Abstracta 6 : 1, pp. 3 – 17, 2010

ON THE POSSIBILITY OF CONTINGENTLY DISPOSITIONAL PROPERTIES

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Abstract
Metaphysicians who hold that there is an ontological distinction between two kinds of fundamental natural properties assume that properties are dispositional or non-dispositional *necessarily*. In contrast to this, I suggest that one can admit the existence of fundamental *contingently* dispositional properties. After some clarifications concerning the content of the suggested view, I respond to several objections regarding its intelligibility and viability and outline two of its important consequences.

The dispositional/non-dispositional[1] distinction is (as Armstrong (2005) recently suggested) one of the main disputes about properties.[2] Some philosophers, however, deny the ontological character of the distinction. For instance, according to Mumford's earlier (1998) view properties can be *characterised* either dispositionally or structurally (categorically), relative to a particular causal role. Others (C.B. Martin (1997), J. Heil (2003) and G. Strawson (2008)) defend an identity theory; for instance, on Martin/Heil's view, dispositionality and qualitativity are the self-same property differently considered and there are no ontological features that ground (or simply are) the dispositionality and qualitativity of any property. In contrast to the above thinkers, a number of metaphysicians hold that there is an ontological distinction between dispositional and non-dispositional properties; one that is not about predicates but rather about specific ontological features of properties in question. On the one hand, *property dualists* think that there are irreducible and ineliminable differences between two *kinds* of property (dispositional and non-dispositional), which both exist in the world. On the other hand, *property monists* argue that *only one* kind of property exists. *Categorical monists* defend the view that no genuine

[1] Instead of the term "categorical" (which for many – including myself – has unpleasant connotations), I shall use the expression "non-dispositional".
[2] The following discussion does not concern mathematical, logical and mere Cambridge properties. It is about the fundamental natural properties that carve nature at its joints.

property is dispositional, whereas *dispositional monists* claim that *every* genuine property is dispositional.

Those metaphysicians who hold that there is an ontological distinction between kinds of *fundamental* natural properties assume that properties are dispositional or non-dispositional necessarily. Namely, they suppose that a fundamental natural property is dispositional (or non-dispositional) in all possible worlds in which it exists. Furthermore, in order to give a verdict on the dispositional character of any property they assume the *rigid* application of any adequate criterion of dispositionality that can be used in the actual world (from now on, an @-criterion).[3] In other words, they examine whether the property in question has in all possible worlds (in which it exists) the appropriate ontological features in order to be dispositional according to the @-criterion. For instance, according to dispositionalists the ontological mark of dispositionality of any fundamental natural property is the necessity of its causal/nomological/metaphysical roles.

In general, it is routinely assumed that ontological distinctions (including, besides the dispositional/non-dispositional distinction, the universal/particular distinction and the abstract/concrete distinction), refer to features that entities possess necessarily. Particulars are particulars in each world in which they exist and there is no world in which a concrete entity exists and it is abstract. There are, however, a few dissenting voices suggesting that certain entities might possess at least some of the aforementioned features contingently. Linsky and Zalta (1994), in their attempt to defend an actualist interpretation of the simplest quantified modal logic, suggest the existence of contingently non-concrete entities. And Fraser MacBride (1999), in the context of his examination of the prospects of modal reductionism, argues that if there are no necessary de re connections in nature, then we may have to countenance the possibility that any particular entity (such as Armstrong himself!) could have been a universal.

Having these remarks in mind, let us now return to the issue of dispositionality of fundamental natural properties. Recall that each metaphysician applies her own @-criterion for dispositionality in all possible worlds. Notice, however, that the implementation of the @-criterion in every possible world does not *in general* guarantee a unique upshot. It may

[3] The relevant criterion is ontological. It aims to demarcate the distinction in terms of ontological features.

well be that a fundamental natural property satisfies the @-criterion of dispositionality in the actual world and fails to satisfy it in another possible world. In other words, it might possess the ontological marks of dispositionality only contingently. So, following the unorthodox route, I suggest that in this case one is entitled to say that the property in question is dispositional in the actual world and non-dispositional in the possible world. More generally, I suggest, one can admit the existence of fundamental *contingently* dispositional properties, provided they fail to satisfy the @-criterion of dispositionality in at least one possible world (whether it is the actual world or not).[4]

Two preliminary clarifications; first, one should clearly distinguish the aforementioned view from a kind of dual-sided theory once being defended by C.B. Martin (1993). According to Martin's view, each natural property has (in each world in which it exists) two distinct but inseparable ontological 'sides', its dispositionality and qualitativity, which are necessarily co-existent. On my view, there are fundamental natural properties which, in each possible world in which they exist, *and in their entirety*, are either dispositional or non-dispositional. Second, I must emphasise that I am not suggesting the common Humean view according to which the contingent laws of nature impose upon any fundamental natural property a *particular* dispositional character. The thesis of Contingent Dispositionality (which, henceforth, I will abbreviate as CD) is not a mere reformulation of the orthodox Humean view. To see that, consider, for instance, the property of being electrically charged. I am not arguing that 'attracts other opposite charged bodies' is a contingent second order feature of the first order property in question. Rather, my claim is that *dispositionality* itself contingently characterises this fundamental natural property.

I am sure that a number of philosophers may find the very idea concerning the alleged contingency of the dispositionality implausible (or even a bit bizarre). There are various reasons that might justify this belief. Consider first the case of natural dispositional properties, such as solubility, which are *by definition* related to a specific causal role. According to CD, the property of solubility, which is dispositional in the actual world, may be non-dispositional in another possible world. In that world, which may have radically

[4] The rigid application of the @-criterion does not entail that all possible worlds are populated only by properties of the actual world. They may exist alien properties which in *their* worlds are dispositional (or not) according to the @-criterion.

different laws from the actual, there is no assurance that solubility confers to its bearers the same causal powers that it actually confers. Since, by hypothesis, solubility is non-dispositional in that possible world, it is the alien laws of *that* world that determine the behaviour of objects that instantiate solubility. Hence, in the world in question, an actual soluble object may fail to dissolve (in the appropriate circumstances) despite the fact that it instantiates solubility. But is it not absurd to claim that objects may instantiate solubility and not dissolve in the appropriate circumstances?

To meet this prima facie strong objection we must notice that dispositional properties which are by definition related to specific causal roles are not fundamental natural properties.[5] Consider, for instance, electric charge which is one of those fundamental properties that belong to the reduction (or supervenience) base of solubility. Charge actually confers to its bearers the power "attracts other opposite charged bodies"; but it is not by definition related to this specific causal behaviour. What holds for charge does also hold for all fundamental natural properties that physical science acknowledges. So, to the extent that CD concerns the fundamental properties, the above objection raises no difficulties to it.[6] Of course, one may insist and raise an objection for the fundamental properties themselves: how can charged bodies fail to attract other opposite charged bodies in other possible worlds? The answer is that they can, provided that we hold that the transworld identity of fundamental natural properties is independent of their causal roles.[7] If there is a genuine difficulty here, it concerns the issue of transworld identity of properties (for which we have some things to say in the sequel) and not the intelligibility of CD. It is important to make clear that the issue of the acceptance of CD is orthogonal to the issue of the transworld stability of property's roles. One may hold that any fundamental natural property *must* be dispositional in *all* possible worlds (in which it exists) and, nonetheless,

[5] They are either supervenient upon or can be reduced to a web of fundamental natural properties.

[6] I would like to thank an anonymous referee for pressing me to make clear CD's range of validity.

[7] Returning to the case of solubility, it is plausible to assume that the 'weird' behaviour of charged bodies in the world in question may prevent any actually soluble object to dissolve in the appropriate circumstances, and since solubility is by definition related to this specific behaviour, the aforementioned object may be no longer soluble. Since we cannot exclude this possibility, it seems that solubility cannot exist in a world and fail to be dispositional in it. (Recall that assuming a non-dispositional character for solubility leaves open the possibility that objects instantiating it do not dissolve; an absurdity that gave rise to the objection in the first place.) But, as we have already remarked, that is not a problem for CD; it is not supposed in the first place that, according to CD, solubility (*qua* non-fundamental property) is a contingently dispositional property.

believe that it may have different roles in different possible worlds. For instance, Hendry and Rowbottom (2009) defend the thesis of dispositional contextualism, according to which to have a dispositional property is to have a single set of actual and possible dispositions, rather than just a set of actual dispositions. Dispositional contextualism is a position that respects the orthodox view according to which dispositional properties possess dispositionality necessarily; it simultaneously allows, however, a kind of transworld variation in a property's dispositional profile. Vice versa, a fundamental natural property may have the same causal roles in all possible worlds in which it exists and, nonetheless, be dispositional in some worlds and non-dispositional in others. In the former worlds, those roles are grounded in the dispositional nature of the property itself; in the latter, they are imposed upon it by the contingent laws of nature.

The claim of the unintelligibility of CD can be also expressed in a different manner. Consider the view according to which properties are ways objects are; by analogy, dispositionality must be a way a property is. The objection is that though we can conceptually discern an object from a way that object is (or could be), the supposed distinction between ways a property is and the property itself is obscure. Saying that there are contingent ways a property is is tantamount to saying that the property itself might have been different. And considering the case of the property that could have been different we just (the objector continues) contemplate a different property. So, once again, how can one and the same property be dispositional in one possible world and non-dispositional in another?

In a sense, the above objection simply begs the question against CD. For, under the perspective of CD, a fundamental natural property can be characterised differently (in other words, there are contingent ways a property could be) though remaining the same. Nonetheless, as we have remarked earlier, it may be that the whole objection rests upon the issue of the transworld identity of contingently characterised properties. Prima facie, it seems that CD is indispensably committed to the controversial thesis of quidditism.[8] There

[8] One might be tempted to think that quidditism is tantamount to the acceptance of quiddities as second order non-qualitative properties which distinguish particular properties. He might say that when two worlds differ quiddistically they disagree about which quiddities are instantiated by which qualitative first order properties.

are various formulations that aim to capture the core content of quidditism, but the most serious objections attack a view (which can be called *extreme quidditism*) characterised by the following three theses: firstly, transworld identification of properties is a matter of strict identity. Secondly, there exist non-qualitative determinants[9] of the transworld identification of properties which just are the identities between the 'inhabitants' of each possible world. And thirdly, transworld identification does not depend at all on qualitative characters; any property can have any qualitative character.[10] As dispositionalists have already argued, extreme quidditism faces several difficulties which, of course, also beset any proposal that is committed to it. The problem has also another aspect; if quidditism is presupposed, CD seems to be almost trivial. If any property can have any qualitative character whatsoever, then *of course* an actually dispositional property may turn out to be non-dispositional and vice versa.[11]

In order to reply to this objection, it is crucial to notice that CD is *not* indispensably committed to quidditism. It is in fact compatible with a kind of transworld identification that differs both from the one that quidditists have embraced and the one that dispositionalists hold. In my (2010) I argue that fundamental natural properties, such as rest mass, electric charge and spin, can be identified by conceptual means which are entirely independent of the powers that those properties confer to their bearers. More precisely, they can be identified as invariants under the action of fundamental symmetry transformations. Consider, for example, rest mass and spin. It is standard (within the mathematical framework) to discuss symmetries using group theory. Various transformations of physical interest form groups that can be analysed mathematically. One of them, the Poincare group, is associated with a symmetry concerning Lorentz boosts, rotations and space-time

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Yet, this is not necessarily so; a quidditist need not believe in second order non-qualitative properties, or even reject the view that there are any second order properties in general.

[9] The qualitative determinants of the transworld identification of a property are related to its causal, nomological and metaphysical roles.

[10] Modest versions of quidditism that allow qualitative constraints on transworld identification of properties spring from some minimal-essential causal, nomological and metaphysical roles of those properties (in other words, there exist limits on how different a property could have been from the way it actually is). Furthermore, there is also a counterpart-version of extreme quidditism, according to which a) each possible world has its own properties, and b) transworld 'identification' of property counterparts is completely independent of their causal, nomological and metaphysical roles.

[11] I would like to thank an anonymous referee for revealing this problematic aspect.

translations. Wigner (1939) showed that rest mass (m) and spin (s) are two properties that characterise the elementary physical particles and are intimately associated with the action of the transformations of the Poincare group. To be more specific, according to group theory, in any irreducible representation of a continuous group, there are operators (called Casimir operators) that commute with all operators of the representation, and they are multiples of the unit operator. These operators have fixed numerical values in a given irreducible representation, which can be used as labels to characterise the irreducible representation (Hamermesh 1989: 318). Wigner (1939) computed all the irreducible representations of the Poincare group and found that the representations can be labelled by the parameters *m* and *s*, where *m* can be identified with the rest mass of the particle and *s* can be identified with its spin. Mass is the property that appears (as a parameter) in the first Casimir operator of the Poincare group; that is, the one which is formalised with the aid of only one parameter (which, of course, represents mass). Having identified mass, we can then identify spin as the property represented by the second parameter that appears in the second Casimir operator (the one which is formalised with the aid of two different parameters).[12]

Given that fundamental natural properties can be identified by means which are entirely independent of the powers that those properties confer to their bearers, it is not absurd – given the similar move that dispositionalists take about dispositional essences – to assume the existence of non-dispositional determinants of the transworld identification of those properties about which, in contrast to quiddities, something substantive can be said. Since the transworld identificatory elements do not involve features that ground @-criteria of dispositionality, the aforementioned suggestion is perfectly compatible with CD.[13]

Furthermore, even holding that CD is indispensably committed to quidditism does not turn it into a trivial position. To illustrate that, suppose that you are a categorical monist (like Armstrong) and you accept quidditism as the most plausible position about the transworld identity of properties. Nevertheless, in line with all categorical monists, you do

[12] The Casimir operators of the Poincare group are $c_1 = -m^2$ and $c_2 = -m^2 s(s+1)$, where *m* is the rest mass and *s* the spin.

[13] I assume that being invariant under the action of fundamental symmetry transformations is not a plausible candidate for being an ontological mark of dispositionality.

not think that natural properties possess their categorical character contingently. You implicitly assume the necessity of the categorical nature and so you accept that natural properties can have different causal roles in different worlds but cannot have dispositional nature in any of these worlds. This shows that in the case of categorical properties quidditism does not imply CD. Now, do we have a cogent reason to suppose the contrary, as far as the dispositional properties and their dispositional character is concerned? I think not and so I conclude that CD is not a trivial consequence of quidditism.

It might also be objected that I offer no explanation of *how* an ontological feature, such as the dispositional character, can be contingent. But what kind of *explanation* is the objector asking for? I suppose that a description of a (causal?) mechanism which explains how a property can acquire or lose its dispositionality in different possible worlds would be enough. In this case, however, I can show that the objector's demand is exaggerated. Consider, for instance, the analogous case of the contingent features of concrete particulars. Humeans and non-Humeans alike accept the fact that there are properties which characterise concrete particulars only at some possible worlds in which they exist; most often the existence of possible worlds at which those particulars do not instantiate the aforementioned properties is grounded only on intuitions regarding what is possible or not. Humeans, for instance, may try to ground these intuitions by invoking a principle of recombination, the application of which 'generates' all possibilities. (Some of these possibilities are compatible with the fact of non-instantiation of the contingent properties.) Following this way, Humeans are able to tell a story about how the actual world (in which the instantiation takes place) differs from possible worlds in which the instantiation of the contingent features does not take place. They merely insist that the difference is due to the different global distributions of properties to the same concrete particulars (or to their counterparts, if they are modal realists). But, in any case, they do not posit a mechanism which (causally) explains the difference by generating the different distributions. I think that something analogous can be said in the case of the contingent dispositionality. It is too excessive to ask Humeans or anyone else to describe a mechanism which generates the relevant differences. Similarly to the previous case, philosophers can rely on intuitions in order to ground the relevant possibilities. Humeans may even try to reply to the objector's

explanatory demand by telling a story about how worlds at which a property is dispositional differ from worlds at which the same property is not dispositional. They may appeal to a recombination principle concerning the ontological features of properties themselves and argue that the relevant difference is due to different global distributions of these features to the same properties.

Finally, some philosophers may object that CD, though conceivable, is not viable. To illustrate that, consider the @-criterion of dispositionality. For CD to be viable, the @-criterion should not prejudge the result of its application in all possible worlds. But how can the @-criterion not prejudge the upshot of its application in other possible worlds, given that, till now, all the suggested @-criteria of dispositionality are modal in character (so, by definition, they involve in their application other possible worlds)?

To this I can reply that the fact that all the suggested @-criteria of dispositionality are modal in character does not imply that the required (for the application of each criterion) range of possible worlds must be universal or be the same in every possible world. The criterion must be the same in all worlds, but the family of worlds used for its implementation may differ; hence, insofar as the @-criterion does not refer to *essential* ontological features (in which case the range of relevant worlds could be universal), a property which satisfies it in the actual world may fail to satisfy it in a possible world that does not belong to the family of worlds relevant for the application of the @-criterion. Hence, the result of the application of the @-criterion is not in general predetermined.

Of course the adequacy of the above reply depends crucially on the assumption that the @-criterion does not refer to *essential* ontological features. It is exactly this assumption, however, that dispositionalists deny. They crucially entangle the transworld identificatory elements of any fundamental natural property with the features that ground its @-criterion of dispositionality. They think that the mark of dispositionality of any fundamental natural property is the necessity of its causal/nomological/metaphysical roles, while the latter are also essential features of the property which *exclusively* constitute its identity in every possible world in which it exists. So they hold that if a property satisfies their criterion in the actual world, it must satisfy it in every possible world (in which it exists), and hence it is necessarily dispositional. In other words, under the perspective of dispositionalists, the

expected result of the application of the @-criterion is unique and fixed in advance. Given that the metaphysical thesis of dispositionalism is independently plausible the aforementioned objection raises (at least prima facie) a serious threat to CD.

The power, however, of the dispositionalist's objection depends upon the adequacy of her @-criterion of dispositionality which, in turn, depends upon the plausibility of her criterion of properties' transworld identity. It is the latter criterion, I argue, that faces the most serious difficulties. It is not only that we can easily imagine possible worlds in which actual properties confer to their bearers different causal powers from the ones they actually confer. Perhaps this intuition can be seriously undermined by embracing the view that imaginability does not entail metaphysical possibility. We have, in addition, cogent reasons to question the universality and the correctness of the criterion. First of all, there is the case of spatiotemporal relations for which it can be plausibly claimed that they confer no causal powers to their bearers. Alexander Bird (2007) recently tried to defend the contrary in the context of General Theory of Relativity wherein the spacetime metrical structure incorporates (in a sense) the set of all spatiotemporal relations. He argues that metrical structure (and, as a result, spatiotemporal relations themselves) confers causal powers because it possesses a dispositional essence. But, as I have argued in my (2008), his argument fails. Firstly, spatiotemporal relations are not active dispositions, because spacetime metrical structure does not *causally* affect material bodies; it just determines which paths are *available* to bodies when moving inertially. And they are not passive dispositions either, because, under a cautious interpretation, Einstein equations do not show that spacetime metrical structure depends causally on matter; they just give a law-like consistency constraint upon the joint features (space-time structure and mass-energy distribution) of any (physically) possible world.

Secondly, there are fundamental properties of the elementary particles (the so called, quantum numbers) that do not only confer no causal powers to their bearers, but, in addition, exclude the latter from possessing certain causal powers. Consider, for example, protons, the well known elementary particles that belong to a kind of entities that experience the strong interaction. Protons (like all baryons) instantiate a fundamental property, the baryon number, the conservation of which prohibits their decay. In other

words, having the property of baryon number exclude protons from possessing the power to decay.

The abovementioned examples show that even assuming the truth of the criterion, we have reasons to question its universality. Finally, we may plausibly doubt the correctness of the dispositionalist's criterion even in its allegedly uncontroversial range of application. For it can be claimed that the identity of fundamental natural properties that dispositionalists themselves often invoke (such as mass, electric charge and spin) can be determined independently of any causal roles that those properties may confer to their bearers. In particular, as we have already remarked, they can be identified as invariants under the action of fundamental symmetry transformations. If the identity of the above fundamental physical properties can be provided via symmetry considerations, why can't we claim that being invariant under the action of fundamental symmetries is an essential feature of the fundamental physical properties? Even if we suppose that this kind of alleged invariance essence would not exhaust the essence of those properties, it would certainly be a constituent of it. Granted that, we have a direct refutation of the dispositionalists' claim that the identity of any fundamental physical property is *exhaustively* constituted by its powers.

I would like to conclude by outlining two interesting consequences of the thesis of Contingent Dispositionality. The first of them is related to Hume's dictum (i.e., the rejection of necessary connections between contingent, wholly distinct, existents). Embracing the suggestion about the contingency of the dispositionality can help the supporters of the dictum to avoid troublesome necessary de re connections. In order to see that, consider the case where one follows the spirit of the dispositionalists' criterion of dispositionality and associate the possession of the latter with the 'necessary' conferment of specific causal powers.[14] Even supposing that, the most the dispositionalist can assume is

[14] It is true that, recently, some philosophers have challenged the orthodox view that there exist metaphysically necessary de re connections between dispositional properties and their manifestations. For instance, Markus Schrenk (2008) argues for a view which arguably may make room for the compatibility between Humeanism and genuine dispositional properties. While examining the antidote cases of the dispositions literature, he posits a dynamic, *intraworld*, de re link between dispositions and their manifestations that has nothing to do with metaphysical necessity. Yet, besides those few dissenting voices, the orthodox view is still prevailing among property metaphysicians. Some philosophers take a step further and suggest that the link between dispositions and necessity is more intimate than that. They embrace what Antony Eagle (2009) calls *Dispositional Actualism*, according to which the metaphysical necessity *itself* is

that an instantiation of a natural dispositional property confers the same causal powers to its bearer only in those possible worlds at which the property in question is dispositional. Given the contingency of dispositionality, there exist worlds in which the property in question is non-dispositional; in those worlds, there is no reason to suppose that the instantiation (by its bearer) of the property is associated with the (actual) specific behaviour characteristic of the possession of the aforementioned causal powers. Therefore, there are no necessary connections between the instantiation of natural properties, the presence of specific activating conditions, the absence of certain disturbing factors (such as finks and antidotes) and the proper manifestations of the aforementioned properties.

Contemporary Humeans (which claim that all fundamental natural properties are non-dispositional) are typically followers of Hume's dictum and so they may take advantage of the above consequence of CD. One of their main problems is to explain the unmanifested dispositions that we often ascribe to particulars (and regularly associate with their properties) without assuming any kind of physical de re necessity. Humeans do not deny that we associate dispositional *truths* with the fundamental properties, but they insist that the truthmakers for such truths are not dispositional properties having an essential dispositional character. Rather, the truthmakers are the fundamental *non-dispositional* properties plus the totality of the (contingent) laws of nature. However, for many metaphysicians the suggested truthmakers are insufficient. For those that do not share Humean intuitions, no distribution of intrinsically inert properties (supported by a 'thin' conception of laws of nature which hardly govern world's events) can serve as an adequate explanation basis for all we observe in a world which is full of 'threats and promises'. So, non-Humeans insist that Humeans are wrong in holding an *eliminativist* view about genuine unmanifested dispositional *properties*. In my opinion, non-Humeans are right in their criticism, but they are too hasty in rejecting Humean position for that reason. For under the perspective of CD, Humeans *can* accept the existence of fundamental dispositional properties *provided that these properties have a modally restricted dispositional character.*

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grounded upon the constraints that the essentiality of actual causal profiles of properties place on the space of possibilities.

Following this strategy they can adequately explain the ascriptions of unmanifested dispositions while avoiding any kind of physical de re necessity.

The second consequence of CD is related to the controversial issue of the contingency of laws of nature. There is a strong intuition that laws are contingent which stands in contrast to the thesis (advocated by dispositionalists) according to which they are necessary (because natural properties confer essentially causal powers to their bearers). Of course, even in the context of dispositionalism (and setting aside the arguments for the 'illusion' of the metaphysical contingency of laws), a kind of contingency can be restored, provided that the fundamental natural properties are *contingent* beings. For in that case, the only thing that dispositionalists can prove is that possible worlds with the same fundamental properties as the actual must be governed by the laws of our world. Strictly speaking, and given that not all worlds are inhabited by the actual properties, the laws of nature are no longer necessary.[15] CD, however, supports a more *robust* kind of contingency for laws of nature, which holds, even granted that actual fundamental natural properties are dispositional *and* necessary beings. To illustrate that, let us first notice an important point about laws of nature. Most metaphysical accounts agree that laws of nature express relations between natural properties but disagree on the nature of these relations. Categorical monists hold that laws of nature are contingent and express *external* relations between natural properties. The latter are non-dispositional and either have no intrinsic nature or, alternatively, have a nature independent of their causal roles. In each possible world, laws express external relations that determine the role of each natural property in that world. In contrast, dispositional monists hold that laws of nature express *internal* relations between natural properties. The intrinsic dispositional nature of properties determines their roles in each possible world; it also determines completely and necessarily the instantiation of internal relations that laws of nature express. Having said that, let us now suppose that all fundamental natural properties are *necessary* beings; a hypothesis that entails that all fundamental natural properties inhabiting the actual world also exist in all other possible worlds. Consider the case of two actual fundamental dispositional properties and a natural

[15] Bird calls this thesis weak necessitarianism. For a defence of strong necessitarianism (according to which all worlds have the same laws), see Bostock (2003) and Bird (2007: 50–59).

law that involves only them. If (as dispositionalists claim) these properties have a dispositional nature in all possible worlds, the aforementioned law would express an internal relation holding between them in all worlds, since any internal relation is determined by the nature of its terms in each possible world. According to CD, however, properties can have different natures in different worlds. Hence, even if the above law expresses an internal relation in the actual world, it would still express an internal relation between those properties only in those worlds where the latter are still dispositional. In any possible world where both properties are non-dispositional, the law could express an external relation, *or could express no relation at all, since in that case nothing determines the existence of the aforementioned relation.* So, according to CD, laws of nature are doubly contingent. A law may express a relation that exists only in some worlds and in those worlds in which it exists it may have different natures.

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