

MARKUS SCHRENK

## HIC RHODOS, HIC SALTA:

FROM REDUCTIONIST SEMANTICS

TO A REALIST ONTOLOGY

OF FORCEFUL DISPOSITIONS<sup>1</sup>

### ABSTRACT

It is widely believed that at least two developments in the last third of the 20<sup>th</sup> century have given dispositionalism—the view that powers, capacities, potencies, etc. are irreducible real properties—new credibility: (i) the many counterexamples launched against reductive analyses of dispositional predicates in terms of counterfactual conditionals and (ii) a new anti-Humean faith in necessary connections in nature which, it is said, owes a lot to Kripke’s arguments surrounding metaphysical necessity.

I aim to show in this paper that necessity is, in fact, of little help for the dispositionalists. My argument makes use of one of the above mentioned counterexamples against Humean reduction: antidotes. Turning the tables, I ask how the dispositionalists themselves can deal with antidotes. The result will be to show that if the dispositionalists are to demystify antidote cases, they must make plausible a conceptualisation of dispositions that does not invoke any kind of necessity. I will cautiously suggest that the anti-Humean link dispositions bring to the world has to be thought of in terms of (Newtonian) forces.

---

<sup>1</sup> Thanks are due first and foremost to Gregor Damschen, Robert Schnepf and Karsten Stueber for the great conference in Wittenberg for which this paper has been written. I am also very grateful to the other participants and contributors to this book for their valuable comments and questions. Further thanks go to Stephen Williams, Stephen Mumford, and Charlotte Mattheson who have read and criticised an earlier version of the paper. I specially thank Matthew Tugby for his many helpful comments on the earlier draft. I have started the paper as Junior Research Fellow at Worcester College, Oxford, and finished it for publication in Nottingham as a Postdoctoral Research Fellow within the AHRC Metaphysics of Science project.

## (1) THE HUMEAN LEGACY

Hume's Followers. There are two major strands in 20<sup>th</sup> century analytic philosophy which both share the Humean sentiment that necessary connections in nature do not exist and that, consequently, dispositional properties (powers, capacities, potencies, etc.) are not real properties and have to be analysed in terms of non-dispositional categories.<sup>2</sup> The two schools I have in mind are *early twentieth century logical empiricism* and the *neo-Humean supervenience program* David Lewis has famously given the name and credo for.

One of the logical empiricists' main aims—known under the heading 'verificationism'—was to give analyses of all notions in terms of observational vocabulary. Only if this was possible, they believed, would those terms belong to a meaningful language. Dispositional predicates—not belonging to observational language themselves—had, therefore, either to be analysed or to be deleted from scientific language. As we know now, verificationism is untenable and it saw its downfall partially because dispositional predicates proved to be indefinable by the means available to the empiricist. One brief part of this paper is the story of the difficulties empiricists had to face.

As mentioned, the second incentive to reduce dispositions comes from the metaphysical position David Lewis has dubbed *Neo-Humean Supervenience* "in honor of the great denier of necessary connections":

It is the doctrine that all there is to the world is a vast mosaic of local matters of particular fact, just one little thing and then another. [...] We have geometry: a system of external relations of spatio-temporal distance between points. [...] And at those points we have local qualities: perfectly natural intrinsic properties. [...] For short: we have an arrangement of qualities. And that is all there is. There is no difference without a difference in the arrangement of qualities. All else supervenes on that. (Lewis 1986: IX-X)

What a follower of this creed wants to fight

are philosophical arguments against Humean supervenience. When philosophers claim that one or another commonplace feature of the world cannot supervene on the arrangement of qualities, I make it my business to resist. (Lewis 1986: XI)

---

<sup>2</sup> Please note that I will use 'natural necessity', '*de re* necessity', 'metaphysical necessity', and 'necessity in nature' synonymously. The same holds for the group 'power', 'capacity', 'disposition', etc.

Needless to say, dispositions are supposed to belong to the things supervening on local matters of fact. The history of the conditional analysis of dispositional predicates which starts with the empiricists will lead us smoothly to Lewis's reductive analysis.

Note the following superficial difference between these two groups of opponents of dispositions: logical empiricism was occupied with the task of confirming an *epistemic* credo by the means of a *semantic* dogma: all factual knowledge comes from sense experience and it can be shown that this is true by proving that the verificationist theory of meaning is adequate. Humean-supervenience is, on the other hand, a *metaphysical doctrine*: all there is, is a huge pattern of point size and separate property instantiations; a kind of 'metaphysical pointillism'<sup>3</sup>.

However, deep down both neo-Humean supervenience and logical empiricism share the same root and this is the aforementioned hostility to (hidden) *links in nature*. That is, they both subscribe to Hume's arguments against any such connection. I will briefly rehearse Hume's well known line of reasoning.

According to Hume "all objects of human reason and enquiry may naturally be divided into two kinds [...] *Relations of Ideas*, and *Matters of Fact*." (Hume 1777: 25) The first, *Relations of Ideas*, can be revealed *a priori* by pure thought, whereas *Matters of Fact* have to be discovered by experience, that is, by sense perception. Whether or not a sharp line can be drawn between *a priori* and *a posteriori* knowledge is a matter of much debate. However, that there is no entirely different third way to obtain knowledge (via dream interpretation, for example) is relatively uncontroversial.

Consequently, the reasons to support necessary connections in nature—here especially those between a certain trigger event, an object being disposed, and a certain reaction—have to arise on either *a priori* or *a posteriori* grounds. Yet, neither, says Hume, is tenable. There cannot be *a priori* grounds for a necessary relation in nature, for as far as we know or as far as we are able to imagine anything may produce anything. No pure thought can reveal that, for example, water has the power to suffocate or fire the capacity to consume. Hence,

*our reason, unassisted by experience, [cannot] ever draw any inference concerning real existence and matter of fact.* (Hume 1777: 27; my italics)

---

<sup>3</sup>A term I borrow from Jeremy Butterfield.

Why is there no possibility of experiencing necessary connections with our senses either? We might repeatedly observe one kind of event followed by another kind of event but, so Hume continues, what we cannot observe is the alleged necessary connection between them and, even less so, an alleged power of the first to bring about the second:

The scenes of the universe are continually shifting, and one object follows another in an uninterrupted succession; but the power or force, which actuates the whole machine, is entirely concealed from us, and never discovers itself in any of the sensible qualities of body. [...] External objects as they appear to our senses, give us no idea of power or necessary connection. (Hume 1777: 63-4)

Hume's first argument, that we have no *a priori* way of discovering necessary connections in nature, is widely accepted amongst both Hume's supporters and his opponents such as dispositionalists.

Hume's Opponents. However, a fast-growing community of philosophers does not accept Hume's second argument anymore. Some people state that some links in nature—certain instances of causation as, for example, forces on our body or successful acts of the will—can be directly and non-inferentially experienced.<sup>4</sup> In fact, I believe that a version of this is correct and that it is the most promising move against Hume (but I cannot argue for this claim here). Yet, many of those who accept anti-Humean *de re* connections do not pursue this line of argument but support ideas put forward by Kripke and Putnam. That is, they conceive of those connections as *a posteriori*, conceptually contingent, yet, metaphysically necessary links which are partially argued for on the grounds of semantic considerations about direct reference and rigid designation but also on grounds of scientific discovery.

Many people have been impressed by these arguments and especially anti-Humeans, such as dispositionalists, saw the chance of a revival of anti-Humean *de re* connections. Stathis Psillos, for example, comments (here speaking of laws rather than dispositions):

It was Kripke's liberating views in the early 1970s that changed the scene radically. By defending the case of necessary statements, which are known a posteriori, Kripke [1972] made it possible to think of the existence of *necessity in*

---

<sup>4</sup> See, for example, David Armstrong: "causation is given in experience" and "the dyadic predicate 'causes' is as much an observational predicate as any other predicate in our language, especially in such cases as our awareness of pressure on our own body." (Armstrong 1997: 228); particularly interesting for my later arguments are passages in Evan Fales's *Causation and Universals*, especially chapter 1, p. 48.

*nature* which is weaker than logical necessity, and yet strong enough to warrant the label necessity. [...] As a result of this, the then dominant view of laws as mere regularities started to be seriously challenged. (Psillos 2002: 161; my italics)<sup>5</sup>

Yet, I am convinced that Kripke's influence has to be thought of as merely psychological rather than philosophical: Kripke has opened people's minds to connections in nature which have been banned from (some) philosophy since Hume, but Kripke has not yet come up with the kind of link in nature dispositionalists need. This will be the main subject of a later section.<sup>6</sup> In the following section I will present a brief history of the conditional analysis of dispositional predicates—first motivated by empiricism and later supported by the Lewisians. I will also describe some of the difficulties this analysis has had to face up to date.

## (2) A BRIEF HISTORY OF SEMANTIC REDUCTION

The history of the attempts to analyse dispositional predicates is well documented and some counterexamples to it have reached folkloric status in analytic metaphysics. Therefore, only a brief rehearsal of the ups and downs of the analysis should be sufficient here.

The Material Conditional Analysis. The very first and most straightforward attempt to analyse dispositional predicates, like “*x* is soluble”, and its rejection can be found in Carnap's *Testability and Meaning*. “ $\supset$ ” is meant to symbolise *material implication*:

$S(x) \text{ iff } T(x) \supset R(x)$  (cf. Carnap's *Testability and Meaning* 1936: 440)

That is, *X* is soluble in water,  $S(x)$ , iff if *x* is put into water,  $T(x)$ , then *x* dissolves,  $R(x)$ .

---

<sup>5</sup> I am not here saying that Psillos is an anti-Humean or dispositionalist. I quote him because he gives expression to the view that Kripke was involved essentially in the anti-Humean revolution of the defenders of strong laws.

<sup>6</sup> I believe something even more heretic, namely that alleged metaphysical necessities like “water = H<sub>2</sub>O” should be treated as normative methodological claims or recommendations with the aim to enhance good scientific conduct rather than as literal truths. That is, I reject the metaphysical doctrine of natural necessity in its fact-stating form while I subscribe to the prescriptive version of it (cf. Watkins 1958: 356-7). Yet, this has only little to do with the main subject of this paper. As I said above, here I only aim to show that even if we accept necessity in its fact-stating form, it is not fit for the purposes of the dispositionalist.

This minimalist suggestion does not work for various reasons: the two most famous difficulties concern so-called “Void Satisfaction” (i) and “Random Coincidence” (ii).

(i) Void Satisfaction. Imagine a match  $m$  which has never been and will never be put into water. The *definiens*, ‘ $T(m) \supset R(m)$ ’, comes out true because its antecedent,  $T(a)$ , is false—this is one of the well known paradoxes of material implication. As a consequence we have to attribute solubility to the match. In other words, the match *voidly satisfies* the criterion for being soluble. An untenable result.

(ii) Random Coincidence. A *coincidence* occurs *randomly* when both the antecedent,  $T(x)$ , and the consequent,  $R(x)$ , happen, yet by sheer accident and not because an object has the disposition to react with  $R$  when  $T$ -ed. To my knowledge it was Jan Berg who coined the term *random coincidence* in the context of dispositional predicates (Berg 1960). An example modelled after Berg’s is this: suppose we define the disposition “ $x$  is explosive” as “if you knock on  $x$ , it bursts into pieces” (I guess Berg had something like a landmine in mind). Imagine you knock on a table and it happens to burst into pieces for some weird reason: an elephant might, a second later, step on it. We would, then, not want to say that it is explosive although, unfortunately, the *definiens* conditions for explosiveness are fulfilled.

Enhancing the Naïve Conditional Analysis. Even readers who are not familiar with the dispositions debate will immediately have a multitude of promising ideas concerning how one could avoid either the void satisfaction or the random coincidence or both. Here are some such ideas:

- (i) We could try to reformulate the antecedent of our conditional so that elephants and other such influences are forbidden as unwanted external factors.
- (ii) We could specify the consequent in more detail so that bursting due to elephants is not the right kind of bursting.
- (iii) We could add a clause demanding that the bursting comes about merely due to the intrinsic setup of the object.
- (iv) We could insist that the object disposed to explode should belong to a kind of object or material which usually shows explosive behaviour (the wood the table was made of would be excluded).
- (v) We could abandon the explicit definition of dispositional predicates and revert to implicit definitions.

- (vi) A time variable ( $t$  for the antecedent,  $t + \Delta t$  for the consequent) might be cleverly inserted into the definition.
- (vii) Finally, we could give up the material conditional and use a stronger logical connective.

All these possibilities have been suggested in one form or another (and I do not claim that this list is exhaustive). Unfortunately, there is no space to focus on all of them here. I will leave aside Carnap's suggestion to define dispositional predicates with the help of reduction sentences (cf. suggestion (v)) and also the various further attempts of Trapp and Essler to overcome certain follow-up problems reduction sentences had to face (including redefinitions with time variables: (vi)).<sup>7</sup> I especially regret having to leave aside Eino Kaila's forward-looking definition which demands of the disposed object not only that a conditional is true of it but also that it is a member of an appropriate class of objects for which the dispositional behaviour is a law-like regularity (cf. suggestion (iv)).<sup>8</sup> I also neglect early attempts to define the relation 'c causes e' as a stronger-than-material conditional and to use it for the definition of dispositions (this is one variant of (vii)).<sup>9</sup> Instead, I will straight away turn towards modern attempts to rescue the conditional analysis with the help of counterfactual conditionals (again suggestion (vii)). We will see that the other above mentioned attempts to save the analysis (suggestions (i), (ii), (iii), (vi)) will also find their way into the analysis.

The Bare Counterfactual Conditional Analysis. The first promising semantics for counterfactual conditionals were introduced independently by Stalnaker and Lewis as late as the 60s or early 70s. We can, for our purposes at least, treat the point at which Lewis enters the stage as the turning point from empiricism to neo-Humeanism. The bare counterfactual analysis

---

<sup>7</sup> (Carnap 1936/7), (Trapp 1975), (Essler 1975), (Essler & Trapp 1977), (Pap 1963). Someone who takes dispositions to be indefinable real properties could actually appreciate reduction sentences as describing the symptoms of dispositions. The fact that reduction sentences are mere implicit definitions (or "conditioned definition" as Carnap calls them (Carnap 1936: 443)) should suit the dispositionalist well. Spohn and Mellor both mention reduction sentences with sympathy (cf. (Spohn 1997) (Mellor 1999)).

<sup>8</sup> At the time Kaila offered his definition, natural kinds were not yet *en vogue* in philosophy so that no successful characterisation of the ominous class of objects could be found. I believe it could be worth rethinking Kaila in the light of essentialism and modern formulations of lawhood (cf. Kaila 1939). Wedberg in (Wedberg 1944: 237) has, independently, developed a very similar if not equivalent definition (see (Storer 1951) for the equivalence). For a discussion of Kaila see also (Berg 1960) and (Pap 1955).

<sup>9</sup> (Burks 1951, 1955), (Sellars 1958)

x has the disposition D  $\leftrightarrow$  if x were exposed to the test T, x would show the reaction R

has, interestingly, never been explicitly suggested in the literature. By the time Lewis and Stalnaker had published their theories of counterfactuals people seemed to have temporarily lost interest in the dispositions debate. On the other hand, everyone seemed to have tacitly assumed that the problems of the original analysis would be solved easily with the rise of counterfactuals.<sup>10</sup> This hope is certainly justified concerning the void satisfaction difficulty. Remember that this difficulty is merely a consequence of the paradoxes of material implication: as soon as the antecedent is false the whole conditional is true regardless of the truth value of the consequent. A counterfactual conditional cures this disease: there has to be a close possible world in which the antecedent and also the consequent are true. If not, the counterfactual conditional is false. Hence, an empty or void satisfaction cannot occur. Other possible worlds take care of that.

However, people should have been suspicious when it comes to the random coincidence difficulty for this is not merely based upon the deficiencies of truth functional logic. The reason is that the random coincidence case is one in which both the antecedent event and the reaction happen: yet, not for the right reasons. And these wrong reasons can be operative even in nearby possible worlds. To see this take again our example, the non-explosive table. We just have to assume that the elephant is trained to step on the table whenever someone knocks on it.<sup>11</sup> In that way we transport the elephant's interference into nearby possible worlds. That is, it becomes true of the table that *if we were to knock on it* (= if it were exposed to the test T), *it would burst into pieces* (= it would show the reaction R). Yet, it is still not the table that is explosive but the elephant that is heavy.

Martin's Finks. Charles Martin revived the dispositions debate in the mid 90s with his seminal text *Dispositions and Conditionals* (Martin 1994). He did not refer to random coincidences but he had a similar idea in mind. Martin has convincingly shown that the bare counterfactual conditional is neither sufficient nor necessary for an object to be disposed to do something. His example is of a live wire (live being the

---

<sup>10</sup> Lewis, for example, writes: "All of us used to think, and many of us still think, that statements about how a thing is disposed to respond to stimuli can be analysed straightforwardly in terms of counterfactual conditionals." (Lewis 1997: 143)

<sup>11</sup> It is true that the earlier cases of *random* coincidences have to be turned into a *regulated* coincidence in order to attack also the counterfactual analysis, but this is a relatively small alteration.



disposition in question)<sup>12</sup> to which a machine—Martin calls it an electro-fink—is connected. This machine is built in such a way that it stops the power supply immediately if the wire is touched by a conductor. The conditional analysis of 'x is live', taken to be 'if x were touched by a conductor, then electric current would flow from x to the conductor', is inadequate, since the wire is live *ex hypothesi*, but the conditional is not true due to the fink. The conditional is not necessary. We can rephrase the story *mutatis mutandis* such that a “reverse-electro-fink” is operating on a non-live wire and thereby show that the conditional is not sufficient either (“We turn a switch on our electro-fink so as to make it operate on a reverse cycle” (Martin 1994: 3)).

Our immediate reply is likely to be that the peculiar intervention of the fink does not really belong to what *normally happens* (compare: the trained elephant). This intuition suggests that we can upgrade the analysans in a straightforward way: “Conditionals which give the sense of power ascriptions are always understood to carry a saving clause (the full details of which are commonly not known)” (Martin 1994: 5). Yet, Martin shows (or maybe only seems to show, as we shall see in a moment) that no appropriate definition can be given for a *ceteris paribus* or ‘all else being equal’ clause. So, it is not an option, after all, to define, for example: “If the wire is touched by a conductor *and other things are equal*, then electrical current flows from the wire to the conductor” (Martin 1994: 5). Martin's conclusion regarding this negative result is radical and pessimistic: counterfactual conditionals are not the appropriate tools to use in defining dispositional predicates. For Martin, dispositions are irreducible (cf. Martin 1994: 8).

Martin's article in the *Philosophical Quarterly* was the starting point for a refreshed debate about dispositions. The prevention of finks (and other counteracting devices; see below) became the main concern in this discussion for over a decade. The goal has been either to enhance the conditional analysis with tenable proviso clauses or otherwise to show that this is not possible and, so, that dispositions are irreducible real properties.

Lewis's Analysis. I turn first to David Lewis's answer to Martin. In “Finkish Dispositions” (1997), Lewis did not want to follow Martin's bold step. Instead, he offers a sophisticated reformulation of the primitive counterfactual analysis adding

---

<sup>12</sup> Other examples are to be found easily if it is in doubt whether *being live* should count as a disposition.

both a certain ontological assumption about dispositions and time variables. The ontological assumption is that there is a causally active, possibly categorical basis *B* underlying each disposition. In the case of solubility, for example, basis *B* may be a molecular structure *XYZ* with which water-dipoles can interact. Lewis argues (with Prior et al. (1982)) in favour of such a basis *B*. Lewis's basic way of accounting for Martin's fink cases is expressed thus: "A finkish disposition is a disposition with a finkish base" (Lewis 1997: 149). Here's his complete analysis:

Something *x* is disposed at time *t* to give response *r* to stimulus *s*, iff, for some intrinsic property *B* that *x* has at *t*, for some time *t'* after *t*, if *x* were to undergo stimulus *s* at time *t* and retain property *B* until *t'*, *s* and *x*'s having of *B* would jointly be an *x*-complete cause of *x*'s giving response *r*. (Lewis 1997: 157)

"An unlovely mouthful" as Lewis himself concedes (Lewis 1997: 157). Let me try to explain the most important feature of his definition. The crucial phrase to make the definition immune to finks is "retain property *B* from *t* to *t'*". Note that since *B* is not the dispositional predicate itself there is no circularity in Lewis's account. Remember that the fink is, as much as the disposition itself, supposed to be activated by the trigger conditions of the disposition. Once they occur the fink destroys the object's basis *B* for the disposition. Yet, Lewis's definition takes care of such an unfortunate event in that it includes the condition "if *x* were to [...] retain property *B* until *t'*".

Lewis seems to have saved the conditional analysis of dispositional predicates. The void satisfaction difficulty is taken care of by the mere fact that counterfactual conditionals are employed and the random coincidence objection, here in the guise of finks and reverse-finks, is ineffective too. Unfortunately, there is a whole zoo of little machines, interferers, and unwanted processes—antidotes, prodotes, masking, mimicking, to name but a few—which can make life difficult for those who aim to provide a counterfactual analysis, even, it will be shown, for Lewis's analysis. I will focus on antidotes as introduced by Alexander Bird in his *Dispositions and Antidotes* (Bird 1998).

Bird's Antidotes. Bird's derivative of finks, namely *antidotes*, do not destroy the intrinsic basis, *B*, of a disposed object but interfere with the causal process extrinsic to the object. One of his examples is of a uranium pile that is above critical mass (cf. Bird 1998: 229). The pile has the disposition to chain-react catastrophically. Yet, there is a safety mechanism which lets boron moderating rods penetrate the pile in

case radioactivity increases. The boron rods absorb the radiation and prevent a chain reaction. Although the intrinsic structure of the uranium pile is not altered, its disposition will not be manifested. Hence, Lewis's demand for saving the intrinsic basis is futile.

Again, the counterfactual analysis of dispositional predicates seems to fail. Yet, Bird also offers an interesting suggestion about how to save it once again. He shows how it might be possible, in contrast to Martin's arguments, to define proviso clauses that exclude finks, antidotes, and everything else that could interfere with the disposition-manifestation process. For that purpose, Bird employs insights of externalist semantics. In short: the class C of normal conditions is the class of all circumstances which crucially resemble those archetypal situations in which we tested objects of the same kind positively. Consequently, if one makes a disposition ascription in a certain context, one assumes that the conditions of the context of utterance are similar to or are the same as those archetypal situations. I know that this summary does not do justice to Bird's ideas. Yet, for reasons of space I can only further highlight the fact that, in his final analysis of dispositions, Bird keeps Lewis's reference to a basis property on top of his own insertion of normal conditions (cf. Bird 1998a: 233).

Latest developments. The next step in the analysis of dispositional predicates suggests itself. Once a successful way to define normal, or ideal, or *ceteris paribus* conditions is found there might not be the need, anymore, to refer to basis properties. I believe that the application of the tools known from externalist semantics (reference to paradigm cases in order to define normal conditions demonstratively) is a promising route. In (Schrenk 1999, unpublished)<sup>13</sup> I have defended such a thin version of the conditional analysis which characterises *communicative-relevant conditions* as context sensitive elements that are partially fixed by paradigm cases.

Yet, since the discussion of conditional analyses is, in this paper, only a vehicle to reach the actual subject, I have to leave things at this superficial stage. What we have to conclude from the whole discussion remains, in any case, open: the conditional

---

<sup>13</sup> I have learned only shortly before the deadline for this paper that Sungho Choi seems to propose a similarly slim analysis in his "The Simple vs. Reformed Conditional Analysis of Dispositions." (Choi 2006). –

Note aside that, although I believe that such a semantic analysis is possible I do not think that dispositions are thereby ontologically reduced to non-dispositional properties.

analysis might or might not succeed depending, amongst other things, upon how many counterexamples along the lines of finks and antidotes will still be found.<sup>14</sup>

### (3) *HIC RHODOS, HIC SALTA!*

#### HOW DOES THE DISPOSITIONALIST DEAL WITH ANTIDOTES?

We have heard about the attempts to analyse dispositional predicates in terms of counterfactual conditionals (§2). In the eyes of the dispositionalists these attempts have failed. Which consequence we should draw from this alleged failure is uncertain. In any case, the counterexamples dispositionalists have launched against semantic reductions—finks, antidotes, etc.—are undoubtedly a hard nut to crack. How hard this nut really is I hope to reveal in this core section of my paper where I will turn the tables and ask what the dispositionalists themselves have to say about the counterexamples.

At this point, the choice of my pompous paper title ‘*Hic Rhodos, hic salta!*’ gets some justification: the origin of this odd saying is a punch line in Aesop’s fable *The Braggart* where an athlete boasts that he once performed a stunning jump in Rhodes. Addressing him with the words ‘*Hic Rhodos, hic salta!*’ a bystander challenges the athlete to demonstrate his capacities here and now.

Antidotes for Dispositionalists. I am especially interested in what the dispositionalists make of certain antidote cases where the trigger of the disposition is pulled, yet, its manifestation still does not occur. Here is roughly where the problem lies. Peter Lipton described a tripartite distinction with respect to the status of an object’s dispositions. The tripartite distinction is, I think, usually taken to be exhaustive: “For dispositions [there is] [...] a tripartite distinction: displaying, present-but-not-displaying, or absent.” (Lipton 1999: 163) However, I will show that these three elements are not enough to capture antidote cases: the realist about dispositions needs one further element in order to account for these cases. I will provisionally call it the *pushing, trying, aiming, or attempting to manifest* element. The need for it emerges if one runs quickly through Lipton’s tripartite distinction.

---

<sup>14</sup> For further discussions see, for example, (Molnar 1999), (Malzkorn 2000), (Gunderson 2000) with a reply by Bird (Bird 2000), (Mumford 2001), and (Choi 2003).

- *Absence*: an object might not have a disposition at all (or it might have lost it due to a fink) hence even if sufficient trigger conditions are fulfilled the object does not display the disposition's manifestation.

- *Displaying*: an object has the disposition, the relevant trigger conditions are fulfilled and, no surprise, it displays the disposition's manifestation.

- *Present-but-not-displaying*: here the difficulty lies. I will explain what I have in mind with the help of two imaginary scenarios.

First, think of sugar's solubility. Clearly, sugar does not display its solubility when it is not in contact with any water. (Likewise, a rubber band does not display its elasticity as long as it is not pulled; a match does not display its flammability as long as it is not struck, etc.) This, then, is one kind of *being present-but-not-displaying*: the trigger is entirely absent.

Bird's antidote case, second, is quite different: the nuclear power station's uranium pile is moderated by boron rods. That is, while the uranium rods are still disposed to melt and, moreover, also triggered to do so, they do not. It is important to note that this is not simply a case where there are no activation circumstances: the mass of the uranium is not reduced to less-than-critical. The uranium is still very much poised to chain react. We have, hence, a second kind of *being present-but-not-displaying*: being present *plus triggered*, yet, not manifesting.

To expose the principal difference between the sugar and the uranium story yet again consider two analogous cases: think, as another antidote (uranium-type) case, of an electron in an electric and a gravitational field. According to its Coulomb capacity it should accelerate in one direction, according to its mass in another. Let us imagine, however, that the two fields' strengths and directions are such that the electron remains stably in its initial position. Again, both dispositions are *present-but-not-displaying*. Yet, they are triggered. They do not display because the gravitational force is an antidote to the Coulomb capacity and *vice versa*.

Now, contrast the latter case of force equilibrium with the case of a stationary electron which is not surrounded by any field at all. It is charged and massive. However, while these dispositions are present they are untriggered and so not displaying. This is similar to the sugar case.

A dispositional stage merely called "presence", is, because of the antidote cases, not enough, for we could not distinguish between (i) being present plus being not triggered and (ii) being present plus triggered, yet, not manifesting.

Yet, what is wrong in further differentiating Lipton's *present-but-not-displaying* into two subgroups, one of which accommodates cases where the disposition is activated and hence pushing towards its manifestation? After all, isn't this what dispositionalism is all about? Dispositions, we are told, are powerful properties which bring about their manifestation... or at least they try. It is precisely this power or link towards their manifestation that the dispositionalists, but not the Humeans, should have available in their ontology. Therefore, there should be no problem for dispositionalists in accepting a fourth stage where the disposition is pushing, trying, or aiming to manifest.<sup>15</sup>

What's the Push? Actually, I have no reason to question this fundamental insight about dispositions. As will be clear later, I endorse this anti-Humean intuition. Yet, I will show that it is not so clear how dispositionalists should conceptualise the *pushing* we have extracted from the antidote case. Can we grasp its nature further? No doubt, to capture its nature in terms of counterfactual conditionals is not possible for the dispositionalists. Claiming that the uranium *aims* to chain react *means* that if the uranium were on its own (without the boron) it would melt is the reductionists', not the dispositionalists', story. In fact, this story is what the reductionists have painstakingly tried to elaborate in their conditional analyses of dispositions, but this is what the dispositionalists believe to have proven impossible with cases like the antidote cases. Clearly, then, counterfactuals are not the tools to use when conceptualising the aiming or trying to bring about the manifestation of a disposition.

The obvious second place to look for a possible conceptual background to those pushes is, of course, the initial place of departure for both the anti-Humean dispositionalists and the Humean reductionists. The major metaphysical difference between, on the one hand, the anti-Humean and, on the other hand, the empiricist or neo-Humean, is their belief or, respectively, disbelief in necessary connections in nature. Naturally, one might think, *de re* necessity has to play its role for the dispositionalists at some point and the place is precisely where reductionism (allegedly) fails; that is, here, in antidote cases. In other words, the disposition's pushing, trying, attempting to manifest, which the Humean accounts do not accommodate, should be cashed out in terms of natural necessity.

---

<sup>15</sup> In a successful display of its manifestation the disposition will also be said to have pushed for its display—effectively.

However, what I aim to show next and what constitutes a main element of this paper, is that metaphysical necessity is the wrong kind of “secret connection”. This necessity, which seemed to have been such a boost for dispositionalists because it promises to be a successful weapon against the Humeans, is of no use. In order to prove my claim I will look in detail at Brian Ellis’s theory of the dispositional pushes, because he does explicitly analyse them in terms of Kripkean metaphysical necessity.

#### (4) NECESSITY CANNOT DO THE JOB

It is not unusual to think of powers in association with necessity. Even Harré and Madden who wrote too early to be under the psychological influence of Kripke subtitled their book *Causal Powers* with “A Theory of Natural Necessity”. Here, however, I want to focus on a theory Brian Ellis has put forward. He relies heavily on Kripkean metaphysical necessity in order to capture the link between a trigger event and a manifestation event mediated by a disposition. Here is, first, his general claim regarding necessity:

Essentialists have their own special brand of necessity. This kind of necessity has traditionally been called “metaphysical necessity”. (Ellis 2002: 110)

When Ellis talks about necessity (and he uses all of “physical necessity”, “natural necessity”, “*de re* necessity”, and “real necessity” as synonyms) he has Kripkean metaphysical necessity in mind which is strongly associated with truth in all possible worlds:

Real necessity is no less strict than any other kind of necessity. [...] If essentialists are right, and the laws of nature are really necessary, then they must be counted as necessary in the very strong sense of being true in all possible worlds. *Truth in all possible worlds is the defining characteristic of all forms of strict necessity.* (Ellis 2002: 110; my emphasis)

Synchronic versus Diachronic Affairs. However, Kripkean necessity relates first of all natural kinds (the elite amongst the properties) to the features (further properties) they possess essentially. That is, the relation of metaphysical necessity is typically a link between one property and another (or things and their properties)—for example, an electron necessarily having unit charge, protons necessarily having rest mass  $1.6726 \times 10^{-27}$  kg, water necessarily being H<sub>2</sub>O. Yet, if metaphysical necessity is typically attributed with respect to one property having another property, then

metaphysical necessity is normally a synchronic business. In the case of dispositions, however, we are confronted with a different affair. There, we have characteristically a diachronic case of one property instance (or event) at  $t$ , namely the trigger (plus other activation conditions if needed), and another property instance (or event) at  $t+\Delta t$ , namely the disposition's manifestation. Consequently, Ellis (and anyone else who thinks necessity can be of help in an account of dispositions) has, in a first step, to explain how the normally synchronic Kripkean necessity can be extended to diachronic trigger-manifestation events.

Ellis has, in fact, a story to tell: not only are there *natural kinds of objects* which have certain properties necessarily (mostly powers in his view), there are also *natural kinds of processes*. And, here comes the crucial point, in the case of natural kinds of processes two event types are indeed linked by metaphysical necessity. The disposition's trigger event leads with natural necessity to the disposition's manifestation event because this process is a natural kind itself:

Suppose, for example, that  $p$  is a natural dispositional property that would be triggered in circumstances of the kind  $C$  to produce an effect of the kind  $E$ . Then *the processes of this kind will themselves constitute a natural kind*, the essence of which is that it is a display of  $P$ . (Ellis 2002:158; my emphasis)

Therefore, [...] for all  $x$ , *necessarily*, if  $x$  has  $p$ , and  $x$  is in circumstances of the kind  $C$ , then  $x$  will display an effect of the kind  $E$  (Ellis 2002: 158; my emphasis)

Although these steps are a little adventurous—is, for example, the move from synchronic to diachronic links warranted that straightforwardly? Is the step from natural kinds of objects to natural kinds of processes legitimate?—I will, for the sake of the argument, accept their tenability. Enough problems arise when we apply Ellis's idea to antidote and similar cases.

Necessity's Failure. Remember that this detour has been taken in order to find out whether one specific conceptualisation of the dispositional push that is needed for antidote cases is tenable. Presently we aim to challenge Ellis's position that states we have to think of the pushes as metaphysical necessity. I will now present two counterarguments against this view.

Suppose there is a disposition  $P$  to react with  $E$  when in circumstances  $C$ . As I read Ellis, this is to say that there is a natural kind of process: the process from  $C$  events to  $E$  events. Further, if I interpret him correctly,  $C$  events and  $E$  events are joined as a matter of metaphysical necessity.



Our problem is now that in antidote cases, E does not come about although C occurs. Yet, how can that at all be possible if C and E are linked by metaphysical necessity? Not even an antidote should be able to interfere with metaphysical necessity, should it? (The uranium pile is triggered, C, to chain react, E, for it has critical mass.) There are only two possible answers I can imagine but both lead into severe difficulties.

(1) In antidote cases, not C but C\* is realised, that is, not those sure-fire circumstances which, if realised, would definitely bring about E, but only those similar, that is, diluted, antidote riddled circumstances. Yet, even if this is so, remember that antidote cases must differ from cases where the trigger is not at all pulled. (Clearly, when C does not occur there is no problem in accommodating E's non-occurrence.) Therefore, while C\* are diluted circumstances they are still circumstances where the trigger, C, *is* pulled. So, C\* has to be imagined after all as a case of C *plus* A (uranium above critical mass plus boron rods), say. However, and this is the crucial argument, necessity is monotonic: if C *necessarily* leads to E, so must C plus A.

In fact, my argument is trivial and it is well known in a different disguise: necessities—in the following historical example of the analytic or *de dicto* kind—cannot handle cascading if-then sentences. Remember Goodman's match: if match *m* had been scratched it would have lighted, but if match *m* had been wet and scratched it would not have lighted, but if match *m* had been wet and scratched and the surrounding temperature had been extremely high it would have lighted... Surely, none of the links in those conditionals can be of *de dicto* necessity. This is a message which has been frequently acknowledged and which was once a reason for Humeans like David Lewis to develop semantics for counterfactuals. But why should, now, metaphysical necessity be able to handle the very same sort of difficulty (antidotes)? It is not clear that it can, yet, this is what anti-Humeans tacitly assume.

(2) This should settle the matter already but maybe I have overlooked a possibility of imagining C\*, the antidote case, in a way other than it being C plus some A. Let us suppose then that C\* is just very similar to C (yet, without properly including C): one might argue that uranium above critical mass together with the boron rods is not just the mereological sum of uranium and boron but something on top (or less). However, even then a problem looms: It is agreed that C events metaphysically necessitate E events, that is, if C were to be realised, E would come

about. Yet, here we are confronted with a C\* event which is only similar to but not the same as a C event. The second crucial problem is now that metaphysical necessity is, next to being monotonic, *discrete*: that some two properties or events C&E are necessarily linked has unfortunately no bearing whatsoever on any other properties or events. In short, the natural kind of process from C to E with its internal metaphysical link has no bearing whatsoever on the alleged link between C\* and E. That is, it cannot help to explain the push from C\* to E; it cannot be at the heart of this push.<sup>16</sup>

One might have the following intuitive reaction towards these arguments; especially to the first one: C has never been the correct first relatum of the necessary relation under concern. Rather, it is the subsequent circumstances that are linked necessarily to E: ‘C and the absence of any interfering factor’. As a result, (1) above is no danger. My answer is that while it is true that (1) might be circumvented in this way, problem (2) can be reiterated: if there’s only a necessary link between ‘C and the absence of any interfering factor’ and E then, because of necessity’s discreteness, C\*’s push towards E remains unexplained.

These are what I believe to be decisive reasons against metaphysical necessity (or, in fact, any kind of necessity properly so called) being the appropriate ground on which antidote cases can be conceptualised.<sup>17</sup> Necessity is in a dilemma: either it is too strong—C to E although A—or it has no power—C\* (different from C) to E. The Kripkean anti-Humean move is of no help for the dispositionalists. It might have been psychologically important for the dispositionalists to gain courage to stand up against the Humeans but here it has no philosophical argumentative impact.

---

<sup>16</sup> In yet other words, the necessary relation between C and E cannot have any influence on a situation in which its first relatum, C, is not realised. Over-exaggerating the affair a little one can make the following parallel: that water is necessarily H<sub>2</sub>O has nothing to do with alcohol being C<sub>2</sub>H<sub>5</sub>OH (and even muddy water or tea might already lose the (necessary) link to H<sub>2</sub>O).

<sup>17</sup> To be fair to Ellis I have to admit that I omitted a line from one of his quotes where he explicitly mentions the possibility of interferences: “Therefore, [...] for all *x*, necessarily, if *x* has P, and *x* is in circumstances of the kind C, then *x* will display an effect of the kind E, *unless there are defeating conditions that would mask this display*.” (Ellis 2002: 158; my emphasis) However, this does not resolve the problems I have indicated above.

## (5) OTHER SUGGESTIONS ON HOW TO CONCEPTUALISE THE DISPOSITIONAL PUSH

Some dispositionalists have conceptualised dispositions along lines other than metaphysical necessity. I will discuss only one such theory from the recent literature: Stephen Mumford's "dispositional possibility" and "dispositional necessity".

We need some kind of dynamic anti-Humean *de re* link between events which can explain the pushes we need for a description of dispositions in antidote cases. This dynamic *de re* link cannot be metaphysical necessity. It has to be some intra-world relation. Now, Mumford does explicitly underline the difference between synchronic and diachronic necessities. After having given two examples of the known synchronic species he introduces a novel "necessary connection that dispositions or causal powers bring to the world" (Mumford 2004: 168). He underlines that dispositional properties "are typically dynamic", i.e., that they are "responsible for, or productive of, changes in those and other particulars". Mumford denies that synchronic necessities (including metaphysical necessity) can have this dynamic aspect (Mumford 2004: 168)

He continues to characterise his very promising new dynamic *de re* link. It is in this closer portrayal, however, that Mumford is, in my opinion, unfortunately partially moving back to the traditional necessity view. He first distinguishes two subspecies of his new dynamic *de re* link:

*Dispositional possibility*: The having of one property may dispositionally make possible the having of another property. For example, being fragile makes possible being broken.

*Dispositional necessity*: The having of one property may dispositionally make necessary the having of another property. For example, having gravitational mass necessitates attraction of other objects. (Mumford 2004: 177)

The intuitions behind these characterisations are clearly akin to mine. Somehow a dispositional push needs to be captured. Yet, I believe that Mumford lapses back onto the old static necessity when he gives the second part of the distinction. I think that what he labels "dispositional necessity" is actually nothing but the old metaphysical necessity: that two objects have gravitational mass necessitates attraction between them, fair enough, but not as a matter of any new dynamic dispositional necessity. Rather, if we also have metaphysical necessity still available, mass and gravitational

attraction could be seen as linked by metaphysical necessity: gravitational mass metaphysically necessitates attraction, i.e., in all possible worlds, where there are gravitational masses they attract each other. Mumford's valuable dynamic force has, however, not entirely disappeared. It can be found in the attraction itself! More radically, I believe the attraction has to be identified with the dynamic *de re* link he is after. Attraction is a sample of this novel *de re* link. I come back to this idea shortly (§6).

First, I want to turn towards Mumford's first kind of dispositional link: dispositional possibility. Another quote concerning this connection reveals again that Mumford has seen the need for an anti-Humean connection in nature that is different from any form of necessity:

There is a connection between these two properties [being fragile and being broken; MAS] that is more than bare compatibility although it is less than necessitation, as being fragile does not necessitate being broken. [...] Fragility has a causal connection with being broken. [...] Thus we need a relation that represents connections in nature that are less than necessity [...] but more than mere unconnected compatibility [...] [*Dispositional possibility*] is the connection. (Mumford 2004: 177)

I believe that Mumford's dispositional possibility comes as close as possible to capturing the pushes we need in antidote cases. He might very well succeed in distinguishing a present, yet, not triggered and a present, triggered, yet, not manifesting case: in the latter dispositional possibility could be seen to be active.

Against this background, it is also more plausible why above I have subsumed attraction under dispositional possibility: attraction might or might not lead to movements, deformations, or holding other forces in check. Yet, clearly, attractions, like pushes, are a kind of anti-Humean glue in nature that are less than necessity but that link otherwise unconnected events.

## (6) WHY FORCES MIGHT BE THE RIGHT KIND OF ENTITIES.

For me, too, Rhodos is here and it is time for my own jump. My plan is to make the proverb of my paper's pretentious title the motto for a possible solution. What we must find is a proper conceptualisation of the pushes dispositions afford when they are triggered in antidote circumstances. What we need are non-modal pushes without

any connotation of necessity or direct reference to other possible worlds; pushes that have their power to jump *here and now*.

A special antidote case I have already described can serve as a model for a possible solution: the electron in an electric and a gravitational field held static in a force equilibrium. The electron's Coulomb capacity faces an antidote: a gravitational force. Coulomb's disposition is present, triggered but not displaying—its display would be the electron's acceleration. What, then, is its push? A Newtonian force!<sup>18</sup> And forces seem to be exactly the kind of thing we need in order to conceptualise the pushes dispositions afford when triggered: intuitively, forces have the relevant 'oomph' while not extending their power to possible worlds.

However, I want to be very cautious and my aim is really only to explore the possibilities an account of forces might open. I am afraid I do not have a full-blown account to offer yet. For example, I am not saying that dispositional pushes *are* Newtonian forces. For a start, my claim is much weaker: the idea of Newtonian forces and the intuitions we have about forces in everyday life form the right *conceptual background* to think of dispositional pushes.

There are many open questions a forces account would bring with it. A crucial question is, for example, how the insights we might gain from the electron case carry over to other cases which do not obviously involve forces: a wire's being live, the uranium pile, or even mental dispositions. Are forces and the intuitions we attach to them mere metaphors for those dispositions? Or do other dispositions have to be reduced to more fundamental ones which, in turn, can be analysed in terms of Coulomb's capacity, gravitational mass, etc., i.e., capacities that do involve forces? After all, solubility, for example, is a matter of molecular structures, chemical bonds, and forces between molecules: water dipoles tear, qua Coulomb force, the Na<sup>+</sup> and Cl<sup>-</sup> ions apart. The possibility of analysing everyday dispositions in terms of molecular goings-on that involve forces could be taken as a warranty for metaphorical talk about dispositional forces even at the macroscopic level.

However, even if this is the route to take there is a multitude of further problems and unsolved questions. One of the most pressing ones is this: forces are no longer respectable entities in present physical science. On the contrary, it seems modern

---

<sup>18</sup> Extreme anti-realists or instrumentalists about component forces (such as Cartwright claims to be) will not be happy with what I am going to say here. Naturally, I have to be a realist about component forces but I cannot defend realism here.

physics has abandoned talk about forces entirely. In macroscopic physics energy-based accounts (Lagrangians and Hamiltonians) replace forces or, in the General Theory of Relativity, geometry replaces forces, and quantum phenomena are best described in terms of probabilistic functions of initial conditions. Forces, one might (radically) conclude, do not exist. Like phlogiston they have been deleted from scientific ontology. If so, the rug is pulled out from under my account.

Luckily, there is a growing community of philosophers who defend forces against reduction: for example, Bigelow, Ellis, and Pargetter in “Forces” (Bigelow et al. 1988) and, very recently, Jessica Wilson in “Newtonian Forces” (Wilson forthcoming in BJPS). There is no space to present their arguments here but I hope that they can rescue forces from phlogiston’s fate.

A further oddity about dispositional forces is that an account of them seems to presuppose that dispositions rest inactive (asleep) until their force is triggered. They are, in some sense, constantly poised to make things happen. Only if certain conditions are met do they start pushing for their manifestation (i.e., until they are woken up). Take inflammability as an example: a match is not constantly on the verge of burning; the push to burn only occurs once certain sufficient conditions (scratching) are met. That is almost to say that dispositions have two conditionals attached to them: if sufficient trigger conditions are met they push to their manifestation *and, furthermore*, if their push to manifestation is unchallenged by antidotes they manifest themselves. Actually, this activation idea is not at all unfamiliar. A system might have certain *potential energy* which can only be released when certain activation energy is put into the system. So, a dispositional ascription is an ascription of potential energy to an object and the trigger specifies the activation circumstances.<sup>19</sup>

To end on a more positive note, forces do not only come with problems they might also have the potential to solve an infamous counterargument against pan-dispositionalism—the view that all properties are dispositional in nature. The argument often referred to as the “always packing, never travelling” argument is this: if the manifestation of all dispositions is yet another disposition then no manifestation will ever really be manifested. The world would be in a state of constant flux. A

---

<sup>19</sup> I owe this suggestion to Stephen Williams.

forces account has the potential to solve this riddle: force equilibria bring things to a halt.

Note also, that we find historical theories of dispositions which my forces account resembles. Compare, for example, Leibniz's *active force* and Aristotle's *dynamis* as presented in this volume by Michael-Thomas Liske and Ludger Jansen respectively.

## (7) CONCLUSION

Hume's arguments against connections in nature have predominantly been read as a rejection of necessity in nature. Yet, necessity, especially when formulated in possible worlds talk, is not the only anti-Humean connection possible. Reconsider Hume:

The scenes of the universe are continually shifting, and one object follows another in an uninterrupted succession; but the power or force, which actuates the whole machine, is entirely concealed from us, and never discovers itself in any of the sensible qualities of body. [...] External objects as they appear to our senses, give us no idea of power or necessary connection. (Hume 1777: 63-4)

Even if this might be the historically correct text exegesis we should not think that Hume is giving synonyms when he says "power *or* necessary connection" but alternatives! Power and necessary connection should not be identified with each other. Events happening due to forceful dispositional pushes should be thought of as more than mere coincidences but as less than being necessitated.

## (8) BIBLIOGRAPHY

- Armstrong, David. 1997. *A World of States of Affairs*. Cambridge: Cambridge University Press.
- Berg, Jan. 1955. "On Defining Disposition Predicates." *Analysis* 15: 85-89.
- Berg, Jan. 1958. "A Note on Reduction Sentences." *Theoria* 24: 1-8.
- Berg, Jan. 1960. "Some problems concerning disposition concepts." *Theoria* 26: 3-16.
- Bigelow, John, Brian Ellis, and Robert Pargetter. 1988. "Forces." *Philosophy of Science XYZ*: 614–630.
- Bird, Alexander. 1998. "Dispositions and Antidotes." *Philosophical Quarterly* 48: 227-234.
- Bird, Alexander. 2000. "Further Antidotes: A reply to Gundersen." *Philosophical Quarterly* 50: 229-233.

- Burks, Arthur. 1951. "The Logic of Causal Propositions." *Mind* 60: 363-382.
- Burks, Arthur. 1955. "Dispositional Statements." *Philosophy of Science* 22: 175-193.
- Carnap, Rudolph. 1936. "Testability and Meaning I." *Philosophy of Science* 3: 419-471.
- Carnap, Rudolph. 1937. "Testability and Meaning II." *Philosophy of Science* 4: 1-40.
- Choi, Sungho. 2003. "Improving Bird's Antidotes." *Australasian Journal of Philosophy* 81: 573-580.
- Choi, Sungho. 2006. "The Simple vs. Reformed Conditional Analysis of Dispositions." *Synthese* 148: 369-379.
- Ellis, Brian: 2001. *Scientific Essentialism*. Cambridge: Cambridge University Press.
- Ellis, Brian: 2002. *The Philosophy of Natur*. Chesham: Acumen.
- Essler, Winfried 1975. "Die Kreativität der bilateralen Reduktionssätze." *Erkenntnis* 9: 383-392.
- Essler, Winfried and Rainer Trapp. 1977. "Some Ways of Operationally introducing Disposition Predicates with Regard to Scientific and Ordinary Practice." *Synthese* 34: 371-396.
- Fales, Evan. 1990. *Causation and Universals*. London/New York: Routledge.
- Gunderson, Lars. 2000. "Bird on Dispositions and Antidotes." *Philosophical Quarterly* 50: 227-229.
- Harré, Rom and E. H. Madden. 1975. *Causal Powers. A Theory of Natural Necessity*. Oxford: Basil Blackwell.
- Hume, David. 1777. *Enquiries concerning Human Understanding and concerning the Principles of Morals*. Ed. L. A. Selby-Bigge and P.H. Nidditch. Oxford: Oxford University Press.
- Kaila, Eino. 1939. *Den mänskliga kunskapen*. Stockholm.
- Kaila, Eino. 1942. "Der physikalische Realitätsbegriff." *Acta philosophica fennica* 4: 33-34.
- Kaila, Eino. 1945. "Wenn .. So .." *Theoria* 11: 88-98.
- Kaplan, David. 1989. "Demonstratives." In *Themes from Kaplan*, eds. J. Almog, J. Perry, and H. Wettstein. Oxford: Oxford University Press.
- Lewis, David. 1973. *Counterfactuals*. Oxford: Oxford University Press.
- Lewis, David. 1986. *Philosophical Papers Volume II*. Oxford: Oxford University Press.
- Lewis, David. 1997. "Finkish Dispositions". *Philosophical Quarterly* 47: 143-158.



- Lipton, Peter. 1999. "All Else Being Equal." *Philosophy* 74: 155-68.
- Malzkorn, Wolfgang. 1999. "On the Conditional Analysis of Dispositions." In *Akten des 22. Internationalen Wittgenstein-Symposiums*, eds. Uwe Meixner and Peter Simons. Kirchberg/W.
- Malzkorn, Wolfgang. 2000. "Realism, Functionalism and the conditional Analysis of Dispositions." *Philosophical Quarterly* 50: 452 - 469.
- Martin, Charles B. 1994. "Dispositions and Conditionals." *The Philosophical Quarterly* 44: 1-8.
- Mellor, Hugh. 1999. "Dispositions." Handout for a talk given at King's College London, 07th December 1999.
- Mellor, Hugh. 2000. "The Semantics and Ontology of Dispositions." *Mind* 109: 757-780.
- Molnar, George. 1999. "Are Dispositions Reducible?." *Philosophical Quarterly* 49: 1-17.
- Molnar, George. 2003. *Powers: a Study in Metaphysics*. Ed. Stephen Mumford. Oxford: Oxford University Press.
- Mumford, Stephen. 2001. "Realism and The Conditional Analysis of Dispositions: Reply to Malzkorn" *Philosophical Quarterly* 51: 375-8.
- Mumford, Stephen. 2004. *Laws in Nature*. London: Routledge.
- Pap, Arthur. 1955. *Analytische Erkenntnistheorie*. Wien.
- Pap, Arthur. 1963. "Reduction Sentences and Disposition Concepts". In *The Library of Living Philosophers Vol. XI: Rudolf Carnap*. Ed. P. A. Schilpp. La Salle, Il.
- Prior, Elisabeth, Frank Jackson, and Robert Pargetter. 1982. "Three Theses about Dispositions." *American Philosophical Quarterly* 19: 251-257.
- Psillos, Stathis. 2002. *Causation and Explanation*, Chesham: Acumen.
- Salmon, Nathan. 1981. *Reference and Essence*. New York: Prometheus Books.
- Sellars, Wilfrid. 1958. "Counterfactuals, Dispositions, and the Causal Modalities". In *Minnesota Studies in The Philosophy of Science, Vol. II*. Eds. Herbert Feigl, Michael Scriven, and Grover Maxwell. Minneapolis: University of Minnesota Press: 225-308.
- Spohn, Wolfgang. 1997. "Begründungen apriori - oder: Ein frischer Blick auf Dispositionsprädikate." In *Das weite Spektrum der analytischen Philosophie – Festschrift für Franz von Kutschera*. Ed. Wolfgang Lenzen. Berlin: 323-345. As "A Priori Reasons: A Fresh Look at Disposition Predicates" available in English

on Spohn's website: [http://www.uni-konstanz.de/FuF/Philo/Philosophie/Spohn/spohn\\_papers.shtml](http://www.uni-konstanz.de/FuF/Philo/Philosophie/Spohn/spohn_papers.shtml)

Stalnaker, Robert. 1968. "A Theory of Conditionals." *Studies in Logical Theory, American Philosophical Quarterly* 2: 98-112.

Storer, Thomas. 1951. "On Defining 'Soluble'". *Analysis* 11: 134-137.

Storer, Thomas. 1954. "On Defining 'Soluble' - Reply to Bergmann." *Analysis* 14: 123-126.

Trapp, Rainer. 1975. "Eine Verfeinerung des Reduktionssatzverfahrens zur Einführung von Dispositionsprädikaten." *Erkenntnis* 9: 355-382.

Watkins, J. 1958. "Influential and confirmable metaphysics" *Mind* 67: 344-365.

Wedberg, Anders. 1942. "Review of Kaila 1939." *Journal of Symbolic Logic* 7: 43-44.

Wedberg, Anders. 1944. "The logical construction of the world." *Theoria* 10: 216-246.

Wilson, Jessica. 2007. "Forces". Forthcoming in the *British Journal for Philosophy of Science*.