Regularities and counterfactuals. Two standard approaches to analysis of causation; Mackie's theory non-committal between them, but now we get committal. Both come from Hume.

> H1. 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.
>
> H2. ...Or, in other words, where if the first object had not been, the second never had existed.

H1 leads to the regularity theory: *c* causes *e* iff both occur and they are subsumable under some law of nature.
H2 leads to the counterfactual theory: *c* causes *e* iff *e* would not have occurred if *c* hadn't. Mysterious how Hume could think they come to the same, but he does. Here is Lewis's precisification of the regularity theory, writing 'O*x*' for the proposition that *x* occurs:

c causes *e* iff (1) O*c* and O*e*, (2) there are laws *L* and particular facts *F* such that *L* and *F* jointly imply that if O*c*, then O*e*, although (3) they do not jointly imply O*e*, and (4) neither individually implies that if O*c*, then O*e*.

Lewis thinks this overgenerates: that *c* and *e* could satisfy (1)-(4) because they are related as cause and effect, but they could also satisfy it because they are related as effect and cause (*L* and *F* might imply that if nuclear explosion, then a certain kind of radioactive decay); or because *c* is an epiphenomenon of *e*'s true cause (like the light on a coke machine); or because *c* would have caused *e* had it not been preempted by some other cause (slow-acting poison preempted by fast). Call these the *problem of effects* (aka priority), the *problem of epiphenomena*, and the *problem of preempted potential causes*. The counterfactual theory does better with these, Lewis thinks.

> CF: *c* causes *e* iff *c* and *e* are "distinct," occurring events, and $\sim Oc \mathrel{\Box\!\!\rightarrow} \sim Oe$.

CF might seem to run into its own versions of the above problems. Let *c* be putting a quarter into the snack machine, and let *e* be peanuts coming out. Effects: It's true if not for *c*, there wouldn't have been *e*; but isn't it also true that if not for *e*, there wouldn't have been *c*? Epiphenomena. Let *c** be the light flashing on the snack machine, the one that shows a quarter has been put in. It might seem that had *c** not occurred, neither would have *c*. Put that together with $\sim Oc \mathrel{\Box\!\!\rightarrow} \sim Oe$, and you get (don't you?) $\sim Oc^* \mathrel{\Box\!\!\rightarrow} \sim Oe$.

A quick and dirty solution to Effects: add a clause saying *c* must precede *e* in time. But (0) the regularity theorist could say the same, (1) no use against Epiphenomena since *c** does precede *e* in time, (2) backward and simultaneous causation are not incoherent, (3) one might rather want to use the direction of causation to define the direction of time.

Lewis's own solution: "flatly deny the counterfactuals that cause the trouble." It's not true that if *e* hadn't occurred, *c* wouldn't have; *c* would still have occurred but for some reason failed to cause *e*. "To get rid of an actual event *e* with the least overall departure from actualty, it will normally be best not to diverge at all from the actual course of events until just before the time of *e*. The longer we wait, the more we prolong the region of perfect match between our world and the selected alternative." *Convincing?* Note that there's still room for *e* to "cause" an immediate precursor.

Preemption: Billy and Suzy throw rocks at a bottle. Suzy's rock deflects Billy's en route to smashing the bottle. Her throw caused the bottle to break. But it's *not* true that but for her throw, the effect would not have occurred, since Billy's rock, no longer deflected, would have hit the bottle itself.

"Digression" (actually anything but). Causation is intuitively transitive, but CF (simple) doesn't make it so. Intransitivity of counterfactuals. *Examples?* So maybe the account should all along have been

> CF: *y* depends on *x* iff *x* and *y* are "distinct," occurring events, and $\sim Ox \Box\!\!\rightarrow \sim Oy$
> *c* causes *e* iff there are x_1 (=*c*), x_2, ...x_n (=*e*) such that each x_{i+1} depends on x_i

In other words, *c* causes *e* iff there is a dependence chain leading from one to the other. And now what do you know? CF seems to solve Preemption. Because let *d* be Suzy's rock heading toward the bottle after deflecting Billy's. *c, d, e* is a dependence chain leading from Suzyy's throw to the effect.

Reasons not to celebrate too soon. Not clear causation *is* intuitively transitive. Also, other forms of preemption don't yield to this method. "Early" preemption versus "late." Suppose Suzy's rock doesn't deflect Billy's, it just arrives first; Billy's then sails harmlessly by. Trumping preemption. What to do now?