Sider on Determinism in Absolutist Theories of Quantity

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Abstract

Ted Sider has shown that my indeterminism argument for comparativist theories of quantity also applies to Mundy's absolutist theory. This is because Mundy's theory posits only "pure" relations, i.e. relations between values of the same quantity (between masses and other masses, or distances and other distances). It is straightforward to solve the problem by positing additional mixed relations.

Eight years ago (although the paper (Baker, forthcoming) is only now forthcoming!) I argued that comparativist theories of quantity, as defended by Dasgupta (2013) and Bigelow and Pargetter (1988) and presumed in work by Field (1980), have a problem with indeterminism. In his new book, Sider (2020) has shown that the same problem arises for the absolutist theory of quantity proposed by Mundy (1987), which is often considered the canonical version of absolutism.[1] If this is right, every view in the metaphysics of quantity is in big trouble.

Sider is indeed right about Mundy's theory as originally formulated, but a straightforward modification of the theory can fix the problem. (By contrast, I don't think it is straightforward to fix the parallel problem for the comparativist, although I won't get into that in this brief note.) The key is to introduce mixed relations–relations between values of distinct quantities.

For brevity and to make this easier to write, I will assume the reader has read Sider's chapter on quantities (Ch. 4 of Sider (2020). Presumably I will one day write this up in

[1] See e.g. Eddon (2013) Sec. 7.

some publishable form with my own paraphrase of Sider's argument, but today is not that day.

Let me draw your attention to the following (bad) solution to the absolutist's determinism problem that Sider uses to illustrate his point:

> There is a conception of representation-function laws available to the mixed absolutist that is stronger than the existential form, but does not involve relativization. On this conception the laws quantify universally over all choices of representation functions; but particular, arbitrarily chosen, determinate properties are used to pick out the values of the constants in the laws, relative to any choice. Let us illustrate with the toy version of the dynamical law in which force is pretended to be constant and acceleration a scalar:
>
> $$1 = kma$$
>
> k here is a constant, with numerical value that depends on the scale used for mass and acceleration. The key move is for the mixed absolutist to pick– arbitrarily!– one particular determinate mass property, m_0, and one particular determinate acceleration property, a_0, and use those to determine the value of k, given any chosen representation functions for mass and acceleration. The determination works as follows. Choose some initial numerical scales for mass and acceleration–say, ones in which m_0 and a_0 both have value 1. The constant k in the dynamical law has some particular numerical value v in this scale. Moreover, in any other scales, the numerical value of k is a function of the number v and the transformation constants relating the new scales for mass and acceleration to the old. This in turn means that there is a function of real numbers, $K_0(x, y)$, which yields the value of k in any scales for mass and acceleration as a function of the values of m_0 and a_0, respectively, in those scales (since the values for m_0 and a_0 in a scale determine the transformation constants between those scales and the initial scales). We can then write the dynamical law in terms of m_0, a_0, and this function K_0:
>
> For any property mass- and acceleration-functions, M and A, with corresponding

> mass- and acceleration-functions m and a, and for any particle p,
>
> $$1 = K_0(M(m_0), A(a_0)) \cdot m(p) \cdot a(p).$$
>
> A similar account can be given of more complex laws. When applied to the (nontoy) laws of Newtonian gravitational theory, the result will be deterministic. (Sider, 2020, 162)

As Sider notes, this law is very unattractive because it has to refer to particular concrete objects, and because the choice of objects is arbitrary. But there is a way for the absolutist to introduce the same information codified in that arbitrary choice by the non-arbitrary introduction of one further relation into Mundy's fundamental metaphysics.

Recall that Mundy's metaphysics of quantity is structured by second-order relations $\preceq$ (*a is less than or equal to b*) and $\star$ (*a is the sum of b and c*) between the monadic properties corresponding to the absolute values of the quantities. Suppose we add to this system a third second-order relation: $\overbrace{K}$ (*the product of m and a equals the constant* $1/k$).[2] This is a two-place relation between values of mass and values of acceleration–what I will call a mixed relation, because it relates distinct quantities.

Then determinism can be restored in Sider's example by introducing the law

For any particle with monadic mass m and acceleration a, $m \overbrace{K} a$).

Note that unlike the law Sider describes in the above passage, this law is stated without using a representation function, but rather is written directly in terms of the quantities' absolute values and fundamental relations between them. In that sense, it is the absolutist equivalent of an "intrinsic" law (to use the term Sider borrows from Field).

The mixed relation permits the resulting theory of quantity to do something that Mundy's metaphysics is incapable of: fix the value of the dimensionful constant k in fundamental terms. Since the value of the constant must be fixed for the law to be deterministic, I think this is the clear solution to Sider's problem for the absolutist. It breaks the symmetry that Sider refers to as "Insensitivity to mass-doubling" (Sider, 2020, 164), and it does so without

[2] Note that the relation is two-place; k is not one of the relata. Note also that the extension of $\overbrace{K}$ would have to be consonant with other facts about the structure of the quantities, including the $\preceq$ and $\star$ relations, so that e.g. if $m \overbrace{K} a$ and $a' \neq a$, then $\neg m \overbrace{K} a'$.

objectionable arbitrariness or reference to particular objects. In the escape velocity case that originally prompted all this discussion, the same can be done with a six-place relation between three values of distance, one value of mass and two values of time, which is sufficient to fix the gravitational constant G.

References

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