

## Russell on Fundamental and Non-Fundamental Causation

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Bertrand Russell is well known for his causal eliminativism in his celebrated *On The Notion of Cause* (1912), a view he famously expressed by his claim that causation is retained as an important scientific notion only because, like the monarchy, people assume it to do no harm. On this view metaphysically fundamental scientific theories, such as mathematical physics, dispense with the notion of cause in their fundamental physical laws.

The basic criticism roughly follows two lines of argument:

1. Both philosophical and folk ideas about causation are either incoherent, trivial or hold so rarely that they could not possibly vindicate the intuitive idea.
2. In our most mature and best established sciences such as space-time physics, field physics and so on there's no notion of causation at the structural or dynamical level. Explanations appeal to mathematical structure: geometry + differential equations.

In this paper Russell also distinguishes a notion of causation linked to determinism, which he interprets functionally. He distinguishes trivial and non-trivial formulations. Given the definition of determinism and of event, it is theoretically possible to arrange many physical structures to be "deterministic". But that's not what is wanted, what we want in science are simple theories.

The surprising thing for Russell isn't that there are laws, but that these are simple & hence discoverable. But while simplicity is something we are drawn to a priori, the a posteriori world might fail to deliver. In connection to this Russell mentions further structure to events: repeatable universals & path-dependency of a system in connection to dynamical evolution equations in differentiable manifold structure.

For causal inference in physics to be possible Russell introduces the notion of a practically isolated system, this is a system which is expected to preserve similarity throughout an interval of time, even if it could deviate in its dynamics from some systemic interaction with outside elements. There is a epistemic notion of causation, causal inference, which Russell explains in virtue of the possibility of identifying similarity patterns in practically isolated systems.

In *The Analysis of Matter* (1927) and *Human Knowledge* (1948) Russell returned to the discussion of causation and argues for the following two views, which are *prima facie* incompatible with each other and incompatible with his earlier claim. First, that there are separable causal lines which should be identified with physically distinguished geodesics in relativistic space-time (1927, 1948) and that, (2) causation is a fundamental postulate in non-demonstrative scientific inference (1948) in his epistemic structural realism.

These two claims seem inconsistent with Russell's main claim in *On The Notion of Cause*, but that inconsistency is only apparent. Russell's underlying methodology never changed, this is logical atomism (Landini, 2014; Klement, 2017; Elkind, 2019). **Logical atomism**, informally, is a research program on which metaphysical necessities are treated as logical necessities in disguise, in principle explainable via logical analysis: the theory of relation-types and the philosophical logic behind it.

In AMt (1927) Russell speaks of world-lines of material objects as just the material objects: fourdimensional space-time worms. Fundamental physical particles are among these as well and physical objects are but logical structures of more basic physical stuff such as these. This is a structural realist theory on which realism is confined to logico-mathematical structure plus a few other primitives (Macias-Bustos, MS).

Russell argues that our knowledge of the physical world is structural in the sense that perception gives structural information of neighboring spatiotemporal regions and matter emanations in those regions (motion, fields) via structure-preserving information that travels from "causal centers" and is preserved in what he calls "semi-independent causal lines". But these are also material time-like geodesics.

The main assumption is that these causal-lines, which are space-time geodesics, are independent in the sense that they are not sensitive to small external disturbances. But it's clear that these are just the practically isolated systems of *On The Notion of Cause* and just as in that paper in AMt Russell again remarks on the simplicity of the laws, captured in the differential equations and their underlying structures and the non-trivial similarity, singled out in that book thorough the primitive of co-punctuality which belongs to the primitive ideology of his relationalist account of space-time physics.

The space-time geodesics are no doubt fundamental in the sense that they can be reduced through Russell's primitive ideology to logico-mathematical structures (relation-types), particulars and co-punctuality: indeed, they are the transitive closure of co-punctual event series.

However, just as logical atomism demands, there's no necessity in the existence or persistence of these "simple" spatiotemporal-temporal structures required for scientific inference, in Russell's metaphysics. To be possible, scientific inference requires assumptions or postulates (HK, 1948) about causal structure, in the above sense, which might fail to hold. But scientific knowledge for Russell, isn't threatened by the fact that there's no modal guarantee of its possibility: science might be only locally possible, but wherever there is science there will be laws (AMt) and these in turn, by requiring the existence of certain logico-mathematical structures, will metaphysically reduce to just particulars, universals and mathematical logic.