

Ch.7—Causal asymmetry

“An empirical analysis of the metaphysics of causation demands that we investigate empirical phenomena that motivate our belief that causation is temporally directed.” (225)

Asymmetry platitudes:

- no backward influence (the past is settled)
- material asymmetries: deterioration of living organisms, the diffusion of gasses, the flow of heat from hotter objects to colder objects etc.

Basic dilemma: According to Kutach, there is no temporal asymmetry at the fundamental level (terminance works both ways).

Strategy: explain the advancement asymmetry, i.e. the fact that there are no effective strategies for making it the case that, at some past time t , some event E occurred (or did not occur) at t . Then we can say that the past is settled even though it is influenced by the present (via terminance) (226).

“The asymmetry experiment”

1. Isolated agents get a description of a coursegrained event E which is either wholly in the future or wholly in the past at the time the experiment starts.
2. Agents randomly receive one of these instructions: “DO” (=make E occur) or “DON’T” (=make E not occur) . Agents are promised a huge reward.
3. The score of each team (DO vs. DON’T) is the number of time E occurred.

Prediction: (a) E is in the past \rightarrow the two teams have (roughly) the same score
(b) E is in the future \rightarrow team DO sometimes outscores team DON’T

(a) e.g. “The agent is born sometime in the past,” “The agent eats a slice of pizza sometime during the previous three hours.”

(b) e.g. “The agent eats a slice of pizza sometime during the next three hours.”

Note that the conception of agency employed in the description of the experimental design is extremely liberal and flexible. It can even include primitive devices such as thermostats. Imagine that the zillion thermostats on the DO team are trying to get the room to be at least 30 degrees and that the zillion on the DONT team are trying to get the room to be below 30 degrees. (229)

What about time travelling agents?

My prediction is only intended for normal circumstances where there is no time traveling to the past. [...] If anyone on Earth conducts the asymmetry experiment with the kind of technology we will have within the next millennium, the bold prediction will be confirmed in spades. (229f)

The explanation

What explains the results is future-typicality.

(:recap:)

The evolution of E from C is bizarre \equiv_{df} $P(E|C)$ is fantastically close to zero (180)
 E is future-typical \equiv_{df} if C precedes E , then the evolution from C to E is not bizarre

Exactly how to incorporate [future-typicality] into our overall conception of reality is controversial. [...] Whatever ultimately explains the asymmetry of entropy will almost surely explain the asymmetry of bizarre coincidences as well. (185)

(:recap end:)

Because the device that selected the team assignment is required to be a paradigmatic random device, its output and hence the recording of that output should not be correlated with some independently chosen target event. Instead, the random selection should so sensitively depend on a vast number of microscopic variables that can only be correlated with the independently chosen E if fundamental reality correlates them by way of a conspiratorial development of matter. This is one sort of bizarre evolution that is definitely ruled out by future-typicality. (236)

Let “the clever” be people who regularly win the *Influence the Past!* show. Then the clever regularly get assigned the instruction DO when E has occurred. But we are assuming that the assignment is done by a random device, which means that

$P(\text{a specific group always gets assigned DO} | E)$ is fantastically close to zero

Hence, the existence of the clever violates future-typicality. (237)

That said, we do influence the past, given that influence is just terminance and terminance works both ways. But we cannot exploit these relations, because of future-typicality. (237f).

The problem of Gold universes

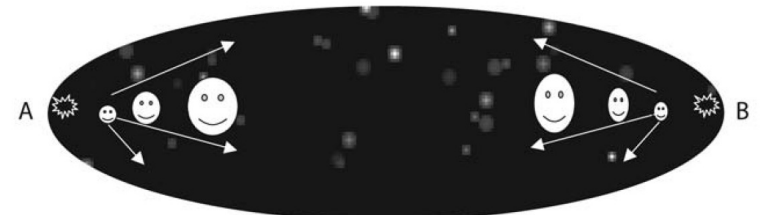


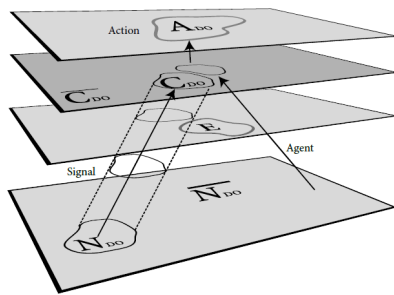
Figure 4.1 A time-symmetrical “Gold” universe. A universe that is bounded at both ends, and that is broadly (not necessarily exactly) symmetrical about its temporal mid-point. The inhabitants of the left-hand side regard A (their big bang) as lying in their past, and B (their big crunch) as lying in their future; the inhabitants of the right-hand side regard B (their big bang) as lying in their past, and A (their big crunch) as lying in their future.
From Barry Dainton: *Time and Space* (Acumen 2010), p.54

Inhabitants at A and B agree about fixing relations, but they disagree about the direction of typicality. As a result, they disagree about the direction in which effective strategies work. In a Gold universe, the direction of exploitable influence is relative in the same sense in which “up” and “down” are relative. (249)

An alternative explanation

We can use shielding (or the lack of backtracking influence) for cases when the past is assumed to be influenced via a future-directed process (the clever do something which impacts the future, which, in turn, somehow influences the past).

Shielding guarantees that this can't happen (236):



C_{DO} = agent gets the instruction “DO”

A_{DO} = what the agent does afterward

Whatever influence the effects of A_{DO} have on E is already there as a result of A_{DO} , thanks to **shielding**.

Shielding \approx If X fixes a probability for Y and X^* is X plus some extra bits of history that do not fall between X and Y , then X^* fixes the same probability for Y . (p.99)

Consequences for pseudo back-tracking prob-influence

Pseudo back-tracking prob-influence is e.g. the influence of barometer readings on thunderstorms. (Influence of one event on another when they have a common cause.)

An agent is asked to choose between green and yellow. A brain correlator is tuned to the agent's brain such that a green or yellow flag is raised. Consider Y = the agent chooses yellow, and YF = the yellow flag is raised.

Experiment 1: Y contrasts with G =the agent chooses green.

Prediction: Prob-influence of (Y,G) on YF is 0 [?] (241)

Experiment 2: Shortly before the brain correlator interacts with the agent, there is some interference.

Prediction: Depending on the type of interference, the correlation between Y and YF may go away completely.

Experiment 3: (slight rephrase): After the brain correlator does its work, the agents see a random flash which is either green or yellow. They get a reward if they choose the colour of the flash.

Prediction: No correlation between Y and YF .

If the agency that is nomically linked with the brain correlator is left alone in the experiment, a robust correlation between the agent's choice and the flag outcome will be exhibited, and that correlation can be interpreted as the result of pseudobacktracking prob-influence. To the extent that some process interferes with the usual nomic link, the correlation will be disrupted. This experimentally revealed difference makes evident the sense in which common-cause patterns cannot be exploited. (242)

Related example: “Smoking gene:” a gene that causes both nicotine addiction and lung cancer. Is abstinence from smoking an effective strategy against lung cancer in this case?

...depends on how you choose the contrasts...

When we hold fixed a contextualized event at some earlier time and consider a contrastivization of whether to abstain or smoke, we can do so by counterfactually twiddling the rational component or the craving component or both. Implementing the choice by a process that holds the rational component at neutral while only adjusting the craving will reveal that the choice promotes cancer because that part of the agent was positively correlated with the smoking gene. That case works just like the brain correlator example where the agent's choice of color partially influences which flag is raised. Implementing the choice by a process that maintains the craving while adjusting the rational component will reveal that the choice of smoking neither promotes nor inhibits cancer. (243)

Alternative explanations for causal asymmetry

Entropy

I am unfortunately unable to make a proper comparison between my own explanation and entropy-based alternatives because I am unaware of any existing explanation of the asymmetry experiment that appeals to the entropy gradient localized in the experiment's environment. (246)

Reason to think that entropy does not ground causal asymmetry: Entropy is only defined for whole systems or isolated subsystems (“branch systems”)

- If we define entropy for the universe as a whole, the direction of causation will depend on what occurs arbitrarily far away
- If we define entropy for subsystems, then
 - (a) advancement asymmetry is not explained
 - (b) no direction of causation if there are no isolated subsystems
 - (c) if entropy locally decreases, is the direction of causation reversed?
 - (d) [Dainton's point]
 - (e) it is conceivable that a device causes a decrease in entropy

The above arguments, I must emphasize, do not violate the methodology of empirical analysis because in the current context, I am using the intuitions merely to flag conceptual disconnections that need to be bridged by any adequate empirical analysis. (246)

What I think is novel about my own explanation of the advancement asymmetry is that it provides an adequate account of how the special character of the big bang vindicates the platitude that we are unable to influence the past by explaining the results of the asymmetry experiment. It does so while easily evading the five previously listed obstacles for entropy-based explanations. (249)

Fork asymmetry

Conjunctive forks:

- (1) $P(A/C) > P(A/\sim C)$
- (2) $P(B/C) > P(B/\sim C)$
- (3) $P(A\&B/C) = P(A/C) \cdot P(B/C)$
- (4) $P(A\&B/\sim C) = P(A/\sim C)P(B/\sim C)$

E.g. A = thunder, B = lightning, C = high atmospheric static charge.

Reichenbach (1956): the direction of time is the direction in which conjunctive forks are open, i.e. $C \rightarrow A\&B$ in (1)–(4).

Kutach's complaints:

(i) the correlations in (1)–(4) not derived from fundamental laws.

Without some component of fundamental reality linking the events in such a way, there is no clear reason (that I can see) why counterfactually altering one localized event should have implications for what happens elsewhere. (231) According to my account ... fundamental relations do not hold between instances of these mundane events and thus any probabilistic relations among them must count as derivative. (255)

(ii) forks do not explain the promotion asymmetry

A mere lack of conjunctive forks open to the past does not by itself make the past "settled" or make events immune from influence coming from the future or otherwise explain the advancement asymmetry. (255)

[Future-typical correlations] might count (together with some action of the agent) as something akin to a conjunctive fork open to the past, and if so there would be some connection between future-typicality and a lack of conjunctive forks open to the past. However, my explanation of the asymmetry experiment does not depend on a general lack of conjunctive forks open to the past, only that there are no conjunctive forks open to the past that involve the random team assignment at one time and the occurrence or non-occurrence of the target event at the other time and some action of the agent as the common cause. That is, my account depends on a much weaker assumption than the general non-existence of conjunctive forks open to the past. (256)

Fundamental Influence Asymmetry

Two ways to introduce fundamental (temporal) asymmetry (258):

- (a) "Restrict the kind of counterfactual dependence that represents influence to the future direction"
- (b) "Deploy a model of counterfactual dependence where the past is held entirely fixed under counterfactual alterations to a given time"

Reasons not to posit such an asymmetry:

(1) By the lights of empirical analysis, it is of absolutely no value that the 'asymmetry by fiat' explanation corresponds better with our naïve conception of influence. (258)

(2) One can dispense with the fundamental direction of influence and still explain the asymmetry experiment without any controversial resources. (258) A standard appeal can be made to ontological parsimony as one finds in arguments for the elimination of preferred rest frames in classical and relativistic physics (259).

(3) The presence of the fundamental direction of influence raises an unanswered question as to why it is aligned with the one temporal direction in which the universe does not evolve bizarrely. (258) The case for a fundamental direction of influence would be significantly strengthened if there were some reason to think that fundamental physics required the non-existence of past-directed terminance besides a pre-theoretical disbelief in past-directed influence (260).

Moreover, even if there were a fundamental direction of influence,

it still makes sense to accept the past-directed partial influence that exists by virtue of a common-cause pattern. [...] [I]t makes sense not to clutter the metaphysics of causation by trying to rule out counterintuitive versions of partial influence just because of an instinctive disbelief in past-directed influence. (261–2)