PURELY DISPOSITIONAL WORLDS

SUNGHO CHOI
***Institute
address, **
E-mail: ***

In this paper I will discuss Richard Holton's defence of dispositionalism that all properties are essentially dispositional. By way of countering the objection that dispositionalism generates an infinite regress, Holton attempts to advance a consistent model of possible worlds where all truths are dispositional truths. But I will argue that the simple conditional analysis of dispositions, on which Holton's model is built, is so mistaken that Holton's model fails to serve his goal. What is more, it is not likely that we can successfully materialize the driving idea of Holton's model on an appropriately revised version of the conditional analysis of dispositions. Finally, I will discuss the lesson on the methodology of philosophy that we can learn from Holton's failure.

1. Dispositional Essentialism and Categoricalism

On dispositional essentialism, the essence of a property is identified by what causal or nomic powers it bestows on its instances. For instance, dispositional essentialists say that the property of being negatively charged essentially bestows on its instances the power to interact with other charged particles. But those powers are most effectively characterized in terms of disposition to exhibit a certain manifestation in response to a certain stimulus. For example, the power the property of being negatively charged bestows on its instances can be characterized in terms of the disposition to attract positively charged particles and repel negatively charged particles. Therefore, dispositional essentialism is acknowledged to entail that properties have dispositional essences, in other words, that properties are dispositional. There are at least two distinct versions of dispositional essentialism one of which says that all properties, without exceptions, are dispositional, whilst the other says that most properties are dispositional but there are some properties, most notably, spatio-temporal properties that aren't. The first and strong version is championed explicitly by Sydney Shoemaker,[1] Popper (Ref. 2, p. 424), Alexander Bird,[3] whilst the second and weak version by Chris Swoyer,[4] George Molnar,[5] Ellis and Lierse.[6,a]

Dispositional essentialism has been advanced as an alternative view on properties to categoricalism that properties are essentially non-dispositional. On categoricalism inexorably advocated by such authors as David Armstrong,[7–9] the identity of a property doesn't depend upon the causal or nomic powers it confers on its instances. Rather, the identity of a property is determined by its internal or self-contained nature that is only contingently related to the specific causal or nomic powers it confers on its instances. Obviously, there is a stark contrast between dispositional essentialism and categoricalism, which has inevitably given rise to an enduring debate between the two positions.

It is remarkable that the foremost significance of this debate lies in the fact that categoricalism and dispositional essentialism necessitate diametrically opposing views on laws of nature. Because the property of being negatively charged has the essence characterized in terms of the disposition to attract positively charged particles and repel negatively charged particles, on dispositional essentialism, all actual or merely possible objects that are negatively charged are disposed to attract positively charged particles and repel negatively charged particles. If so, it is not conceptually possible that a negatively charged particle aren't so disposed, entailing that Coulomb's law, which describe how charged particles interact one another, is metaphysically necessary. In general, dispositional essentialists maintain, laws of nature are just universal descriptions of dispositional essences of properties; and they are metaphysically necessary because the truth of them is ensured by the dispositional essences of relevant properties in all possible worlds where those relevant properties exist. Conversely, on categoricalism, the property of being negatively charged has an internal or self-contained essence that doesn't necessitate specific ways in which a negatively charged particle is disposed to interact with other particles. Therefore, it is conceptually possible that a particle has the property of being negatively charged but is not disposed to attract positively charged particles and repel negatively charged particles, which means that Coulomb's law is metaphysically contingent. In general, on categoricalism, the identity of properties isn't determined by how their instances are disposed to act or react, and hence

[a] I believe that Ref. 4 can be best understood to promote the first and strong version of dispositional essentialism. But Armstrong points out that, in person communication, Swoyer has told that he doesn't mean to buy into the strong version of dispositional essentialism that *all* properties are dispositional (Ref. 7, p. 76).

it is perfectly possible that the same set of properties is subject to different laws of nature. It follows from this that, on categoricalism, laws of nature are metaphysically contingent.

In view of the fact that the nature of natural laws is one of key issues in contemporary metaphysics, from what has been said, it is clear that the stake of the debate between dispositional essentialism and categoricalism couldn't be higher. If so, it will be instructive to carefully appraise criticisms the two sides have exchanged so far. Keeping this in mind, in this paper, I will call attention to one crucial criticism which is brought forth against the strong version of dispositional essentialism, i.e., the view that all properties are dispositional, with an eye on the connection between dispositional ascriptions and counterfactual conditionals.

2. Dispositions all the way round?

To begin with, it will be useful to say a word about the conception of dispositional property at work in what follows. Approximately, something has a dispositional property insofar as it would exhibit a certain distinctive manifestation in response to an appropriate stimulus. For instance, salt is water-soluble insofar as it would dissolve in response to being submerged into water. Analogically, metal is electrically conductive insofar as electric current would flow in response to its being connected to an electrical source. But what does it mean to say that something would exhibit a certain distinctive manifestation in response to an appropriate stimulus? According to the simple conditional analysis of dispositions, its meaning can be cashed out in terms of the counterfactual conditional that if it were to undergo an appropriate stimulus, it would exhibit a certain distinctive manifestation. Here, as usual, I will assume the standard Lewis/Stalnaker possible worlds semantics for counterfactual conditionals according to which the truth condition of a counterfactual conditional is given in terms of possible worlds. So conceived, we seem to be able to say that dispositional ascriptions are made true by what is going on in other possible worlds.

This observation has been utilized by some philosophers to make one important criticism against the strong version of dispositional essentialism that all properties are essentially dispositional properties — for short, let us call it 'dispositionalism'. A simplified version of the criticism goes as follows: "Suppose that all properties are dispositional. Then all truths must be dispositional truths. According to the conditional analysis of dispositions, this means that all truths in the actual world are counterfactual truths, and therefore made true by what are true in other possible worlds. But all truths in those possible worlds are again dispositional. Therefore, assuming the conditional analysis of dispositions, they are counterfactual truths, which means that they are made true by what are true in still other possible worlds. This incurs an infinite regress. To avert such an infinite regress, we have to oppose the idea of purely dispositional worlds, namely, dispositionalism".

This criticism, however, is severely challenged by Richard Holton (**1999).[10,b] His basic idea is that if we can construct a finite, coherent model of purely dispositional worlds, this will establish that dispositionalism doesn't necessarily give rise to an infinite regress, and thereby we will be able to rebut the criticism described above. To begin with, Holton observes that it is strictly false to say that, on dispositionalism, all truths in the actual world are made true by what is going on in other possible worlds: "It is only counterfactuals with unactualized antecedents — counterfactuals that really are counter to fact — that are made true by what happens at neighbouring worlds; or to put the point in terms of dispositions, it is only unmanifested dispositional properties that are made true in this way" (Ref. 10, p. 10). Dispositional properties are manifested or not manifested. But, in case of manifested dispositional properties, their stimulus and manifestation conditions are actually satisfied. Therefore, true ascriptions of manifested dispositional properties are analyzed by the simple conditional analysis of dispositions into counterfactual conditionals whose antecedents and consequents are actually true. But, on the standard Lewis/Stalnaker semantics, the truth of a counterfactual conditional is entailed by the truth of its antecedent and consequent. Therefore, on the standard Lewis/Stalnaker semantics, those counterfactual conditionals which are meant to analyze manifested dispositional ascriptions by the simple conditional analysis of dispositions are made true solely by what happens in the actual world. Hence, according to the simple conditional analysis of dispositions, manifested dispositional ascriptions are made true by what is true in the actual world (as opposed to what is true in neighbouring possible worlds).

Based on this observation, Holton argues that we can provide a finite and coherent model of possible worlds where all contingent truths are dis-

[b]The objection explicitly discussed by Holton is due to Ref. 11, p. 64. But similar objections have been advanced by other authors, most recently, by Armstrong (Refs. 7, p. 80; 8, p. 31–33).

positional truths. To be specific, Holton suggests that the following four sentences are dispositional sentences and that it is possible to provide a finite model of possible worlds which are entirely described in terms of them and, at the same time, consistent with their definitions.

$$P =_{df} (R \diamondsuit\!\!\rightarrow S)$$
$$Q =_{df} (S \diamondsuit\!\!\rightarrow R)$$
$$R =_{df} (P \diamondsuit\!\!\rightarrow Q)$$
$$S =_{df} (Q \diamondsuit\!\!\rightarrow P)$$ [c]

Obviously, here Holton assumes the simple conditional analysis of dispositions and hence defines dispositional ascriptions in terms of simple counterfactual conditionals. As we will see, though, even Holton admits that the simple conditional analysis of dispositions, as it stands, is indefensible. Since Holton's key claim is that there is a consistent model of possible worlds where all truths are *dispositional truths*, it will be convenient to have another set of symbols that primarily represent dispositional ascriptions. Let us suppose that '$P*$' primarily represents a dispositional ascription whose characteristic stimulus and manifestation are R and S, respectively. That is, $P*$ is that S is disposed to be the case in response to R's being the case. By the same token, '$Q*$'primarily represents a dispositional ascription whose characteristic stimulus and manifestation are S and R, respectively. That is, $Q*$ is that R is disposed to be the case in response to S's being the case. The same goes for '$R*$'and '$S*$'. Thus understood, P, which is defined to be '$R \diamondsuit\!\!\rightarrow S$', is identified with the dispositional ascription $P*$ by the simple conditional analysis of dispositions. Likewise, Q, which is defined to be '$S \diamondsuit\!\!\rightarrow R$', is identified with the dispositional ascription $Q*$ by the simple conditional analysis of dispositions. The same can be said about R and S.

Holton, in Ref. 10, p. 10, maintains that when we have similarity between possible worlds given by agreement over the four sentences — i.e., P, Q, R, S —, it can be proved that there are four possible worlds which can be entirely characterized by them and their negations and, at the same time, consistent with their definitions. The following diagram represents the four possible worlds and their relations.

[c] It is evident that these definitions are circular. For example, P is defined in terms of R which is in turn defined in terms of P. Holton though goes to great length to argue that this circularity doesn't mar his defence of dispositionalism (Ref. 10, p. 12–13).

$PQRS$
$\bullet\ w1$

$\sim PQR \sim S \quad w2 \bullet \qquad\qquad \bullet\ w3 \quad P \sim Q \sim RS$

$\bullet\ w4$
$\sim P \sim Q \sim R \sim S$

Holton's Model

Here the distance on the page between two points is meant to correspond to the similarity between possible worlds. It is easy to see that P, Q, R and S are true at $w1$; and that $\sim P$, Q, R and $\sim S$ are true at $w2$, and so on. Thus, on the standard semantics for counterfactual conditionals, Holton's four possible worlds are consistent with the definitions of the four sentences. Here it is to be noted that, in Holton's model, some of the counterfactual conditionals and their negations are made true at a possible world solely by what happens at that world. For instance, P, which is defined to be '$R \Diamond\!\!\rightarrow S$', is true at $w1$ in virtue of the fact that R and S are true at $w1$. By the same token, P is false at $w2$ in virtue of the fact that R is true but S is false at $w2$. This reveals that the idea that some of counterfactual conditionals and their negations are true at a possible world solely in virtue of what is going on at that world is at work in Holton's model.

In Holton's model, each of the four worlds is entirely specified by counterfactual conditionals and their negations. For instance, the possible world $w3$ **$w2$?!** is fully specified by the four sentences, $\sim P$, Q, R and $\sim S$. Therefore, Holton's model can be said to offer a set of possible worlds where all truths are counterfactual truths. Moreover, on the assumption of the simple conditional analysis of dispositions, the simple counterfactual conditionals, P, Q, R and S are equivalent to dispositional ascriptions, $P*$, $Q*$, $R*$ and $S*$. From this Holton concludes that his model serves to show that there is a finite, consistent model of possible worlds that are entirely characterized by dispositional ascriptions and their negations; and therefore that the idea that all truths are dispositional truths is not incoherent nor does it lead to an infinite regress.[d] But I will argue below that Holton's conclusion is unjustified.

[d]Holton's argument has been explicitly endorsed by such philosophers as Alexander Bird (**2004,2006?!** Refs. 12, p. 270; 12, p. 506 n4).

3. The problem of random coincidence

It is unquestionable that Holton's four possible worlds are completely described by counterfactual conditionals and their negations. Does this entail that they are completely described by dispositional ascriptions and their negations? Yes if the simple conditional analysis of dispositions is accepted. For clarity, it will be useful to offer an exact formulation of the simple conditional analysis of dispositions:

SCA Something x has the disposition at time t to exhibit manifestation m in response to stimulus s *iff* if x were to undergo s at t, it would exhibit m.

According to SCA, from the fact that there is a consistent class of possible worlds completely characterized by Holton's counterfactual conditionals, P, Q, R, S and their negations, it is deducible that there is a consistent class of possible worlds completely characterized by dispositional ascriptions, P^*, Q^*, R^*, S^*, and their negations.

However, as already mentioned, Holton himself concedes that the simple conditional analysis of dispositions is not fully successful. Referring to Charlie Martin's memorable examples of finkish dispositions,[13] Holton says "any plausible counterfactual analysis of dispositions will have to be more sophisticated than this [SCA]. I hope that the central feature of the account sketched here will remain when we substitute the more sophisticated counterfactuals" (Ref. 10, p. 3 n.3). I agree with Holton that we can defend SCA against Martin's examples in a way that doesn't affect the central features of Holton's argument, which I will not recount here. But I believe that SCA has quite a different kind of defect which can't be repaired without impairing Holton's argument. Indeed I take it that Holton's argument takes advantage of this defect.

One persistent criticism of the simple conditional analysis of dispositions is due to a feature of the standard Lewis/Stalnaker semantics for counterfactual conditionals which is that the truth of the counterfactual conditional that if it were to be the case that F then it would be the case that G is trivially derivable from the truth of F and G. Suppose that I actually twist my left foot and then scratch my right shoulder and that my twisting the left foot has nothing to do with my scratching the right shoulder. Then, according to the simple conditional analysis of dispositions, I am disposed to scratch the right shoulder in response to twisting the left foot because the counterfactual conditional that if I were to twist my left foot I would scratch my right shoulder is trivially true (Refs. 14, p. 393; 15, p. 10–11; 12, p. 159). However, it is preposterous to say that I have the disposition to scratch the right shoulder in response to twisting the left foot. This is what I call 'the problem of random coincidence' for the simple conditional analysis of dispositions.

Here it should be noted that it is also a true counterfactual conditional that if I were not to twist my left foot I would still scratch my right shoulder. Given that my twisting the left foot has nothing to do with my scratching the right shoulder, I would still scratch my right shoulder in the closest possible worlds where I don't twist the left foot. According to the simple conditional analysis of dispositions, this entails that I am disposed to scratch the right shoulder in response to not twisting the left foot. As a consequence, I am both disposed to scratch the right shoulder in response to twisting the left foot and disposed to scratch the right shoulder in response to not twisting the left foot. In general, when it is supposed that F is actually true and utterly unrelated to G, according to the simple conditional analysis of dispositions, F is both disposed to be the case in response to G's being the case and disposed to be the case in response to G's not being the case. That being said, the two dispositions are manifested regardless of whether the corresponding stimuli obtain or not. But this is blatantly counterintuitive. Given that there is no connection whatsoever between F and G, what is more reasonable to say is that F is neither disposed to be the case in response to G's being the case nor is it disposed to be the case in response to G's not being the case.

At this point it might be objected that the problem of random coincidence is not a real problem: "Admittedly we are reluctant to accept that I am disposed to scratch the right shoulder in response to twisting the left foot. But this is just because the dispositional ascription under consideration is not useful to us. Thus there is a pragmatic explanation of why we are inclined to deny the dispositional ascription in question. This means that we can keep the simple conditional analysis of dispositions safe by maintaining that I am indeed disposed to scratch the right shoulder in response to twisting the left foot but this dispositional ascription is not useful in our everyday life. The same can be said about my disposition to scratch the right shoulder in response to not twisting the left foot".

I take it, though, this objection is not acceptable. To be sure, there are some true dispositional ascriptions that are not useful to us. But in those cases we can offer an explanation of why this is so. For instance, a fragile glass is disposed to shatter in response to a far-off sneeze in a circumstance where via a butterfly effect the sneeze would bring about a major disturbance.[e] This, I think, is a true dispositional ascription that is not useful in our everyday life. For under normal circumstance a butterfly effect does not occur, and therefore the characteristic stimulus of the disposition in question does not occur often enough in our everyday life. But when the characteristic stimulus of a disposition D does not occur often enough in our everyday life, there is no pressing need to sort things in terms of D, and hence the true ascription of D is not useful to us. Supposing that, on Mars, butterfly effects frequently occur because of unstable atmosphere, however, it will be of great use to Martians to sort things in terms of the disposition to shatter in response to a far-off sneeze via a butterfly effect.[f] Thus we can offer an explanation of why it is not useful in our everyday life to say that a glass is disposed to shatter in response to a far-off sneeze via a butterfly effect although it is a true dispositional ascription.

However, the same doesn't apply to the cases that give rise to the problem of random coincidence. Should I be indeed disposed to scratch the right shoulder in response to twisting the left foot, there would be no reason why this dispositional ascription is not useful to us. In fact, even if it is supposed that I twist my left foot very often, we will still be loath to say that I am disposed to scratch the right shoulder in response to twisting the left foot. This indicates that the reason why we are inclined to deny the dispositional ascription at issue is not merely that it is not useful.

Furthermore, we firmly believe that the stimulus of a disposition is essential to its manifestation. That is, the stimulus must be necessary to bring about the manifestation. Otherwise, there would be no point of associating dispositional properties with their characteristic stimuli. Therefore, as long as it is true that x is disposed to exhibit a manifestation m in response to undergoing a stimulus s, we are inclined to think that it is not disposed to exhibit m in response to not undergoing s. This is so regardless of whether the dispositional ascription is useful to us or not. For instance, it may be that the disposition to shatter in response to the presence of a far-off sneeze is not useful to us. Nonetheless, we are tempted to say that, if x is disposed to shatter in response to the presence of a far-off sneeze, it is not the case that x is disposed to shatter in response to the absence of a far-off sneeze. But this is not the case for the disposition to scratch the right shoulder in response to twisting the left foot. As already noted,

[e]This example is due to Alexander Bird (Ref. 16, p. 231).
[f]This point is also made in (Ref. 17, p. 578).

according to SCA, I have both the disposition to scratch the right shoulder in response to twisting the left foot and the disposition to scratch the right shoulder in response to not twisting the left foot. I hold that this should be taken to be a telltale sign betraying that there is something wrong with SCA. If so, it is not a profitable move to suggest that both of the dispositional ascriptions at issue are indeed true and that we can explain away our strong inclination to deny them by saying that they are not useful.

In short, the problem of random coincidence is a real problem. When F and G both are true and utterly unrelated to one another, we have every reason to deny that F is disposed to be the case in response to G's being the case. But, on the standard semantics for counterfactual conditionals, SCA says to the contrary, namely, that F is disposed to be the case in response to G's being the case. Therefore, I conclude that SCA must go.[g] I urge, however, that this is exactly where Holton's model goes wrong.

4. What is wrong with Holton's model?

As I said in Section 2, in Holton's model, each of the four worlds is entirely described by counterfactual conditionals and their negations. And, on the basis of SCA, Holton identifies counterfactual conditionals, P, Q, R, and S with dispositional ascriptions, P^*, Q^*, R^*, and S^*, from which he derives that each of the four worlds is entirely described by dispositional ascriptions and their negations. Now that it proves that SCA is crippled by the problem of random coincidence, though, it is doubtful that Holton's reasoning still remains valid.

For example, let us examine what truth value P^*, which is that S is disposed to be the case in response to R's being the case, has at $w1$. Surely, the counterfactual conditional P is true at $w1$. But it has been revealed that the simple conditional analysis of dispositions is in real trouble, which suggests that the truth of a dispositional ascription is not immediately

[g]Strictly speaking, the problem of random coincidence arises from the standard Lewis/Stalnaker semantics for counterfactual conditionals and simple conditional analysis of dispositions combined. This might lead one to think that we shouldn't blame the problem of random coincidence on the simple conditional analysis of dispositions but on the standard Lewis/Stalnaker semantics for counterfactual conditionals. Indeed, with a view to solving the problem of random coincidence, Gundersen gives up the standard Lewis/Stalnaker semantics for counterfactual conditionals, in particular, its thesis that the truth of a counterfactual conditional is implied by the truth of its antecedent and consequent and proposes a modified semantics for counterfactual conditionals.[14,15] But, as I've thrashed out,[18] this is the right way of looking at the matter. I maintain that the blame must be laid squarely on the simple conditional analysis of dispositions.

deducible from the truth of the corresponding simple counterfactual conditional. That is, P^* is not immediately deducible from P. Here it may be pointed out that Holton, in Ref. 10, p. 11, claims that P, which is defined to be '$R \Diamond\!\!\rightarrow S$', is not just stipulated to be true at $w1$ but is 'made true' at $w1$ by the fact that both R and S are true at $w1$. But this makes no difference. P^* is not deducible from the truth of R and S, either. Indeed, we have found above that SCA is inflicted with the problem of random coincidence precisely because SCA validates the inference of the truth of a dispositional ascription from the obtainings of its characteristic stimulus and manifestation. Having said that, we have no reason at all to think that P^* is true at $w1$. Similarly, at $w1$, Q^* is not immediately deducible from Q nor, as revealed by the problem of random coincidence, from the truth of R and S. Hence, we can't justifiably suppose that Q^* is true at $w1$. In general, once we repudiate SCA, we have no good reason to think that dispositional ascriptions are true in Holton's possible worlds in a way that is intended by Holton.

What is more, there is a clear analogy between Holton's model and the case of random coincidence. It is to be observed that '$\sim R \Diamond\!\!\rightarrow S$' is true at $w1$: S would be true in the closest possible world to $w1$ where R is false, namely, at $w3$. If so, on the assumption of SCA, we are forced to say that it is true at $w1$ that S is disposed to be the case in response to R's not being the case. Then it follows that, on the assumption of SCA, at $w1$, S is both disposed to be the case in response to R's being the case and disposed to be the case in response to R's not being the case. We can get the same result for other sentences at $w1$. For instance, '$\sim S \Diamond\!\!\rightarrow R$' is true at $w1$: R would be true in the closest possible world to $w1$ where S is false, namely, at $w2$. But Q, which is defined to be '$S \Diamond\!\!\rightarrow R$', is also true at $w1$. Therefore, assuming SCA, at $w1$, R is both disposed to be the case in response to S's being the case and disposed to be the case in response to S's not being the case. And much the same can be said about the sentences that are true in other possible worlds. For example, Q, which is '$S \Diamond\!\!\rightarrow R$', is true at $w2$. But '$\sim S \Diamond\!\!\rightarrow R$' is true at $w2$ as well: R would be true in the closest possible world to $w2$ where S is false, namely, at $w2$. Hence, given that SCA is accepted as an adequate analysis of dispositions, at $w2$, R is both disposed to be the case in response to S's being the case and disposed to be the case in response to S's not being the case.

But this is precisely what happens in the case of random coincidence: on the simple conditional analysis of dispositions, I am both disposed to scratch the right shoulder in response to twisting the left foot and disposed to scratch the right shoulder in response to not twisting the left foot. And, as I have argued earlier, this is just an inauspicious consequence of the simple conditional analysis of dispositions which we should consider as a ground for reductio ad absurdum against the simple conditional analysis of dispositions. So much worse for Holton's model as it crucially relies on the simple conditional analysis of dispositions. Note further that I've argued earlier that what is reasonable to say in the case of random coincidence is that I am neither disposed to scratch the right shoulder in response to twisting the left foot nor disposed to scratch the right shoulder in response to not twisting the left foot. In view of the parallelism between Holton's model and the case of random coincidence, what is reasonable to say in Holton's model is that, for example, at $w1$, S is neither disposed to be the case in response to R's being the case nor disposed to be the case in response to R's not being the case. As a consequence, we not only have no reason to think that P^* is true at $w1$ but also we has a good reason to think that P^* is false at $w1$. In general, whenever, in Holton's model, the simple conditional analysis dispositions entails that A is both disposed to be the case in response to B's being the case and disposed to be the case in response to B's not being the case, what is more reasonable to say is that A is neither disposed to be the case in response to B's being the case nor disposed to be the case in response to B's not being the case. As a consequence, we may well maintain that none of P^*, Q^*, R^* and S^* is true at $w1$. But this is far from what Holton wants to say about his model. From this I come to the conclusion that, once the problem of random coincidence for SCA is recognized, Holton is not entitled to claim that his model exemplifies a consistent set of possible worlds that are entirely characterized by dispositional ascriptions and their negations in a way intended by him.

What if we improve SCA in such a way that it gets around the problem of random coincidence? Recall that Holton's reasoning is that P^* is made true at $w1$ by the truth of P which is in turn made true at $w1$ by the truth of R and S. But this reasoning relies on the very feature of the simple conditional analysis of dispositions from which the problem of random coincidence arises. If so, there is no guarantee that, when we revise the conditional analysis of dispositions in a way that solves the problem of random coincidence, the central feature of Holton's reasoning can be preserved. In fact, I suspect that such a revision will annul Holton's reasoning not least because, in order to solve the problem of random coincidence, we need to modify the very feature of the simple conditional analysis of dispositions on which Holton's model is built. To illustrate this point, it will be useful to consider one promising solution to the problem of random coincidence.[h]

Very plausibly, it may be suggested that we can solve the problem of random coincidence by adding to the analysans of SCA the causal requirement that the stimulus would cause the manifestation. This idea has been flirted with by many philosophers of dispositions such as Molnar (Ref. 20, p. 2), Armstrong (Ref. 7, p. 72) and Bird (Ref. 16, p. 233). Indeed, Lewis has incorporated this idea into his analysis of dispositions — although he does so for other reasons than to solve the problems of random coincidence.[21] For the present purpose, it will be fine to discuss the simplest way of incorporating the causal requirement into the simple conditional analysis of dispositions:

CCA Something x has the disposition at time t to exhibit manifestation m in response to stimulus s *iff* if x were to undergo s at t, s would cause x to exhibit m.

Unlike SCA, CCA requires that the stimulus would *cause* the manifestation. It is easy to see that CCA has no troubles in handling the case of random coincidence. Let us consider the case of random coincidence where I actually twist my left foot and then scratch my right shoulder. In this case, my twisting the left foot doesn't cause me to scratch my right shoulder. Then, according to CCA, I am not disposed to scratch the right shoulder in response to twisting the left foot. Also, I am not disposed to scratch the right shoulder in response to not twisting the left foot because if I were not to twist my left foot, this wouldn't cause me to scratch my right shoulder albeit I would still scratch my right shoulder. What if we suppose that my twisting the left foot actually causes me to scratch my right shoulder? Then CCA delivers the verdict that I am disposed to scratch the right shoulder in response to twisting the left foot. But this result is not counterintuitive at all, as can be seen from the fact that, in this case, there is a strong inclination to say that I am indeed so disposed. As a result, I

[h]Recently, the problem of random coincidence has been attracting attentions from some philosophers of dispositions. For instance, Malzkorn, in Ref. 19, p. 463, claims that we can solve the problem of random coincidence by adding to the analysans of SCA the additional requirement that, to a first approximation, if x were not to exhibit manifestation m, it would not undergo the stimulus s. Meanwhile, Gundersen,[14,15] as noted earlier, argues that we can solve the problem of random coincidence by modifying the standard Lewis/Stalnaker semantics for counterfactual conditionals. I think though that neither of Malzkorn's and Gundersen's attempts is successful. For my extended discussion on this issue, see Ref. 18.

believe that CCA is not troubled by the problem of random coincidence. Of course, this doesn't mean that CCA is a perfectly adequate account of dispositions.[i] Nonetheless, CCA is undoubtedly a good attempt to solve the problem of random coincidence.

In Section 2, we have seen that, based on the idea that, according to SCA, dispositional ascriptions are made true at a possible world by what is going on in neighbouring possible worlds, some philosophers have presented the charge of infinite regress against dispositionalism that all properties are dispositional properties. It should be noted that, with CCA in place of SCA, much the same can be done. This is because, just like SCA, CCA analyzes dispositional ascriptions in terms of counterfactual conditionals. This means that, even if CCA is substituted for SCA, dispositionalism is still under the threat of infinite regress. If so, it will be an interesting question whether the central feature of Holton's defence of dispositionalsim can be preserved under the substitution of CCA for SCA.

On the assumption of CCA, we can define P, Q, R and S in a way that is analogous to Holton's definitions:

$$
\begin{aligned}
&P =_{df} (R \Diamond\!\!\rightarrow (R \text{ causes } S))\\
&Q =_{df} (S \Diamond\!\!\rightarrow (S \text{ causes } R))\\
&R =_{df} (P \Diamond\!\!\rightarrow (P \text{ causes } Q))\\
&S =_{df} (Q \Diamond\!\!\rightarrow (Q \text{ causes } P))
\end{aligned}
$$

As with Holton's model, let us consider possible worlds specified by the four sentences P, Q, R, S and their negations. Some of the possible worlds are incompatible with the above definitions. First, the apparently possible worlds where one of the four sentences is false but the rest of them are true are inconsistent with their definitions. For example, let us consider the apparently possible world where P, Q and R are true but S is false. Given that R is true, P is true *iff* it is true that R causes S. But S is supposed to be false. And unless both A and B are true, it is not true that A causes B. That is, 'A causes B' is true only if both A and B are true. Since S is false, it is false that R causes S, which is inconsistent with the supposition that P is true. Therefore, there is no possible world where P, Q and R are true but S is false. Much the same reasoning applies to other apparently possible worlds where one of the four sentences is false but the rest of them are true. Second, not all but some apparently possible worlds where two of the four sentences are true but the rest of them are false are

[i]In fact, I think that CCA is not fully acceptable, which I have argued in Ref. 18.

inconsistent with their definitions. For example, there is no possible world where P and R are true but Q and S are false. This is because, according to their definitions, if P and R are true, S must be true as well. The same can be said about the apparently possible world where Q and S are true but P and R are false.

To sum up, there are ten possible worlds that are completely described by the four sentences and their negations and, at the same time, individually consistent with their definitions:

$w1$ at which P, Q, R, S are true
$w2$ at which $\sim P$, $\sim Q$, R, S are true
$w3$ at which P, Q, $\sim R$, $\sim S$ are true
$w4$ at which P, $\sim Q$, $\sim R$, S are true
$w5$ at which $\sim P$, Q, R, $\sim S$ are true
$w6$ at which P, $\sim Q$, $\sim R$, $\sim S$ are true
$w7$ at which $\sim P$, Q, $\sim R$, $\sim S$ are true
$w8$ at which $\sim P$, $\sim Q$, R, $\sim S$ are true
$w9$ at which $\sim P$, $\sim Q$, $\sim R$, S are true
$w10$ at which $\sim P$, $\sim Q$, $\sim R$, $\sim S$ are true

Note that the truth of P and R necessitates that R causes S, the truth of Q and S necessitates that S causes R, and so on. If so, all of 'P causes Q', 'Q causes P', 'R causes S', and 'S causes R' are true at $w1$. Conversely, all of 'P causes Q', 'Q causes P', 'R causes S', and 'S causes R' are false at $w2$. 'P causes Q' is false at $w2$ since P and Q are false at $w2$. For the same reason, 'Q causes P' is false at $w2$. And, according to the definition of P, 'R causes S' is false at $w2$ since R is true but P is false at $w2$. By the same token, according to the definition of Q, 'S causes R' is false at $w2$ since S is true but Q is false at $w2$. As a result of this, all of the four causal sentences are false at $w2$. By applying similar reasoning to other possible worlds, it can be demonstrated that, for each possible world except for $w1$, all of 'P causes Q', 'Q causes P', 'R causes S', and 'S causes R' are false.

Here again let us assume that similarity between possible worlds is determined by agreement over the four sentences. Then $w10$ is equally similar to $w6$, $w7$, $w8$, and $w9$; and $w10$ is more similar to $w6$ than to $w2$, and so on. It is easy to recognize that this time the model created by the ten possible worlds is not consistent on the standard Lewis/Stalnaker possible world semantics for counterfactual conditionals. Let us consider the possible world $w2$ where R, which is defined to be '$P \Diamond\!\!\rightarrow (P \text{ causes } Q)$', is true. There are two closest possible worlds to $w2$ where P is true. They are $w1$

and $w4$. But 'P causes Q' is false at $w4$. Hence, it is not the case that 'P causes Q' is true in all closest possible worlds to $w2$ where P is true. Then it follows that, on the standard semantics for counterfactual conditionals, '$P\Diamond \rightarrow (P$ causes $Q)$' is false at $w2$, which contradicts the supposition that R is true at $w2$. What about the sentence S that is supposed to be true at $w2$? Recall that S is defined to be '$Q\Diamond \rightarrow (Q$ causes $P)$'. There are two closest possible worlds to $w2$ where Q is true. They are $w1$ and $w5$. But 'Q causes P' is false at $w5$. If so, it is not the case that 'Q causes P' is true in all closest possible worlds to $w2$ where Q is true. As a consequence, on the standard semantics for counterfactual conditionals, '$Q\Diamond \rightarrow (Q$ causes $P)$' is false at $w2$, which doesn't agree with the supposition that S is true at $w2$. We can get the same result for other possible worlds. For instance, consider the possible world $w6$ where P is true. Recall that P is defined to be '$R\Diamond \rightarrow (R$ causes $S)$'. Then what is the closest possible world to $w6$ where R is true? It is $w8$. But, 'R causes S' is false at $w8$, which is to say that, on the standard semantics for counterfactual conditionals, '$R\Diamond \rightarrow (R$ causes $S)$' is false at $w6$. Again, this is at odds with the supposition that P is true at $w6$.

As I said earlier, there are ten possible worlds which are entirely described in terms of the four sentences P, Q, R and S and individually consistent with their definitions. And, it has come to light that the model consisting of all of them isn't consistent on the Lewis/Stalnaker semantics for counterfactual conditionals. It is to be recognized, though, that we don't have to use all of the ten possible worlds to construct a candidate for finite and consistent models of purely dispositional worlds. That is, we can only use some of them with a view to constructing such a candidate. For example, one might consider the following selection of possible worlds:

$w1$ at which P, Q, R, S are true
$w2$ at which $\sim P$, $\sim Q$, R, S are true
$w5$ at which $\sim P$, Q, R, $\sim S$ are true
$w10$ at which $\sim P$, $\sim Q$, $\sim R$, $\sim S$ are true

These four possible worlds form a model that is much more likely to be consistent on the Lewis/Stalnaker semantics than the one formed by all of the ten possible worlds. For example, unlike the second, the first has no problem with the truth of R at $w2$. R, which is defined to be '$P\Diamond \rightarrow (P$ causes $Q)$', is true at $w2$. This time there is only one closest possible world to $w2$ where P is true, which is $w1$. But 'P causes Q' is true at $w1$. Then it follows that, on the standard semantics for counterfactual conditionals,

'$P \Diamond\!\!\rightarrow (P$ causes $Q)$' is true at $w2$, which is in line with the supposition that R is true at $w2$. The same reasoning applies to the truth of R at $w5$. Also, we have satisfying results for $w10$. P, which is defined to be '$R \Diamond\!\!\rightarrow (R$ causes $S)$', is false at $w10$. And $w2$ and $w5$ both are the closest possible worlds to $w10$ where R is true. But, in both worlds, 'R causes S' is false, which means that it is not the case that 'R causes S' is true in all closest possible worlds to $w10$ where R is true. If so, on the Lewis/Stalnaker semantics, '$R \Diamond\!\!\rightarrow (R$ causes $S)$' is false at $w10$, which in agreement with the supposition that P is false at $w10$.

Unfortunately, however, it doesn't take much time to see that the model at issue eventually fails. S, which is defined to be '$Q \Diamond\!\!\rightarrow (Q$ causes $P)$', is true at $w2$. There are two closest possible worlds to $w2$ where Q is true. They are $w1$ and $w5$. But 'Q causes P' is false at $w5$. Then it follows that it is not the case that 'Q causes P' is true in all closest possible worlds to $w2$ where Q is true. If so, on the Lewis/Stalnaker semantics, '$Q \Diamond\!\!\rightarrow (Q$ causes $P)$' is false at $w2$, which clashes with the supposition that S is true at $w2$. We can have the same result for the truth of Q at $w5$. Then we are led to the conclusion that the four possible worlds, $w1$, $w2$, $w5$, and $w10$, fail to form a finite and consistent model of purely possible worlds on the Lewis/Stalnaker semantics for counterfactual conditionals.

What about other selections from the ten possible worlds? A little thought reveals that the only consistent model is the one composed solely of $w1$. Note though that $w1$ is a possible world where all dispositional properties are manifested. But *unmanifested dispositions* are the main source of trouble for dispositionalism which most critics cast doubt on. Therefore, unless those critics are offered a finite model where truth values are consistently assigned to unmanifested dispositions, they won't withdraw the charge of infinite regress described in Section 2. Once this is seen, we can justifiably say that the fact that $w1$, by itself, generates a finite and consistent model for dispositionalism doesn't in the least suffice to expunge our misgiving that underlies the charge of infinite regress against dispositionalism.

To recapitulate, I've argued that the problem of random coincidence is a real problem for SCA and tentatively proposed CCA as a revision on SCA. And, based on CCA, I have defined four dispositional ascriptions which are analogous to those discussed by Holton. But it has been brought to light that the model of possible worlds generated by these four dispositional ascriptions is not consistent on the standard Lewis/Stalnaker possible world semantics for counterfactual conditionals. This naturally leads to the conclusion that the central feature of Holton's defence of dispositionalism can't be upheld when the simple conditional analysis of dispositions is so improved as to overcome the problem of random coincidence.

5. A concluding remark

Holton's model successfully exemplifies a set of possible worlds each of which is completely described by simple counterfactual conditionals and their negations. But it fails to exemplify a set of possible worlds each of which is completely described by dispositional ascriptions and their negations as the simple conditional analysis of dispositions is mistaken. What is more, it is unlikely that we can materialize the driving idea of Holton's model on a revised version of the conditional analysis of dispositions that would be free from the problem of random coincidence. This brings us to the conclusion that dispositionalism has yet to be cleared of the charge of infinite regress.

Finally, it is remarkable that the failure of Holton's defence of dispositionalism teaches us one important lesson about the methodology of philosophy. The key question is whether or not all properties are essentially dispositional. This is primarily an ontological question in that it concerns what exist in the world independently of our mind. As discussed earlier, some philosophers answer in the negative by arguing that the idea of purely dispositional worlds results in an infinite regress. Holton, though, counters this argument by claiming that it is possible to construct a finite, coherent model of purely dispositional worlds. Here it is important to realize that this ontological debate presupposes a rough and ready conceptual understanding of what we mean by saying that a property is dispositional. More specifically, both sides of the debate, explicitly or implicitly, seem to agree that, to a first approximation, when we are talking about dispositional properties, we mean simple counterfactual conditionals. Without such a conceptual understanding, it would be hard to make sense of what this ontological debate is all about. Indeed, I believe that, in most areas of philosophy, we need to address conceptual questions before being able to embark on ontological questions properly (Refs. 22, p. 415; 23, p. 758**Mellor2000**).

What is suggested by this point is that, should our rough and ready conceptual understanding of dispositions prove to be mistaken, we couldn't rule out the possibility that the entire debate has got lost. Unfortunately, I take it, this is the case for Holton's defence of dispositionalism. In defending dispositionalism from the charge of infinite regress, Holton tentatively assumes the simple conditional analysis of dispositions for the purpose of making sense of what a dispositional property is. But, as it turns out, the simple conditional analysis of dispositions is mistaken in such a way that Holton's defence of dispositionalism is completely misdirected. The methodological lesson to be drawn from this is that it is always hazardous to carry out ontological investigations in the absence of a proper understanding of relevant concepts; and therefore that it is vital to have a proper understanding of relevant concepts in order to keep ontological investigations on the right track.

Acknowledgments

I've got my Ph.D in the philosophy of science from Seoul National University. My Ph.D dissertation focuses on how to spell out causation in terms of a particular type of dispositional property within the framework of the conserved quantity theory of causation. My research has been dedicated to causation and dispositions ever since. I was teaching at the Department of History and Philosophy of Science, University of Cambridge, UK. Now I am working as a HASS research fellow at the Centre for Time, Department of Philosophy, University of Sydney, Australia. And, I will be teaching at the Departement of Philosophy, Queen's University, Canada, from July 2007 onwards.

References

1. S. Shoemaker, Causality and Properties. In S. Shoemaker, *Identity, Cause, and Mind*. Cambridge: Cambridge University Press (1980).
2. K. Popper, *The Logic of Scientific Discovery*. London: Hutchinson (1959).
3. A. Bird, Nature's Metaphysics: Dispositions, Laws and Properties (manuscript). (Available online: `http://eis.bris.ac.uk/\simplajb/research/Natures-Metaphysics.pdf`).
4. C. Swoyer, The Nature of Natural Laws. *Australasian Journal of Philosophy* **60**, 203–223 (1982).
5. G. Molnar, *Powers*. Oxford: Oxford University Press (2003).
6. B. Ellis and C. Lierse, Dispositional Essentialism. *Australasian Journal of Philosophy* **72**, 27–45 (1994).
7. D. M. Armstrong, *A World of States of Affairs*. Cambridge: Cambridge University Press (1997).
8. D. M. Armstrong, The Causal Theory of Properties: Properties according to Shoemaker, Ellis, and Others. *Philosophical Topics* **26**, 25–37 (1999).
9. D. M. Armstrong, Four Disputes about Properties. *Synthese* **144**, 309–320 (2005).

10. Richard Holton,** (1999)**.
11. S. Blackburn, Filling in Space. *Analysis* **50**, 62–65 (1990).
12. A. Bird, Structural Properties. In: H. Lillehammer and G. Rodriguez–Pereyra (Eds.), *Real Metaphysics: Essays in Honour of D.H. Mellor*. London: Routledge, 154–168 (2003).
13. C. Martin, Dispositions and Conditionals. *The Philosophical Quarterly* **44**, 1–8 (1994).
14. L. Gundersen, In Defence of the Conditional Account of Dispositions. *Synthese* **130**, 389–411 (2002).
15. L. Gundersen, Outline of a New Semantics for Counterfactuals. *Pacific Philosophical Quarterly* **85**, 1–20 (2004).
16. A. Bird, Dispositions and Antidotes. *The Philosophical Quarterly* **48**, 227–234 (1998).
17. S. Choi, Improving Bird's Antidotes. *Australasian Journal of Philosophy* **81**, 573–580 (2003).
18. S. Choi, Revising the Conditional Analysis of Dispositions (manuscript).
19. W. Malzkorn, Realism, Functionalism and the Conditional Analysis of Dispositions. *The Philosophical Quarterly* **50**, 452–469 (2000).
20. G. Molnar, Are Dispositions Reducible? *The Philosophical Quarterly* **49**, 1–17 (1999)
21. D. Lewis, Finkish Dispositions. *The Philosophical Quarterly* **47**, 143–158 (1997).
22. D. Lewis, Reduction of Mind. In S. Guttenplan (Ed.), *A Companion to the Philosophy of Science*. Oxford: Blackwell, 413–431 (1994).
23. D.H. Mellor,** (2000)**.