

## ***“Tasting the Coffee” or What are Dimensions and why are those for Space and Time so Puzzling? [Iain Orr’s talk on 3 May 2015 to the SLPC]***

There is a route from Starbucks to the stars, a long distance but one that can perhaps be measured using coffee spoons.

My reason for thinking that dimensions might be an interesting philosophical topic comes from often wondering: “Why does space have three dimensions – or, allowing for quantum physics, at least three dimensions? And is this a question to which there could be meaningful answers?” I had been unable to find any way into the subject until last year when I came across by chance a philosophy Ph D thesis by a graduate student at my alma mater, St Andrews University, Heather Walker-Dale: **SPACE AND ITS DIS-CONTENTS : NEW DIRECTIONS FOR INTRINSICALITY, SUBSTANCE AND DIMENSIONALITY**

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I will start with these the key quotations from the introduction and from chapter 11

“Part III looks at space in itself and the properties commonly attributed to it. I explore issues of separability using key experiments, and what makes spaces ‘physically real’, before an extended examination of dimensions and dimensionality, highlighting the confusion physicists express toward such a ubiquitous concept in modern physical theories. I also explore how we use dimensions and reasons for adopting realist or instrumentalist approaches toward them, arguing that much more work should be focused on this area. I conclude with ways in which physics motivates new metaphysical models and suggest improvements for future methodological partnerships.”

“This distinction between physical space and abstract space is interesting, not least because of which qualities it reveals as the grounds for our metaphysics. We find things like momentum and geometric position on an extended coordinate system to be valuable for explanation, prediction and organisation in a way that we do not find sensory

qualities like colour, smell or mood<sup>74</sup>. But we can talk of *abstract* momentum or position in *abstract* spaces in mathematical texts or when making weather charts or financial analysis reports. In this we can separate the concept of space from physical space, though the details and rationale for this separation may be somewhat lacking. As noted above, space is instrumentally useful for revealing objects, but it also actively

participates in the behaviour and characteristics of those objects and is interesting in its on right.” P 153

“Relating observed particles in this way not only simplifies and smoothes the mathematics by removing infinities, it also provides a more fundamental explanation for the structure and type of particles in our best account of particle physics. The diversity of particle types is explained by the movement of one basic object, the string, just as the diversity of musical notes can issue from a single plucked string. To capture this intimate and reductive connection between particles, several spaces are conjectured: “In the superspace, we can think of bosons and fermions as two different projections of a single object, much as an electron and its neutrino can be thought of as two different projections of an object in an internal space” (Kane, p.67). If we can think of two seemingly different objects as one in the superspace, can we also think of them as one object in *real* physical space? That is, “does the fact that (before symmetry breaking) a boson can be transformed into a fermion by the supersymmetry transformations mean that the two are, at a deeper level, a single particle...Or does it just mean that physically the two can change into each other?...The answer appears to hinge on how realistically we can (or should) interpret superspace” (Weingard, p.147).”

However, what I now wish to do, having used these passages to set the scene is to start with a cup of coffee [how big? Length, height and depth?] and then ask you to join in a debate in which I will be advancing the following propositions:

First: Space has no dimensions (nor does time). Spaces and times do have dimensions, but these are not properties of objects – what we might colloquially call “physical reality”. Rather, they are abstract models that help us organize, think about and effect changes to the world we experience through our senses and our instruments. (The latter allow us to extend our senses to scales which go beyond our direct sensory experience but which we can imagine – for instance the “spaces” between individual atoms and sub-atomic particles; or at another scale, the population of China.).

Second: the model we have for space and for spaces is that of a box or sphere. That model is one which makes sight “the monarch of the senses” [see passage on pp 16-17 of Simon Ings – *The Eye-A Natural History*, Bloomsbury 2008] But this model that is less useful when applied to aspects of the world not experienced as solid objects with sharply delineated boundaries and positions.

Third: a dimension is a continuous and uniform scale for measuring a single abstracted aspect of an object or process. That is to say an inch that is an inch away from me has exactly the same value as an inch on the other side of the sun. These inches are therefore often used to measure “things” other than those of which we have direct experience.

Fourth: continuous scales are nevertheless only measurable in discrete units. So measurements always need to be interpreted in relation to a scale.

Fifth: the difference between God (or gods) and humans is that God can design but not create, while humans can do both – they are builders as well as architects (though, in the case of gods, they can only imagine them, not create them).