



Report on Joanna Luc's PhD thesis: Modalities in the Physical World

This is an excellent PhD thesis: it is insightful, original, and written with exemplary clarity. It covers a great deal of ground in contemporary metaphysics of science, and does so with a higher level of precision than most of the extant literature.

Overview

Chapter 1 offers a short and crisp introduction to the thesis. Its ambitious aim is to reconstruct a whole family of modal notions using as primitives only the notions of fundamental laws together with logical modality.

Chapter 2 motivates the approach by criticizing a competitor: the dispositionalist approach. I found the introductory remarks on dispositions (sections 2.1-2.2) insightful and useful, more so than much of the literature on the topic; moreover, the introductory remarks on laws of nature (sections 2.3-2.4) improve upon much of the existing literature by taking actual laws of physics, in their mathematical form, seriously rather than replacing them with a philosophers' toy law ("all Fs are G"). The main argument of the chapter, beginning in section 2.5, argues that "it is impossible to replace [a well-working law-based account] with an equally good disposition-based account." (p.27) It is argued that a disposition-based account loses information if the dispositions are specified in the usual, rather imprecise way (2.6.1); requires more independent assumptions to explain the lawful goings-on in the world (2.6.2); and is threatened with triviality or loss of intuitive content when adapting its conception of dispositions so as to match the law-based account's explanatory power (2.6.3-6).

Chapter 3 sketches the outlines of the author's favoured account and provides some insights into the central concepts, such as fundamentality and normality. I want to applaud the chapter, again, for its clarity, and I think it serves very well as a basis for what is to come.

Chapter 4 lays the formal groundwork for what is to come. I am a somewhat less formally-oriented philosopher than the author of the current thesis, so I will not judge the details. I do wish to commend the author for imposing this level of precision, although it might be useful to provide some motivation or foreshadow some of the pay-offs of formalization, and of this specific way of formalization, just to keep the run-off-the-mill metaphysician on

board. That said, the author does an admirable job of explaining every bit of formalism in prose and makes it clear what it is supposed to stand for.

Chapter 5 is, as it were, the positive counterpart of chapter 2. It sets out to show that, while dispositions cannot replace laws in an account of what happens in the world, using the notion of fundamental laws that has been developed we can give an account of dispositions. The author clearly sets out what are, and what aren't, her desiderata; distinguishes between different types of dispositions (kind-based and individual dispositions; gradable dispositions and dispositions *simpliciter*) and provides an analysis for them all. It begins with an analysis of non-gradable, kind-level dispositions, the general gist of which is this: an object *I*, of kind *K*, has disposition to *M* if *S* iff all members of kind *K* that are subjected to stimulus *S* in fundamentally possible, normal conditions (i.e. in possible worlds that share the fundamental laws of *I*'s world and are normal for its kind), show manifestation *M*. To apply this disposition to individual-level dispositions (not relative to kinds), the author introduces the idea of a 'qualitative counterpart', requiring not all objects of kind *K*, but only those which are qualitative counterparts of *I*, to show *M* upon being subject to *S* in normal conditions. To introduce gradability, a disposition's degree is measured roughly by how many of the stimulus-worlds are manifestation-worlds. (My formulations give only the most general idea of the definitions, and gloss over many precisifications.) The definitions are applied to examples (5.3.3), used to solve the standard problems of finks, masks, and mimics (5.4), and substantiated and defended with a more detailed discussion of the role of 'normal conditions' (5.5). As an added bonus, the author provides an interesting and intriguing alternative definition of intrinsicity which applies to dispositions even when they are relative to the (actual, external) normal conditions.

Chapter 6 discusses non-fundamental natural kinds, natural properties, and laws. Each of these are defined in ways that are similar to ch. 5's definition of dispositions, making reference to kinds and normal conditions. I think the chapter's most interesting and innovative idea is that we should assess the naturalness of a set of kinds, laws, or properties not one by one but as part of a 'package'. This holism has predecessors in the literature, but it is articulated here, in chapter 6.4, admirably: with great precision and in much detail. (The only thing that I would have liked to see here is an example, if only an illustrative one.)

Chapter 7, finally, turns to different kinds of modality. Logical possibility and necessity have been taken as primitive (at least for the purposes of the thesis), and fundamental possibility and necessity – which, the author notes, may well be what is often referred to as 'natural' or 'nomological' modality – are defined in terms of logical modality plus fundamental laws (the other primitive of the theory). Other types of modality are introduced in ch. 7 by relativization to kinds. This corresponds in many cases to such concepts as biological, psychological, etc. possibility and necessity, but may also be used more flexibly. The author gives no account of metaphysical modality (though I think she might have an elegant way of doing so, by appealing to the most general kinds: object, property, and whatever else there might be).

Chapter 8 briefly and helpfully summarizes the chapters of the thesis.

As this outline already makes clear, this is an excellent thesis. It is ambitious and original, knowledgeable and written with exemplary clarity. It employs a sophisticated formal machinery (the merits of which, on their own terms, I cannot fully judge). It cannot be stressed enough that the thesis is almost entirely original and constructive: it formulates its own theory, starting in many places entirely from scratch. This is a demanding task, and I think for the most part it succeeds admirably well.

In what follows, however, I want to take up some points for critical discussion. Many of them are a testament to the thesis being an engaging and interesting piece of philosophy, rather than criticism in the narrower sense.

Critical discussion

Chapter 2 is the critical part of the thesis, clearing some ground for the more constructive work to follow. I found the argument in this chapter very interesting and original, but it did leave me with a few questions. The first two are minor, but the third is, I think, central to the dialectic of the chapter.

First, the obstacles for the dispositionalist account arise from certain assumptions that a dispositionalist may reasonably question, and which have been questioned in the literature: for instance, that dispositions must be properties of individual objects (p. 40), or that their manifestations should not themselves be dispositions (p.47). A dispositionalist view which adopted Alexander Bird's pandispositionalism (Bird 2007) together with my view that dispositions can be jointly possessed by several objects, and have functionally specified manifestations (Vetter 2015), might get around many of the objections given here. I suspect that the author's response would go with her remark on p. 37: "such a disposition-based account ceases to be a genuine alternative to [a] law-based account", because it all but incorporates the laws *into* the dispositions. However, here my *second* concern becomes relevant: the chapter begins with a law-based account and argues that a disposition-based account cannot *replace* it. But here, again, a dispositionalist might want to object that there is some bias in the dialectic already, which begins with a law-based account and measures the dispositionalist's success by her ability to live up to that account's standards. (I think this second objection can probably be met, but it might be made clear just how.)

A *third* worry is that the author imposes conditions for success on the considered accounts – and an idea of what they are accounts *of* – that does not quite match up with that of most existing dispositionalist accounts. Here is the author's succinct statement of her criteria: "the main purpose of our accounts is to give predictions on the basis of some assumptions ... and inference rules" (p. 37). But are these the right standards for evaluating metaphysical theories? I think that dispositionalists (well, some dispositionalists: Alexander Bird, not Nancy Cartwright) might object here that their objective is not to provide an alternative to the appeal to laws in making predictions, but rather to provide a story of what underlies these laws and the predictive power that they enjoy. It is not clear, at least to me, how such an account is refuted by the arguments given here.

My comments on the constructive part of the thesis will focus on chapter 5, but also take into account the two chapters that follow.

One very general question I have about the account proposed in these chapters concerns how strongly it makes good on the promise of chapters 1 and 3: the promise of an account of modal phenomena in terms of fundamental laws and logical modality.

This question has two sides. First, are fundamental laws and logical modality the *only* primitives that are employed? Possible worlds are an important part of the definitions, and while other notions (like kind and normality) are defined and belong to what the author calls the "factual" component of her definitions, they seem to be more distinctive of her approach than the fact that fundamental laws are taken as basic. Little is said about the nature of possible worlds themselves, and how they might relate to fundamental laws of nature. It seems to me that the account of dispositions given in ch. 5 could be used by a Lewisian, who takes possible worlds to be (concrete) primitives and analyses the funda-

mental laws by a best-systems account. Ingenious though the definitions are, it would have been nice to see their role within the overall metaphysical project of the thesis substantiated a bit more.

The second side of the question is whether the assumption of fundamental laws does any explanatory work in the account at all. In ch. 5, what is needed to define dispositions is a restriction to fundamentally possible worlds that are normal – but normality could be imposed as a restriction on the logically possible worlds and do the same job. In ch. 7, types of possibility and necessity are formulated as restrictions on the fundamentally possible worlds, considering only those where certain kinds are instantiated. However, this appeal to fundamental possibility seems to me inert and perhaps even somewhat counterproductive: given that biological, psychological, sociological etc. kinds may well be multiply realizable (i.e. arise with different underlying fundamental laws), might we not take into account logically or metaphysically possible worlds that have different fundamental laws but the same or similar biological, psychological, etc. kinds?

My other general question on chapter 5 is whether we really need to distinguish the four types of dispositions that the author treats separately. She distinguishes between gradable and non-gradable dispositions, where the latter are such that the stimulus (in normal conditions) guarantees the manifestation. But could we not see such dispositions as simply a limiting case of gradable dispositions, as those whose degree is always at a maximum? The author also distinguishes between kind-dispositions and individual-dispositions. One might think that the former are reducible to the latter, and that a kind-disposition is simply one that is shared by all (or perhaps by all 'normal') members of a kind. The author justifies her choice to give "separate treatment" to kind-dispositions (p.121) in section 5.3: "First, sometimes we assert dispositions about a kind (or all members of a kind), without mentioning any particular object ... Second, ... some of our epistemic practices [such as inductively justified disposition ascriptions] rely on kind-dispositions rather than individual-dispositions". These considerations seem to me to overgeneralize: by the same reasoning, we would have to posit kind-colours, kind-weights, and kind-charges, and so on for any kind of property that allows for generalizations and inductive projection. The author might respond that her distinctions are not metaphysical: she makes it clear that dispositions, for her, are not deep metaphysical phenomena, and that all she wishes to capture is our way of ascribing them, especially in scientific contexts. Perhaps the cases are distinguished to allow us to work with the simpler definitions whenever it comes to non-graded disposition ascriptions or generalizations over dispositions for a particular kind. That kind of justification, however, would be more instrumentalist than that given in the text.

One final critical remark concerns the literature used. The thesis is certainly highly competent and involves a great deal of literature, in particular from the philosophy (and the metaphysics) of science and from logic. In some places, however, it touches on issues of more general philosophical concern, and in these places it would have been nice to see links to some other literatures. Thus in chapter 3, fundamentality is discussed in relation to reduction, emergence, and supervenience, but there is no mention of the thriving and rich current literature on fundamentality in relation to metaphysical grounding (some of the main players being Kit Fine, Jonathan Schaffer, and Benjamin Schnieder). Likewise, in chapter 3 and later, normality is discussed as a statistical concept, but no mention is made of the current debates on normality in epistemology (where "normal conditions" are supposed to hold in the possible worlds relevant for knowledge; see e.g. Hawthorne & Lasonen-Aarnio 2009) and in the philosophy of language (where normality seems charac-

teristic of so-called generic sentences, e.g. “tigers have stripes”). Both debates make it clear that normality is a lot more complex than statistical likelihood. In chapter 5, there is extensive (and very interesting) discussion of the intrinsicity of dispositions, which does not mention Jennifer McKittrick’s prominent work in defense of extrinsic dispositions. (I think the author’s ideas are in line with McKittrick’s, so here she is missing out on a potential ally.) And in chapter 7, different kinds of modality are discussed – as, one must assume, types of modality expressed in ordinary discourse – but no mention is made of the flourishing literature on modal semantics, based in particular on the work of Angelika Kratzer, which proceeds somewhat differently from the approach that is here advocated. I would have liked to see some comments on why we should be restricting kinds of possibility and necessity in terms of kinds, rather than in terms of any contextually salient facts, as in the framework of standard modal semantics?

It would be too much to expect of a PhD thesis that all of these areas are fully integrated. But it would have been nice to see some indications of these relevant debates.

Assessment

As I have said several times, this is an excellent thesis. It is wonderfully clear, formally proficient, ambitious, innovative, and constructive. It makes a genuine and constructive contribution to several debates at once: the metaphysics of laws, of dispositions, and of kinds, as well as formal theories of each of these. I think that the critical remarks that I have raised above could be addressed, and that the author has everything it takes to address them well, in a published version of the thesis. There is no doubt at all that its author deserves the title of a Doctor of Philosophy!

The concerns I have laid out above can be summarized as: (i) sometimes the metaphysical side of the formally developed account is not discussed enough to make its motivations and consequences entirely clear, and relatedly, (ii) some of the metaphysical and other philosophical literature that would in my view have been relevant is not considered. But there are so many published books of philosophy of which the same could be said – or more often in this area, which discuss metaphysical issues but pay no heed to the formal issues that are so done so well in the current work – that I do not think these concerns detract too much from the overall very impressive quality of the thesis.

Thus my overall verdict on the thesis is: **pass with distinction.**

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