

## A BRIEF ANALYSIS OF CAUSAL THEORIES

### 1. INTRODUCTION

**Causation** - or the studies in causality - can briefly be summarized as relationships between agents in where one event is said to have some type of influence on another event. In a simple and single causal chain consisting of two events - A and B - we can say that *A causes B* if A had some relative responsibility in B and that therefore B is also dependent on A. The study of this dependence, the mechanisms for constructing such relationships, and the subsequent formalized framework of events which attempt to explain this relation remain to be pivotal within the fields of Contemporary Philosophy and Metaphysics.

Our goal, therefore, is to understand some of the prevailing frameworks which aim to explain these causal ties and investigate the validity in the work both logically and from a “common sense” viewpoint (that is the one that seems to make sense by means of simple human intuition). By looking at both intuition and formal logic, we are able to get a better understanding of the theory as a whole and subsequently characterize it in our discussion. In this analysis, we will investigate two major theories of causation: **Counterfactual Theory** as well as **Process Theory**. Both theories are widespread and offer different fundamentals in formalizing causal ties and relationships, yet both attempt to explain the tie between two events in the simplest form. That is, both theories, while very different, attempt to answer the same primary question in causal studies.

### 2. COUNTERFACTUAL THEORY OF CAUSATION

We will first investigate the Counterfactual Theory of Causation. In the work of Hume and really in the the subsequent primary focus of David Lewis’s studies, we are presented with a method of explaining causal relations by means of counterfactuals. Simply stated, a counterfactual can be written in the following form: “*If A had not occurred, then B would not have occurred.*” This is a fairly straightforward statement for us to follow. We can also write these in the form “If A were the case, then B would be the case.” We notice that these counterfactuals simply negate the antecedents in their standard form

(making them false) - hence the intuition behind the name. Lewis was interested in forming a more concrete relation, as the counterfactuals alone do not allow us to expand for a general theory of causation. Lewis formulated this in his counterfactual approach to *causal dependence* - or formalizing the simple counterfactual into relations between events. The fundamental integration of counterfactuals in this causal dependence is seen in the following statement: ***“An event  $e$  causally depends on some cause  $c$  if and only if cause  $c$  occurred then  $e$  occurred, and if cause  $c$  did not occur then  $e$  did not occur.”*** Lewis is simply describing an event that must occur if its causal process ( $c$ ) occurs, and does not occur if its causal process does not occur. This seems very intuitive: this certainly holds true for events in the real world (coarsely defined as the world in which this paper was written by a human) where we can state that if a cause to some event did not occur, that event did not occur. By Lewis’s framework, therefore, this could be extrapolated to state that if some agent causes an event to occur, then it posits that there is a sequence of events in which each event in the sequence depends on the prior event all the way to our event occurring. Again, this is a fairly intuitive approach as thinking of an event being caused by all prior causal chains until the event occurs does flow fairly straightforwardly. We can imagine some event  $E$  that is caused by a sequence of potentially infinite prior causes from our direct cause  $C$  - there are potentially infinitely many *causes that caused  $C$* ! This is the basis of the causal chain of dependence, or the idea that an event can be linked to a chain of causes in a sequence. To this note, Lewis is making a Metaphysical claim about the way any event occurs. By formulating the causal dependence chain of events, Lewis’s approach to causation involves all prior causal events, and if those causal events did not occur, then the event in question could not have occurred. This is a very strict argument, however, and assumes that every causal chain event must have occurred for an event to occur. Again, intuitively this makes sense at first - we can think of all the causal events as a line of Dominoes and if one falls, the line does not exist anymore (as it was before). However, digging deeper into this theory, we run into some problems, primarily the question *“If one causal event did not occur in the chain, does that really stop our event from occurring?”* This is a central question that we will come to when discussing and comparing the merits of the Counterfactual Theory, however it is safe to say that we can think of situations where this strong statement of dependence does not particularly make sense.

One such Philosopher, Sarah McGrath, brings up a potential point with the general causal dependence chain theories like derived directly from Lewis’s Counterfactual Theory. McGrath brings up causation by omission, which is tied into Lewis’s approach by Counterfactuals. As it

sounds, causation by omission is simply causing some event to happen by not doing something (doing something here can be very vague; it is simply the act of omitting theoretically). McGrath further wrote that *“there is either way more causation by omission than we think or can reasonably count or there is none.”* This is a partial rebuttal to the simplistic counterfactual approach in that we have a dilemma. We must account for the theoretically infinite amount of omissions that could occur and fail to cause some event, or we can simply state that there is no causation by omission - something that would bring issue with Lewis’s theory. However, Lewis’s theory **does** indeed account for too much (infinite) causation by omission - he agrees that there is an infinite amount of omissions that can occur and that is perfectly fine with his theory. McGrath contends stating that it is not how conversations flow (I would not mention every other human being that *could have* caused an event to not occur because their omission - that is very unnatural indeed). In conversation today - and stepping forwards for a moment- we generally speak in responsibility. Extrapolating away from the theory, at a very high level in our world (and specifically the United States), the Justice System is designed such that responsibility, actions, and volition’s are fairly well-defined. For Lewis, this would hold to his theory. While McGrath does bring up points of theoretical nature (such as the example of a plant dying because the agent that was to water the plant did not, but he was never going to, and a friendly neighbor did not happen to make her daily walk that specific day) we cannot still extrapolate that completely as an issue to Lewis’s theories. Again, Lewis is on-board with the idea that there is infinite omission, and it is part of his infinite chain of causal dependence! The argument here is that there may be contextual situations where you cannot state a clear pathway of causal chains, but if we look at this at a lower level, we can still write Lewis’s approach with counterfactuals - albeit messier - to explain situations such as those brought up by McGrath. The chain would branch, but it would still connect, thereby providing a foundation for the methods of Lewis’s theory.

### 3. PROCESS THEORY OF CAUSATION

Another theory of causation is the Process Theory, and Dowe is a strong proponent of this theory. Process Theory does not utilize omissions or lack of omissions or counterfactuals - instead, it relies on a “science-first” approach. Dowe is very aware of the Physics that goes (often) hand-in-hand with the Philosophy, and Process Theory can be simply defined as a lower-level extrapolation of the current state of what scientists believe today about time and space. Specifically, Dowe and others following the Process Theory would see all major

entities as having a world line. This world line is simply a continuous line through time and space that consists of conserved quantities in Physics. Only things like momentum or matter, for example, make up these world lines. The world lines are initially not disturbed; that is they are in a “straight” motion - but **any** interaction between world lines causes a collision and disbursement of these quantities. As a result, the world line would now change depending on the specific event, and any influence would come from that interaction within the world line. Different types of reactions can occur depending on the collision - aptly named Y, X, and  $\lambda$ -type interactions for their resultant world line pathways. Intuitively, this may not seem as clear cut as Lewis’s theory. However, Dowe believes in the region of space where we exist upon abstract world lines (at least abstract right now). A common criticism of Process Theory is that it is not clear and doesn’t seem to make as much sense when thinking about events in the real world (our world). It would appear, on the surface, that Dowe is not thinking rationally and that there is no intuition for his arguments. This is a flawed statement against Process Theory, however, because it is based on the lack of intuition alone. While Process Theory generally *is* more complex to understand at first glance over the counterfactual proposals, we cannot rule it out simply because of its complexity. Other arguments against it are the lack of one hundred percent truly defined entities in Process Theory - that is Dowe considers items like shadows to be “pseudo-” as the science of shadows would focus on the sources - light, optics, etc. Because of these lack of defined terms for some processes that aren’t yet fully understood or studied, Process Theory will often get shrugged off. This is, again, a weak argument at best. Rooted in science, Process Theory describes objects, entities, events, interactions of such events, and these “sideline derivatives” as they would be formulated in most Physics lectures. Because of this strong attachment to the sciences, certain things are not perfectly clear, but we can understand when given an explanation. For example, if one were to ask about shadows, it would not be hard to speak about the science of shadows and sources that cause them as the main motivators today and thereby making the abstractness much less vague. An understanding of the sciences would make Process Theory very appropriate to the discourse because of the blending of some empirical data and the very interdisciplinary-nature of the approach.

#### 4. DISCUSSION

As we have reconstructed two widespread theories on causation, it is important to see the differences. When we look at the differences in the theories, there are many. In fact, Process Theory and Lewis’s

Counterfactual Theory of Causation have very little to do with each other. Process Theory does not utilize the *idea* of a counterfactual let alone any implementation of it nor does it utilize any direct chain of causal events that are in a sequence of dependence. These two theories are indeed very different, but they aim to explain our goal: causation. Looking between the two theories, Lewis offers a lot of straightforward intuition. We can see that it comes off familiar - easy to map to the real-world and not as technical in scope. Furthermore, it is easier to map to our real world using predicate logic, whereas the work of Dowe is not easy at all. The fundamental difference is, of course, the approach taken. Process Theory is a very straightforward approach once the science is understood. It doesn't leave too much room for ambiguity besides the undefined or non-mapped structures that we have not, in the sciences, completely explained. Yet the Process Theory view doesn't suffer from any type of obvious transitivity issues like you could construct fairly easily with the counterfactual-based theories. Because of its vagueness and the world line structure being very generalized and not specific to our world, there is a sense of completeness to the theory. The core arguments against it are mainly of technical scope, and less to do with the actual methodologies behind it. Because it views causation as an interaction between world lines that are fundamentally conserved physical quantities, we have reason to think that this is a strong theory that extrapolates outwards as a more broad compass of causation. It is indeed vast in scope - while the Counterfactual Theory explains things in a vector-like dimension in a specific world (a chain of causal events), Process Theory explains causation as interactions between world lines of very abstract nature. This very core difference in scope makes Process Theory a broader yet more complete form of describing the potential Metaphysical nature of causal processes and interactions. It also gives a very strong framework to expand upon, backed by lots of science, and is a clearer pathway to explaining causation with significantly fewer points of contention, especially on the moments of transitivity and scale where extrapolating the general idea of Counterfactual Theory would not prove to be as easy of a task. The conclusion that comes to mind is that Counterfactual Theory is an intuitive way of thinking of causation, but it is merely a subset of Process Theory. Even though Process Theory itself doesn't include many of the proposals in Lewis's work, you can see the idea of such work fitting in a Process Theory driven model. Because you can abstract outwards with world line interactions, the causal chains could be formed as part of a "secondary" layer within. This is, of course, assuming that Process Theory does accurately describe causation, and that we can then bring in the chain of events within the larger picture of interactions with world lines to create a stronger

picture. As it stands, and with the information that we know today in Physics, Mathematics, and other related fields, Dowe and similar Process Theory proponents have a cleaner picture of causation.