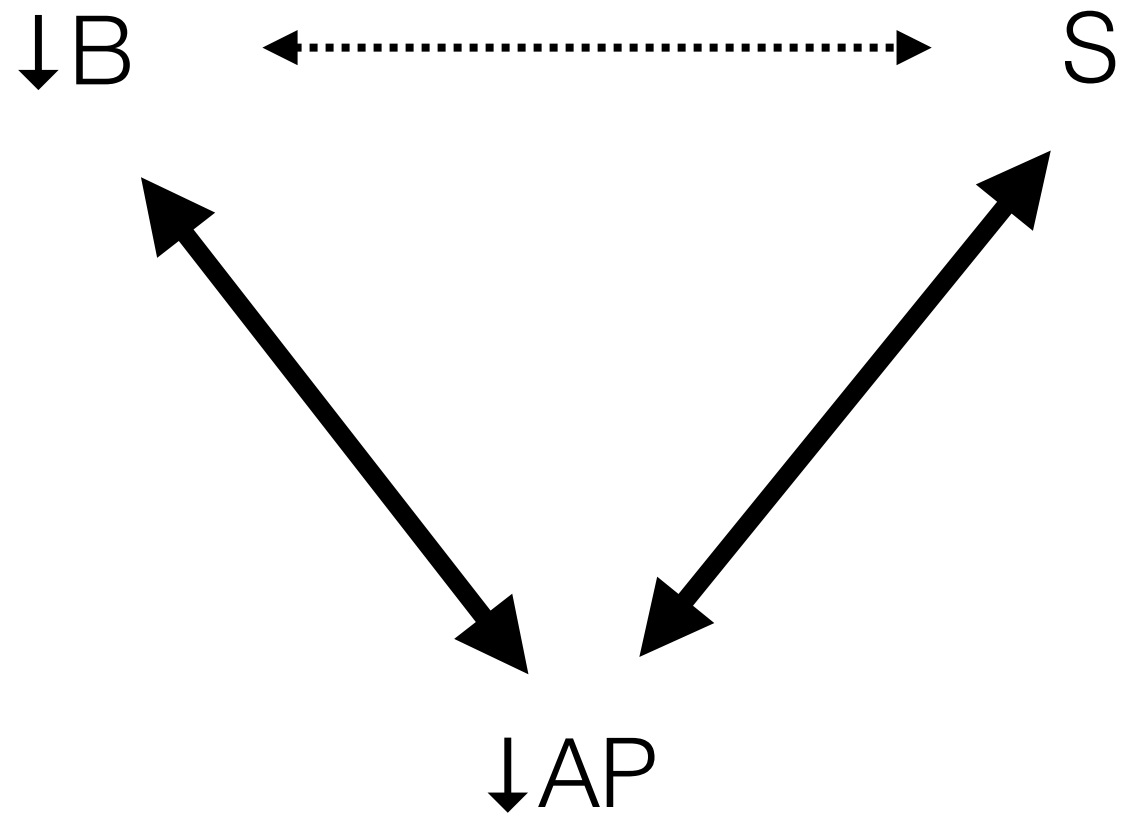
if and only if '...' -> analysans

-> two sorts of objections to an analysis:

-analysandum true, analysans false -> condition not **necessary**

-analysandum false, analysans true -> condition not **sufficient**

Problems for the regularity account



Problems for the regularity account

-> the problem of the common cause

-The reading on the barometer drops iff the atmospheric pressure drops.

-It rains iff the atmospheric pressure drops.

Let us suppose that:

The reading on the barometer drops (event A) & It rains (event B)

Problems for the regularity account

- > there exist instances of **one-off** causation
- ‘the Big Bang caused a rapidly expanding universe’

Can there be causation without regularity?

Singular causation: one event causes another to happen *without* this particular (singular) sequence of events falling under a regularity.

Should 'c causes e' be different from 'x loves y'?

Single-difference account: an event *c* causes an event *e* if and only if *c* was **the last—or, the only—difference** in *e*'s environment before *e* occurred.

Causation links **individual events** independently of any **regular association** that there may, or may not, be between events like the cause and events like the effect.

-> **But can they get the epistemology of causation right?**

-> **And can we dispense with general facts anyway?**

Can there be regularity without causation?

Some events regularly follow each other (like the night always follows the day) without being the cause of each other.

John Stuart Mill and John L Mackie: regular association is not enough for causality. A regular association of events is causal only if it is “unconditional”, that is only **if its occurrence does not depend on the presence of further factors which are such that, given their presence, the effect would occur even if its putative cause was not present.**

events that are invariably conjoined are effects of a common cause.

Causal are those invariable successions that constitute **laws of nature.**

INUS analysis of causation - Mackie

-> Effects have often a variety of causes

-> A specific effect E can be caused by a number of different sets of factors

$(A' \& B' \& C')$

$(A'' \& B'' \& C'')$

each set can cause E (each set is **sufficient** for E)

$(A \& B \& C) \rightarrow E$

$(A' \& B' \& C') \rightarrow E$

$(A'' \& B'' \& C'') \rightarrow E$

but

no set is **necessary** for E

$E \not\leftarrow (A \& B \& C)$

$E \not\leftarrow (A' \& B' \& C')$

$E \not\leftarrow (A'' \& B'' \& C'')$

-what is **necessary and sufficient** is the **disjunction**:

$[(A \& B \& C) \vee (A' \& B' \& C') \vee (A'' \& B'' \& C'')] \leftrightarrow E$

INUS analysis of causation - Mackie

-what is **necessary and sufficient** is the **disjunction**:

$[(A \& B \& C) \vee (A' \& B' \& C') \vee (A'' \& B'' \& C'')] \leftrightarrow E$

-> it expresses a regularity in nature

-> each individual factor is an **INUS-condition**

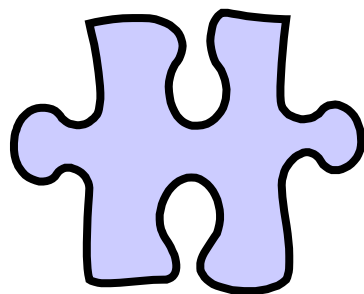
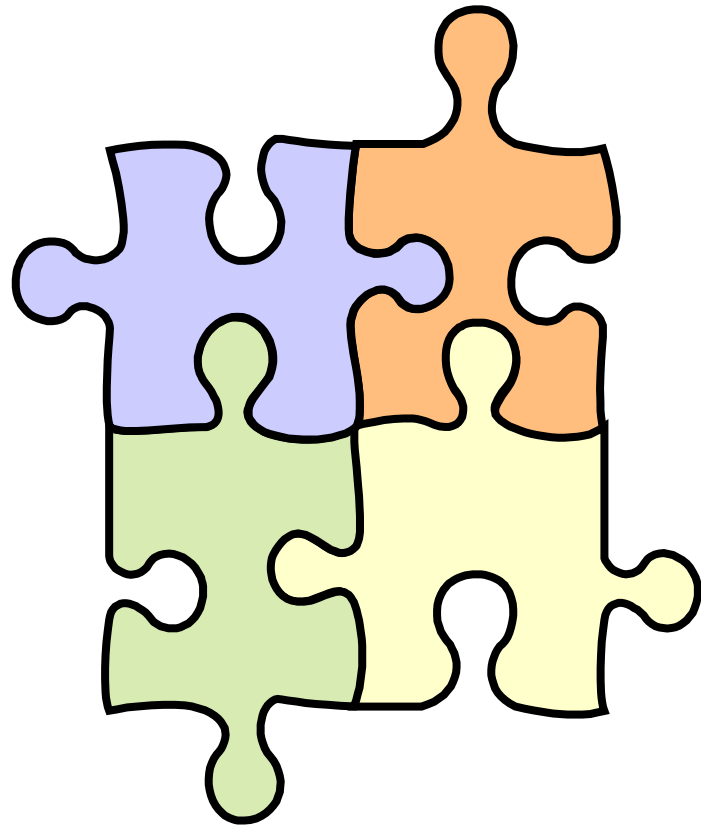
(I)nsufficient &

(N)ecessary part of an

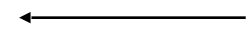
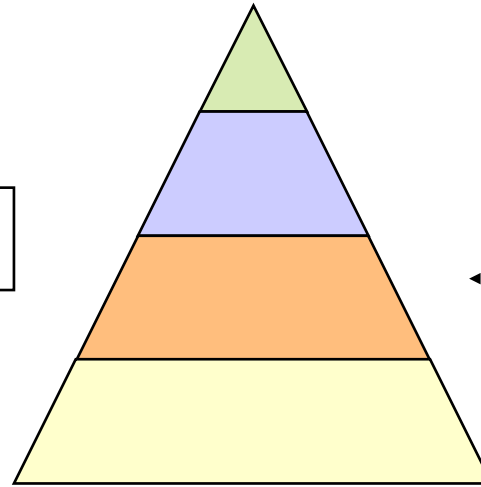
(U)necessary but

(S)ufficient condition for E

Mackie: INUS - condition



OR



The effect

Is an *insufficient* but *non-redundant* part of an *unnecessary* but *sufficient* condition for *E*

Causes as inus-conditions

The counterfactual analysis of causation

(Lewis, 1973 'Causation')

A causes B if and only if:

(i) A and B occur

(ii) A occurs before B

(iii) if A had not occurred, B would have not occurred ($\sim A \square \rightarrow \sim B$)

-it solves the problem of the one-off cause

Some problems:

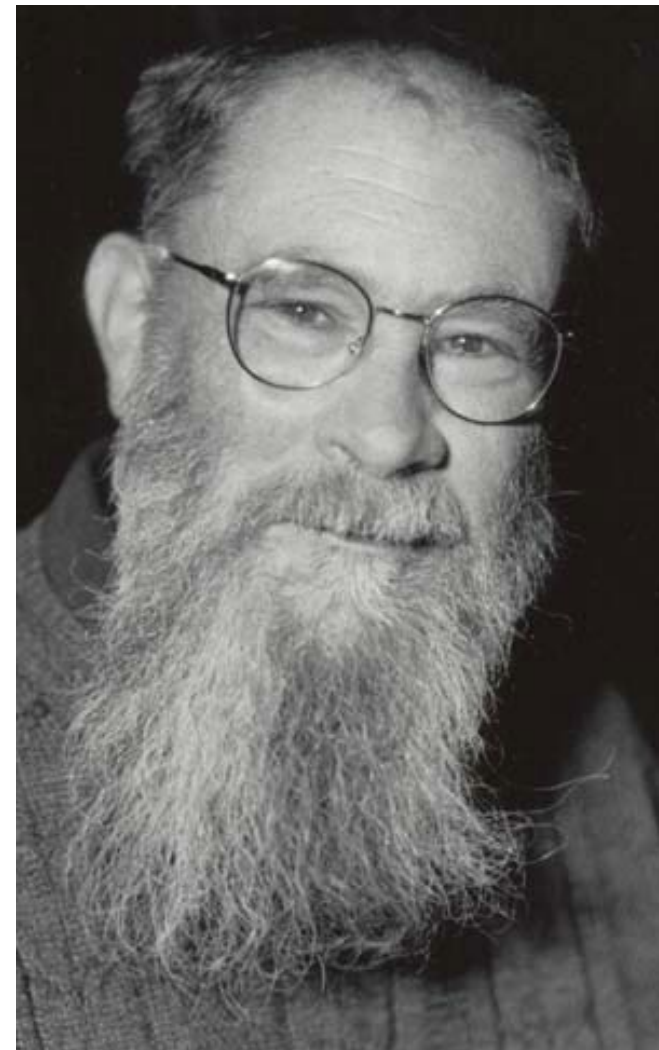
-The problem of the common cause

-Early preemption

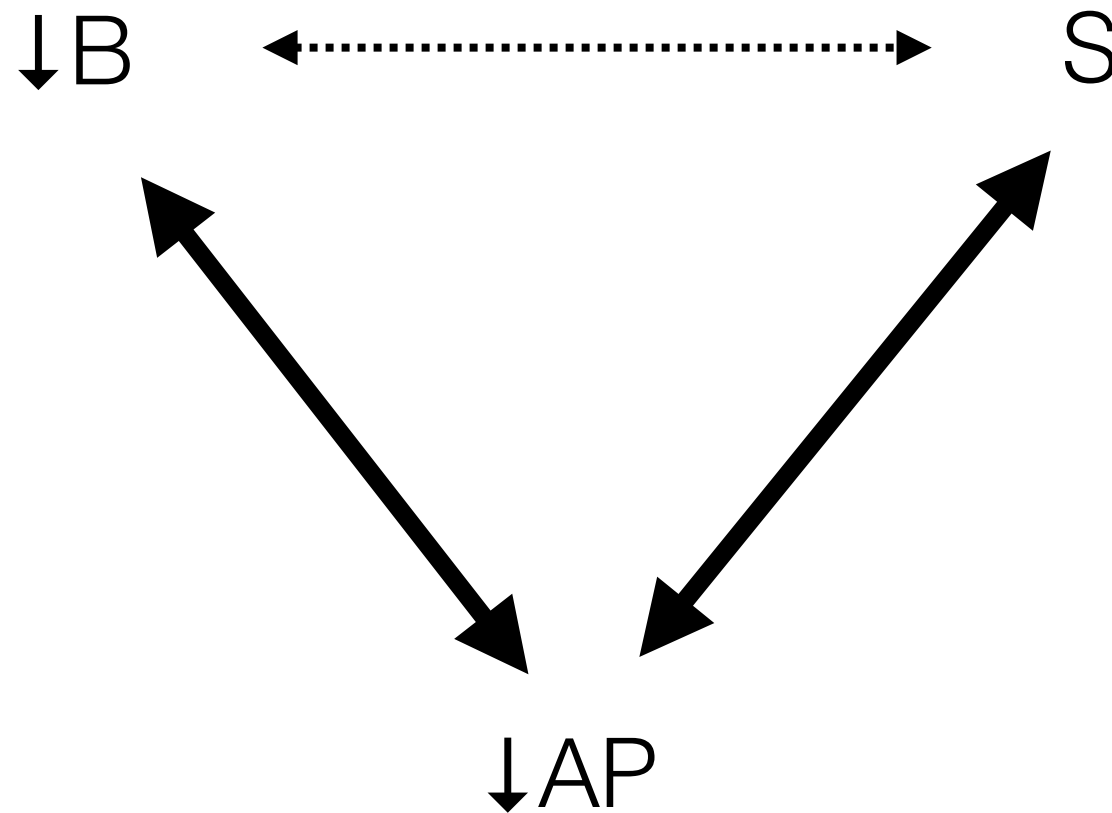
-Counterfactual conditionals

-Late preemption

-Overdetermination



The problem of the common cause



It should not be the case (since there is no causation in this case):

$$\sim\downarrow B \quad \square \rightarrow \quad \sim S$$

$$\sim\downarrow B \quad \square \rightarrow \quad \sim\downarrow AP$$

$$\sim\downarrow AP \quad \square \rightarrow \quad \sim S$$

$$\sim\downarrow B \quad \square \rightarrow \quad \sim S$$

The problem of the common cause

-pressure -> barometer (A) & storm (B)

Then:

(i) A and B occur

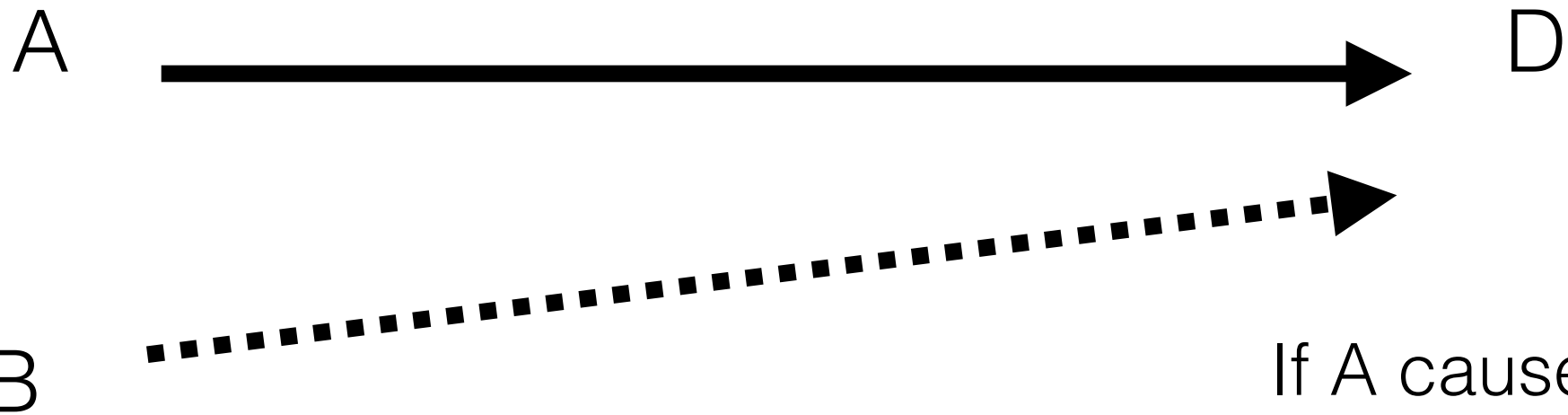
(ii) A occurs before B

(iii) if A had not occurred, B would have not occurred

Why (iii);

-> So, we have to conclude that A causes B !

Preemption



If A causes D, then it should be the case that:

$$\sim A \square \rightarrow \sim D$$

$$\sim A \square \rightarrow B$$

$$B \square \rightarrow D$$

$$\sim A \square \rightarrow D$$

Preemption

Two marksmen, A and B, are planning to assassinate a dictator.

A has been told to shoot the dictator.

B has been told to shoot the dictator if A fails to shoot.

-Event A: A shooting

-Event D: dictator dies

Then:

(i) A and B occur

(ii) A occurs before B

~~(iii) if A had not occurred, B would have not occurred~~

Why; If $\sim A$, then B would have shot and killed the dictator.

So, D would have occurred.

Counterfactual conditionals

How do we analyse sentences of the form:

'if it were the case that p , then it would be the case that q '

the sentence is true in the actual world, iff:

there is a world w at which **($p \& q$)** is true and w is **closer** to the actual world $@$ than any world at which **($p \& \sim q$)** is true.



Counterfactual conditionals

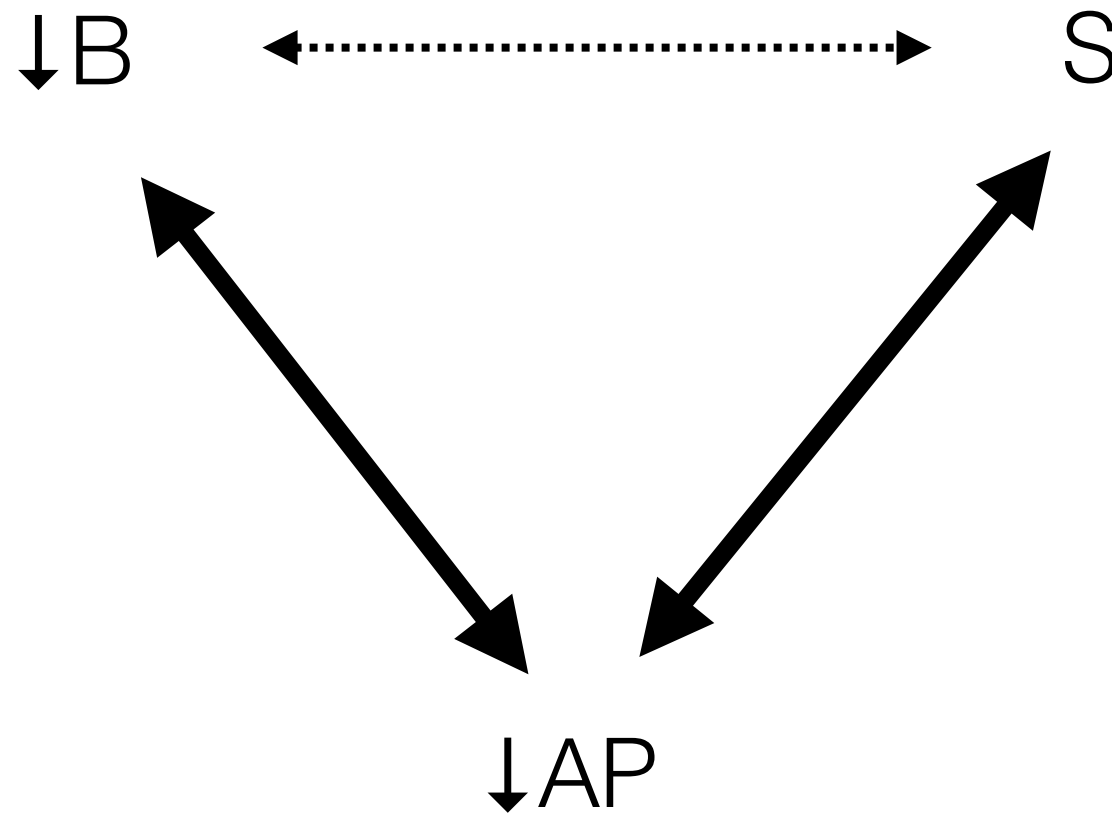
BUT:

How do we measure distances between possible worlds?

According to Lewis, the distance between worlds w and w' depends on:

- How many **laws of nature** are shared by w and w' .
- How many **local matters of fact** **γεγονότα** are shared by w and w' .
- Does this analysis help with the problems of the common cause and pre-emption?

The problem of the common cause



It should not be the case (since there is no causation in this case):

$$\sim\downarrow B \square \rightarrow \sim S$$

$$\sim\downarrow B \square \rightarrow \sim\downarrow AP$$

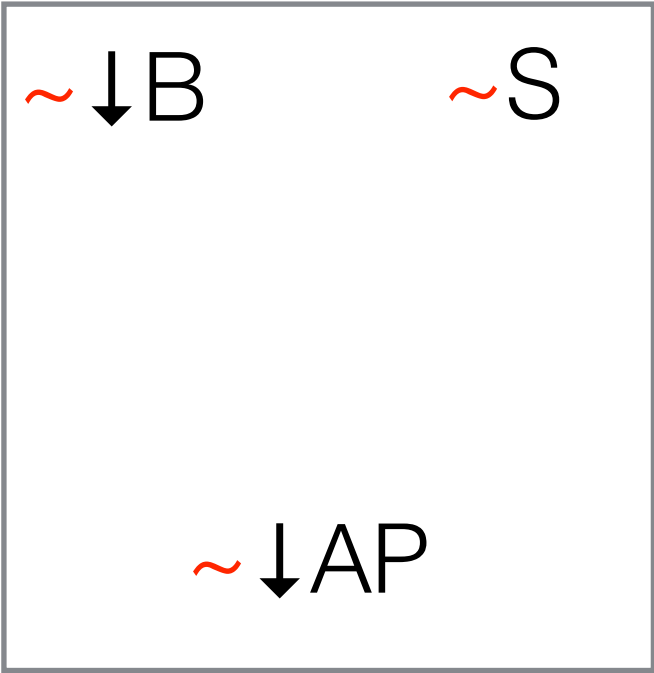
$$\sim\downarrow AP \square \rightarrow \sim S$$

$$\sim\downarrow B \square \rightarrow \sim S$$

The problem of common cause

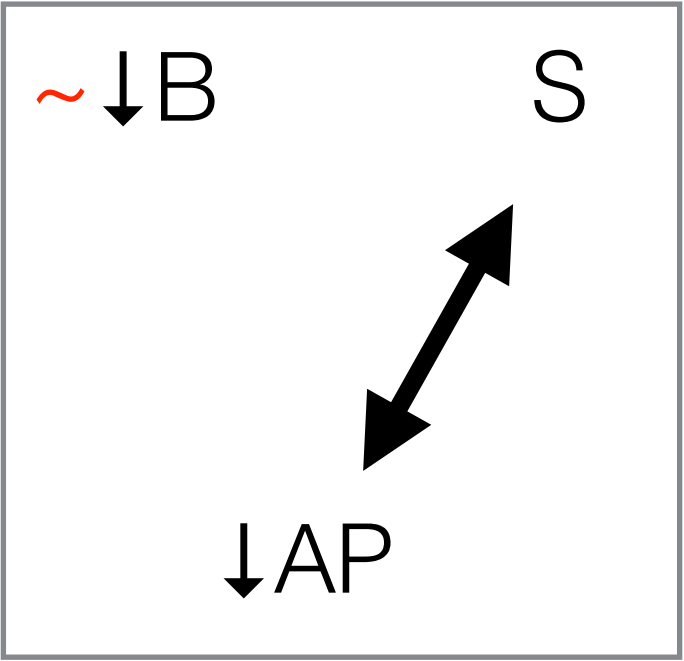
It should not be the case (since there is no causation in this case):

$$\sim \downarrow B \quad \square \rightarrow \quad \sim S$$



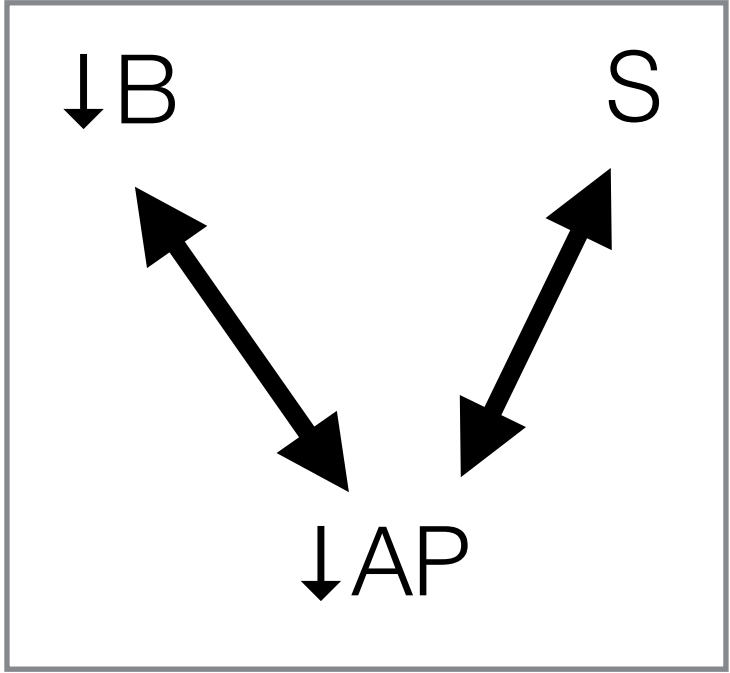
w1

$$\sim \downarrow B \quad \& \quad \sim \downarrow S$$



w2

$$\sim \downarrow B \quad \& \quad \downarrow S$$



@

Lewis's solution to the problem of the common cause

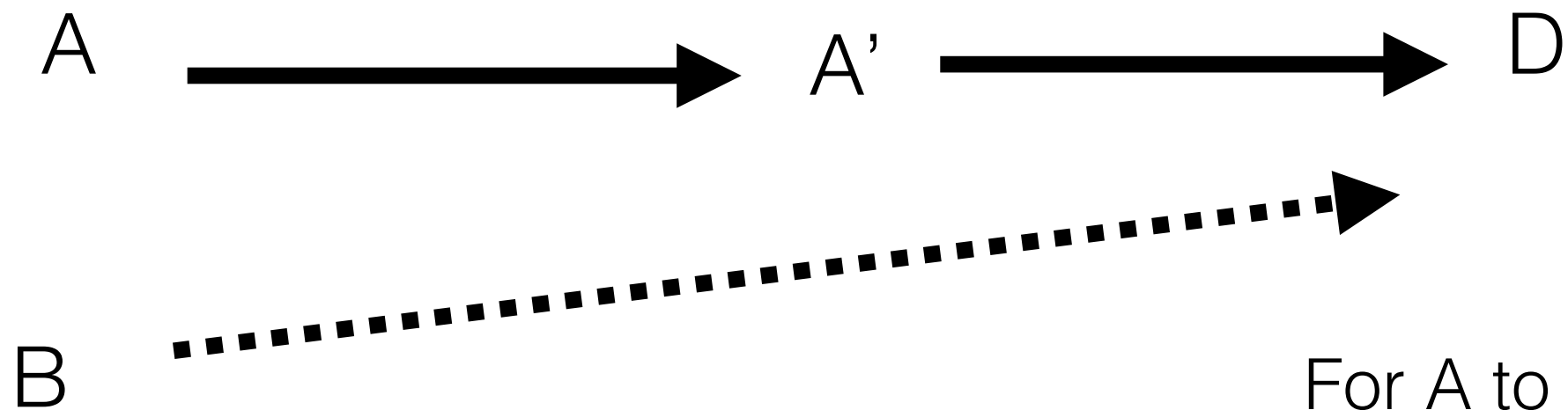
Lewis claims that: condition (iii) does not hold -the counterfactual conditional is false.

-There is a w where $(\sim A \ \& \ B)$ is true, which is closer to $@$ than any w' where $(\sim A \ \& \ \sim B)$ is true.

Why;

In world w more **local matters of fact** are preserved, but at the expense of **laws of nature**.

Lewis's solution to the problem of preemption



For A to cause D, it should be the case that:

$$\sim A \square \rightarrow \sim A'$$

$$\sim A' \square \rightarrow \sim D$$

Lewis's solution to the problem of preemption

Marksmen example

A causes D iff,

(i) A and D occur

(ii) A occurs before D

(iii) There is a sequence of events A, A', D
such that

- If $\sim A$, then $\sim A'$
- If $\sim A'$, then $\sim D$

where A' is the bullet at midpoint between A's gun and the dictator's head.

Lewis's solution to the problem of preemption

Lewis's solution: modification of (simple) counterfactual account (modification of conditions (iii))

A causes B iff,

(i) A and B occur

(ii) A occurs before B

(iii) There is a sequence of events $E_1, E_2, \dots, E_{n-1}, E_n$,

όπου $E_1 = A$ & $E_n = B$

such that

- If $\sim A$, then $\sim E_2$

- If $\sim E_2$, then $\sim E_3$

...

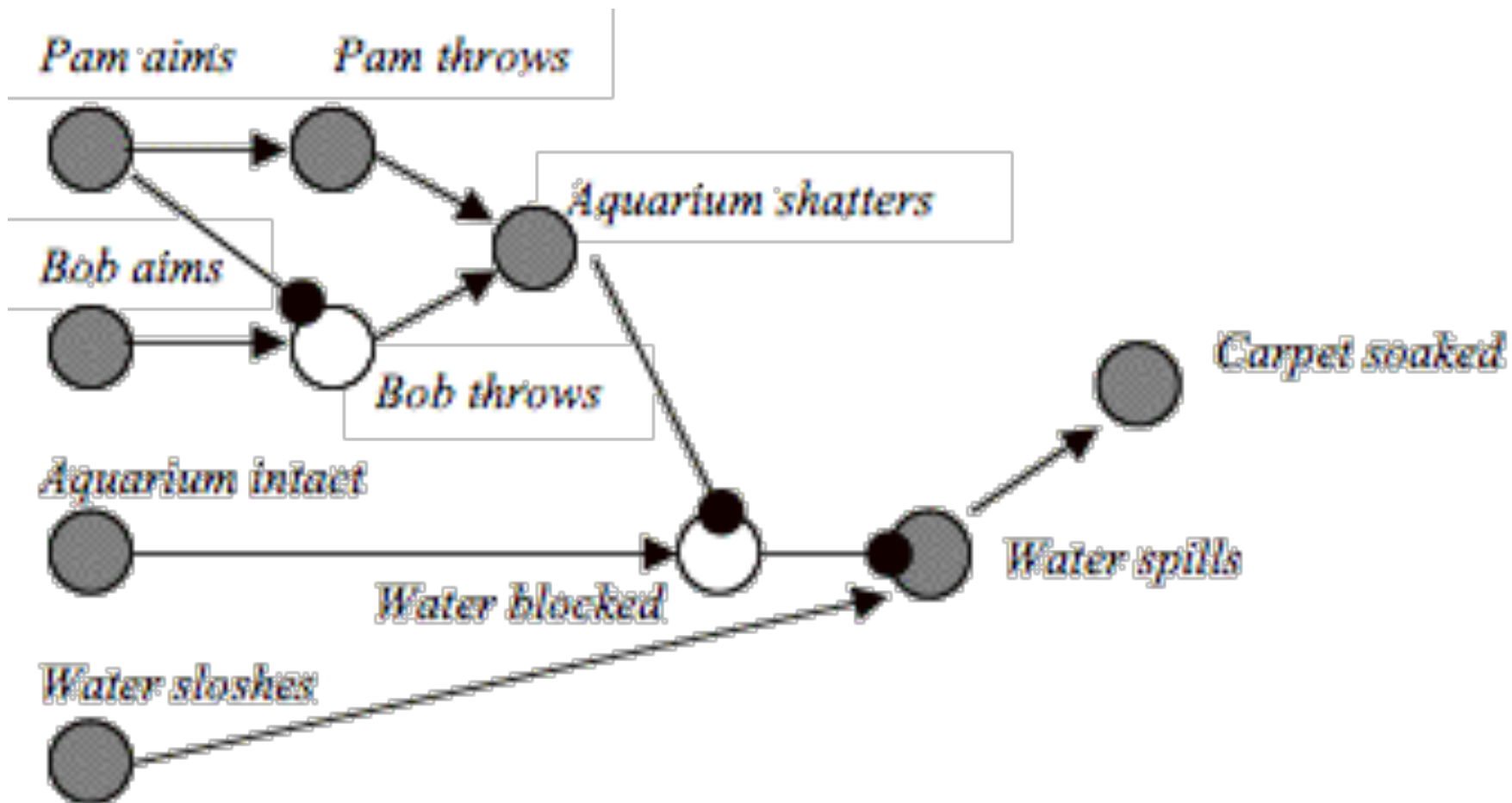
- If $\sim E_{n-2}$, then $\sim E_{n-1}$

- If $\sim E_{n-1}$, then $\sim B$.

Late preemption

- A and B are throwing stones at a glass bottle.
- They release their stones at the same time and both are heading straight for the bottle.
- A's stone hits the bottle and smashes it; B's stone flies through the open space that it leaves.
- But, if A's stone hadn't smashed the bottle, the bottle would nonetheless have smashed because of B's stone.
- Event A: A throws his stone.
- Event B: the bottle breaks.
- Does Lewis's modified counterfactual account apply in this case?

Causation II: Non-humean approaches



Production Theories

❖ *Transference accounts*

when x causes y , a property of x is communicated to y

physical properties such as **energy-momentum**.

Mechanistic theories of causation: there is a **mechanism** that connects cause and effect.

An event c causes an event e if and only if there is a **causal process** that connects c and e .

A causal process is characterised by **causal unity**, e.g., the **persistence** of a **quality** or the possession of some characteristic.

The resurrection of mechanism: causation

Generic account of mechanism—mechanisms as processes of a certain sort

- **Mechanisms have been taken to be the tie that connects cause and effect and explains the productivity of the cause: how the cause brings about the effect.**

As Hume claimed, the alleged **necessary tie between cause and effect is not observable**. But as John Mackie (1974) argued, we might still *hypothesise* that there is such a tie, and then try to form an intelligible theory about what it might be. The tie consists in a “causal mechanism”, that is, “some continuous process connecting the antecedent in an observed (...) regularity with the consequent” (1974, 82).

But processes of what sort?

Mechanisms

- **Something gets transferred—Transference models**
Wesley Salmon's process theory of causation I
Wesley Salmon's process theory of causation II
- **Something persists—Persistence models**
J. L. Mackie's version
Dowe's version
- **Power-based production**
Generative mechanisms
The MDC approach: powerful mechanisms
The Glennan approach: powerless mechanisms

Persistence models--Something persists

J. L. Mackie's version

- The causal mechanism consists in **the qualitative or structural continuity, or *persistence*, exhibited by certain processes**, which can be deemed causal. There needn't be some **general feature** (or structure) that persists in every causal process.

Something always does persist (e.g. the shadow of a moving car). Notion of persistence is unhelpful unless there is a suitable characterisation of the properties, or the features, that persist.

Salmon's account of causation

Causal processes, **causal interactions**, and **causal laws** provide the mechanisms by which the world works; to understand *why* certain things happen, we need to see *how* they are produced by these mechanisms (1984, 132).

But Salmon was aware of the fact that 'persistence of structure' is not enough to characterise a process as causal.

Structure-transference (or more generally, **mark-transmission**) became the distinguishing characteristic of a mechanism.

Salmon on Mechanisms

Salmon: 'causal' are those (and only those) processes that are capable of transmitting a *mark*.

- *Generic account of a mechanism.* The details do not matter, provided that there is a process **capable of transmitting a mark**.
- **Promise for a theory of causation that does not involve counterfactuals.**
- But the promise was not to be fulfilled.
 - *Ability* of a process to transmit a mark: a process is causal, even if it is not actually marked. The ability is a capacity or a disposition. Counterfactuals loom large!
 - In order for a process *P* to be **causal** it is necessary that “the process *P* would have continued to manifest the characteristic *Q* if the specific marking interaction had not occurred”. *Cfs* again.
- **A double role for cfs in Salmon's theory.**
 - They secure that a process is causal by making it the case that the process does not just possess an actual uniformity of structure, but also a **counterfactual** one.
 - They secure the conditions under which an **interaction is causal**. If the marking would have occurred even in the absence of the supposed interaction between two processes, then the interaction is not causal.

Salmon's process theory of causation II

Conserved Quantity theory: transference of CQ

It can be generalised as an account of causality *simpliciter* only if it is wedded to **strong reductionistic views** that all worldly phenomena (be they social or psychological or biological) are, ultimately, reducible to physical phenomena.

Possession

Dowe's version

Possession of conserved quantities

“The central idea is that it is the possession of a **conserved quantity**, rather than the ability to transmit a mark, that makes a process a causal process” (Dowe 2000, 89)

Dowe fixes the characteristic that renders a process causal and, consequently, the characteristic that renders something a **mechanism**. A conserved quantity is “any quantity that is governed by a conservation law” (2000, 91), e.g., mass-energy, linear momentum and charge.

Too narrow—applicable only to physical mechanisms. Non-physical processes (biological, geological, medical, social) should be understood either in a reductive way or in non-mechanistic terms.

Salmon's and Dowe's *conserved quantity* theory of causation.

- ***CQ-D1***
- *A causal process* is a world line of an object that possesses a conserved quantity.
- ***CQ-D2***
- *A causal interaction* is an intersection of world lines that involves exchange of a conserved quantity.
-
- ***The CQ theory is supposed to do away with counterfactuals.***
But:
- 1) Shadows with zero quantity of charge (pseudo-processes) vs particles at rest (causal processes). How is this difference to be grounded? Particles *could* enter into interactions, which *would* make their momentum non-zero. *Cfs* seem necessary
- 2) *Uninstantiated* causal processes: they do not possess conserved quantities, and yet they are causal.

Power-based production

Causes produce their effects because they have active powers to bring them about.

Causation is productive precisely because *the cause has the power to produce the effect*.

Leibniz: causes are ‘producers’

- Causal powers constitute a **deeper layer of reality**, behind or beyond the constant succession between events of certain type.
- Causal powers as regularity-enforcers.

But also: powers are meant to explain (at least partly) the *deviation* from regular behaviour—they can exist unmanifested/unexerted; they can be blocked from producing the standard effect/masked etc.

There is ϕ -ing: under circumstances C, there is ϕ -ing, because X has the power to ϕ .

- But also:
- There is no ϕ -ing: under circumstances C', there is no ϕ -ing, even though X has the power to ϕ , because the power to ϕ can exist unmanifested; or because the power to ϕ is masked etc.

The power to ϕ explains (by causally contributing to) both the ϕ -ing and its absence (at least partly).

The new mechanists

The **New Mechanism** is **not** tied to a mechanical conception of nature of the sort that has characterised the Old Mechanism. Nor it is committed to the view that mechanisms are simply suitably understood causal processes.

A **mechanism** is a complex system that consists of some parts (its building blocks) **and** a certain **organisation** of these parts, which determines how the parts **interact** with each other to produce a certain output. The **parts** of the mechanism should be stable and robust, that is their properties must remain stable, in the absence of interventions. The **organisation** should also be stable, that is the **complex system** as a whole should have stable dispositions, which produce the behaviour of the mechanism. Thanks to the organisation of the parts, a mechanism is more than the sum of its parts: each of the parts contribute to the overall behaviour of the mechanism more than it would have achieved if it acted on its own.

Monistic vs Dualistic Conceptions of Mechanism

Glennan (2002, S344): “A mechanism for a behaviour is a complex system that produces that behaviour by the interaction of a number of parts, where the interactions between parts can be characterized by **direct, invariant, change-relating generalizations**”.

-> ‘direct, invariant, change-relating generalizations’: it connects mechanisms with **Woodward’s replacement of strict laws with generalisations (or relations) that remain invariant under actual and counterfactual interventions.**

But there is a **dualist** conception of mechanism

Machamer-Darden-Craver (2000, 3) “Mechanisms are entities and activities organised such that they are productive of regular changes from start or set-up to finish or termination conditions”

- MDC: a mechanism consists of two distinct kinds of building blocks—**entities** (organised in a stable way into a spatio-temporal pattern) *and* **activities**.

the concept of **activity**: to account for the interaction between the parts of the mechanism and its overall causal efficacy.

- MDC: the productivity of a mechanism “requires the productive nature of activities”.
- Activities are the ontic correlates of (transitive) verbs and are necessary for the grounding of the **productivity** of mechanisms. Mechanisms are supposed to be “active”: “they do things”.

The Glennan approach: powerless mechanisms

- **The later Glennan:** The interaction of the parts of the mechanism is characterised in terms of invariant, change-relating generalizations.

No appeal to powers and/or activities

Instead, **interventionist counterfactuals** explain (or ground) the laws that govern the interaction of the parts of the mechanism.

- Mechanisms (e.g., the thermostat) are supposed to explain why certain counterfactuals hold, e.g., if the temperature had risen, the furnace would have turned off. And similarly, the breakdown of a mechanism would explain why certain counterfactuals fail to hold.
- **Mechanical laws** are those whose holding is explained by the presence of mechanisms.

Two worries/problems

- ***First: what is the relation between laws, mechanisms and counterfactuals?***
- It seems that **mechanisms ground certain laws** (the mechanical laws) by **grounding certain interventionist counterfactuals**. But it is also that **interventionist counterfactuals render some (mechanically explicable) generalisations *laws***. For if they did not hold, we could not talk about a mechanism proper (since we could not explain/ground the interactions between the parts of the mechanism) and hence we could not talk about a law proper.
- Call it a **loop** and not a circle! It is not clear *where* it can be broken so that the relation between mechanisms and interventionist counterfactuals can get going.

- ***Second:* Perhaps, the loop is broken at the level of fundamental laws of physics, of which Glennan says that they are not mechanically explicable. “all laws are either mechanically explicable or fundamental, *tertium non datur*”.**
- **But then, if fundamental laws are *not* mechanically explicable, and if they too support counterfactuals (as they certainly do), it is not necessary for the truth of a counterfactual that there is a mechanical explanation of it. So (the truth of) a counterfactual conditional need not have a mechanical explanation.**

But is the presence of mechanism sufficient for the truth of a counterfactual conditional?

- Glennan (1996, 66) says:

Although the mechanism responsible for connecting two events may supervene upon other lower-level mechanisms, and ultimately on mechanically inexplicable laws of physics, it is not these laws which make the causal claim true; rather it is the structure of the higher level mechanism and the properties of its parts.

- This simply evades the problem. **For how can it be that Y supervenes on X, but facts about X are not part of the truth-makers for claims about Y?** Even if they do not fix the truth-makers of claims about Y, they certainly contribute to them.

Dispositional account of modality and mutual manifestation

“an effect or manifestation occurs when two or more powers are brought together that are partners for that effect”

(Mumford 2014)

- Power P is disposed to ϕ
- If power P is disposed to ϕ , then **nothing happens**
- Power Q is disposed to ψ
- If power P is disposed to ψ , then **nothing happens**
- How does anything happen when power Q and power P get together—it seems all there is a joint (in some sense) disposition. How can one power act as an actualisation principle of the other?
- **Aristotle had two categories—power and act.**
- Action is irreducible to power, though it is explained by it. Actually, **ontically it is prior to power.**
- Dispositionalists want to do with **one** category: power

Pandispositionalism: Always Packing, Never Travelling

- **Standard argument against powers:** Molnar (2003, 173), following Armstrong (1997, 80), has called it the “always packing, never travelling” argument. The idea is this. If properties are nothing but powers, then when a power is manifested, its *effect* (the acquiring of a property by a particular) will also be a *power*. Hence, nothing really happens apart from the shifting around of powers from particular to particular. As Armstrong put it “Given purely dispositionalist accounts of properties, particulars would seem to be always re-packing their bags as they change properties, yet never taking a journey from potency to act” (1997, 80).
- A powerful *reductio* of the view that powers explain action: they do not. No manifestation (action) is possible if all properties are pure powers.

- Stathis Psillos , Causation & explanation