

Research project 2010-2011: Fundamentality

Philipp Keller, UNAM

Reconciling science with common sense

The present project attempts to investigate the central notion of *fundamentality*, and cognate concepts such as *in virtue of*, *explanation*, *grounding*, and *dependence* – in the hope that a better understanding of these concepts will help to reconcile Aristotelian common sense with the surprising findings of modern science, physics and biology in particular. The overall aim of this research project is to work towards a reconciliation of contemporary science and contemporary metaphysics by understanding the notion of *being fundamental*, exploring its conceptual ties with classic metaphysical notions such as *substance* and *dependence*, integrating the notion of fundamentality into a re-conception of metaphysics, as studying *fundamentality ties*, and drawing on contemporary physics to better understand what is, and what is not, fundamental to reality.

We live in a world of middle-sized dry physical objects, moving with more or less constant mass and average velocity, persisting in time and undergoing moderate and gradual change. We take these objects to be substances, entities possessing an inner nature possibly unknown to us, and exemplifying intrinsic properties. We assume that these objects have stable identity conditions, and can be individuated separately from each other. We take it for granted that most of these objects are composed of smaller parts, and that their mode of composition bestows them with an inner structure and identifiable properties.

Modern science has radically challenged these assumptions. Physics tells us that time is a much stranger phenomenon than anyone ever imagined. Special relativity tells us that our watches run slower if we travel quickly, and general relativity permits travel not only forward and backward in space, but also backward in time. Fundamental physical laws are typically time-reversible, and thus cannot underpin any asymmetry in the ordering of our experiences. Contemporary, and admittedly more speculative, attempts at unifying the general theory of relativity and the other pillar of modern physics, quantum mechanics, entail an even more puzzling – and disturbing – claim: time is not even a fundamental physical magnitude according to one of the two major approaches to such a unification. Put differently, there is no longer a fiducial time with respect to which any evolution can be understood to happen. There is no change whatsoever at the most fundamental level of nature!

Not just our ordinary conceptions of time and change have become fundamentally challenged by modern physics, but physics also tell us that the things persisting in time and undergoing change are very different from what we usually think: they have very few, if any, intrinsic properties and come in homogeneous kinds, with little to distinguish different members. Take two electrons in the orbital of a helium atom: they have the same energy eigenstate and the same position state, and still they are two – how that? In fact, we can show that they are two, because we can show that they have opposite spins. They are indiscernible by monadic predicates, but satisfy a binary irreflexive relation (of having opposite spin to), hence there must be two, and hence, in some sense at least, they are two objects (Saunders 2006). But these objects are very different from tables. It is not just that we cannot distinguish them, rather there is nothing to there being one of these two electrons rather than the other. They are not just identified purely relationally, but they themselves seem nothing else than nodes in a network of relations. But can we go from there to the “wholesale abandonment of the ... intuition that there must be something of which the world is made” (Ladyman/Ross 2007: 12)?

The astonishing scientific claims that clash with common sense make essential use of the concept of “fundamentality” or of some cognate notion. Physicists claim, for example, that *fundamentally*, there is no time, or that, *fundamentally*, there are no objects. Biologists argue that,

fundamentally, not persons but genes are the agents of evolutionary processes, while neuroscientists profess to have found out that, *fundamentally*, there is no such thing as free will. It is of the utmost importance to understand the precise meaning of these claims, because only given such an understanding will it be possible to properly assess the challenge to common sense they represent.

The key idea of the present project is to approach the problem of reconciling science and common sense from an unexpected angle. Presumably, relativity theorists do not want to say that their lives could have started with their death and ended with their birth, no more than researchers in loop quantum gravity want to say that nothing ever changes (their own scientific careers included). No one seriously denies that, in some sense at least, there are tables and other persisting objects that undergo change. But the following seem to capture what those who derive astonishing claims from basic science have in mind:

- (i) Fundamentally, there is no time. (loop quantum gravity)
- (ii) Fundamentally, nothing changes. (time is gauge)
- (iii) Fundamentally, there are no objects. (ontic structural realism)

It is not clear, however, what “Fundamentally, such-and-such is the case.” means. Does it, for example, imply that such-and-such is the case? If it does, then what does it add to say that such-and-such is not just the case, but *fundamentally* the case? If it does not, then which of the things that are not the case, are still fundamentally the case?

But even if this prior question were answered, the notion of fundamentality would remain problematic. What is the relation between the more and the less fundamental? Does the less fundamental reduce to, supervene on, or depend on the more fundamental? Can, or must, it be explained in terms of the more fundamental? Is it “nothing over and above”, or does it have its own existence? Is it somehow less important, perhaps even dispensable in a description of the world?

One of the most important contemporary philosophers, Kit Fine, has recently argued in a number of influential publications for a distinction between what exists and what REALLY exists. This distinction is closely related to the one between the fundamental and the non-fundamental. While reductionists and anti-reductionists, realists and anti-realists may agree that there are tables, space-time points, persisting and changing things and indiscernible objects, they still disagree, according to Fine, about whether they REALLY exist. But what does this disagreement consist in?

A venerable approach to these questions operates with the concept of reduction. Some things are more fundamental than others, it is held, because theories about the latter can be transformed into or give rise to theories about the former. The classic account is in terms of bridge laws explicitly linking concepts of the reduced theory with concepts of the reducer theory (Nagel 1961). Much of the debates on the place of the life sciences have centred around arguments concerning the possibility of reducing parts of biology to physics and chemistry. The reducibility of classical genetics to molecular biology has served as a test case for the standard model of theory reduction. Today, however, there is an almost universal consensus that it fails the test. No derivations of biological laws from physico-chemical laws of the sort required by the model have ever been produced.

A much weaker successor concept, that of supervenience, has been introduced into the mainstream by Donald Davidson to characterise how “mental characteristics are in some sense dependent, or supervenient, on physical characteristics” (1970: 214), ‘nothing over and above’ them, even if there are no psychophysical laws. A long and still ongoing discussion on how to characterise this notion of supervenience ensued. While there is much disagreement over the details, supervenience is generally defined as a species of modal covariation: for some properties *A* to supervene on some other properties *B*, it is at least required that there can be no difference between two things with respect to some *A*-property without there also being a difference between them with respect to some *B*-property. Until this decade it was widely supposed that *being fundamental* could be analysed via the modal notion of a supervenience base. Thus Kim would complain: “the idea that supervenience is a dependency relation has become firmly entrenched, so firmly that it has by now acquired the status of virtual analyticity” (1993: 139).

However, it has been widely questioned recently whether supervenience so-defined satisfies the above desiderata. While reduction is arguably irreflexive and asymmetric, supervenience is reflexive and not asymmetric. As Leuenberger (2006) argues, we may have reduction without supervenience, if the distribution of *A*-property, which is intuitively reducible to *B*, counterfactually depends on the absence of some property not in *B*. Keller (2007) conversely argues that we may have supervenience without reduction: the mere fact that some characteristics of things ‘stand and fall together’ does not yet entail that the characteristics stand in some relation of determination. For these and related reasons, McLaughlin and Bennett state categorically: “Supervenience is not a relation of ontological priority; the supervenience of *A* on *B* does not guarantee that *B*-properties are ontologically prior to *A*-properties” (2005).

A more recent, and more speculative way of characterising the disagreement between realists and anti-realists, reductionists and anti-reductionist about a given domain is in terms of ontological dependence. When God created the world, the reductionist thought goes on this account, all He had to do was creating the unchanging fields of fundamental properties, including the gravitational field – without further ado, He *thereby* created our familiar world of persisting and changing ordinary objects. This two-for-one feature of God’s creating the universe is then explained in terms of ties of ontological dependence from the less to the more fundamental. Tables ontologically depend on (owe their existence to) certain configurations of elementary particles which in turn are ontologically posterior to the fields they are ‘abstracted’ from. Not all cases of ontological dependence, however, share that two-for-one feature. Maria’s smile, it is ordinarily held, ontologically depends on Maria: it could not exist without her. A particular football match in the same way depends on its participants – without them, *this* particular game could not have existed. The two-for-one feature, however, is absent in these cases: even after God created Maria, more was necessary to make her smile; He could, after all, have left her cry forever. Why should God’s creating the bottom level suffice for His creating the whole layered structure if what’s dependent necessitates that which it depends on but not the other way round? Ontological dependence alone cannot make these distinctions.

Extant attempts to cash out reduction, such as derivability using bridge laws, supervenience, and ontological dependence, all face serious problems. It is time to look for alternatives. While it may be futile to ask for a definition or analysis of relations such as reduction and determination, we still hope to clarify them. We can then try to characterize fundamentality in terms of these relations. Alternatively, we could take the concept of fundamentality as primitive.

More particularly, this project should address the following questions, which either have not yet been addressed in the existing literature, or are only beginning to be addressed:

- *What is the grammar of fundamentality?* Above, we used a sentential operator “fundamentally”. Alternatively, “fundamentally” can be construed of operating on a predicate, an open sentence, or a quantifier. Different approaches and their suitability for the reconciliation project will be discussed.
- *What is the logic of fundamentality?* Given a language containing “fundamentally”, what inferences are valid? A central question is whether “fundamentally *A*” entails “*A*”.
- *Is fundamentality derived from a comparative notion of priority?* The fundamental would then be that to which nothing is prior. Then the questions we raised about fundamentality arise for priority.
- *Might there be nothing fundamental?* Could everything be on a par, metaphysically (Schaffer 2003)? Or could there be infinitely descending chains of the priority-relation (Cameron 2008)?
- *How does fundamentality relate to other central metaphysical concepts?* Do fundamental properties need to be intrinsic? Do fundamental facts need to be contingent?
- *How does “fundamentally” relate to other terms in its neighbourhood?* How does it differ from “really” or “strictly speaking”, for example?
- *Is “fundamentally” univocal?* Is one and the same notion at work in different uses of that term?