The Power of Powers: Dispositions, Essences, and Laws of Nature

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Abstract

This thesis aims to articulate a dispositionalist theory of possibility.

The standard way of explaining possibility, and modality in general, is by reference to possible worlds. At the same time, discontentment with possible worlds and their role in the metaphysics of modality has been present in the literature at least since Kripke. The later years this scepticism towards possible worlds has been voiced by a group of philosophers known as 'new actualists'. They generally support a view of modality *not* based upon possible worlds while displaying a more positive attitude towards concepts like *dispositions*, *powers*, and *potentials*. My project shares this attitude towards the metaphysics of modality, and the aim of this thesis is to explain modality, particularly possibility, by referring to this world only. That is, I will ask what, in the *actual* world, substantiate the truth of modal claims.

The solution defended in this thesis, *dispositional essentialism*, takes as a starting point a particular subset of dispositional properties. I refer to these properties as *powers*, or *dispositional essences*, and they are defined as sparse, fundamental properties which are essentially dispositional—and electrical charge can serve as a good example. There are two positive aspects of assuming powers to be existing. Firstly, we get an account of property identity at the fundamental level. We may say that the distinction between what these fundamental properties *are* and what they *do* is removed, so what it is to be a certain property becomes equivalent with what it is *disposed to do*. Thus, the dispositionality present in the world goes 'all the way down' to the most fundamental level where there is no further structure to appeal to. There is no need to ground dispositions in 'respectable categorical properties', because dispositions are respectable entities in themselves.

Secondly, this account of fundamental properties yields automatically an account of the laws of nature. The fundamental laws are now grounded in the essential relations between fundamental properties. This means that we, by assuming powers to be a part of our ontology, gain an account of laws which is more parsimonious than what the competing views offer, since these competing views will need an account of laws *in addition to* an account of fundamental properties. Assuming powers to exist gives us both of these things at once.

However, another consequence of assuming powers to exist is that relations between fundamental properties will have to be seen as necessary, because these relations are given

by the *essences* of these properties—they *could not have been* different. This entails one particularly important consequence for the accounts of laws based upon powers: the laws of nature will have to be seen as absolutely, *metaphysically*, necessary. This, in turn, influences what is deemed possible, since what is possible is limited by the laws of nature. Hence, in my account the domain of the possible is radically diminished, as compared to other accounts of possibility and the laws. This is generally perceived as a problem for the dispositional essentialist, because it collides with our intuition that the laws of nature are contingent, and that happenings going beyond the laws of nature, *metaphysically* could happen. That is, we may say that, for the dispositional essentialist, the metaphysical modalities collapse into the nomic. Our grounding of possibility in the properties of the actual world gives us a domain of the possible which is consistent with the laws of nature. We do not have grounding for possibilities going beyond this; there is nothing *in the world* in which these alleged possibilities may be grounded.

Thus, we see that the dispositional essentialist view of the fundamental properties of the world is radically different—particularly when it comes to the idea of nomic change—from views advocated by defenders of Humean supervenience. We can get a rough idea of this difference by considering the following illustration. Humean accounts of fundamental properties are often visualised by speaking of the 'Humean mosaic'. Yet, as I shall argue, the powers theorist can in a similar fashion speak of the *'dispositional essentialist web'*. These metaphors make the difference between the two views especially clear. Where the removal of a tile in a complex mosaic floor might lead to minuscule change, perhaps not even noticeable, removing a thread from a web has a much more dramatic effect; the web *unravels*.

If we accept that possibility and the laws of nature are closely related in the way I described, this gives us a third reason to assume powers to be existing. Powers will—through their capacity to determine the laws of nature—also constrain possibility. Accounts of possibility in terms of *dispositions* have become popular lately, but I hold that some of the assumptions made by some of the proponents of these accounts—such as the expectation that dispositional accounts of possibility can deliver genuine possibilities going beyond the laws of nature—are problematic. Thus, we are better off by explaining possibility by referring to *powers* and not *mere dispositions*. However, an account of possibility in terms of *dispositional essences* will perhaps seem less impressive than a more general dispositional account of possibility, since it is not able to directly explain each and every possibility in the world. However, I argue that we will have to settle for an explanation of what *generates* possibility. The hope is still that such an account of property identity, laws of nature, and possibility will fare better than any competing view, because of its parsimony and its closer connection with science.

Finally, we need to note that because of the discrepancies between our intuitions about the laws of nature on the one hand, and the view advocated by the dispositional essentialist

on the other (who holds these laws to be necessary), accepting dispositional essentialism entails that we need to defend our distrust of intuitions in this case. Hence, an additional aim of my thesis is to show that the necessity of the laws of nature is not a *'bug'*, but rather an *attractive feature* of dispositional essentialism.

Contents

Chapter 1

Leaving possible worlds behind

1.1 Introduction

This thesis is a defence of *dispositional essentialism*—roughly speaking the idea that the fundamental properties of the world are essentially dispositional—and in the subsequent chapters I will argue the following.

1. Possible worlds provide an unsatisfactory account of modality, including the modal features of properties.

2. The appeal to possible worlds should be replaced with *dispositional essentialism* as the main metaphysical position explaining the modal features of the world.

3. Following this, I argue that the laws of nature—given by the dispositional essences of fundamental properties—limit the domain of what is possible.[1] Although dispositional essentialism is not meant to tell us *which* things are possible, we can get an understanding of the modal limitations that are at play, and as such figure out *under which conditions* something is possible. Bearing in mind that the laws of nature are grounded in *essences*, accepting dispositional essentialism entails that the laws of nature are not only physically but *metaphysically necessary*.

This introductory chapter of the thesis will proceed as follows. In section 1.2 I will address some overarching research questions in the metaphysics of modality, focusing on which problems we aim to solve and which theoretical methods we have available. I will in particular give a criticism of the framework based upon possible worlds. I will focus mainly on the role played by possible worlds in modal logic and metaphysics, deeming the

[1] Laws of nature are one of the most important topics in this thesis, but it is critical that we do not make the mistake of thinking that the laws discussed are coextensive with the laws found in contemporary science. These scientific laws can be revised, proven wrong, or be inaccurate in some way or another, but this is not the case for the genuine laws of nature. These are the laws we *through science* strive to discover and understand. Thus, I place myself in the landscape of *naturalism*, but my views here, while informed by current scientific practice, are not limited by it.

first use legitimate and the second highly questionable. Thereafter, I will present some of the problems that possible worlds were meant to solve, as well as some of the problems created by their introduction. Both what may be referred to as 'genuine modal realism' and 'actualism' about possible worlds are problematic, but I will *mainly* target the problems faced by the actualistic interpretations of possible worlds. I suggest that it is advisable, firstly, to leave possible worlds as *an important metaphysical entity* behind, and, secondly, to support an understanding of modality in terms of *dispositions*.

In section 1.3 I will present the alternative conception of modality based upon dispositional features existing in the actual world. I will address certain challenges tied to the conceptual apparatus which has hitherto been used in this field, as well as narrowing down the vocabulary I will use in the thesis. I will also distinguish between different kinds of dispositionality, as there are several options available. Generally speaking, I will give my support to dispositional essentialism, an account which specifically focuses on the essences of fundamental *properties* rather than the more general dispositions of *objects*.

Section 1.4 presents the plan for the rest of the thesis.

1.2 Possible worlds

1.2.1 Metaphysics of modality

At its core, the metaphysics of modality is about the following question: *what makes modal claims true?* The goal of my project is to find what *in the actual world* witnesses the truth of modal claims, that is, claims including operators such as *possible, necessary, can*, and *must*, such as 'It is not possible to travel faster than light', or 'I could have been a dancer.' In what follows this will be limited mainly to the question of what makes something possible. This includes related queries such as what limits the domain of the possible, or what makes claims of possibility true. This perspective, focusing on finding truthmakers for modal claims among what exists in the world is a relatively recent development, but it is implicit in earlier debates too, e.g. in the modal actualism we find in the work of Saul Kripke.[2] The view I will argue for in this thesis carries with it a commitment to some kind of realism about modality, going *beyond* the actualism of Kripke. The modal features of the world are thought of as *real* features, not something to be explained *away*, but something we should embrace.[3]

We can think of the metaphysics of modality as an attempt to account for, in a systematic way, the basic properties of the world. This is the underlying metaphysical structure

[2]Particularly Kripke (1981)

[3]We can take the following formulation from Lewis (1970, p. 175) as an example of explaining modality *away*: "Given an obscure modal argument, we can translate it into a nonmodal argument (...) Once we have a nonmodal argument, we have clear standards of validity; and once we have nonmodal translations of the premises, we can understand them well enough to judge whether they are credible."

of the world which grounds all its modal features, that is, the features of the world which enable us to make modal claims in ordinary discourse with the conviction that they make reference to something *real*.[4] A different, but related, question is how we can come to *know* something about the truth of modal claims. This latter epistemic question is undoubtedly important, but it is not one which will primarily be discussed in my thesis, which will mainly be a metaphysical endeavour, rather than an epistemic one.[5]

The most widely known and commonly accepted explanation of modality has been through the concept of *possible worlds*. I have already stated that I find the possible worlds centred understanding of modality unsatisfactory, but in order to see why this is the case, we need to know what the possible worlds are set to explain; more precisely, which role they are seen to play, and what problems appear if we choose to go down this well-travelled path.

1.2.2 Leibnizian biconditionals

The background for much of the metaphysics of modality, particularly in the 20th century, has been the Leibnizian biconditionals, named after Leibniz's postulation that God chose the best of all possible worlds.[6] With these biconditionals as a starting point, we explicitly tie the concepts of possibility and necessity to the idea of a plurality of possible worlds, so that what is assumed to be basic modal concepts can be defined in *non-modal terms* as follows:

- Something is *possible* if and only if it is the case at *some* possible world
- Something is *necessary* if and only if it is the case at *all* possible worlds.

Starting with these two biconditionals, we are able to define both contingency and impossibility in similar fashions. Something is contingent if and only if it is the case at some worlds but not at others, and something is impossible if and only if it is not the case at any possible world. Thus, by doing this we explain, or perhaps even remove, the problematic modal notions of possibility and necessity. We replace them with something categorical, and postulate the existence of these categorical entities or categorical truths across possible worlds.[7]

[4]The term 'grounding' used in a more technical way has become popular in later years. I do not enter into this debate, and when I use this word, I simply mean to address a relation where something is the foundation or explanatory base of something else. See (Maurin, 2019) for a discussion of the relationship between grounding and metaphysical explanation.

[5]I will, however, discuss questions tied to conceivability and intuitions in chapter 7. For an introduction to the epistemology of modality, see (Vaidya, 2016).

[6](Leibniz, 1985, p. 67)

[7]Again, Lewis (1970, p. 175) may serve as an example of this kind of attitude towards the modal notions: "Philosophy abounds in troublesome modal arguments—endlessly debated, perennially plausible, perennially suspect. The standards of validity for modal reasoning have long been unclear; they become clear only when we provide a semantic analysis of modal logic by reference to possible worlds and to possible things."

Possible worlds as a philosophical tool have been useful in many ways, and they still are—particularly in modal logic. But we need to untangle where the concept is of use, and where it is not, as well as which roles possible worlds are justified in having in our explanations. We also need to clarify what job exactly the concept is supposed to be doing. Are such possible worlds meant to be solely a formal device, or can they provide more substantial explanations as part of a conceptual analysis? Extending the importance of possible worlds beyond their role as a formal tool is often seen as problematic, and Robert Stalnaker notes the following:

> In both formal and philosophical discussions of modality, the concept of a possible worlds has shown itself to have considerable heuristic power. But, critics have argued, a heuristic device should not be confused with an explanation.[8]

And, following this, it is claimed that if possible worlds are to be more than heuristic aids in modal logic, the concept *itself* must be both explained and justified. This is the predominant story in much of the literature on the development of possible worlds, and the roles they may be seen to have. The possible worlds have proven fruitful as long as its use as a formal model is concerned, but as soon as their use goes beyond this formal role, the concerns regarding the ontological status of the possible worlds that make up this framework becomes prominent.[9]

In relation to this, I will argue that possible worlds can be said to have *at least* three different roles, as follows:

1. Possible worlds may be employed in modal logic as a formal tool with a semantic function.

2. Possible worlds can give a conceptual analysis of what modality is.

3. Possible worlds may be used as truthmakers for modal claims.

Each of these claims demands a more ontologically substantial role for the possible worlds than the former, and I will argue that these roles are largely independent of each other. It is for example clear that possible worlds can provide an informative conceptual analysis of modality, and that this is seen as something which will enlighten our views of modality. For a traditional conceptual analysis to be seen as successful, however, it should match up with the intuitions we have about the concepts at hand.[10] Even though I argue that we should be sceptical of this role being given to intuitions, it is still possible to agree that possible worlds give us some kind of picture, or story, which is illuminating.

[8] Stalnaker (1976, p. 65)

[9] An example of this way of presenting the story of the possible worlds is found in (Marmodoro and Mayr, 2019, p. 112).

[10] Margolis and Laurence (2019) specify that 'matching up' with intuition is seen as problematic for example by philosophers of a naturalistic persuasion, as they would want for philosophy not to rely on intuitions in this way, and rather be continuous with science.

At the same time, even though we might find possible worlds useful as a heuristic device, it is not given that we at the same time agree that they provide *truthmakers* for modal claims. Still, we see that modal claims *are* in need of truthmakers, and that possible worlds can be viewed as a provider of this. Regarding this latter role we have to ask the following: Firstly, whether possible worlds can do this job in a satisfactory way. Secondly, whether we have good reason to assume that they can play this part. In addition we might want to ask whether there are better candidates for the job available.

It is particularly pressing to stress, as hinted at above, that these different roles are not automatically connected to each other. The fact that something may be a useful formal tool is not *in itself* a good enough argument for it also being introduced into metaphysical explanations. And, subsequently, if we think possible worlds provide a good conceptual analysis of modality, this is also not an argument for them *thereby* being truthmakers for modal claims.[11] In addition it should be mentioned that we can also question whether possible worlds provide a *good* conceptual analysis at all. Even though we are able to replace modal talk with pictures or stories about worlds—which are easier for us to grasp—this does not entail that the conceptual analysis is correct.

This means that arguing that possible worlds should be used in certain ways, e.g. as a formal tool, is not automatically an argument for them being used in other ways as well. This point is of utmost importance for my thesis, as I do not aim to rob the possible worlds of all philosophical use. However, I aim to gain a more adequate picture of the modal features of the world, and this, I argue, entails removing possible worlds as the central concept in this context.

Arguing, as I am about to do, that possible worlds should not play the role they have been set to play in contemporary philosophy is no small task. Explanations of modality in terms of possible worlds have been the standard story we tell as philosophers—it is what we teach our undergraduates. Possible worlds is a concept which is deeply ingrained in theoretical philosophy. This means that if we aim to dispose of the possible worlds' role as an important entity in metaphysical explanations, we should have good reason to do so. This requires explaining the usefulness of the concept, which subsequently requires a closer look at the use we currently put the concept to. It is this task we now turn our attention to.

1.2.3 How did the notion of a possible world become so important?

1.2.3.1 Possible worlds and their role in modal logic

Modal logic is the field of logic dealing with inferences about the possible, the necessary, and the impossible. In order to express this we generally use $\Box$ to express necessity, and $\Diamond$

[11] An example of how possible worlds is used as truthmakers can be found in (Lewis, 2001b).

in order to express possibility. As opposed to standard first-order logic, modal logic is not extensional, but rather intensional. This entails that the truth values of the propositions in modal logic are determined not only by their forms and the extensions of their parts, but by something additional. Hence substitutivity principles holding in standard extensional logics no longer hold here.[12] Even though the entities involved in modal logic are associated with extensions in the actual world, these extensions are not enough to distinguish what are intuitively distinct entities of that kind.[13]

The fact that modal logic is intensional was not the only challenge for early 20th century logicians trying to make sense of the logic of the possible and the necessary. Another obvious problem was that modal logic is a field with a vast array of non-equivalent logical systems we can work within. Some of these systems existed already in the earlier parts of the century. We find five such systems presented in (Lewis et al., 1959), originally published in 1932, where the *syntax* of these systems were given. However, the fact that no complete *semantics* existed was clearly problematic, and meant, in particular, that even though the syntax of the different systems could be specified, the logicians lacked the means to interpret the systems. This also meant that they were not able to give completeness proofs. Because of this, it was a breaktrough when the introduction of the notion of a possible world, with an intuitive core taken from Leibniz's idea of necessity as truth across possible worlds, made it possible to give semantics for the different systems of modal logic. Although these ideas were presented by several philosophers at roughly the same time, Kripke's articles from the late 50s and early 60s are generally seen as the starting point for a complete possible world semantics for modal logic.[14]

In (Kripke, 1959) Kripke introduces the possible world semantics for normal modal logic systems, and states that we should intuitively think of the model structure as including a set of all 'possible worlds', a particular world which is the actual world, and a relation, R, between worlds.[15] Kripke explains the R-relation as follows. If we have $w_1 R w_2$, then w_2 is *possible relative to* w_1. I prefer to use the notion of an *accessibility relation* instead, such that w_2 is accessible from w_1. In addition to a model structure, we need the notion of a *model*. A model is an ordered triple $\langle W, R, V \rangle$, where W is a non-empty set of objects (the 'worlds'), R is a dyadic relation defined over the members of W, and determines for each w and $w' \in W$, whether or not wRw'. That is, this relation determines for every world in the model which worlds are related to each other. This also includes whether the worlds are accessible to themselves. V is an assignment of values to all formulas in the model, structured as pairs $\langle \alpha, w \rangle$, such that each formula has a truth value at each world. The modal operators are then interpreted as follows. $\Box\alpha$ is true in w if α is true in every

[12] Menzel (2017)

[13] Divers (2006, p. 9)

[14] See (Kripke, 1959) and (Kripke, 1963), but also, for example, (Hintikka, 1969) and (Prior, 2003).

[15] Normal systems are those which includes the statement **K**: $\Box(\alpha \to \beta) \to (\Box\alpha \to \beta)$ as well as the rule of necessitation: $\vdash \alpha$ implies $\vdash \Box\alpha$. For simplicity I will only consider propositional modal logic here.

accessible world, and otherwise false. $\Diamond\alpha$ is true in w if α is true in at least one accessible world.

With this as a starting point we are able to say something about validity in the different systems of modal logic as well. The key is the accessibility relation R, and the different restrictions we can place upon it—these restrictions are directly tied to validity in the different systems. For validity in the weakest of the normal systems, **K**, there is no restriction placed upon the relation; **K**-validity is validity on every model no matter how the worlds are related. Kripke's article restricts itself to four systems in which R is *at least* reflexive, that is, for every $w \in W$, wRw.[16] Let us look at three of these systems, **T**, **S4**, and **S5**.[17] The weakest of these systems, **T**, demands that the models be reflexive, whereas **S4** requires reflexive and transitive models, and **S5** needs the models to be reflexive, transitive, and symmetric. With these restrictions in place, we can start speaking of **T**-validity, **S4**-validity, and **S5**-validity, as validity in precisely those classes of models (with the relevant restriction on R).

Given these models, the question of choosing between the different systems becomes a question about the relationship between worlds, as that is what the divergence amongst the systems amounts to. Because of this we can make a more informed choice about the systems we should be working within. Michael J. Loux (1979) highlights the following case for assuming **S5** as the correct system for addressing points concerning metaphysical questions. Here we can ask ourselves if we think that what is metaphysically possible or necessary is something which can vary in different possible worlds. If we answer this in the negative, as is common, we end up with **S5** as constituting the correct system for metaphysical modality. Hence, we see that through the introduction of the possible worlds we were able to limit the modal operators, $\Box$ and $\Diamond$, by way of accessibility relations between worlds, such that the modal operators are working as quantifiers over possible worlds.

Kripke's formal semantics ensured that we could make sense of the difficult intensional notions of possibility and necessity through focusing exclusively on extensional features of each particular world, and the relationships between such worlds. This is exactly the same move as we saw when presenting the Leibnizian biconditionals; they eliminate problematic notions and replace them with notions which somehow seem more respectable. In the same way as modality can be seen to emerge from sets of categorical entities existing across worlds, so the modal logic can be understood as referring to extensional features of different possible worlds, and the modal operators are seen as quantifiers over these worlds.

[16] There are exceptions where we would not want R to be reflexive. (Hughes and Cresswell, 1996, p. 43) highlights the system **D** as an example of this. Here the necessity operator is interpreted as an obligation, or a 'moral necessity', hence we would not want the axiom $\Box\alpha \rightarrow \alpha$, which demands reflexivity, to be the case because this would mean that what ought to be the case actually is the case as well.

[17] **T** is in some publications, among these Kripke's article, referred to as **M**.

1.2.3.2 Possible worlds and their role in modal metaphysics and other fields

Given the success of modal logic, it is perhaps not surprising that philosophers wanted to use the powerful tool of possible worlds in other fields and for other, albeit related, problems.[18] After all, as we have just seen, possible world semantics were able to turn the very problematic field of modal logic into a logic with the extensional formal semantics it formerly lacked. In addition, it might be argued that by explaining possibility as truth in some possible world we are very much in line with some of our intuitions about the nature of modality and the meaning of modal discourse.[19]

When spelled out in this way, it does not seem particularly puzzling that some wanted to use this powerful tool to gain understanding not only of the logical machinery of modality, but also of the related questions of what possibility and necessity really *are*.[20] If we take the Leibnizian biconditionals at face value, they seemingly give us a tool to provide exactly this, and thus, the advancements based upon possible worlds made modal notions more acceptable in philosophy. This meant that the Leinbnizian idea that our world is just one of many possible worlds—and that these possible worlds establish *what we are talking about* when we are using modal notions—re-entered the field of philosophy after modal notions had been viewed with great scepticism by certain philosophers. We find an example of this general scepticism towards modal notions before the introduction of possible worlds in (Quine, 1948):

> Wyman's slum of possibles is a breeding ground for disorderly elements. Take, for instance, the possible fat man in that doorway; and, again, the possible bald man it that doorway. Are they the same possible man, or two possible men? How do we decide? How many possible men are there in that doorway?[21]

Quine found modal notions, particularly those representing modality *de re*, to be both unclear and ontologically esoteric; it is difficult for us to separate between what is necessary and what is only accidentally the case, for instance. However, following Quine's work we also see that the introduction of possible worlds does not automatically provide any help, unless we are explicit about what sort of entity a possible world is, because possible world semantics in itself leaves some vital questions about the *nature* of the worlds wide open:

> Surely, such semantics are formulated in an extensional metalanguage, but since in this metalanguage one quantifies over possible worlds, the semantics does not bring us any further toward understanding the modal notions unless the notion of possible worlds is made clear.[22]

[18] Kripke (1981) is a readily available example.
[19] Menzel (2017)
[20] See for example Lewis (1986a).
[21] Quine (1948)
[22] Quine (2013, p. xxii) Preface to the New Edition, by Dagfinn Føllesdal.

I believe this is a correct characterisation of the burden of explanation which rests upon the shoulders of the possible worlds theorist. Even though it seems quite natural to want to include the use of possible worlds in fields like metaphysics, such an inclusion also leads to the need for more knowledge regarding the nature of the possible worlds themselves, a question which is not answered by the way we use the worlds in modal logic. If this notion is to be used in a successful way, we need to know the identities of the possible worlds. This realisation might be seen as a starting point for one of the more substantial complications regarding the use of possible worlds semantics to gain a further understanding of modality and modal notions; our explanations mean nothing if they cannot be supplement with a convincing interpretation of what possible worlds *are*. This is a crucial question also here, and I will return to it in section 1.2.4.

The problem of the identity of the possible worlds is clearly a substantial issue, and I propose that due to the sheer size and importance of this question we have to a great extent ended up speaking about the wrong things when discussing modal metaphysics. The goal of our enterprise in the metaphysics of modality should be to gain a further understanding of what modality is and what modal notions mean, and I contend that simply tying all modal notions to possible worlds does not provide satisfactory explanations of them.[23] However, we tend to never get any notable further progress regarding answering these questions once the possible worlds have been introduced, because questions concerning modality gets translated into questions concerning possible worlds, and the most important questions end up being those which are related to the possible worlds, their ontological status, and their identity. It is certainly the case that these questions need answers, given that we want to explain modality in this way. But there are other questions which sorely need attention too, such as whether possible worlds can explain all modal notions in a satisfactory way, or even whether possible worlds gives the correct picture of modality. Before going into the inevitable debate regarding just what sort of entities possible worlds are, I want to focus on some of the issues which have been considered to be elucidated by the introduction of possible worlds.

When looking at the use of possible worlds in fields other than modal logic, we find instances of philosophers utilising possible worlds as a purely formal tool at first, before turning to a more widespread use of the worlds as a more philosophical or conceptual tool later. We find an example of this in (Kripke, 1981), where the preface states that the work presented in *Naming and Necessity* grew out of his earlier work on modal logic and possible world semantics. This book steps quite far outside the domain of logic, and discusses both clearly metaphysical questions, such as the queries concerning identity, and also questions which have more to do with the philosophy of language (such as the considerations around a theory of names and of rigid designators). These inquiries all make explicit use of possible worlds.

[23] This is also addressed by Vetter (2015, p. 6).

By introducing talk of possible worlds also in areas like philosophy of language, epistemology, and metaphysics, we have been able to give answers to quite a few problematic questions. We find that possible worlds have been employed, for example, in order to explain what a proper name is, and how it differs from definite descriptions.[24] It is, for example, possible than another person was the tutor of Alexander the Great, so the description 'the tutor of Alexander the Great' cannot in any way be *equivalent* with the proper name Aristotle. By considering questions concerning possibility, we see that even though it might seem tempting, names cannot be reduced to definite descriptions, not even to sets of, or loose clusters of, such descriptions. The contingency we see when considering definite descriptions is no longer in place when we consider proper names, at least not if we follow Kripke and his claim that names are *rigid designators*. 'Rigid designator' is yet another concept which may be explained with the use of possible worlds, as rigid designators are those designators which will refer to the same individual in *all possible worlds*.[25]

From these considerations alone, we already see that the question of identity across possible worlds have to be of great importance. That is, if we are to speak of individuals existing at possible worlds and *across* possible worlds (which we have to do in order to explain rigid designators), we need to sort out what is meant by this, and which ontological commitments these claims come with.[26] The query concerning identity across possible worlds is of a more metaphysical nature than the questions regarding designators are, hence we see how the issues concerning philosophy of language and those concerning metaphysics are very much intertwined. There are several additional important examples of the role of possible worlds in contemporary philosophy. They have, for example, been seen as providing a notion of truth-conditions, and they have been contributing to arguments and thought experiments about physicalism in the philosophy of mind.[27] However, the *prime* target for the use of possible worlds, outside modal logic, must be said to be the area of *metaphysics*, and it is this use which is of particular importance for my thesis. According to this use, possible worlds are not only useful in order to clarify metaphysical debates, but also that they may be used in order to distinguish *the metaphysical modalities*, or modalities interpreted in a metaphysical way, from other classifications we may employ.

We have already seen how the modal notions—possibility, necessity, contingency, and impossibility—may be understood in terms of possible worlds, and how the worlds can show us how these terms are related to each other. This other role taken on by possible worlds is supposed to provide an understanding of how different *kinds* of modality relate to each other. We commonly distinguish between several different varieties of modality, such as logical, metaphysical, nomological, and deontic. These distinct kinds of modality are

[24] See, for example, (Lycan, 2018, Chapter 4)

[25] We might add 'where that individual exists', to make sure no-one uses this claim to posit necessary beings.

[26] I will return to this question in section 1.2.4.

[27] Kirk (2019)

generally seen to be related to each other in a particular way, which possible worlds can help enlighten. John Divers speaks of this in terms of how different kinds of impossibility limits the realm of the possible, such that something which is nomically *impossible* will still be metaphysically *possible*, for example. "Possible worlds talk is involved to elucidate these distinctions", Divers states, and the distinctions he is referring to can for example be what kinds of necessity entail other kinds of necessity, and what kinds of possibility entail other kinds of possibility.[28]

In these cases, modality of a given variety will be characterised by what is the case in *a specific range* of possible worlds. To clarify this by way of an example, this understanding entails that the *logically possible worlds* will be those worlds which comply with the set of constraints which we may refer to as the laws of logic, whereas the *nomically possible worlds* will be those which are constrained by the laws of nature. The laws of logic are generally seen as more permitting—including further possibilities—so the set of all logically possible worlds will *include* the set of all nomically possible worlds. Hence, we gain some understanding of the relationship between the logical and the nomic modalities. This relationship between the set of all logically possible worlds and all the nomically possible worlds can explain facts about necessity as well. We can for instance see that the fact that nomic necessity does not entail logical necessity is witnessed by there being at least one logically possible worlds which is not a nomically possible world.

It may still be argued that possible worlds represent what Loux describes as "an exotic piece of metaphysical machinery, the armchair invention of a speculative ontologist lacking what Bertrand Russell called 'a robust sense of reality'."[29] A defence against these types of criticism can be to state, as Loux does, that possible worlds are really only formalising what are *generally held prephilosophical views about modality*. If we agree with this, we might argue that what is done in modal logic and possible worlds centred metaphysics is just taking these thoughts some steps further, by formalising and systematising them in this framework.

If we support this kind of argument, we have to agree that possible worlds are somehow connected to our intuitions. That is, Loux's point seems to be that the possible worlds are supposed to be *cleaning up* our prephilosophical ideas regarding modality, but also that the worlds add nothing more than clarity. However, if all they offer is clarity, and a more formal way of presenting generally held views about modality—if possible worlds are simply reflecting our intuitions—how can we know whether or not those intuitions point towards correct assumptions about what is possible and necessary?[30] If they reflect only already existing ideas about what is possible or not they cannot be used to separate between those

[28]Divers (2006, p. 4ff). I note that seeing the metaphysical possibilities to outstrip the nomic ones is a common intuition to have, but it is something I will argue against in this thesis.

[29]Loux (1979, p. 30)

[30]I will return to this question in chapter 7, where I will present an example showing that what we intuitively believe to be possible does not reflect genuine possibilities in all cases.

intuitions which point toward genuine possibilities and those that do not. We may also ask why we should be able to intuitively pick out all and only the *possible* worlds, given that there is no adaptive advantage to getting things right about possible worlds.[31]

In addition, when we are speaking of these prephilosophical assumptions or intuitions we also need to ask *whose* intuitions we are referring to. It is overly optimistic to assume on behalf of humanity that there is a set of prephilosophical beliefs or intuitions which can be referred to in this way, and which our philosophical concepts are directly connected to. We also need to consider that our intuitions might not reflect what is genuinely possible, or that different people have differing intuitions, due to several different reasons, such as cultural background, or even our level of education.[32] If this is indeed the case, philosophical concepts which are seen to elegantly match our intuitions only seem even more problematic.

In addition to the fact that the connection between possible worlds and intuitions can be seen as problematic, it should also be mentioned that the label *possible worlds* has lead to some issues in itself. At the same time as arguing that possible worlds can be used in more fields than logic, Kripke urges us not to get carried away by the fact that possible worlds are called precisely this. That is, he worries that referring to these entities as possible *worlds* might lead us to picture them in unfortunate ways, and that this image we have of the possible worlds as something along the line of faraway places, or distant planets, has contributed to the creation of problems which might not have been so prominent had they been otherwise named.

Kripke goes so far that he refers to the possible worlds as a *metaphor*.[33] He also suggests that in order to avoid these misunderstandings, we could use 'counterfactual situation' or 'possible state (or history) of the world' instead, or even replace talk of worlds with plain modal talk, like 'it is possible that...'. This last suggestion is extremely problematic. If the talk of possible worlds can so easily be discarded and replaced by the modal notions they were supposed to explain in the first place, what explanation is left for the possible worlds to do? It seems that if Kripke is right, possible worlds have no particular explanatory role over and above just being an alternative way of saying that something is possible or necessary.

1.2.4 Genuine realism or actualism

1.2.4.1 Possible worlds—concrete or abstract?

Let us, for now, disregard the worry that possible worlds talk might not be explanatory after all, and assume that modality is indeed best understood in terms of possible worlds.

[31] This is discussed in (Nozick, 2001, Chapter 3), see also (Vaidya, 2016, Section 1.2.4). I will return also to this topic briefly in chapter 7, when dicussing the limited use of intuitions.

[32] See for instance Weinberg et al. (2001) which investigates how intuitions might be differing between cultures.

[33] Kripke (2005, p. 228)

That is, we assume that these worlds really are the explanatory entities we wish them to be, and that they can provide a conceptual framework for modality, as well as supplying modal claims with their much needed truthmakers. If this is indeed the case, the following two questions will have to be satisfactory answered by all accounts of possible worlds.

1. What is a possible world?

2. What does it mean to exist at a possible world?

The answer to the first question will to a large degree determine the answer to the second question, and I will in general mainly focus on the first question. In addition, we should note that all the answers provided by the notion of possible worlds will in turn depend on, and be coloured by, the answers we are able to provide here. I will go so far as to argue that if we are unable to find satisfactory answers to these questions, the framework of possible worlds, tempting though it may seem, can turn out to be quite problematic in itself.

When debating the identity of the possible worlds—what sort of entity the possible worlds are—there are several options available, and these alternatives largely fall into two separate camps which we may refer to as being either *genuinely realistic* interpretations, or *actualistic* interpretations. For the former, the possible worlds are seen as really existing entities on a par with our world. The most well-known proponent of such worlds is David Lewis, and because this interpretation of possible worlds is so dominated by his work it is quite uniform.[34] For the latter, the possible worlds are in one way or another made up by certain entities, such as states of affairs, already existing in the actual world, and the worlds themselves are supposed to be 'abstract entities'. The existence of these abstract entities are *stipulated* because they have a job to do; modal claims are in need of truthmakers, and possible worlds are assigned to this task. There are multiple suggestions from a substantial amount of philosophers available regarding exactly which entities make up these worlds and how the worlds themselves should be interpreted—but no general agreement concerning what sort of entity these abstract worlds are supposed to be—something which leads to this field being very diverse.

A genuine modal realist will have no problem explaining what a possible world is, or what it means for something to exist at a world. A possible world is the same sort of thing as our world, and different individuals inhabit other worlds in the same way as we inhabit our world. A world is made distinct by what is spatially or temporally related; that is, things that are related either spatially or temporally exists *in the same world*. Different worlds are not related to each other in this way. This entails that all other worlds are

[34]This does not mean that he is the only one arguing for, or accepting, genuine modal realism. Divers (2006), for example, ends up concluding that *if* we are to be realist about possible worlds, *then* we should definitively be genuine realists. This is a conditional claim, surely, but his book highlights several of the reasons why genuine realism would be preferable over any of the actualistic varieties.

inaccessible to us, because all worlds are inaccessible to each other. Referring to a world as 'the actual world' as opposed to other worlds is not an indication of difference in the ontological status, nor is it something which entails that the actual world is somehow 'more real' than the other worlds. For the modal realist, pointing out 'the actual world' is on a par with speaking of 'this house' as opposed to all the other really existing houses; it is an indexical picking out the object of interest, but without imposing ontological difference.

The biggest problem for the modal realist, ontological cost aside, is to explain identity across possible worlds in a satisfactory way. Given that all worlds are really existing entities, the same object cannot exist in several different possible worlds. Hence, modality *de re* will have to be witnessed by way of *counterparts* existing across possible worlds. Following this, 'I could have been a dancer' is true because a counterpart of me *is* a dancer in another possible world. The counterpart relation is questionable for several reasons, but especially because it demands there to be a relation of similarity between objects existing in different possible worlds.[35]

It should be noted that questions concerning the identity and structure of possible worlds are far more pressing and difficult to answer for the actualist than they are for a possibilist of Lewis's description. This is due to the fact that since all worlds are really existing and fundamentally the same sort of entity as our world for Lewis, what it means to be a world and what it means to exist in a world will be answered in exactly the same way whether we are speaking of our world or of some other possible world, although this simplicity comes at a great ontological cost. This solution is not open for the actualist, hence they must be able to describe what kind of entity a possible world is.

If we want to make use of the beneficial features of possible worlds, but are reluctant accept the existence of a plurality of *really existing* worlds—ontologically on a par with our world—we might instead interpret these worlds as something else than real flesh and blood worlds. As already mentioned, this will in general entail viewing the worlds as some form of abstract entity, made up of the things that exist in our actual world. We should note that several, if not all, of the alternatives presented as actualistic possible worlds are to greater or lesser extent underdeveloped compared to the genuine realism of Lewis.

Even though the actualist worlds are not genuinely existing worlds of the same general constitution as ours, these views are still *realistic* interpretations of possible worlds, as the worlds are made up of entities which already exist in the actual world. Because of this we can say that each possible world actually *exists*—that is, for each possible world there is some actually existing entity to which that world is identical—but only one is actualised.[36] Hence, we can safely refer to these interpretations of possible worlds as a kind of *realism* as well, of an actualistic variety. This assumption, alongside the idea that there exists a

[35]This is one of the things Kripke argues quite forcefully against in his (Kripke, 1981), and other early criticism is also found in (Plantinga, 1974). For a more contemporary criticism, see for example (Fara and Williamson, 2005).

[36]Divers (2006, p. 21f.)

plurality of (actualist) possible worlds, is the theoretical backdrop behind the different kinds of actualist realism, all of which answer the question of the identity of the possible worlds in a slightly different way. To get an idea of the diversity among the actualists, I will present some of the suggestions briefly.[37]

The most common way of viewing actualist worlds is perhaps to see them as *maximally consistent states of affairs*. This is referred to as Plantingan Realism in Divers's book,[38] because it is presented and defended by Alvin Plantinga, for example in his (Plantinga, 1974). According to this view, the possible worlds are possible states of affairs, possible in 'the broadly logical sense'.[39] But not every possible state of affairs is a possible world. In order to be a world a state of affairs must be what Plantinga refers to as *maximal* or *complete*. Completeness or maximality in this context amounts to the following:

> [A] state of affairs S is *complete* or *maximal* if for every state of affairs S', S includes S' or S precludes S'.[40]

A key idea for this branch of actualistic realism is the distinction between something *existing* and something *obtaining*. All the possible worlds exist, and represent through their existence, the different things that *could have happened*, but only one world *obtains*. The actual world is the only maximally consistent state of affairs which obtains.[41]

Another option is to advocate a form of combinatorial realism, in which possible worlds are seen as constructs out of actually existing individuals and actually existing properties. This view is advocated by, among others, John Bigelow describing it as

> a kind of Restaurant Theory of the Modal Universe. Something is possible when the ingredients all exist, which constitute its recipe.[42]

Bigelow assumes that combinatorialism is capable of providing truthmakers for modal claims to the same extent as genuine modal realism can, because combinatorial realism can construct a replacement for each and every possible world the genuine realist has in their theoretical depository. That is, according to Bigelow, to supply truthmakers for "whichever modal opinions we happen to hold".[43]

A third option is what Divers refers to as 'book realism'. This understanding of possible worlds take them to be *world books*, or maximal or *complete stories of the world*, which are made up by structured propositions or interpreted sentences of a specific (world making)

[37] For a more comprehensive survey of different interpretations of possible worlds see e.g. (Divers, 2006).
[38] Divers (2006, p. 173f.)
[39] Plantinga (1974, p. 44)
[40] Plantinga (1974, p. 45)
[41] Plantinga (1974, p. 45)
[42] Bigelow (1988, p. 41)
[43] Bigelow (1988, p. 42). If we do not want possibility to correspond perfectly with conceivability this is an obvious problematic approach.

'language'.[44] Book realism is also described in (Plantinga, 1974), and here the possible worlds are all and only the maximally consistent sets of sentences:

> [B]ooks too have a maximal property; if B is a book, then for any proposition p, either p is a member of B or else not-p is. And clearly for each possible world W there will be exactly one book.[45]

Finally we have what we may call 'nature realism'. Nature realism is the view that seems most closely related to the position defended in this thesis. These philosophers understand possible worlds as either *world natures*, *world-properties*, or *ways that they world might have been*.[46] This view has been advocated by, among others, Bigelow and Pargetter (1990).[47]

In addition to these more specified genres of actualistic interpretations of possible worlds there are some philosophers who are clearly actualist without subscribing to one particular interpretation. One example of this is Kripke. Although his way of describing possible worlds have traces of both book realism and nature realism Divers acknowledges Kripke as 'a most influential advocate' of a more generic actualistic realism.[48] In Kripke's writing we also see tendencies that for the actualistic realist the goal is not primarily to present a thorough account of possible worlds, but rather to utilise possible worlds in order to investigate particular issues in the metaphysics of modality. This means that possible worlds are more a means to an end than the object of enquiry.[49]

These things are part of the reasons why someone (e.g. Divers) may argue in favour of genuine realism. These actualist positions are invariably less comprehensive, and in some cases based upon underdeveloped accounts which are perhaps meant to present a very specific application of possible worlds, and to distinguish this view from genuine realism. Because of this, the proposals are often not meant to be comprehensive accounts in every case—this nonetheless means that the actualist side have no comprehensive theory which can match genuine realism.[50]

Following the many suggestions of what possible worlds are, according to the actualist, it becomes clear that the question of the identity of worlds is both real and difficult for the advocates of actualism to answer, and as of now there is no particular account which stands out from the other interpretations in terms of either clarity, usefulness, or comprehensiveness.

[44] Divers (2006, p. 178)
[45] Plantinga (1974, p. 46)
[46] Divers (2006, p. 177)
[47] Bigelow goes on to argue for a view even closer to mine in (Bigelow et al., 1992).
[48] Divers (2006, p. 337)
[49] But the question regarding the identity of the possible worlds still needs to be answered, and, hence, these accounts come across as less comprehensive and, as mentioned earlier, often underdeveloped as compared to genuine realism.
[50] Divers (2006, p. xiii)

1.2.4.2 Stipulating possible worlds

When arguing for the existence and use of actualist worlds it is common to say, as I have also done, that we *stipulate* the existence of possible worlds in order to solve certain issues in the metaphysics of modality. Stating that possible worlds are *stipulated* is also an important part of Kripke's critique of the genuine modal realist, particularly as a way of meeting the apparent demand for a criterion of identity across possible worlds. However, we need to ask, firstly what stipulation is meant to be doing, and, secondly, whether stipulation is performing these tasks in a successful way. Let us first take a closer look at what Kripke means we can achieve by way of stipulating the existence of possible worlds.

One important question to ask when it comes to the inhabitants of possible worlds is how we are supposed to know that the individuals we are speaking of as members of another possible world are the same as those we are making modal claims about. If we assert that Nixon could have lost the 1968 US presidential election, we are in effect saying that there is a possible world where Nixon exists, ran for president, and subsequently lost. How do we know whether the 'Nixon' of this other possible world is the same Nixon we have here in our world? Do these kinds of issues entail that we need to have particular criteria of identity across possible worlds?

According to Kripke, arguing that there is need for such a criterion is a result of viewing possible worlds in a completely erroneous way.

> 'Possible worlds' are *stipulated* not *discovered* by powerful telescopes. There is no reason why we cannot *stipulate* that, in talking about what would have happened to Nixon in a certain counterfactual situation, we are talking about what would have happened to *him*.[51]

Thus, it is *given* that the world in which Nixon lost the election includes Nixon—this very man—with whatever features he is to have in the given world, because as Kripke puts it, "[g]enerally, things aren't 'found out' about a counterfactual situation, they are stipulated."[52]

I do however contend that the role of stipulations advocated by Kripke is problematic in itself, and that stipulations cannot play the intended role in a satisfactory way; as a solution, invoking stipulations is simply not good enough, even though they do prevent the actualist from having to deal with some of the more problematic features that a genuine realist of Lewis's ilk will have to solve.

In order to show that the role intended for stipulations is problematic, we need to distinguish between different ways of using this concept. It seems to me that Kripke is using the notion in two slightly different ways. Firstly, stipulations are used to ensure, as we saw above, that we are talking about the same individuals across possible worlds.

[51] Kripke (1981, p. 44)
[52] Kripke (1981, p. 49)

Secondly, it also seems that stipulation is what in some sense *creates* the possible worlds, i.e. that we stipulate the world and thereby know that what we have just stipulated is a *possible* world. If facts about possible worlds are not generally 'found out', but rather stipulated, the stipulation is what gives us access to the worlds.[53]

I will grant Kripke the following. Stipulation does indeed pick out the correct individual. We can stipulate that *this very person* exists in another possible world and be sure that we are speaking of the right person. However, what I am more unsure about is whether stipulation gives us access to possible worlds. That is, if we stipulate something about a particular individual, how can we be sure that the stipulated situation is indeed *possible*? Divers states that even though we are able to stipulate distinct situations, we cannot thereby be guaranteed that the situation is possible.

> What is not in the gift of my stipulation (...) is that such a world is a *possible* world. It is one question how we know which objects are the objects of our de re modal thought and talk, and perhaps there stipulation has a legitimate role. It is another question altogether how we know what is modally true of those objects, and there stipulation has no legitimate role to play.[54]

I can, by stipulation, specify what I am talking about, but I cannot thereby successfully distinguish between possible and impossible worlds, it seems, *unless* I take possibility to be coextensional with the things I can consistently imagine. Divers takes this to be another feather in the hat for the genuine realist, since they at least have a guarantee that the worlds they are referring to are possible.[55]

From this we see that if we choose to follow the lead of the more traditional actualists we are left with a conceptual understanding of possible worlds which more or less correspond to situations we can consistently imagine. After all, our ability to stipulate is limited by our ability to consistently imagine or conceive of things. This seems to still be the case also if we specify that possible worlds are maximally consistent sets of e.g. states of affairs, because our ability to judge what is to exist in such a world is still largely dependent on our ability to stipulate what is supposed to be existing in the given world. The relationship between stipulating something and being able to conceive of something is most certainly complicated; is it the case that we, in order to be able to stipulate something need to be able to consistently conceive of it? If this is the case, subscribing to a stipulation based view is at the same time a subscription to an unfortunate conflation of terms in which possibility collapses into mere conceivability. We simply cannot assume that our ability to consistently picture situations, i.e. stipulate a possible world, will be able to capture

[53] As far as I can tell, this is an example of what Divers (2006, p. 273) refers to as stipulations giving *epistemic access* to possible worlds.

[54] Divers (2006, p. 273)

[55] Divers (2006, p. 274). But if we remember Bigelow's comment earlier in this chapter, even genuine realists seems to be in danger of conflating possibility and conceivability.

all and only those situations which are possible. This is a gross overestimation of the human ability to picture things consistently, and I hold there will be errors both because we are able to consistently picture situations which are not possible, and because there are possible situations which we may not be able to consistently picture. Whereas the eventual relationship between stipulation and conceivability will not be a main topic of this thesis, I will return to problems tied to conceivability and intuitions in relation to the laws of nature in chapter 7.

1.2.4.3 The Humean connection

An important question to ask is whether the success of possible world semantics led us to be inspired to look outside the actual world in order to find the ground of modality, or if we were so deeply entrenched in empirical and categorical assumptions about the world that we simply had to look outside the actual world, because the grounding of modality *could not* be found in the actual world anyway. If it is the latter, this is based upon an assumption about the structure and properties of the world which is deeply Humean in character—and this is an assumption we can argue against. As far as I can tell, this point has not received the attention it deserves in the literature, something which is a forceful reminder of the influences of empirical traditions and Humeanism in philosophy.

By assuming possible worlds as the *key concept* in modal metaphysics, we can say that the modal features of the world are determined by categorical properties, not only in this world, but in other possible worlds as well. Hence, the assumption that we need possible worlds seems grounded in the assumption that the properties and objects *in the world* cannot themselves provide this, or in the assumption that modality cannot be a real feature of the actual world. That is, we need to ground modality in respectable features of reality, i.e. in something which is *categorical*. This shows that the assumption that possible worlds are needed is an assumption that is deeply rooted in Humean metaphysics. I will go into details about Humean views of properties in particular both in chapter 2 and 4, but for now it suffices to say that a Humean view of properties entails there are no essential modality located in the properties themselves. Hence, a consequence of having Humean inspired metaphysics is that modality will have to be 'outsourced', so to speak. There is no modality in the entities in the world which substantiate the modality we want to explain—we need possible worlds if we are to have modality at all.

Instead of accepting properties which are inherently modal in the actual world, a plurality of worlds, each with its own categorical properties and claims, are posited to be existing in some way or another. Thus, modality is something which results from considering several other worlds, but never just our actual world. I argue that at the core here we find Humean assumptions about what are and are not respectable metaphysical entities; and dispositional properties which are not grounded in something categorical are examples of entities which the Humean will not accept. I reject Humeanism, and contend that there

are indeed respectable entities to be found *in the world*, in which modality is grounded.[56] If we reject Humeanism, we may also reject the possible world centred understanding of modality, because the ground for accepting this view is at its core deeply anchored in a Humean way of viewing properties.

1.2.5 Towards a new actualism

This thesis is clearly actualist, and aims to contribute to the *new actualism* that takes inspiration from Kripke, in stating that the starting point for establishing what grounds the truth of modal claims should be the actual world. These new actualists harbour a scepticism about possible worlds which I wholeheartedly share. Because of this, a distinction between *softcore* and *hardcore* actualists found in (Contessa, 2010) is useful at this point. Whereas the softcore actualists agree with the possibilist that a version of the Leibnizian biconditional capture modality in an adequate way, and that this commits us to the existence of possible worlds in some shape or form, the hardcore actualists want to get rid of the possible worlds in the context of metaphysics. That is, possible worlds might still be *useful* in many ways, for example as a heuristic device, but a reductive analysis of modality on the basis of possible worlds should be rejected:

> Hardcore actualists think that what makes modal propositions true are irreducible modal features of the world (such as laws of nature, dispositions, or essences).[57]

Although it is clear that it is relatively easy to oppose the modal realism of Lewis (e.g. by pointing out the aforementioned ontological cost of assuming fully real possible worlds, or by arguing that the question of transworld identity becomes too difficult to answer properly), the new actualists argue that the actualist interpretations of possible worlds have their problems too. It is, as mentioned above, not the case that we are freed from complications when Kripke, for example, argues that possible worlds are *stipulations*, even though specifying that possible worlds are stipulations makes the question of transworld identity clear.

In conclusion, I argue that if we are able to find alternative ways of explaining the modal features of the world—and this thesis argues that we are able to do just this—it does seem that possible worlds are *metaphysically redundant*. I argue that modality is indeed real, but instead of constructing actualist possible worlds as truthmakers for the modal claims, we should rather account for the reality of modality by *exclusively* relying on the things

[56] The tendency of speaking of dispositional properties as being 'respectable' stems from Mellor (1978): "Dispositions are as shameful in many eyes as pregnant spinsters used to be—ideally to be explained away, or entitled by a shotgun wedding to take the name of some decently real categorical property. It is time to remove this lingering Victorian prejudice. Dispositions, like unmarried mothers, can manage on their own."

[57] Contessa (2010, p. 341f.)

existing in the actual world. We need not go through the toil and trouble of explaining what an actualist possible world is, because we do not need possible worlds in order to do metaphysics at all.

This last specification is important. I argue solely that possible worlds should be deprived of their role as important metaphysical entities, not that they should be stripped of all philosophical importance. Possible worlds are still useful, or even of crucial importance in a wide array of fields, and I am not arguing that these uses of the concept are in any way unjustified. This means that utilising possible worlds as a formal tool in modal logic, or employing them for limited purposes in epistemology, philosophy of language and so on is absolutely fine. They can even be accepted as useful in metaphysics, but then solely in order to provide enlightening examples or illustrations, and in order to provide explanations which will make things easier to grasp for the human mind. The only role I want to rob them of is their role as truthmakers, and their more general role as important *explanatory* entities in metaphysics. In a nutshell, possible worlds have little to do with the metaphysics of modality.[58]

1.3 The new actualism: dispositions and essences

By now it should be clear that I wholeheartedly agree with the new actualist assumption that removing the notion of possible worlds from the metaphysical account of modality altogether is a good idea. Moreover, these worlds should be replaced with modal properties existing in the world. I hold that there is no need to try to construct actualist possible worlds if the purpose is to explain the *metaphysics* of modality. The possible world semantics is a powerful tool, for example in modal logic, but I hold that we may do just as well, if not better, by avoiding making reference to possible worlds as important *metaphysical* entities. As Barbara Vetter states; having a powerful formal model is not the same as having a good metaphysics.[59]

1.3.1 Replacing possible worlds

A whole new field of metaphysics has emerged searching to use dispositional concepts to replace the possible worlds. This field can be traced at least back to (Bigelow et al., 1992), and (Ellis and Lierse, 1994), but we find similar ideas also in (Shoemaker, 1980) and (Swoyer, 1982). However, we might also search further back in the history of philosophy to

[58]This is also stated clearly by some of my fellow new actualists, e.g. Vetter (2011, p. 742)

[59]Vetter (2015, p. 6). She does not expand on her claim in this passage, so an answer to the question of what good metaphysics amounts to is not answered. We find similar concerns in e.g. (Dipert, 1997, p. 334): "[L]ogical structure is historically associated with highly conceptualized thought, and in fact with thoughts that are easily expressed in natural language. (...) Following such interests may ultimately make logic a good theory of the linguistically expressible, a good philosophy of language, but a poor theory of the metaphysical structure of the world (...)."

find inspiration for this set of related views:

> If a historical reference is required (or desired), the new actualists replace Hume, as the metaphysician's hero, with Aristotle; many of them would happily describe themselves as 'neo-Aristotelians'.[60]

Replacing inspiration from Hume, in this context, entails a general rejection of the thesis of Humean Supervenience, that is, in the famous formulation from Lewis, that "all there is to the world is a vast mosaic of local matters of particular fact, just one little thing and then another".[61] Recall that if a Humean, such as Lewis himself, is to find modality at all, they need possible worlds, because modality is not built into the world in any way. This entails that a rejection of possible worlds as important metaphysical entities seems to bring with it the rejection of Humeanism as well. I happily endorse this move. The tendency to be anti-Humean is found already in (Shoemaker, 1980) with his argument for focusing more on properties and objects when speaking of causality, as well as arguing that property identity is tied to the causal powers of the given properties. Sydney Shoemaker's article 'Causality and properties' is thus an important precursor to the later dispositional views of properties and objects.

It is important to note that what I refer to as *the new actualism* has grown to a diverse field with quite a bit of substantial disagreement between the different philosophers and branches, something which will be discussed thoroughly in my thesis. However, what they all have in common is the belief that the modal features of the world in some way or another can be explained by referring to the dispositions of objects or properties. Such dispositions are actual, they exist even if they are never manifested, but they point, in some sense, beyond themselves to something which might very well be counterfactual. The egg on your kitchen counter *could have been* pushed to the floor and subsequently smashed, and the slug in your garden *could have been* trodden on and squeezed. These counterfactuals are partially grounded in the dispositions of the egg and the slug, and these dispositions are present in the objects, it is argued, even though the egg was never smashed and the slug was never trodden on.

The different accounts which may all be seen as new actualist are operating under a quite wide array of names, which does not simplify things when we try to get a grasp of the whole field. In this thesis I will use the term *dispositionalist* as a catch-all term for philosophy done in this field, regardless of how the different philosophers refer to their own theories, and which vocabulary they use to describe the tendencies in nature which are meant to account for the modal features of the world. But how are we to understand these dispositional features which are supposed to account for modality? A favourite of dispositionalists is the disposition that a fragile glass breaks if struck with sufficient force.

[60] Vetter (2011, p. 744)
[61] Lewis (1986b, p. ix)

It can be tempting to account for dispositions in terms of possibility: the glass has a disposition to break because there is a possible world in which I hit it and it breaks. But since possibility is what we are trying to make sense of, and since dispositions also point specifically to properties of *actual things*, it is natural for an actualist to attempt instead to turn the explanation in the other direction. We can argue, in particular, that it is possible that the glass might break precisely *because* it has a disposition to do so. Specifically, the disposition of the glass to break could be taken to be the truthmaker for the modal claim that it is possible that the glass will break (or, indeed, that it could have been broken already). This move is at the core of the dispositional account of modality.

This entails that the dialectic is reversed in comparison with most accounts; we are no longer taking necessity and possibility to be the primary notions. The focus is now on concepts I find more discriminating, and possibility and necessity *themselves* need to be explained by reference to some of these other entities. The hope is that by working with more discriminating notions as a starting point, we may be able to give a more detailed and accurate analysis of modality. By using concepts such as *essence*, *power*, and *disposition*, we are able to tie modality to properties that exist in the world, and to the objects having these properties.[62] An essence is always an essence *of* some particular property or object, and the same is the case for dispositions, so the modality that follows from this is clearly anchored *in the actual world*. One might set out to explain all familiar modal notions, such as necessity, possibility, and counterfactual conditionals by appealing to these features of the actual world. However, for the moment, I limit my attention to the notion of metaphysical possibility.

I do, however, have to specify that these kinds of *macro-dispositions* tied to (macro) objects are not the focal point for all dispositionalists, and that the dispositions of the fragile glass will get little attention in this thesis simply because my main focus will be on dispositional *essences* of *fundamental* properties, not on dispositional expressions tied to middle sized dry goods. However I do defend the use of the fragility example, or my earlier examples with the egg and the slug, as a way to get *a first grasp* of what dispositionality is about. Particularly with respect to gaining an understanding of how something might be disposed to behave in certain ways under certain circumstances, and that the disposition will be *just as real* even if those circumstances never come about, and the disposition remains unmanifested.

I hold that if this kind of dispositional actualism is to be successful it needs substantial further development; my goal is that this thesis is a part of this development. This entails, among other things, that I have to provide a clear specification of what a conceptual framework based upon dispositional entities can actually provide. Research questions which

[62]It should be noted that the accounts seen to fall under the new actualism puts very different weight on the notion of an *object*. The theory presented here sees objects as an important metaphysical category relevant for the explanation of dispositionality. If we on the other hand look at theories of dispositional *essentialism*, the notion of a *property* is prior to that of objects. See e.g. (Bird, 2007).

will be explored throughout this thesis include addressing the question of how possibility may be understood in terms of some form of dispositional account, as well as the related subjects of the status of higher order (chains of) dispositions, the possibility of very unlikely events and alien non-actual beings and properties. The overarching theme of the thesis, and the most important topic in the field in my opinion, is the question of the modal status of the laws of nature. The reason for this being the main focal point is that the answer to this question limits the domain of what is *really* possible in an effective and uncompromising way. Moreover, it is a question we seem to have certain prephilosophical intuitions about, which we will have to be able to bypass if we are to accept the understanding of laws of nature I will argue for.

In addition to a specification of what dispositions might be able to do, we also need a greater degree of clarity when it comes to distinguishing between different kinds of dispositional expressions, as well as a specification of what the different terms entail. This field of study is unnecessarily complicated because a large vocabulary is used to refer to the dispositional features of reality which are supposed to carry modality with them. Different authors use words like 'dispositions', 'dispositional properties', 'powers', 'tendencies', 'capacities', 'propensities', and so on, to refer to these modal features of reality in different ways, and this can be confusing.

The most obvious example of this problem is the term *power* which is used in widely different ways in different publications. Because of the problematic aspects of using terms in diverging ways, several authors have introduced new, better defined theoretical vocabulary to replace the problematic and ambiguous pretheoretical terms. We find this in for example (Bird, 2007), where he proposes that we use the word *potency* as a specific theoretical term picking out a dispositional essence of a property, and we find it in (Vetter, 2015) where she introduces *potentialities* as a way of picking out a very widely defined dispositionality.[63] However, if these new expressions do not catch on, we end up with even more words aiming to describe the same features of the world. For this reason, I will not introduce new terminology in this thesis. It is my hope that the way I define the words I use will be enough to avoid contributing to further confusion based on vocabulary. I will mainly use the terms *disposition*, and *power*, the latter being a term solely used for what I will also refer to as a *dispositional essence*. I will return to the question of terminology in chapter 2.

Another distinction which is of crucial importance in what follows is the difference between a (mere) disposition and a dispositional *essence*. That is, between an overarching and wide understanding of a disposition (similar to Vetter's *potentiality*), and the specific use of dispositional essence at the *fundamental level* of metaphysics.[64] This also entails that we need to distinguish between dispositional accounts of modality, and dispositional

[63]Bird later departs from using *potencies* as his main theoretical term, settling with *powers* instead in his later publications.

[64]This fundamental level is a level where there is no further structure to appeal to.

essentialist accounts. This thesis is primarily an example of the latter, although I argue in my chapter 3 that dispositional accounts of possibility might still be useful as a way to gain understanding of possibility at *non-fundamental* levels. Such theories are similar to theories of how *we* understand possibility from the dispositions of everyday language. Still, I argue that these accounts are no longer helpful when they include assumptions that dispositional accounts of possibility allow possibilities going beyond the laws of nature.[65] This is often a result of putting too much weight on what Vetter refers to as 'extensional correctness', or what I will call *catering to intuitions*.[66]

Thus, I will rather argue for what is, at present, an incomplete theory of possibility based upon dispositional essences. This means that what is possible is largely a matter of supervenience, that is, that possibility is limited by, and grounded in, dispositional essences in combination with both micro and higher order structures, and not a matter of manifesting irreducible dispositions existing at each level of complexity. The example of the fragile glass manifesting the disposition of *fragility* by breaking or shattering is an illustration of the latter.

1.3.2 Dispositionalism tied to *objects*

Different dispositionalist accounts diverge not only when it comes to the level of metaphysics on which they operate, but also when it comes to the question of being either largely object-focused or property-focused. The accounts centred on the level of non-fundamental metaphysics are naturally more object focused, whereas the explanations on the level of fundamental or near-fundamental levels are mainly focusing on properties. The former will concentrate on objects possessing certain dispositional features, such as a piece of chalk being *brittle*, while the latter will deal mainly with fundamental properties, such as *electric charge*. Furthermore, these dispositional accounts of possibility, which examine higher complexity things, also naturally focus on objects.

In addition there is divergence when it comes to the question of essentialism, and we see that several dispositional accounts of modality are also *essentialist* accounts, among these my own. Hence, this thesis is not only meant as a contribution to the literature on dispositional understandings of modality, it is also at its core a thesis arguing for *essentialism*. Essentialist accounts take inspiration from Kit Fine, who in his (Fine, 1994) introduces important distinctions between *essence* and *necessity*. Fine shows that the understanding of essences in terms of necessity—that is, the traditional possible worlds centred explanation—is flawed, and that it does not capture the differences between the two concepts. This has lead to the notion of an essence getting a far more important role in

[65] This is explicitly stated in (Borghini and Williams, 2008, Footnote 2, p. 21f.) and is assumed to be an premise which can coexist with Vetter's general account too, although she chooses to leave the question wide open in (Vetter, 2015, p. 290). I return to this debate in chapter 3.

[66] Vetter introduces how the concept of extensional correctness is of relevance to her proposal in (Vetter, 2015, p. 15), and she refers to it throughout the book.

the metaphysics of modality. In order to understand the concept of an essence we might have to take it as something which is ontologically *more* fundamental than necessity.

Just as we will focus mainly on either objects or properties when speaking of dispositionality, this is also the case when it comes to the question of essentialism, different accounts will have an overarching focus either on objects or on properties. An example of the former, which Vetter (2011) calls object essentialism, would be a view taking inspiration from e.g. Kripke's 'Identity and Necessity', and some of the examples he presents there.

> Supposing this lectern is in fact made of wood, could this very lectern have been made from the very beginning from ice, say frozen from water in the Thames? One has a considerable feeling that it could *not*, though in fact one certainly could have made a lectern of water from the Thames, frozen it into ice by some process, and put it right there in place of this thing. If one had done so, one would have made, of course, a *different* object.[67]

The thoughts from Kripke taken slightly further can be understood to lead to the localised modality of the new actualists, and this is a further distinction from the more traditional interpretation of modality, a tradition Kripke's work is an example of. Whereas possibility and necessity are non-localised and general, the modality tied to dispositions is at its core *local* and hence it is anchored in the actual world in a far stronger way than we find in more traditional actualism. As Vetter puts it, "an essence or a disposition is always the essence or disposition *of* some particular object."[68] This focus on a *local* understanding of modality is yet another difference between *softcore* and *hardcore* actualists, and the new actualists are generally hardcore actualists.

Adopting the more discriminating notions of dispositional properties, powers, and essences, in addition to departing from the more narrow understanding of modality as something which should primarily be seen as concerning possibility, necessity, and the counterfactual conditional, means that we, through the approach of new actualism, are able to defend a more nuanced approach to modality. The hope is that this will entail that we will also be able to more correctly capture the modal features of the world. In traditional possible world centred metaphysics of modality, the notions of possibility and necessity are at the core of the modal package, so to speak, and all the other concepts will have to be explained in terms of these core ideas.[69] This often entails that important differences—such as the aforementioned distinction between essences and necessity—is at least to some degree glossed over or overlooked. We remember how Fine shows that an understanding of essence in terms of necessity is not viable, and that we need to turn the order of ontological importance around, that is, it is *essence* not *necessity* which is the

[67] Kripke (2005, p. 232)
[68] Vetter (2011, p. 743)
[69] Vetter (2011, p. 743)

central concept here. We find similar ideas in (Lowe, 2008) where it is claimed that "metaphysical necessity is (...) *grounded in the essences or natures of things*".[70] This means that we actually have to ask whether such an understanding of modality in general in terms of possibility and necessity is even possible.

The relativisation to objects entails that modality in itself is a matter of circumstances concerning objects, and following this it is clearly anchored in the world; the move from focusing on the general concepts of possibility and necessity to the focus on dispositions of objects ensures actualism. However, *new actualism* and an overarching focus on objects need not entail essentialism. Among philosophers considered to be dispositionalist, but not *essentialist*, we find for instance Mumford (2005) with his arguments against an object focused essentialism, claiming for example that we can accept natural kinds without accepting their essences. In addition it is also possible to speak of dispositional understandings of possibility without invoking the concept of an essence. One example of this is found in (Borghini and Williams, 2008), but also the account of possibility found in (Vetter, 2015) is dispositionalist without being essentialist. In this book, she explicitly argues against dispositional essentialism.

1.3.3 Property essentialism

However, the object-focused essentialism just discussed is *not* the kind of essentialism I will examine primarily in this thesis. The branch of essentialism I defend is directed far more towards *properties* than objects. It should also be noted that there is a substantial divergence in the literature regarding to which degree objects are of importance at all. As mentioned, this is particularly the case when we move from a more general dispositionalism towards dispositional *essentialism*, but there is also divergence internally among the dispositional essentialists. Brian Ellis's essentialism which is generally considered to be in the dispositional essentialist camp, and hence more property focused, also employs the notion of a natural kind and thus speaks more of objects than for instance Alexander Bird.[71] Bird's essentialism is more clearly tied solely to properties.

The topic of this thesis will mainly be a form of *property essentialism*, which have been referred to as *scientific essentialism* in (Ellis, 2001), and *dispositional essentialism* in (Bird, 2007). I will mainly use the latter term. According to Vetter (2011, p. 748), dispositional essentialism is not intended to provide an account of metaphysical necessity in general. However, one of the preliminary assumptions I will make in this thesis is that dispositional essentialism is the *foundation* upon which the rest of the metaphysics of modality can be built. That is, even though dispositional essentialism cannot directly explain which particular situations are possible, and even though we can probably not use dispositional essentialism as a recipe to enable us to discriminate between possible

[70] Lowe (2008, p. 24)
[71] See for example Ellis (2001)

and impossible situations or scenarios in our everyday lives, it is the dispositional essences which *ground* these possibilities. I will argue that we will have to settle for a relation of supervenience here, and in addition that the main target for our endeavours should not be to pick out which particular situations are possible, but rather to show *under which conditions* something is possible. We are not directly explaining possibility, but giving the grounds from which all the possibilities flow. This will also be the case for the account of laws which follows from assuming dispositional essentialism. We might not be able to explain every single non-fundamental law of nature directly, but we are explaining the grounds from which the laws flow.

We see that there is a distinction between dispositional theories of modality which are approaching the matter at hand from two different sides, so to speak. The first option is to go through dispositions more broadly, as seen in for example (Vetter, 2015) and (Borghini and Williams, 2008), and the second is to focus more specifically on the dispositionality which is tied to certain essences, as seen in (Bird, 2007). Dispositional essentialism has two features which are often considered problematic. Firstly, it is inextricably tied to a particular view about the laws of nature, and secondly, it is closely tied to a conditional understanding of dispositional essences. An additional goal of this thesis is to show that the fact that the dispositional essentialist has to accept metaphysically necessary laws of nature is not a problem, but rather something which makes the account more attractive. In order to see this, we need to distinguish clearly between our expectations about possibility—that the possible should somehow match what we are able to consistently conceive of—and what possibility really is. This is the sole topic of chapter 7.

I will also defend the view that if we stick with dispositional *essences* as our main topic, the conditional understanding of them does not pose insurmountable problems for the view. In order to grasp this point, we should note that there are two main routes available when we are to account for dispositions. One through the aforementioned counterfactual conditional, and one more directly through possibility. The counterfactual conditional analysis entails there is some kind of a stimulus-manifestation relation tied to dispositions, and that each disposition will have particular stimulus conditions and particular manifestations. The possibility approach centres around only the manifestation of the disposition, and this view is perhaps most forcefully advocated by Vetter (2015).

I hold that the former, and more travelled, route through the counterfactual conditional is to be preferred if we stick with dispositional essentialism as the starting point. However, I will argue that the analysis of dispositional essences through counterfactual conditionals is perhaps better seen as a picture to aid our understanding than a complete reductive analysis. I contend that there is no reason to explain these dispositional essences away—they are acceptable metaphysical entities in themselves—but we still need to *understand* them. The picture is slightly different if one is arguing for an understanding of modality in general starting from dispositions in themselves (not dispositional essences). The anal-

ysis of mere dispositions in terms of counterfactual conditionals is clearly flawed in ways which have problematic consequences at the level of non-fundamental metaphysics. This is due to the fact that there is always room for interference between the stimulus and the manifestation at non-fundamental levels. These features are commonly known as *finks* and *masks* and I will return to these problems in chapter 2.

I maintain that dispositional accounts of possibility may be useful ways of gaining understanding about possibility, but I will also argue that this is not the case if these accounts are made with assumptions which allow possibilities going beyond the laws of nature. My suggestion in this regard will be that some of the problematic features these theories entail stem from the combination of focusing solely on the manifestations of dispositions (that is, a blatant disregard of the concept of a stimulus condition), as well as putting too much weight on prephilosophical intuitions. As mentioned, I maintain that such theories, exemplified by publications like (Borghini and Williams, 2008) and (Vetter, 2015) are similar to accounts of how *we* understand dispositional possibility because of their attention given to the aforementioned extensional correctness:

> We have certain firm convictions about what is or is not metaphysically possible or necessary, and these had better come out mostly true on any metaphysical account of modality.[72]

As mentioned, I tend to refer to this as *catering to intuitions*. It represents an overly enthusiastic belief that our prephilosophical grasp of modality is more or less correct. This might be the case regarding everyday modal beliefs, that is, our belief that the glass will break when we drop it to the floor and similar things, but this cannot easily be transferred to modal claims about, for example, the very big or the very small. It is *very hard* (if not impossible) to find well grounded arguments for how and why we are supposed to have proper *intuitions* about these domains.

Instead of accepting such a view, I will settle for an, at present, incomplete dispositional essentialist account. Such a view entails that rather than explaining possibility at each level where it occurs, we will have to see possibility as a case of supervenience, so that it arises from fundamental dispositional essences *in combination with* the structural compositions that underpins the configuration of macro-properties, macro-relations, and so on. This view will depend on the laws of nature in order to explain possibility, and the laws in question will have to be metaphysically *necessary* because they are grounded in essences—*that which could not have been different*.

Dispositional essentialism is at its core a *holistic* view of the property structure at the fundamental level. Thus, where the Humean views of fundamental properties can be illustrated by referring to a mosaic floor—where the change of one single tile makes little difference for the rest of the floor—dispositional essentialism is rather a *web*. If a thread is

[72] Vetter (2015, p. 15)

removed from the web, it *unravels*. This is not the dispositionalism of everyday language, e.g. 'the glass was disposed to break because it was fragile', but the hope is that it will account for possibility in a more *correct* way nonetheless.[73]

1.4 Plan for the thesis

The thesis will proceed as follows. In chapter 2 I will clarify the topic of dispositional essentialism (and the concept of powers), as a theory of properties which is an alternative to the more traditional categoricalism. Limiting the notion of powers to the level of fundamental metaphysics, I argue that the assumption that powers exist may give us an account of property identity and the laws of nature. In chapter 3 I discuss two examples of *dispositional* theories of possibility. First Borghini and Williams' dispositional theory, and then Vetter's account based on potentiality. I argue that dispositional theories of possibility cannot support a notion of possibility going beyond the nomic, even though some of them claim to be able to accommodate such results. Hence, the laws of nature limit the domain of the possible.

Chapters 4 through 6 will be centred around the topic of the laws of nature. Chapter 4 will outline those accounts of laws available for the categoricalist, and I mainly focus on Lewis's and David Armstrong's versions. If we are to argue that the accounts of laws implicit in dispositional essentialism are superior to those available to the categoricalist, we need to know what we are up against. Chapter 5 discusses the different accounts of laws open to the dispositional *essentialist*. There are mainly two options available: one relying on the concept of a natural kind in addition to that of a power, and one stemming directly from the fundamental powers themselves. I will advocate the latter view. Chapter 6 presents the most pressing problems the dispositional essentialist will have to solve in order for the account of laws to be successful. These problems include how to deal with what I will call *global* laws of nature, and fundamental constants. I propose that the fundamental structure of the world is a *web*, not a mosaic, and that this holistic understanding of the most fundamental properties in the world is helpful when we are to grasp the resistance to nomic change I shall argue for.

Chapter 7 discusses what is generally seen as the biggest obstacle to accepting a dispositional essentialist account of the laws of nature. Dispositional essentialism *entails* that the laws are metaphysically necessary, and that the domains of nomic and metaphysical possibilities as such are coextensional. However, it is common to assume the laws to be metaphysically contingent even if they are nomically necessary, hence dispositional essentialism collides with our prephilosophical *intuitions* in this area. This chapter focuses on the role intuition may be seen to have in our philosophical theories, as well as the differ-

[73] I will return to the question of supervenience in chapter 5, but note already that also the structural composition also depends on the fundamental powers.

ences between possibility and conceivability. I argue that even though the contingency of the laws is conceivable, or imaginable, for us, this does not entail that this is also thereby a genuine possibility.

Chapter 2

Powers and Dispositions

2.1 Introduction

This chapter is about properties, and about the properties of properties. If we are to use dispositional properties in order to understand questions regarding modality, we should know which properties are fit for the job, and which are not. In this chapter I will introduce the account I defend in this dissertation, *dispositional essentialism*, and show the areas in which this view will be useful, as well as drawing attention to its limitations. Dispositional essentialism is *not*, I argue, an account which can give us the answers we crave in all areas related to modality. Rather, its scope is more limited than what it is often assumed to be, and we should be careful not to overestimate the usefulness of the account.

The chapter will proceed as follows. First, in section 2.2, I present some important distinctions regarding properties, and the properties of properties. Of special importance are the distinction between sparse and abundant properties on the one hand, and the distinction between *quiddities*—properties which are not essentially dispositional—and *dispositional essences*, or *powers* on the other. In section 2.3, I turn to the discussion of dispositional essentialism, a dispositional account focusing on the essences of fundamental properties.

Section 2.4 points out the crucial differences between fundamental and non-fundamental metaphysics. Some dispositional explanations are, I argue, only suitable for addressing issues in *either* fundamental metaphysics *or* non-fundamental metaphysics, but not both. The question of where the concept of *powers* belong is the key question both in section 2.4 and in section 2.5, where the latter section asks whether powers, understood as sparse properties with dispositional essences, can be seen as existing also outside the domain of fundamental metaphysics.

2.2 Properties

2.2.1 Dispositions and powers—abundant or sparse?

As specified in chapter 1, I am defending a view of modality which may be referred to as a *new actualist* view, which entails removing the notion of a possible world from the metaphysics of modality and replacing it with certain modal entities existing in the actual world, in particular dispositional properties. However, different dispositionalist accounts rely on different kinds of properties, so it is important to specify exactly *which kinds of properties* we are speaking of when discussing these accounts. Because of this I will commence by making some general remarks about properties, which will be of crucial importance later on.

When we speak of properties, it is common to make a distinction between sparse properties and abundant properties.[74] Abundant properties are such that for each predicate we can think of (and quite possibly some we cannot even conceive of), there is some property that corresponds to it. The abundant properties' job is simply to provide semantic values of meaningful predicates.[75] Sparse properties, on the other hand, will be a subset of the abundant ones, more strictly defined; we can say that these properties are the ones which are needed in order to give a complete and correct scientific description of the world. Sparse properties may also be referred to as natural properties. I will, at present, limit the sparse properties to the realm of the fundamental properties, and return to the question of non-fundamental sparse properties in section 2.5 of this chapter.

The distinction between different kinds of properties is relevant at this point for two reasons. Firstly, it is relevant as a background for the different accounts based on dispositional terms, because the notion of properties invoked varies between accounts. For example, both Andrea Borghini and Neil E. Williams' article 'A dispositional theory of possibility', and Vetter's book 'Potentiality: from dispositions to modality' (which will be thoroughly examined in chapter 3), both feature a liberal view regarding which properties are the relevant ones. This is not the case for the account for which I will argue. Secondly, the distinction between the sparse and the abundant properties is also crucial if we are to explain the difference between dispositions and *powers*. Here I will follow Bird (2016), and argue that there *is* an important difference between dispositions and powers, and that treating these terms as interchangeable is a disadvantage for any dispositional theory, as it clouds genuine and important differences between two different concepts.

Dispositions are commonly exemplified by things being *fragile*, *soluble*, and so on. These are properties that in some sense point beyond themselves, or *tend towards* something, as they have the ability to bring about some manifestation when they are met with appropriate stimulus. Thus, the fragile glass is *disposed* to break if it is, for example, struck with

[74] Lewis (1983), Lewis (1986a)
[75] Schaffer (2004, p. 98)

sufficient force. It is important to note that the disposition in question is present in the properties of some object even if they are never manifested. If we have a set of six identical glasses, where one of them breaks, the remaining fragile glasses that perhaps never break are just as disposed to break as the fragile glass which actually happened to do so.

The term *disposition* is suitable for describing abundant properties, as the examples show, but it is not reserved only for these properties. 'Disposition' is treated as a catchall term in this thesis, and can refer to a very large group of different properties which may be used to describe features of objects or of other properties. What we refer to as dispositional properties, broadly construed, will often be abundant properties, and they can also be accidental properties. However, in some cases they will be sparse properties, and a particularly interesting subset of the dispositional properties is what I will refer to as the *powers*. These powers are sparse properties which are essentially dispositional, so in this case we are using dispositional terms to describe the essences of properties. The way these properties act, react, and interact is grounded in their dispositional essences. What they can and must do are essential to them.

I will argue that the specific case when a sparse property has a dispositional essence is the only instance where the *powers* term should be used. As my preliminary concept of sparseness is restricted to the fundamental properties, this entails that the fundamental properties in our world would act as they actually do no matter what. The concept of essence invoked here is similar to the idea of a *real essence* in Locke's *An Essay Concerning Human Understanding*. It is what makes something *what it is*.[76] This means that we may go so far as to say that these properties *are what they do*. However, it is important to note the following: "Even if properties are what they do, a propertied entity does not have to be doing things at all times; it has merely to be capable of doing them."[77] In the essences of these properties lies the capacity to interact with other properties which in turn also have dispositional essences. As is generally considered to be the case, altering an essence will make whatever possesses this essence, be it an object or a property, into something else than what it actually is. Locke speaks of objects, but the concept translates to properties as well. As the essence of the property is dispositional, it will necessarily have the same dispositional role across possible worlds, or simply 'no matter what' if we are reluctant to speak in terms of possible worlds.

Thus, we see that when we are moving from speaking about dispositions to speaking of powers, we are, on the one hand, moving from speaking largely about objects and abundant properties to speaking of *fundamental properties*. On the other hand, we are also moving from a more general to a more specific term. This means that rather than focusing on the fact that things may be disposed to do something (e.g. break when hit),we are talking about fundamental properties with a particular kind of essence which is characterised in

[76]Locke (2004, p. 373f.)
[77]Bird (2007, p. vii)

a dispositional way. This is in contrast with several dispositional accounts of possibility which are largely focusing on objects. I will go into details regarding such accounts in the following chapter. When discussing dispositional *essentialism*, however, it is all about properties.

It is important to note that in my view we are not only describing different things when we speak about powers or dispositions, but we are also, crucially, operating at different levels of metaphysics depending on which notion is used. Most things described as dispositions (fragility, solubility), belong to the area of non-fundamental metaphysics, and are *not* powers. A power, understood as a property with a dispositional essence, is a concept that belongs in *fundamental* metaphysics, that is, metaphysics dealing with the most fundamental entities.[78] Hence, there is a substantial difference in the ontological commitment behind assuming there to be *dispositions* and assuming there to be *powers* existing:

> [E]veryone thinks that things have dispositions. But it is highly contentious whether anything has a power.[79]

We may say that these terms differ in degree of contentiousness such that arguing that something may be characterised in a dispositional way is a very different statement to assuming that powers really exist. Accepting the existence of dispositions is something that most philosophers will do to some degree, although their understanding of what a disposition *is*, and how it is best described will vary. This is *not* the case when it comes to assuming the existence of powers. Powers are far more problematic, because holding that there are actual powers existing entails a commitment to essentialism. In addition, powers can do work which I argue dispositions are not fit to do, such as grounding the laws of nature.[80]

The distinction between dispositions and powers, as described here, is not generally agreed upon. There are substantial amounts of literature arguing that the notions of both dispositions and powers are useful when we are to understand modalities, but there is no consensus on exactly what each term refers to.[81] This means that when navigating the literature of this field it is of *crucial* importance to investigate exactly *what* is entailed by the terminology that is used.[82] Particularly problematic is the fact that several philosophers do not notably distinguish dispositions from powers. Some even explicitly state that they take dispositions and powers to be interchangeable terms. Because of this it is common to see examples like 'the glass has a *power* to break' in some of the literature, something which

[78] Bird (2013) and Bird (2016). I return to this topic in section 2.4.

[79] Bird (2016, p. 341)

[80] The question regarding the relation between powers and the laws of nature will be explored in more detail in chapter 5.

[81] See for example (Mumford, 2004), (Mumford and Anjum, 2011), (Vetter, 2011), (Vetter, 2015), (Ellis, 2001), (Bird, 2007), (Bird, 2013), (Bird, 2015), and (Bird, 2016)

[82] For a survey of this, see for example (Bird, 2016), where he argues that the powers terminology has been stretched too far, and that the notion is often used in ways that is not warranted by the definition he prefers.

is unfortunate in my opinion as it creates confusion solely on the basis of terminology.[83] To avoid this, I argue that we should acknowledge the difference between dispositions and powers. In addition, we should note that it is not the case that accepting one of these concepts as part of our ontology requires or entails accepting the other.[84] It is possible to argue for dispositional understandings of several concepts without arguing that there are powers. It is also possible to argue for a powers based ontology without accepting any of the more general dispositionalist theories on the market.

To sum up: *dispositions*, following Bird's vocabulary, is a subset of *all* properties, and this subset contains both abundant and sparse properties. This is in line with Vetter's, and Borghini and Williams' liberal dispositionalist views. They do not discriminate between different kinds of properties in their theories, and do not put particular weight on the fundamental ones. Vetter *does* hold that *if* there are such things as fundamental properties, then these will also be dispositional, as the dispositionality goes all the way down.[85] A *power*, understood as a property with a dispositional *essence*, is something different, and more specific, than a disposition. Because the assumption that there are dispositions and the assumption that there are powers are quite different assumptions to make, I hold that specifying that there *is*, and *should be*, a distinction between these terms is fruitful.

2.2.1.1 A note on terminology

An important question I would like to address in this chapter is whether we can use the existence of powers as fundamental metaphysical entities to explain modal features in non-fundamental metaphysics, and in philosophy more generally. I will argue that, in most cases, assuming the powers ontology to be able to do such work is not justified by the theory, and that often it goes far beyond the function such a framework may have. As a result, the importance of powers in non-fundamental metaphysics will have to be, for example, in the form of supervenience. That is, the non-fundamental properties will be understood as supervening on the powers. I will return to this issue in chapter 3, section 3.6.

In order to discuss such questions in a sensible and unambiguous way, however, I need to first make some distinctions regarding the terminology I will use. This is of particular importance, as *some* of the problems related to wrongful usage of the powers ontology are due to issues connected with choice of terminology. However, one cannot blame it all on such linguistic issues. I presented some issues related to terminology in chapter 1, but the character of this field means that it does indeed seem justified to go into further detail regarding this.

[83] See for example (Mumford and Anjum, 2011) for a very clear example of this use of the powers term. We find these tendencies also in (Jacobs, 2010), and (Borghini and Williams, 2008).

[84] (Bird, 2013), (Bird, 2016), as well as Vetter's discussion regarding the laws of nature in (Vetter, 2015) support this claim.

[85] Vetter (2015, p. 25)

Throughout this thesis, the word *disposition* will in general be used such that it denotes being disposed to do something in a wide sense. That is, it is a term that can be used about all kinds of properties, both abundant and sparse, and we can also use a disposition based terminology to speak about objects. We may say that this object has that disposition, and in that case we are speaking of how this object will behave, or is likely to behave in certain circumstances. We might even extend the disposition term such that it can include what Vetter calls *potentialities*, which includes things which fall outside our ordinary understanding of dispositions, such as the potentiality that a robust bridge might break. I will save the details of Vetter's account for chapter 3, section 3.4, but for now it suffices to say that potentialities are dispositional possibilities rooted in objects, which include *both* instances like abilities, *and* things which seem weaker than dispositions, such as potentials.[86]

However, such a wide understanding of dispositionality might just as well be included in what we address as 'dispositions', rather than introducing new terminology to take care of this interpretation. Including such things in my concept of dispositions does of course entail shifting the term somewhat from its use in daily language. By doing this, we give it a more technical meaning and a range that exceeds its common usage, but this needs not be problematic in and of itself. For the purpose of this dissertation I will argue that such a *wide* understanding of dispositions is defendable. This means that we can say, for example, that a robust bridge is still *disposed* to collapse under certain circumstances. For the remainder of this dissertation, I will use the *potentiality* term only when quoting Vetter or directly referring to her work, otherwise I use *disposition*.

Powers, on the other hand, is usually seen as a more technical term but it is still often used interchangeably with dispositions. I do *not* support this use. Here, the word power will *always* be a technical term, and it will solely refer to a property with a dispositional essence, such as *charge*, and nothing else. Following from this it makes little sense to say that a macro-object has a *power* to do something. This is in line with (Bird, 2013) and (Bird, 2016), while (Bird, 2007), as mentioned in chapter 1, uses the word *potency*. Bird wished to avoid both the powers term and the disposition term when writing 'Nature's Metaphysics', as the use of these notions often are confusing at best, but he has not kept this terminology in his later works. *Potency* is a technical term for a property with a dispositional essence, so it is interchangeable with his use of *power* in his subsequent articles. I will use the term *potency* only when quoting directly from (Bird, 2007), otherwise I use *power*. In addition, we should be careful not to confuse Bird's *potencies* with Vetter's *potentialities*. The similarity of these notions is also a motivation for me to not use either of them.

[86] Vetter (2015, p.19)

2.2.2 Quiddities or Dispositional Essences?

So far, we have seen how the terms 'disposition' and 'power' relate to different sets of properties, and that the relevant subset of properties for applying the powers term is the so-called sparse ones. However, in addition to highlighting the difference between abundant and sparse properties, there is yet another distinction pertaining to how we understand the natures of the *sparse* properties themselves which needs to be discussed. Should such properties be understood as having dispositional essences, or should they be seen as *quiddities*?

The distinction between properties seen as quiddities and properties seen as having dispositional essences is important because we may distinguish between different metaphysical theories depending on how they view *fundamental properties*. I follow Bird (2007) in introducing three categories. These categories refer to views regarding the modal status of the most fundamental properties in the world:

1. Categorical monism
2. Dispositional monism[87]
3. Mixed view

An understanding of sparse, fundamental properties solely as quiddities will be an example of categorical monism.[88] Seeing all sparse, fundamental properties as having dispositional essences is an example of dispositional monism, and this is the view I find most plausible. Arguing that the set of all sparse, fundamental properties contains a mix of quiddities and essentially dispositional properties, entails holding the mixed view.[89]

It is important that we do not make the mistake of defining quiddities as being utterly non-dispositional. It is undeniable that properties with a dispositional character exist in the world, exemplified by the standard instances of things being fragile, soluble, or elastic, but also in those cases where we are dealing with sparse properties, such as charge. Categoricalists do not deny the existence of such properties. The key point is rather a case of holding that a certain property has an *actual* dispositional character, while *at the same time* denying that this has anything to do with the *essential* characteristics of this property—thus one can argue that *the same* property could exist in another possible world without having this dispositional characteristic. In this case, the property is understood as a *quiddity*, and when I classify philosophers as being *categoricalists* about properties in what follows, *this* is the main tenet of their view which is of relevance.

A property is seen as having a *brute* identity according to categorical monism; it is self-identical, but its essence does not contain much more than this. The dispositional character

[87] I have chosen to keep the vocabulary from (Bird, 2007) here, but dispositional monism can also be referred to as *powers monism*, as it is in (Bird, 2016).

[88] See Lewis (1986a), Armstrong (1983)

[89] See Ellis (2001), McKitrick (2018)

of a property is not essential to it, and thus the properties are only contingently tied to the theoretical roles they play. These theoretical roles include such things as the roles they play in actual laws of nature. The point is that these kinds of dispositional characteristics are in no way *essential* to the properties if we see the properties as quiddities. This understanding entails that properties have no essential modal character, and the nomic features of the property are seen as contingent. Thus, properties may swap roles with each other in the nomic structure of different possible worlds.[90]

We can, for example, picture a world which is *isomorphic* to ours, but where every fundamental property and relation is replaced with alien properties and relations. This is a world which would appear to be *exactly* like ours, but which according to the quidditist should still be seen as a world distinct to ours. The result is what Robert Black refers to as *distinctions without differences*.[91] A common concrete example of such a situation, is to imagine that there is a possible world where mass and charge has completely swapped properties with each other. The quidditist will argue that the resulting world is *distinct* from the actual world. This option is open for the quidditist because of the *primitive* transworld identity invoked for properties. However, the alleged difference between the two possible worlds is mysterious indeed, and for a dispositional essentialist such examples makes very little sense. Swapping the nomic roles of mass and charge makes no difference to the world—the only change would be calling mass 'charge', and vice versa.

Seeing the fundamental properties as quiddities and hence as being *categorical* is basically a Humean understanding of properties, and it excludes modality from the supervenience base. In Hume's own words:

> [T]here is nothing in any object, consider'd in itself, which can afford us a reason for drawing a conclusion beyond it[92]

Such a view of properties will generally go hand in hand with the idea of laws of nature as contingent.[93] In addition, these theories are most often combined with a possible worlds framework in order to explain modality. As mentioned in chapter 1, the Humeans, if they are to find modality at all, are in some sense forced to look outside our actual world. This entails that the metaphysics of modality will, for the Humean, be equal to the metaphysics of possible worlds.[94]

It is an interesting fact that these quiddities are required for the Humean supervenience base, even though it seems like this is at odds with present day science. This is peculiar because some of the motivation for assuming that properties are quiddities is that this idea is assumed to be closer to science than other theories.[95] This is challenged by, for

[90] Cowling (2016, Section 7.1), Armstrong (1989, 59f)
[91] (Black, 2000, p. 94). Black is generally using *quality* where I use *property*.
[92] Hume (2007, Book I, Part III, Section XII)
[93] I will return to the question of accounts of laws of nature compatible with Humeanism in chapter 4.
[94] Vetter (2015, p. 7)
[95] See for example Lewis (1986b).

example, Simon Blackburn, claiming that science "finds only dispositional properties all the way down".[96] Blackburn argues that the best physical understanding of the world does not give us any idea of what categorical properties, or quiddities, might be. They play no role in the scientific understanding of the world, and that they do not ground anything.[97] Without the closeness to science as motivation it is hard to see why Humean supervenience should be accepted at all. In addition, if we reject Humeanism it is equally hard to see why we would want, or even allow, possible worlds as an important part of the metaphysics of modality.[98]

As opposed to this, I argue that certain sparse properties are *essentially* dispositional, that is, I argue for a form of dispositional monism, or pandispositionalism, *for fundamental properties*. According to this view, sparse fundamental properties will necessarily have the same dispositions and thus have the same theoretical role in all possible worlds, so to speak. We can view *this* as the identity criterion for these properties, rather than resorting to the brute identity conditions of the quiddities. Dispositional essentialism *guarantees* transworld identity of fundamental properties, without resorting to a notion of primitive identity. A further crucial point is that these essential features of the properties also entail that we cannot have a case of fundamental properties being *related* otherwise than what they actually are, as these relations are part of the essence of the property. This is the key assumption behind dispositional essentialism. Let us now go into the details of this view.

2.3 Dispositional Essentialism

2.3.1 Essences of fundamental properties

The variety of dispositional essentialism I defend in this thesis originates in a view first articulated in (Ellis and Lierse, 1994). However, the most complete versions of the view are found in (Ellis, 2001) and (Bird, 2007).[99] As already mentioned, dispositional essentialism is a view of the nature of *properties*. It is not primarily concerned with objects, and as such it differs from several other dispositional accounts, some of which will be discussed in chapter 3. In addition, dispositional essentialism is a theory which clearly distinguishes between different kinds of properties, where the relevant ones are the *fundamental natural, or sparse, properties*. We assume these properties to be *universals*, and hold that such properties have essences, or particular *natures* which are dispositional, and which determine the identity of the property.

[96] Blackburn (1990, p. 63)

[97] Blackburn (1990, p. 65). Arguments against a Humean understanding of properties is also found, more recently, in for example (Maudlin, 2007), and (Karakostas, 2009).

[98] (Vetter, 2015, p. 10)

[99] Traces of the account is also found in (Shoemaker, 1980), (Swoyer, 1982), and (Bigelow et al., 1992). Important later sources are also (Ellis, 2002), (Ellis, 2009), (Bird, 2013), and (Bird, 2016).

As already mentioned, the identities of dispositional essences are not simply primitive, as the identities of quiddities are, and they are also not purely a matter of intrinsic character. The essences, being *dispositional* in character, are determined not only by their intrinsic character, but also by their relations to other properties (which also have dispositional essences):

> If properties have a dispositional essence then certain relations will hold of necessity between the relevant universals; these relations we may identify with the laws of nature. The necessity here is metaphysical.[100]

This entails that the necessary features of a world also depends on the relationships *between* properties, not only the intrinsic essences of the properties themselves. The essences we address when speaking of properties includes relations *between* fundamental properties which will hold necessarily.[101] The world is thus, at the fundamental level, an interwoven web of necessary relations.[102] These relations are what we know as the *laws of nature*—laws simply reflect the essences of the properties. Because of this, the dispositional essentialist is *committed* to seeing the laws of nature as necessary, a feature which I will consistently present as an attractive feature of the account, and not a 'bug'. In addition, there is no need to posit any primitive transworld identity for such properties. Transworld identity, and intra-world identity, for that matter, is *secured* by the identity of the dispositional character, given that these dispositions are presumed to be essences.

2.3.2 Are all fundamental properties dispositional?

Arguing for dispositional essentialism entails arguing that at least some sparse, fundamental properties are powers. This naturally leads to the question whether *all* properties at this level are powers, and here we find a striking difference of views among proponents of dispositional essences. We remember that, at the fundamental level, Ellis holds the mixed view, while Bird is a dispositional monist, the difference being that the dispositional monist holds that all fundamental properties are dispositional, while the advocate of the mixed view will hold that some properties are not essentially dispositional (that is, some are categorical). While this is in general presented as a distinction with consequences for the fundamental level, Ellis's mixed view stretches beyond this, because he holds that there are dispositional essences at other levels of metaphysics too, for example essences tied to the natural kinds of chemistry. Hence, this dispute does not only reflect what goes on at

[100] Bird (2007, p. 43). I will return to what I take laws of nature to be more generally in chapter 4. For now it is important to bear in mind that the concept of law debated in this thesis is a philosophical one, and will as such not be exactly the same as a *scientific* law. Thus, when I am speaking of the laws of nature I am not limited to speaking of the current laws of science, that is, the terms *law of nature* and *scientific law* are not coextensive, although they are, I argue, overlapping.

[101] Bird (2007, p. 139)

[102] I return to this particular understanding of the relationship between the properties at the fundamental level in chapter 6, section 6.3.3.

the fundamental level. I do, however, argue that *powers* are entities which belong at the fundamental level.

When it comes to the question of whether all fundamental properties are dispositional, the problematic properties are generally held to be the structural ones, i.e. properties that are required to account for the structure of things, and relations which are structural in character (geometrical shapes, or distance/displacement for example). If we cannot explain how such properties may be accounted for in dispositional terms, this is a problem for the dispositional *monist*, not for the dispositional *essentialist* as such, because one can perfectly well hold the mixed view, as Ellis does.[103]

If spatial and temporal properties and relations are *fundamental* properties and relations, then the dispositional monist must provide reasons for thinking that they have dispositional essences even though it does not seem like they do.[104] In order to argue that this is the case, Bird makes reference to contemporary physics, which seems to hold that theories should be *background-free*. This entails that the structures in such theories (and hence the structural properties we worry about, such as displacement) are no longer seen as a background, a stage where happenings unfold, but rather as something which may be recipients of effects, and also causes of effects. The requirement of background-freedom gives us an opportunity to formulate an account of spatial and temporal properties where also these kinds of fundamental properties have dispositional essences. I side with Bird in this question, that is, I support a version of dispositional monism. However, I also hold that this might not be the most important question for me to answer at this point. We can get a long way by stating that *at least some* fundamental properties have dispositional essences, and concentrate on the consequences this starting point has. This is what I intend to do. Hence, I leave the question whether all fundamental properties are powers open, even thought I hold that it is likely that this is the case.[105]

2.3.3 The Conditional Analysis

As briefly mentioned in chapter 1, there are in general two ways of understanding or explicating dispositions. We will either connect them with possibility, or we will see them as related to the counterfactual, or subjunctive, conditional. Both Borghini and Williams, and Vetter are examples of the former, while the latter is the more canonical approach. If we are to understand dispositional *essentialism*, however, we need to take a closer look at the conditional analysis, and some of the problems with which this analysis is faced. This is so because dispositional essentialism is inextricably connected with the conditional analysis.

[103] See for example (Ellis, 2001, p. 111)

[104] We should note that questions of geometrical shape are not counterexamples, as such properties are not *fundamental* ones, but can be further reduced.

[105] While the discussion regarding structural properties is slightly off topic for my dissertation, (Bird, 2007, Chapter 7) discusses it in great detail.

In (Bird, 2007, p. 24) the conditional analysis of dispositions is presented as follows (where $D_{S,M}x$ means that x is disposed to manifest M in response to stimulus S, and $\Box\!\!\rightarrow$ is the counterfactual conditional):

Conditional Analysis (CA): $D_{S,M}x \leftrightarrow Sx \Box\!\!\rightarrow Mx$

There are several formulations in the literature, Lewis presents it as:

> Something x is disposed at time t to give response r to stimulus s IFF, if x were to undergo stimulus s at time t, x would give response r.[106]

Thus, we see how the *dispositional essences* are defined in terms of conditional statements. If we agree that at least *some*, and perhaps all, sparse fundamental properties are essentially dispositional, and that these properties have real essences which includes a disposition to some particular manifestation M in light of some particular stimulus S, then this may be expressed conditionally. If an object possesses some property, and this property has the power P, then no matter what, the property (and hence the object) in question is disposed to yield M in response to S. This is formulated as

$$\Box(Px \rightarrow D_{(S,M)}x)$$

At the same time, if we were referring to a simple conditional analysis of mere dispositions at this point, rather than dispositional *essences*, we might as well note straight away that the consensus is that this analysis is, as Lewis puts it, "Simple indeed—but false".[107] This is due to well-known problems, including several acknowledged counterexamples.[108] Since these problems are so prominent in the literature, my presentation of these issues will be brief. An important point to note is that Bird proceeds to argue that these counterexamples may not be as damaging as they seem for the dispositional essentialist. To the contrary, Bird (2007) argues that they have an important role to play when it comes to explaining the relationship between the dispositional essences and the laws of nature. I'll argue Bird is in general right, that is, the counterexamples need not be damaging for the dispositional essentialist. However, his additional point about how these counterexamples have important roles to play for the explication of the laws of nature fails. The reasons for this failure lie in the relationship between fundamental and non-fundamental metaphysics, so I save the details for section 2.4.3.

Following this, the main points I want to address in the current section are that, in spite of the fact that the conditional analysis indeed has its problems, these problems are mainly a concern for non-fundamental metaphysics. They are, I argue, in no way damaging for the powers ontology, such that *dispositional essences* might still be explained by way of conditionals.

[106] Lewis (1997, p. 143)

[107] Lewis (1997, p. 143)

[108] The criticism starts with (Martin, 1994), and his notion of a finkish disposition, but there are several other examples, see e.g. (Lewis, 1997), (Bird, 1998) and (Bird, 2007), and (Vetter, 2015)

There is also another way of looking at the conditional analysis of dispositional essences which I am sympathetic towards. According to Ellis, we may, in a sense, turn the account up-side-down, and subsequently argue that the analysis of dispositional properties as essential natures may explain why it is the case that dispositions have such a special relationship with the counterfactual conditional:

> Dispositional properties support subjunctives because their existence entails that certain kinds of natural processes would occur in certain kinds of (possibly idealized) circumstances to the objects that have these properties. The subjunctive conditional simply spell out these implications.[109]

Hence, what we are speaking of here is not so much a *definition* of dispositional properties as it is is a *criterion for identification*. That is, not something which gives their precise *identity*, but something which describes important features of them nonetheless. This point may be a useful idea to keep in mind when speaking of the conditional analysis of dispositional essences too. Perhaps it is not so much a clear definition as it is a way of recognising the behaviour of a particular subset of properties. Following this, the important point is not how we choose to formulate the content of a disposition, but rather how it really works. In light of this it seems that the conditional analysis, rather than *defining* what the different dispositions or powers may be, are providing a *useful approximation* of the dispositional content in question. These approximations will be more or less accurate, depending on our knowledge about the subject in hand. I do, however, assume that in ideal circumstances specifying some counterfactual conditional corresponding with the dispositional essence in question would be possible, and that the specification that there is a need for both a stimulus condition and a manifestation is absolutely crucial. I will return to this discussion in chapter 3, section 3.5.

2.3.3.1 Finks and Masks

The counterexamples to the conditional analysis of dispositions are generally referred to as *finks* and *masks*.[110] The finkish dispositions, as presented in (Martin, 1994) are dependent on the fact that the manifestation of a disposition usually takes some amount of time to come about. The finks need this time gap in order to work, because a finkish disposition is a disposition that is lost *after* the stimulus condition has occurred, but *before* the manifestation has taken place. Thus, the manifestation of the disposition does not come about *even though* the object *had* the disposition, *and* the stimulus condition occurred. This entails that one of the claims of the biconditional is false while the other is true. This is obviously problematic for the analysis.

[109] Ellis (2002, p. 79) Note that Ellis's vocabulary is different from mine, and so is his ontology, so I will be restricting the relevance of this quote to the dispositional essences at the fundamental level, although he would argue that this is relevant at certain non-fundamental levels as well.

[110] Masks are sometimes referred to as *antidotes*, see e.g. (Bird, 1998). I will generally use *masks*.

If we stick to the level of everyday, non-fundamental, examples, an instance of a finkish disposition can be the familiar disposition of fragility in a glass object, where the object is subjected to rapid heating or cooling. A cool glass has the disposition of being fragile, but in this case striking it leads to the glass heating up substantially, such that the disposition disappears, and the glass is not broken or shattered even though it *had* the disposition and *was* subjected to the correct stimuli. In the same way, objects may gain dispositions. A piece of heated glass is not disposed to break, but cools rapidly upon being struck, gains the disposition and breaks nonetheless. Lewis (1997) presents a *reformed* conditional analysis as a response to these problems, but as this reformed analysis does nothing to repair the problems of masking, which we shall turn to now, I propose that we stick to the simple conditional analysis—for simplicity.[111]

While the disposition in the finkish case would vanish if put to the test, the disposition remains throughout when we are speaking of dispositions being masked. The time gap that allows for the finks to come about is irrelevant for the cases of masking. In the case of masking, the causal chain leading to the manifestation of the disposition is interrupted. A simple example is that of poisoning, where one, if poisoned, can inject some form of antidote to the poison, and as such prevent the manifestation of the poisoning from coming about. The poison's disposition to kill or harm is left unchanged, but is interfered with by the medication.

These problems may be seen as being so damaging that the conditional analysis of dispositions must be abandoned. An example of this approach is found in Vetter (2015). She presents a substantial critique of the conditional analysis in *far* greater detail than what I have presented here, and proceeds to go beyond these simple complaints focusing on finks and masks. Her discontent with the conditional analysis is so great that it actually makes it impossible for her to accept a connection between her theory of possibilities and a dispositional essentialist view of properties and laws. This is something I will return to in chapter 3. For now, I will turn to how, if at all, these issues affect the understanding of powers.

2.3.3.2 A connection with *ceteris paribus* laws?

We remember that the conditional analysis is seen by Bird as the following necessary equivalence:

$$\Box(D_{(S,M)}x \leftrightarrow Sx \mathrel{\Box\!\!\rightarrow} Mx).$$

The essences of the fundamental properties in question are such that they include dispositions to give some particular manifestation M in response to stimulus S, as articulated

[111] Lewis's reformed conditional analysis is formulated as follows. 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. "An unlovely mouthful" as he himself points out.(Lewis, 1997, p. 157)

earlier. Because of this, it is the case that in all possible worlds any property with the dispositional essence in question is disposed to yield M in response to S. Hence, we have the necessary counterfactual conditional

$$\Box(Px \rightarrow D_{(S,M)}x)^{112}$$

From these two together we can derive the following universal generalisation:

$$\forall x((Px \wedge Sx) \rightarrow Mx)$$

This universal generalisation is basically referring to the *strict* laws of nature; those for which there are no exceptions. Yet we know that this cannot be the whole story, as the conditional analysis is known to be false because dispositions may be finkish, or they may be masked. This means that both finks and masks needs to be taken into account. Including these features entails that the universal generalisation would look like this: $\forall x((Px \wedge Sx \wedge$ *finks and antidotes to D are absent*$) \rightarrow Mx)$. This version is such that it admits exceptions, that is, it can be interpreted as reflecting what we normally refer to as *ceteris paribus* laws, that is, laws which do not hold under certain circumstance, but which only hold 'other things being equal'. Finks and masks can in such cases explain the circumstances where these laws do not hold. Thus, dispositional essentialism explains both strict and *ceteris paribus* laws, Bird suggests. This connection with *ceteris paribus* laws is supposed to make the problems created by the existence of finks and masks appear less damaging. But can such a connection really be found?

First, we should look at whether or not the problems represented by finks and masks are troublesome also at the fundamental level. This can be done by asking whether *ceteris paribus* laws are a macro phenomenon, or whether this is something which may also occur when we are dealing with the most fundamental laws of nature. In the standard cases of finkish dispositions, Bird reminds us, the causal basis for a disposition is removed before it can complete its causal work. However, for the fundamental dispositions there is no such distinct basis, as we are already operating on the fundamental level.[113] In addition, as previously mentioned, the finks need time in order to work, so the manifestation of a fundamental disposition must in that case not be instantaneous if it is to be finkish. Bird argues that the manifestations for fundamental dispositions either are instantaneous or that they occur at the next possible time (given that time is discrete), in both of these cases there is no intervening moment where the fink can occur.[114] The conclusion is that there are no finkish fundamental powers.

[112] Bird (2007, p. 45)

[113] A conceivable problem at this point is that this will not work in a world which is infinitely complex, because in an infinite descent there are no fundamental properties. This is discussed in, for example, (Schaffer, 2004, p.99). I am aware of this, but assume fundamentality in this thesis. That is, that there is a level where there is no further structure we can appeal to in order to explain the behaviour of the properties.

[114] Bird (2007, p. 61f.)

When it comes to the concept of masks at the fundamental level, the conclusion seems to be that figuring out whether or not there are masks at this level is a task for fundamental science, not philosophy, but it is at least plausible to assume both the finks and masks to be a macro-level phenomenon.[115] If this is the case then *ceteris paribus* laws are also a macro-level phenomenon. A consequence of this would be that the conditional analysis is *not* problematic at the fundamental level. Bird suggest that it would, in addition, be outright helpful at the non-fundamental level, because of its connection with the *ceteris paribus* laws.[116] This sounds promising, but, as mentioned earlier, saying that finks and masks are macro-level phenomena giving us the *ceteris paribus* laws at this level does not quite work. In fact it is *outright problematic*. In order to see how and why this is the case, we need some additional machinery. Because of this, I will return to this question after establishing *where* the powers ontology belongs in a landscape that we might divide into two separate domains: *fundamental* and *non-fundamental* metaphysics.

2.4 Fundamental versus non-fundamental metaphysics

2.4.1 Identity, laws, and modal fixity

By now it should be clear that when we are speaking of properties, we are speaking of different things when discussing *dispositions* as opposed to *powers*. Our general conception of dispositions does not entail that these entities are powers. Dispositions, in my framework, can be all sorts of properties, including both abundant and accidental properties, whereas *powers*, by definition, are sparse *and* essentially dispositional. In addition, when we are speaking of powers we are operating at the level of *fundamental metaphysics*, and powers cannot do much work outside this quite narrow area, except as a supervenience base. I will return to this topic towards the end of chapter 3, but for now it suffices to say that powers will not be able to directly generate explanations of phenomena at non-fundamental levels.

I support what may be labelled as a necessitarian conception of powers, that is, one which holds that a power is a sparse property which has a dispositional essence, and that the *identity of the property* is given by this dispositional character.[117] What I aim to provide in this section are plausible reasons to assume that powers are a key part of our general metaphysical framework, and show the consequences such an assumption will have for related issues in the metaphysics of modality. This means that the arguments aim to show us what we gain by introducing these entities in our ontology, but they give *no conclusive* answers to whether or not powers exist.

[115] This is in line with (Bird, 2007, p. 63) stating that "the direction of the development of physics with ever fewer fundamental properties and corresponding forces indicates that the prospects for antidote-free fundamental properties and thus strict laws only at the fundamental level are promising." Bird prefers 'antidote' instead of 'mask'.

[116] Bird (2007, p. 59ff.)

[117] Similar to (Bird, 2016).

It should also be made clear from the start that not everyone agrees with this sharp distinction between dispositions and powers, nor with this definition of powers. Some argue that powers may in fact give explanations of a very wide spectrum of philosophical conundrums, like causation, free will, and even morality.[118] The most common area to assume the usefulness of powers seems to be that of causation. Causation initially appears to be very closely connected with questions of fundamental metaphysics, but the properties discussed when debating causality are most often non-fundamental ones. Hence, I argue that powers have no relevance in such debates.

The problem with the excitement tied to the assumed usefulness of a powers ontology is that many such assumptions are wrong. The reason for this is that the proponents of certain powers-based ontologies expect these ontologies to offer not only explanations regarding fundamental properties, but also explanations of what certain non-fundamental properties are, or, in the most extreme cases, what *all* properties are. This is problematic because we do not, at present, have arguments justifying this use of the powers ontology. Opposing this, I will use this part of the chapter to argue that powers can do the following:

1. They can explain what the fundamental properties are, that is, they give a good account of property identity at the fundamental level, and

2. They can explain what the fundamental laws of nature are.[119]

Bird (2018) suggests a third possible use of powers, which is more speculative, but very interesting.

3. Powers *may* be able to give us an account of possibility and necessity. That is, they may give us an account of modality in general: "If powers are ontologically fundamental, then this fact about dispositions may be used to ground facts about what is possible."[120]

If this is the case, powers may be all we need in order to explain modality. I will mainly focus on the two first points now, and return to the third, more speculative, point in the next chapter.

Firstly, we should recognise that the reasons for assuming powers at the fundamental level are particularly related to the *modal fixity* of these powers. It is because of *this* feature we are able to say that a powers-based view of properties will tell us what it is to be a particular property. And it is because of this same feature that powers give us such a compelling account of the laws of nature. If we recall the discussion regarding quidditism, and the example of properties swapping places with each other in the structure of the world, the powers theorist will hold that two fundamental properties are in fact the very

[118] See for example (Groff and Greco, 2013) for several examples of this.
[119] Bird (2016, p. 379)
[120] Bird (2018, p. 250)

same property if they share dispositional character. The modal fixity of the powers makes this the case.

Secondly, for the powers ontology to be useful *beyond* the fundamental level of metaphysics, we would have to argue either that fundamental powers directly explain macro phenomena, or that many or all macro properties are powers too, and that these macro powers are playing an important role in explaining the given phenomena.[121] This does not, initially, seem too far fetched. If the fundamental powers can explain both property identity and the fundamental laws of nature, would it not be natural to assume that there exists *macro* powers which can explain macro phenomena in much the same way? An example of this can actually be found inside the dispositional essentialist camp with Ellis's explanation of higher-level laws, such as the laws of chemistry. I will return to this in my discussion of laws in chapter 5.

If we look at the two most compelling arguments for assuming powers to be existing at the fundamental level, we can make this situation a little more clear. Let us, first, assume that we take fundamental powers to be existing because they provide a favourable account of property identity as compared with the alternative, which is to view them as quiddities. Would it not entail that we should aim for the same result at the non-fundamental level as well? That is, we argue that there are non-fundamental powers in order to avoid having to see these properties as quiddities. This might seem like the rational choice to make, and it probably would have been so if there were exactly two possible answers to the question of what a property can be like at the non-fundamental level. If our choices were indeed limited to seeing these properties *either* as powers *or* as quiddities, we would probably want to categorise them as powers. But even though these are the two alternatives which are available for us at the fundamental level, there is *at least* one third option available at the non-fundamental level. For these properties, we can look at the manner in which they supervene on the fundamental properties.

> If one property is compounded out of other properties, then the identity of the property may be given by the nature of that composition.[122]

That is, the essences of composite properties are not dispositional, but rather something which reflects their composition or *structure*. This determines both *what* they are made of as well as how the parts are *structured*.

We can present a similar argument if we, alternatively, assume powers to be existing because this provides a good explanation of the fundamental laws of nature. Does it not, in that case, seem natural to also assume there to be non-fundamental powers which can account for the non-fundamental laws in much the same way? It might *seem* that way, but we need not do so. These non-fundamental laws of nature, such as the laws we find in

[121] Bird (2016, p. 342)
[122] Bird (2018, p. 251)

chemistry, already supervene on the fundamental laws of nature. Hence, the powers existing at the fundamental level already explain the fact we hoped the macro-powers would explain. From these two cases we see that macro-powers are redundant as explanations of property identity and laws of nature.

In addition, I will argue that assuming powers alone may be used to account for other macro phenomena, such as causation, are examples of *illegitimate extensions* of the powers ontology. Hence I agree with Bird when he claims that moving from fundamental to non-fundamental metaphysics in this way is to overextend the powers ontology.[123] The arguments for powers existing at the fundamental level cannot be used to support the thesis that macro phenomena should be explained by macro powers, because the arguments do not establish the existence of macro powers, as we shall see in the following section. Arguing that powers are useful and might do important work at a fundamental level does not directly imply that one should, or even can, argue that powers may do the same kind of work at a non-fundamental level; we are neither committed to, nor entitled to do this.

Let us look at some examples of what such an overextension can amount to. One instance of stretching the powers ontology too far is seen when arguing for something like *pandispositionalism*, which states that absolutely all properties are either powers or clusters of powers. We find this in e.g. (Mumford and Anjum, 2011), presented as follows.

> If we take properties just to be causal powers, then we have a more parsimonious ontology than that in which there are properties as well as the powers they bestow. (...) All properties are clusters of causal powers, not just the overtly powerful ones such as being explosive or corrosive.[124]

A less extreme example, which is nonetheless overextending the powers ontology, is a form of the mixed view, where the main claim is that there will be both powers and non-powers at all levels of fundamentality. All properties will not be considered to be powers on this view, but the powers will exist on all levels of our ontology. Ellis (2002, p. 123ff.) holds this view, and argues for a wide use of the powers ontology, for example in fields like philosophy of mind, where the *power of agency* is discussed.[125]

Thinking that powers may have a use in such fields, or thinking that a powers ontology is fitting for *all* properties is overly optimistic on behalf of the theory. Rather than supporting any of these accounts, I am committed to a more restricted view—more specifically a restricted form of dispositional monism—where it is maintained that *all* fundamental properties are powers, while it is quite possible the case that *none* of the non-fundamental properties are.[126] These three views—pandispositionalism, unrestricted mixed view, and a restricted dispositional monism—are the options we are faced with if we believe that

[123] Bird (2013), Bird (2016)
[124] Mumford and Anjum (2011, p. 3)
[125] The power of agency is also the topic of his (Ellis, 2013).
[126] This is referred to as *Restricted Powers Monism* in (Bird, 2016, p. 354)

there are powers at the fundamental level. Either all properties are powers on all levels, or there are both powers and non-powers on all levels, or the powers are restricted to the fundamental level only.[127]

2.4.2 Three arguments and three questions

In this section I will look at some further assumptions which can be made regarding the existence of powers at non-fundamental levels. There are three common arguments for powers extending beyond the realm of the fundamental found in the literature.

1. Properties that supervene on powers will also be powers.
2. The existence of macro *dispositions* entails that there are also macro *powers*.
3. The distinctive features of powers—direction, intensity, and the ability to exist unmanifested—explain important macro phenomena, and, following this we should assume that the relevant macro properties are powers.[128]

Corresponding to these claims are three questions we need to answer at this point.

1. Are compounds of powers also powers?
2. Are all dispositions powers as well, that is, are the terms co-extensive?
3. Can the existence of successful dispositional accounts of non-fundamental phenomena be used as arguments for the existence of powers?

The short answer to all three questions is simply *no*. Let us investigate why this is the case.

We start with the first question, and assume that we already agree that there are powers at the fundamental level. If you believe that all the facts about a world supervene on the instantiation of the fundamental properties and relations, should not also the compounds of powers *themselves* be powers? This does not initially seem like a particularly implausible claim to make, and we do find arguments in the literature claiming that dispositions actually do combine to form 'bigger' dispositions.[129] However, even simple compounds of dispositions are not themselves necessarily dispositions.[130] This is in line with arguing, as I will proceed to do, that properties at a non-fundamental level, for instance the properties of chemistry, do not in general have dispositional essences. It seems clear that certain

[127]The fundamental level of metaphysics is the level where there is no further structure to appeal to. To explain the behaviour of properties at this level, we either need to appeal to external laws of nature, or, as I do, to *powers*.

[128]Bird (2018, p. 252)

[129]Mumford and Anjum (2011, p. 175). Remember that Mumford and Anjum explicitly state that 'dispositions' and 'powers' refer to the same things.

[130]Bird (2016, p. 358f.)

combinations of powers will result in properties with *structural* rather than *dispositional* essences. A particular molecule, for example, will definitively have dispositional properties which entails that they will react in certain ways when interacting with other molecules for example, but the important question is not whether it has such properties, but whether such properties are representing its *essence*. It seems more sensible to say that the structure of a molecule is its essence, and that the property of being that molecule is supervening on its building blocks, and the way they are related to each other. The dispositional characteristics of these composite entities will depend on their structure, and on the dispositional essences of the parts of that structure. This is not the same as saying there are no emergent properties, but these emergent properties will not be essentially *dispositional*. An essence of a compound property, even if it is made up of powers is not itself necessarily a power. On the fundamental level we do not have such a structure to appeal to

When it comes to the second question—whether 'dispositions' and 'powers' refer to the same set of entities—we have to note that equating dispositions with powers is a common thing to do, and if this was only a question of terminology the problem would perhaps not be so significant.[131] This means that I have *partly* answered this question already, when discussing the terminology used. However, there is *more* going on here than simply a confusion of words.

If the problem really *was* confined to linguistic details, or simply the choice of words, the dispute could be solved by particular attentiveness regarding our choice of vocabulary. Perhaps even changing some of the terminology would help, such as using another word for what has been defined as *powers* in this dissertation, since this term may be accused of causing confusion because of its many different uses. However, simply doing this would probably *not* solve the problem. The issue at stake here is that when the term *power* is used in the way I have done, it is not possible that this is the same as a *disposition*, but these distinctions are still conflated in parts of the literature. Hence, if we see powers as denoting sparse properties that are essentially dispositional, and we proceed to argue that *such* powers are relevant for the explanation of, for example, causality, we will get unfortunate results.

This may happen if we, for example, argue that the disposition of fragility is the same as the power of fragility, and that this power is causally involved in the breaking of the fragile glass. In this case, the fact that the object is *disposed to break* leads us to conclude that it has the disposition of fragility, and from this we conclude that it has the *power* to break. But stating that fragility is a power is a highly contentious claim. By doing this we are not only asserting that powers exist (remember that this claim is slightly contentious

[131] (Zagzebski, 2013) may be used as an example of usage of powers terminology which is *clearly* not intended to or committed to seeing human powers as modally fixed properties, and which is thus an entirely legitimate use of the expression. In such cases we see that the concept which is referred to as *a power* is something quite different than the meaning of *powers* I advocate. For Zagzebski, the powers are more like what I call dispositions, and dispositional theories of things like epistemology might well be enlightening.

in itself), but we are actually claiming that there are *non-fundamental powers*; that is, non-fundamental sparse dispositional properties which are modally fixed, which is an even more contentious claim. If we are equating dispositions with powers in this way, the word is used in a very *loaded* sense, and the question we have to ask is whether the property of fragility can live up to this description. For fragility to be a power, it would have to be a sparse property—a property needed to give a complete and correct scientific description of the world. How could we possibly defend placing fragility in such a position?

It is more likely that in such cases we are not speaking of powers—in the sense of a highly specific kind of property—but we are rather addressing the fact that the glass is *disposed* to break, in the more metaphysically innocent way of understanding the word, that is, we want to express that fragility is a *mere* disposition. Stating that there are macro-dispositions in this way is uncontentiously true. As we have seen earlier, both dispositionalists and quidditists can accept that some things are disposed to act in one way or another. The difference between the metaphysically *loaded* and the metaphysically harmless use of the term dispositions, or between *powers* and *mere dispositions*, makes it the case that philosophers who clearly reject any idea of a powers ontology still may engage in talk of dispositions without contradiction.

To show that this is not simply a verbal dispute, something that can be resolved simply by adopting clearer terminology, (Marmodoro, 2009) may serve as an example. The way Anna Marmodoro presents the powers term is largely in line with how I understand it, but she then proceeds to 'stretch' the term way beyond this use. Marmodoro holds the question of whether or not there exists 'pure powers' to be of particular importance. Pure powers are powers that are not dependent on categorical properties. Powers, for Marmodoro, are entities that are in a state of 'readiness for action', which entails that given appropriate circumstances, they interact with the environment. Basically, powers do not *have* directionality, but a pure power *is* directed towards some manifestation.[132] The 'readiness for action' is *all* that powers are, and it is *directed towards* some kind of particular manifestation happening.

Marmodoro uses the example of electric charge, a pretty canonical choice of example, when she is to illustrate what a power amounts to. This choice of example further strengthens the suspicion that when she speaks of powers she is indeed addressing the same type of entity I am talking about. She explains how there is nothing more to charge than simply the disposition to repel or attract other charges, and she clearly makes a connection between the powers and the fundamental level of metaphysics, speaking of the "fundamental properties of the fundamental particles".[133] All in all, her concept of pure powers is closely resembling the powers I argue for.

However, even though she speaks of powers in this way in the beginning of the article,

[132]Marmodoro (2009, p. 349)
[133]Marmodoro (2009, p. 337)

she is clearly expecting the term to deliver more than just an account of certain aspects of fundamental properties. She is in some sense using the existence of powers in fundamental metaphysics to argue for a powers account of non-fundamental modal happenings. This is detected by looking at her choice of further examples. She moves on to address fragility, another canonical example, but one which refers to happenings on a completely different level of metaphysics. The two examples are presented in the same way, meaning that she maintains that there is nothing more to fragility than the disposition to break under certain circumstances.[134]

In line with my earlier arguments, the case of fragility is far more complex than this, and the analysis which is fitting for the fundamental powers falls short when we are to understand more complex things, like the *disposition* of fragility. Marmodoro's description seems overly simplified for phenomena like fragility, and it is unable to capture the large array of different ways in which something might be fragile. Again, remember the modal fixity which is supposed to be one of the core features of powers. This feature is, to the best of my knowledge, not present when we speak of things being fragile. 'Fragility', and similar dispositional ascriptions, refer to a rather large group of similar properties for which finding *one explanation* seems difficult, if not impossible. If we have a fragile glass and a fragile ancient document, their fragility do not amount to the same thing, even though both items are correctly labelled as being *fragile*. The reason for this might well be the fact that there are no *powers* at this level of complexity, and we have to make do with dispositions. Marmodoro's notion of *pure powers*, I argue, is not something that can be expanded to be used also for non-fundamental cases in the way she does.

Let us move on to question three. Can the existence of successful dispositional accounts of non-fundamental phenomena be used as an argument for the existence of powers? So far we have noted that the term *disposition* may be used both in a metaphysically loaded and a metaphysically innocent way, and that both a power and a disposition may be described in a dispositional way, 'x is disposed to y'. This does not support equating dispositions with powers, but does it mean that we can use the existence of dispositions to argue for there being powers as well? We note that the more innocent use of 'disposition' allow us to assert something like 'poisons have the disposition to be harmful', but this does not entail that there is a modally fixed property, a power, grounding this. The confusion over the extensions of powers and dispositions might lead us to think that the fact that some phenomenon has a fruitful *dispositional* explanation should be an argument for or a way of confirming that powers exist, but we need to resist this temptation. The eventual fruitfulness of dispositional accounts are *irrelevant* for the existence of powers. Powers rely solely on their *modal fixity* in order to explain the things they actually *can* explain. This is not automatically transferable to dispositions.

Still, many *dispositional* accounts may be very useful. What is important is to refrain

[134]Marmodoro (2009, p. 339)

from thinking that this usefulness is any reason to assume the existence of powers at this level. Dispositions can be useful in themselves without the expectation that there is supposed to be something metaphysically more substantial behind this. Successful dispositional accounts of different phenomena do not entail the existence of powers at any level, but that does not make these accounts less successful in regard to what they were originally meant for. As already stated, the assumption that powers indeed do exist needs its own arguments, and the arguments I have addressed so far are not relevant for non-fundamental metaphysics, so we cannot use them to support the existence of non-fundamental powers.

The arguments for answering these three questions in the affirmative fail mainly because one cannot give satisfactory arguments for *how* macro-powers exist. That is, we have no sound explanation of how we are supposed to move from the assumption that there are fundamental powers, to the conclusion that there are also non-fundamental powers. As long as no such explanation is provided we have no reason to assume that the properties in non-fundamental metaphysics or in other areas of philosophy are powers. The fact that I hold that the fundamental properties are powers does not give me the right to assume that the non-fundamental ones are as well.

2.4.3 Back to *ceteris paribus* laws

Now that we have established the distinction between fundamental and non-fundamental metaphysics, and firmly placed the powers ontology in the fundamental domain, we may return to Bird's thoughts about finks, masks, and their alleged connection to *ceteris paribus* laws. As mentioned in section 2.3.3, Bird (2007) argues that the finks and masks may be useful in explaining *ceteris paribus* laws, and that in doing so they provide a positive rather than destructive contribution to our analysis of dispositions. However, by arguing in this way Bird *himself* violates the restrictions he imposed regarding where the powers ontology might be applicable. This entails that some of the points in (Bird, 2016) can be used as arguments against certain aspects of (Bird, 2007).

In the argument found in 'Nature's Metaphysics' Bird takes the powers' usefulness at the fundamental level as a starting point—particularly the way they elegantly generate the laws of nature—and extends this beyond the fundamental level without proper argumentation for actually doing so. We remember how the finks and masks are not seen as being problematic at the fundamental level, so they are not relevant as modifications of the fundamental laws of nature. However, at the non-fundamental level, finks and masks *are* troublesome for the dispositionalist, and Bird attempts to turn these problems into a positive feature of dispositional essentialism by tying them to the non-fundamental *ceteris paribus* laws. However, without a successful argument for the existence of macro-powers, such a connection is not possible to make. The finks and the masks existing at the non-fundamental level cannot be tied to the *ceteris paribus* laws in the suggested way because laws on the non-fundamental level are not related to macro-level dispositions in the same

way that fundamental *powers* are related to the laws of nature.

The laws at the non-fundamental level are not construed in this way, because there are no macro-powers there to support them. Rather, the non-fundamental laws will supervene on the lower-level laws; they are dependent upon the powers of the parts of the properties, as well as their structural relations.[135] As mentioned, the essences of the properties at this level are not dispositional, but rather constrained by the structural composition of the property, so the laws are not directly given solely by the dispositions of properties at this level. Because of this, Bird's argument for the usefulness of the finks and masks at the non-fundamental level does not work as intended.

It is correct that the finks and masks pose no threat to the conditional analysis of dispositions at the *fundamental level*, but it is *not* the case that the finks and masks can give a positive contribution to the way we understand *ceteris paribus* laws at the non-fundamental level. For Bird's argument about *ceteris paribus* laws to work, we actually need the existence of general non-fundamental powers, something he himself has argued forcibly against. However, we might ask whether there are arguments for a more restricted form of non-fundamental powers? This is the question we turn to now.

2.5 Non-fundamental powers after all?

2.5.1 Evolved functional properties

So far I have argued for limiting the scope of powers strictly to the fundamental properties, but it should be made clear that none of these arguments are such that they eliminate the possibility that non-fundamental powers exist. What we have demonstrated so far is that the most common arguments for assuming there to be non-fundamental powers do not in fact establish this to be the case. And it is with this as a background that I will now turn to a novel argument aiming to establish that such powers could indeed be seen as having a legitimate existence. After having restricted the domain of powers to fundamental metaphysics in the aforementioned way, it is surprising that Bird (2018) suggests that some particular non-fundamental properties may be powers after all. His suggestion demands that we revisit the question of the existence of non-fundamental powers *even though* earlier arguments for the existence of these entities have been unsuccessful. Since the old arguments fail, we need *new* arguments, and that is exactly what Bird aims to provide.

An important question at this point is why we would want to argue for macro powers in the first place. Bird states that if modality in general can be explained by fundamental powers, there are no possibilities left to be accounted for by way of macro powers.[136] Hence,

[135] I will return to this discussion in chapter 5, section 5.3.3.
[136] Bird (2018, p. 251f.)

an explanation of modality in general cannot be the motivation behind this extension of the power term. The motivation must be something else, and it seems more tied to the first argument for the existence of fundamental powers—the fact that powers give an account of property identity. Through a successful account of macro powers we might be able to understand some of the *emergent* properties better.[137]

Bird's latest suggestion is that a *particular subset* of non-fundamental properties are powers. The properties in question are the *evolved functional* properties. That is, the non-fundamental powers are those properties that exist because they have been selected for their function.[138] The main arguments for assuming that there are powers—that they can explain both property identity and the laws of nature—do not give us reason to believe that non-fundamental powers exist, but maybe the new road through evolved functional properties can offer what has been missing so far.

When I addressed the fundamental powers in section 2.4.1, one important feature of these properties were their *modal fixity*, the fact that their dispositional features remain fixed across possible worlds—or, to phrase it in another way, that these dispositional features are *essential* to the property. Bird argues that precisely this has been missing from the earlier arguments for macro powers.[139] The arguments 1 through 3 for macro-powers presented earlier neither focus on, nor establish the modal fixity of the macro powers. Without this feature the property in question is not a power, even though it can, as we have seen, be a dispositional property.

To ensure that what we are addressing really are powers, the features tied to modal fixity—that powers have a particular essence or identity—has to be present also at the macro level. We cannot overlook the fact that powers, by definition, are essentially dispositional just because we have moved beyond the fundamental level; the identity of a power is related to what it does, or what it has potential to do. This needs to be the case for the proposed macro-powers as well. The properties we are searching for must fulfil this and two additional criteria. A macro power is a property which is

1. Non-fundamental — it supervenes on the fundamental properties
2. Genuinely sparse — not abundant, not a mere disposition
3. Essentially dispositional — the property's identity is not constituted by the way it supervenes on the fundamental properties.[140]

As mentioned, Bird claims that a set of properties fulfilling these demands exist, and that the properties in question are the evolved functional properties:

[137]Bird (2018, p. 272)
[138]Bird (2018, p. 248)
[139]Bird (2018, p. 255)
[140]Bird (2018, p. 255f)

> **Non-fundamental powers (NFP)**: [I]f a sparse property exists in virtue of objects being selected for their dispositional characteristics, then that property will satisfy those requirements.[141]

If this is correct, these properties should rightfully be seen as powers. To show how this works, Bird uses the example of sightedness, where it might be argued that the *capacity* of sightedness is just what sightedness *is*. The essence or the identity of the property is the disposition to be able to see, hence the property clearly has a dispositional essence, Bird argues. In addition, the property of having sight supervenes on a structure, so it is clearly non-fundamental. In fact, it supervenes on *several* different structures, because the property is multiply realised; there are many different kinds of sight. Still, the particular *structure* giving each individual the ability to see is *not* the essence of the property, the essence is the disposition. This entails that certain properties at this non-fundamental level differ significantly from other non-fundamental properties, which, as I have argued earlier, have structural essences.

But how do properties like sightedness differ from, say, fragility? We would not, and should not, argue that fragility is a sparse property. Bird contends that explanations involving sightedness, and other evolved functional properties, have a unity to them which explanations involving fragility, and other abundant properties, lack. The reason why certain individuals are sighted is fundamentally different than the reason why some things are fragile. Fragility does not have a shared evolutionary story among the individuals instantiating the property.[142] Sighted individuals have such a shared evolutionary story, even though different kinds of sight are varied in structure. So, whereas the essence of sightedness is the ability to see, the essence of fragility is not one single thing; rather, there are several essences, one for each structure leading to the object being fragile.

When it comes to the question of sparsity, Bird focuses on the idea that the property of sightedness is a product of natural selection on the basis of *function*, and is something which enters into scientific explanations. As such it may be argued that it is sparse. This conclusion presupposes that we hold the scientific and not the fundamental conception of sparse properties. The scientific conception entails assuming that sparse properties may be drawn from all of science, and not just fundamental physics. If Bird's question about the existence of non-fundamental powers is to be a genuine question, we need to assume the scientific conception to hold. Assuming the fundamental conception decides the outcome from the start. At the same time, we might want to discuss what is to be entailed in 'all of science', but that debate is outside the scope of my thesis.[143]

Bird's argument *seems* compelling so far. However, some of his formulations used to argue that evolved functional properties are powers are highly problematic. The statement

[141] Bird (2018, p. 256)
[142] Bird (2018, p. 258)
[143] See (Schaffer, 2004) for additional detail about the scientific and fundamental conceptions of sparse properties.

NFP is one such statement. Another one is the following.

> (...) natural selection is selection for function. When this gives rise to a new, functional property, that property's nature (...) will be the dispositional characteristics that played a role in selection.[144]

These formulations have in common that they claim that some properties exist because they are selected for. Vetter (2018) points out that properties that are selected for must be developed before they are available for selection.[145] Hence, selection is the reason they *continue to* exist, but to the best of our knowledge properties come about *before* they are selected for, so the functional role of the property cannot be the reason the property exists *simpliciter*.

If we, as Bird does, assume what may be referred to as an ontic conception of sparse properties, we do not want to say that the properties in question *became* sparse when the evolutionary process started to select for this particular property. This is due to the fact that the ontic conception of sparse properties ties these properties to universals: "whether F-ness is sparse is a matter of whether there exists a universal (...) of being F".[146] As mentioned earlier in this chapter, Bird explicitly assumes powers to be universals. The sparse properties, understood as universals, simply cannot start being sparse when they are selected for. If they could possibly be selected for, they would have to exist prior to this. However, evolution by natural selection is seen as a highly contingent process, and in the following section I will argue that the ontic conception of sparseness alongside this contingency leads to some unfortunate consequences for Bird's view.

2.5.2 Powers all over the place?

Vetter (2018) argues that the contingency of evolution by natural selection means that many properties that *could have been* selected for ended up not being so, and also that the properties that *were* selected for do not have this status necessarily. In short, evolution by natural selection could have gone differently than it actually did. Hence, if evolved functional properties are to have some special status—sparsity—this status must also be the case for those properties that *could have been* selected for throughout history. This is due to the fact that property existence and sparseness is generally not seen as a contingent matter.[147] Holding the ontic conception of sparse properties entails having to say that also the potentially functional properties are sparse, given that evolution is to play the role that Bird suggests it does. Vetter's argument shows how this combination of views about sparse properties makes Bird's argument over-generate properties to such an extent that

[144] Bird (2018, p. 271)
[145] Bird *mentions* this, but he does not address the problems Vetter articulates.
[146] Vetter (2018, p. 280)
[147] Vetter (2018, p. 282)

his theory of powers becomes almost indistinguishable from those he warns us against in (Bird, 2013) and (Bird, 2016), particularly as his argument does not only include biological properties such as sightedness, but also mental properties, and perhaps even properties of artefacts.[148] His account becomes overly *enthusiastic* in its acceptance of non-fundamental powers.

One possible solution to this, proposed by Vetter, is to suggest a form of *explanatory dispositionalism*, rather than Bird's dispositional essentialism, which she refers to as *existential dispositionalism*. The focus for explanatory dispositionalism is the way in which dispositionalism reverses the order of explanation in accounts of modality and laws, such that dispositions have been "turned from a problematic *explanandum* into a respectable *explanans*".[149] This should also be the centre of attention at the non-fundamental level, according to Vetter. All we need to explain a macro disposition is within the object itself, in its categorical properties and the dispositions of its parts.[150] Thus, we are able to explain, for example, lawful generalisations at the non-fundamental level directly by the dispositions present at that level, and indirectly by the more fundamental dispositions of its parts, she claims.[151] The crucial point for Vetter is the *role* the property actually plays in explanations, and as such it does not really matter whether another property possibly could have existed instead of the actual one due to evolution taking a different turn. The actual role is what makes the property *special*, in the sense that it is explanatory relevant, but this does not make it *sparse*.

The lacking sparsity is not seen as a problem for Vetter, it is rather the case that accepting her argument entails "accepting that there is no interesting and sharp distinction distinction to be drawn among the non-fundamental properties, between 'sparse' and merely 'abundant'".[152] Hence, her solution is compatible with holding the fundamental view of sparse properties, but not with the scientific view, since this view assumes there to be sparse properties also among non-fundamental properties. If there is no sharp distinction between sparse and abundant properties, assuming there to be sparse properties in non-fundamental physics or in chemistry becomes unintelligible.

If Vetter's critique of Bird is correct, this alone is enough to abandon the course he has set in this matter. However, her *solution* is not an option if we think the distinction between sparse and abundant properties is substantial and real. If we think this divide between different kinds of properties is referring to something real, also at certain non-fundamental levels, we have to keep looking for a solution to this problem. I hold that this distinction *at least* is an important divide at the levels of physics and chemistry. It might

[148]He does not provide any examples of these artefacts, and do not provide any details about which concrete properties of artefacts could possibly be powers.
[149]Vetter (2018, p. 293)
[150]Vetter (2018, p. 295)
[151]I will return to this discussion in chapter 3.
[152]Vetter (2018, p. 292)

even be relevant for biology and certain other fields too.[153]

2.5.3 Back to square one

A point which Vetter does not fully explore is the following. There seems to be tension between the criterion that sparse properties are to contribute to causal and nomic explanations, and the fact that evolution by natural selection is playing a crucial role, if we assume the ontic conception of sparse properties. Bird agrees that a test to figure out whether a property is sparse or not is to see if it is employed by our best scientific theories, in a non-redundant way. Such use is *strong evidence* that the property is sparse.[154] This is an epistemic point, and not a definition of sparseness; it is a way for us to discover these properties.[155]

However, the connection is deeper than a mere epistemic point for Bird. He asks, "Must any ontic/sparse property be involved in some law or explanation?", and answers that for the dispositional essentialist it is *necessary* that any sparse property is engaged in such a relation.[156] Hence there is a *necessary connection* between the sparse properties and the laws and explanations. This is in conflict with the idea that evolution by natural selection is a highly contingent process. Let us have a closer look at this.

1. There is a necessary connection between sparse properties and laws or explanations.
2. Evolution determines which properties are involved in biological explanations.
3. Throughout our evolutionary history, some sparse properties have been selected for, and some have not — given that sparsity does not spontaneously come about, and that evolved functional properties are supposed to be sparse.
4. Hence, there exists some sparse properties which are not connected with laws or explanations. This contradicts point 1.

How can we argue against Bird? Since he has two criteria for the evolved functional properties being powers, apart from the obvious non-fundamentality of the properties in question, it seems that we need to argue that one of them is false. So, either

I. (some of) the evolved functional properties are not sparse, or

II. (some of) the evolved functional properties are not essentially dispositional

[153]Schaffer (2004) makes reference to things like beliefs and minds, but I am sceptical of whether these things truly are sparse properties or if they can be satisfactory accounted for by sparse properties at lower levels.

[154]Bird (2018, p. 248)

[155]Note that this also entails that there is room for us to be mistaken about which properties are sparse, and that we at the present moment might not be able to recognise certain properties as sparse.

[156]Bird (2018, Footnote 3, p. 249)

Given the strength of Bird's arguments for the dispositional essences of evolved functional properties (at least in biology), I argue that the best option is to assume that some of the evolved functional properties are not sparse. As far as I can see, there are three main ways of arguing that this is the case.

The first, and simplest solution is to argue that the evolved functional properties are not sparse by denying the *scientific conception*, since this basically erases the question. This is not a good option because the scientific conception seems more plausible than the fundamental conception, even though some redundancy must be allowed if we are to accept sparse properties beyond the fundamental ones.[157] However, as little redundancy as possible should be an ideal. If something can be adequately explained by properties which are ontologically on a lower level, the property on the higher level describing the same is not sparse. I suggest this might be the case for some of the mental properties which both Bird and Jonathan Schaffer refers to. Even though things like beliefs may seem to be sparse from out present scientific vantage point, they could turn out not to be so. That is, they could possibly be accurately explained by properties on an ontologically lower level.

The second option is to deny the *ontic conception*, and instead, for example, adopt some comparative notion of sparsity, where properties can be 'more or less sparse' than each other.[158] We might also choose to accept Vetter's solution and effectively eradicate the whole distinction between sparse and abundant properties at the non-fundamental level. That would entail losing a distinction which is useful, relevant, and which I hold to be real. There *is* a distinction between the class of properties needed to be able to give an accurate description of the world, and the class of all predicates.

A third option is denying that evolution based on function is an indication of sparseness. The fact that the evolutionary story opens for a veritable avalanche of sparse properties is problematic if we want our theory of powers to be distinguishable from, say, Stephen Mumford and Rani Lill Anjum's pandispositionalism. Remember that the properties that *could have been* selected for are all *actually* sparse properties, because the ontic conception does not open for things being more or less sparse, or things *becoming* sparse; the properties are, or they are not, sparse. If we are serious when we state that evolution is a highly contingent process, then evolution is not a good judge for what makes a property sparse or not.

How does this influence our view of dispositions in general? According to Bird, dispositions can be:

1. Abundant—not sparse

2. Accidental—sparse, but not essentially dispositional

[157]Lewis (1986a, p. 60) demands sparse properties to 1. ground objective similarities, 2. carve out causal powers, and 3. serve as a minimal ontological base. Schaffer (2004) replaces the minimality demand with a primacy demand, hence allowing redundancy among the sparse properties.

[158]Lewis (1986a) argues that the distinction between the natural and other properties admits of degree.

3. A power—sparse and essentially dispositional

A consequence of my argument is that the first category will include some abundant properties with dispositional essences, because that is what we end up with if we argue that the evolved functional properties are not sparse while accepting the rest of Bird's account; they are not part of the ontological back-bone of the world, so to speak, but they nonetheless seem to be modally fixed. Given that properties that are selected for through evolution are selected *for their function*, i.e., what they do or can do, it seems fair to say that they are essentially dispositional, without at the same time being sparse. In addition, it seems correct that the identities of these properties are not constituted by the mode of supervenience; the properties are all supervening on some kind of structure, but this structure is not the property's essence.

Bird's arguments for viewing the evolved functional properties as properties with dispositional essences are compelling, the arguments for seeing these properties as sparse are not. The actual properties Bird use as examples, like sightedness, might be sparse for all we know, but not for the reasons he points to. Basing his argument on the contingent process of evolution by natural selection, there are *countless* properties that *could have been* selected for but were not. Since Bird holds the *ontic* conception of sparse properties, the properties that are sparse carve out the structure of the world and are universals. Such properties do not start out as abundant and become sparse 'along the way', they are sparse from the start. Hence all the properties which potentially *could have been* selected for—those which were not, but could have been, selected for—must also be sparse.[159]

As mentioned earlier it seems like the combination of the ontic conception of sparse properties and the role given to evolution in Bird's argument is not viable. Given the contingent nature of evolution by natural selection it is not a reliable source when we want to figure out which properties are sparse and which are not, and the consequence of the argument is an enormous over-generating of sparse properties. Without a reliable criterion for sparsity, we have no clear argument for the existence of non-fundamental powers either. Hence, the situation has not changed; at present we only have well founded arguments for assuming powers at the fundamental level. If we are to argue that some biological properties are indeed powers, for example, we are still searching for a satisfactory argument establishing this.

2.6 Conclusion

In this chapter I have argued for dispositional essentialism about fundamental properties. That is, I have argued that one of the basic entities in our ontology should be that of

[159] A possible solution is arguing that evolution is not truly contingent, but this does not seem to be in line with our ordinary conception of evolution by natural selection; a precondition for evolution actually happening is that there are real alternatives.

powers—sparse properties which are essentially dispositional. Given the inclusion of such a concept we have a machinery which is able to yield both an explanation of property identity at the fundamental level, as well as an account of the fundamental laws of nature. Even though attempts have been made to expand the domain of powers to that of non-fundamental metaphysics as well—even by Bird who has argued forcefully against this in earlier publications—such an expansion runs into several problems which makes it a suboptimal choice. For the present time we are better off assuming powers to be a feature of fundamental metaphysics only.

Chapter 3

Dispositional theories of possibility

3.1 Introduction

In this chapter I will give an in-depth examination of two accounts of possibility based on dispositions, namely Borghini and Williams' dispositional theory of possibility, and Vetter's understanding of possibility in terms of potentiality. In addition I will consider whether an account of possibility in terms of dispositional essences, or powers, is a viable option.

When discussing the dispositional theories of possibility, I will in particular focus on the connection between these accounts and the laws of nature. The most important question in this regard relates to whether or not the notion of metaphysical possibility advocated by the dispositionalists will be seen as going beyond the laws of nature. I argue that this is an important question also when discussing dispositionalist, as opposed to dispositional *essentialist*, accounts. This is so even though an account of the laws of nature does not automatically follow from assuming general dispositionality in the world. In this respect, we see that Borghini and Williams (2008) clearly argue that their explanation of metaphysical possibility encompasses more than merely the nomically possible, while Vetter (2015) does not wish to draw a conclusion on this matter. That is, she seems to hold that her account of possibility in terms of potentiality can quite happily coexist with several explanations of laws of nature, and that basing our understanding of modality upon potentialities does not commit us to a particular view regarding the laws.

I hold that the way the relationship between the dispositional accounts of possibility and the laws of nature is presented by these authors entails that a discussion about the *domain* of the possible is unavoidable. We need to investigate whether the supposition that dispositional possibility can be detached from the domain of the laws of nature is true. In this chapter, I will argue that the belief that the metaphysically possible goes beyond the nomic is an ill-advised assumption to make when possibility is explained in a dispositional way. In addition, I will argue that Vetter's open minded position regarding accounts of laws might not be a viable choice either.

The chapter will proceed as follows. I will commence by examining some of the reasons

why a dispositional theory of possibility may be seen as advantageous compared to a more traditional approach based on possible worlds, in more depth than what the introductory chapter of the thesis gave room for. Following this I will turn to two dispositional theories of possibility. In section 3.3, Borghini and Williams' 'A dispositional theory of possibility', and in section 3.4, Vetter's 'Potentiality: from dispositions to modality'. I will be focusing my attention primarily on the *domain* of the possible. In that respect, Borghini and Williams (2008) argue that the domain of the metaphysically possible resulting from their theory will encompass more than solely possibility restricted by the laws of nature, whereas Vetter (2015) does not want to conclude decisively either way regarding this question. Her account of possibility does not give us a clear conclusion as to whether laws are necessary or contingent, she claims. I dispute whether she really can leave the door open for both of these options.

In section 3.5, I delve deeper into the conundrums concerning definitions of possibility in terms of the manifestations of dispositions alone, and the subsequent removal of, or disinterest directed towards, the stimulus condition. I suggest that even though the removal of this condition from dispositional accounts of modality seemingly solves several problems tied to the conditional understanding of dispositions, this move also create further, and quite severe, problems of its own. I bring the chapter to a close, in section 3.6, by exploring the option of having a theory of possibility based on dispositional *essences*.

3.2 Background assumptions

The background for Borghini and Williams' and Vetter's explanation of possibility is the assumption that the world we live in is a modal world, and that the modality it contains is localised in the *objects* existing in the world. In line with the new actualism as presented in chapters 1 and 2, their assumption is that we may use this localised modality to explain matters which have earlier been settled by reference to possible worlds. As will be the case for the better part of this thesis, I will limit my attention somewhat, and focus mainly on metaphysical modality, particularly the notion of metaphysical possibility and the way this relates to the laws of nature. Possibility explained in a dispositional way will be the main topic of this chapter, while the following chapters will go into the details about the laws of nature.

We remember from chapter 1 that the so-called new actualists want to explain modality in a localised way, and that this enables us to dislodge the concept of a possible world from its role as an important metaphysical entity. The localised modality which is assumed to replace the focus on possible worlds is often thought to be situated in the dispositions of objects and properties of the actual world. This actual world is the only world which grounds modality, something which makes the metaphysical landscape radically different for this kind of actualism, as opposed to a more traditional possible world centred metaphysics.

We can mention three main advantages for assuming dispositionalism about modality. Firstly, it is parsimonious. If we already have dispositional properties in our ontology, there is no need to add anything more in order to explain modality. If we for example agree that we need dispositions in order to explain certain properties of actually existing entities, we have reasons that are not *ad hoc* to assume that there are properties that have a modal character. Then it seems like a good idea to investigate if it is possible to use these properties to explain other things as well, like metaphysical modality in general.[160] Secondly, we have the naturalness of the ontological picture which accompanies it. Possibility is anchored in what Vetter refers to as "realistically respectable bits of the world, ordinary concrete objects".[161] Everything possible needs to be tied to actually existing entities. If no connection can be made, then the alleged possibility in question is not genuinely possible.

The third advantage is related to this connection between actually existing entities and the modal notions, and it is an epistemological point; we *have* epistemic contact with these entities, at least potentially. Based on this contact we *can* get knowledge of the modal properties of the world. In contrast, we do not have any epistemic access to non-actual possible worlds, something which makes the alleged modal knowledge resulting from the accounts based on such concepts highly speculative. Given the dispositional picture, the knowledge of modal properties will *not* be a matter of pure philosophical speculation, but rather a matter of practical and scientific knowledge about the world. This entails that our ways of knowing about dispositions and our ways of knowing about metaphysical modality will be the same.[162] In addition, the dispositional explanation of modality is also advantageous from the viewpoint of finding truthmakers for modal claims. Such truthmakers are problematic if we agree with some form of Humeanism, where modality has to be separated from the properties and objects themselves. As discussed in chapter 1, something along the line of explanations in terms of possible worlds will be needed if we are to be able to explain modality while remaining Humeans. The option given by dispositionalism offers something actually existing as modal truthmakers instead.

Chapter 1 sketched several possible ways to tie modality to something which is *dispositional* and which also actually exist in the world, be it objects or properties, and with greater or lesser focus on the concept of an essence. The accounts examined in the present chapter focus mainly on dispositionality as a route to possibility. This is done under the general supposition that if we are able to define possibility in a dispositional way, the other common modal notions, such as necessity, will follow. The exchangeability between possibility and necessity is of course the same as always even if we explain the concepts in a new way, so the explanation of possibility will also be an explanation of necessity. What we need to pay attention to, however, is that in contrast with the preceding chapter we are now operating on a whole different level of metaphysics, and the main focal area

[160]Borghini (2016, p. 168)
[161]Vetter (2015, p. 11)
[162]Vetter (2015, p. 12)

is no longer the dispositional essences of *fundamental* properties, but rather 'everyday' dispositions of macro-properties as well as dispositions tied to *objects*.

3.3 Borghini and Williams' dispositional account of possibility

3.3.1 Dispositions and dispositional properties

Borghini and Williams (2008) present and argue for a version of the aforementioned new actualist understanding of modality. In line with the general tendencies of this segment of the metaphysics of modality, this understanding entails removing the notion of possible worlds from the discourse concerning the metaphysics of modality. The possible worlds are replaced with particular modal properties existing in the world, the key components being dispositional properties and dispositions. As should be clear from my arguments so far in this thesis, I do agree with quite a few of Borghini and Williams' background assumptions, such as there being several good reasons why we should leave the framework of possible worlds behind, and rather appeal to modal properties found in the world. While this may be the case, I will proceed to argue that there are some quite substantial problems lurking in the details of their account. Most importantly, I argue that they are defending a notion of metaphysical possibility which is *wider* than what their own framework really allows for.

Borghini and Williams' account is an established version of the dispositional view, but I argue that their version of dispositionalism fails to make a proper connection between the domain of the possible they argue for, and the actual dispositions in the world which are supposed to ground this. Hence, my present goal is to bring attention to certain consequences of their account which have been overlooked so far. Their proposal is explicitly presented to have two main purposes. It is both a presentation of a theory of possibility, and also an argument for a particular interpretation of the domain of the metaphysically possible. I will in particular focus on the latter theme. The reason for this being that one of their main claims regarding the domain of the possible, is that the metaphysically possible will go *beyond* what is allowed by the laws of nature. This will also be the case when possibility is explained in a dispositional way.

I will argue against this idea, not only because I disagree with this understanding of metaphysical possibility, but also because this claim is, as far as I can tell, *not* warranted by Borghini and Williams' own theory. I will suggest instead that the metaphysically possible and the nomically possible are pointing to the same set of possibilities, also when our explanations are merely *dispositionalist* and not *dispositional essentialist*. Explanations in the dispositionalist manner do *not* provide a notion of the metaphysically possible that goes beyond the nomic. This makes the notion of nomic possibility redundant in this context.

In order to understand Borghini and Williams' suggestion of how possibility may be

grounded in dispositional features of the world, we need to get a grip on the vocabulary and general theoretical machinery they employ. The first concept which is of particular importance is their most basic notion; the *dispositional property*. These properties are quite loosely defined as properties which ground the *dispositions*, but they are not further specified in any way, such that there is no restriction at play regarding what kind of properties the dispositional properties may be. Thus, I assume that *both* sparse and abundant properties may exhibit these characteristics according to Borghini and Williams.[163]

Since dispositional properties and dispositions are *not* the same concept according to Borghini and Williams, we need to carefully distinguish them. The dispositional properties are the irreducible *base* for a distinctive set of dispositions. This means that one single dispositional property can produce a range of dispositions, and it is this particular set of dispositions which individuates the dispositional properties. The *dispositions*, on the other hand, are individuated by the *manifestations* they produce. We note that the focal point here is solely on the *manifestations* of the dispositions, and not on a combination of stimulus and manifestations for each disposition. This is an important point for both the account of Borghini and Williams, and that of Vetter. A *disposition* may, in this framework, be exemplified by the standard cases of things being fragile, soluble, and so on, that is, what we might classify as everyday macro properties. The dispositional properties are the properties which *make it the case that* the objects possess these various dispositions. A concrete example of a *dispositional property* is not provided.

Even though there is no example of a dispositional property in Borghini and Williams' article, they do provide examples of the relationship between a dispositional property and a disposition, and also some of the different dispositions that may stem from the very same dispositional property. One such example is their claim that it is the *same* dispositional property in virtue of which a key has the disposition both to open a particular door, and to be a device one can use to open bottles.[164] What exactly this property might be seems quite mysterious. In addition, I find it problematic that it is not only the case that *one single* dispositional property is supposed to be able to support a complex disposition such as fragility, but each dispositional property also support *several* other dispositions of equal complexity. It is for example stated that a fragile glass has some set of dispositional properties, and in virtue of instantiating *one* of these, the glass has *several* dispositions, one of which is fragility. An explanation of how these mechanisms are supposed to work is not given.[165]

[163]If my assumption is correct, this is in line with Vetter's liberal account in (Vetter, 2015). She is far more explicit regarding this point compared with Borghini and Williams.

[164]Borghini and Williams (2008, p. 27)

[165]The lack of detailed explanation may be seen to reflect the fact that we cannot always know which dispositional properties are responsible for which particular dispositions, as mentioned earlier. However, one should perhaps ask whether *some* additional detail would have been beneficial when it comes to providing examples of dispositional properties, particularly as there is no restriction that these properties be sparse.

As explained earlier, Borghini and Williams' goal is twofold. They want to explain what the ontological basis for possibility is, in addition to determining the *range* or *domain* of the possible. Both of these may be explained starting with the assumption that objects possess dispositions, and that these dispositions are *all we need* in order to explain the fact that some happenings are in fact possible. We should note that it is the *dispositional properties*, not the dispositions, which are the truthmakers for metaphysical possibility, even though it is claimed that the distinction between the dispositional properties and the dispositions is not a deep one.[166]

3.3.2 Possibility explained

Their suggestion for a dispositional definition of possibility is initially presented as follows:

> State of affairs S is possible iff there is some actual dispositional property D, which supports a disposition d, the manifestation for which is (or includes) S.[167]

By grounding possibility in this way, Borghini and Williams manage to explain it while referring exclusively to this-worldly objects. From this we get *almost* all the possibilities we need, they argue. By making this qualified statement they are anticipating criticism claiming that there exists possibilities we need to be able to account for which the dispositionalist seemingly cannot accommodate. An example of cases which go beyond what the dispositionalist can provide is the alleged possibility of alien properties, or the ascription of particular counterfactual properties of particular kinds of objects.

Borghini and Williams comment that asking whether a particular theory manages to give us 'all the possibilities we need' is a puzzling question to ask, as it seems to imply that we already know what is metaphysically possible, and that our job is simply to find a theory that can explain this particular set of possibilities. This point is related to what Vetter refers to as *extensional correctness*; the idea that accounts of possibility, hence also potentiality- or disposition-based accounts, must respect, at least to a rather large degree, our prior judgements about what is or is not metaphysically possible. This is an idea I briefly addressed also in chapter 1. We remember that Vetter presents the idea of extensional correctness as stemming from the fact that we have certain *firm convictions* about what is or is not possible, but she also goes on to state the following:

> The potentiality account should vindicate sufficiently many of those convictions, or provide a plausible explanation where it does not.[168]

[166] Borghini and Williams (2008, p. 29). This statement only serves to make the relationship between dispositional properties and dispositions more unclear.
[167] Borghini and Williams (2008, p. 28)
[168] Vetter (2015, p. 247)

I think the last point is of particular importance, and I also believe that this point has not received the attention it deserves in contemporary metaphysics of modality. If the theory should prove *not* to respect our earlier ideas about what is and is not metaphysically possible, it is important that it gives an explanation for how this might be the case.[169] This is related to my general concern that we are not accurately acknowledging that our intuitions about metaphysical modality could be mistaken, and that because of this it will be unwise to simply aim for a theory that matches our pre-philosophical ideas.[170]

If we accept that our intuitions may be mistaken, aiming for a theory that closely matches our intuitions may not be the best starting point. Concerning this, I argue that by putting additional weight on the ability of our theory to provide an explanation of how and why our views could be wrong in the first place, we may get closer to correct modal knowledge. We should see explaining metaphysical possibility in an accurate way as more important than simply catering to our intuitions.

While Borghini and Williams explicitly do not think we should let intuitions lead the way, they do believe that we should be worried if a dispositional account of possibility is not able to give a domain of the metaphysically possible which coincides with the standard view of metaphysical possibility encompassing more than nomic possibility. In order to mitigate the discrepancy between the expected domain of possibilities and the one they can provide by their initial suggestion, they introduce a notion of *higher-order* dispositional properties—properties included in the manifestation of other dispositions. The higher-order dispositional properties will often be identical to already existing ones, but the key point is that they *need not be*. Hence, the theory makes room for dispositional properties which are not identical with any property currently existing in the world, that is, properties which are *merely possible*. Higher-order dispositional properties, in conjunction with the ones we already have present in the world give us the whole domain of the metaphysically possible:

> [**POSS**] State of affairs S is possible iff there is some dispositional property D^n (of some order $n \geq 1$) which supports the disposition d^n, the manifestation of which is (or includes) S.[171]

As an example of such a higher-order disposition, Borghini and Williams use the common example of the fragile glass. In line with what has been described earlier, this glass has some unspecified dispositional property, which gives the glass a whole range of dispositions, one of which is fragility. If the glass were to be treated in such a way that it were to break, this would be the manifestation of the disposition:

> That state of affairs will mean some change in the glass's properties. We are in no position to say exactly what that change is—short of describing the glass

[169] We find similar ideas in (Lowe, 2006, p. 142) where he argues that claims going against our intuitions about natural laws must be backed up by substantial argumentation.

[170] I will return to the question of the role of intuitions in chapter 7.

[171] Borghini and Williams (2008, p. 31)

> as broken—but with whatever new properties the glass has, it now has some different dispositions. One of these dispositions, not apparent beforehand, is its disposition to be used as a cutting tool. But this is just one of many; with each change of properties comes a change in dispositionality—and this means greater possibilities.[172]

This example does of course not provide a *new* property, but it does show how the concept is supposed to be working, and with this in place we can move on to look at how Borghini and Williams use the notion of higher-order dispositions in order to argue for a particular domain of metaphysical possibility.[173]

3.3.3 Going beyond the nomic?

As Borghini and Williams' account is based upon actually existing dispositional properties, they declare that it might be assumed that this is simply an explanation of nomic possibility, that is, possibilities which are consistent with the laws of nature. However, the higher-order dispositional properties provide ontological grounding for a *wider range* of possibilities than any account of nomic possibility would provide, they argue, introducing the term *super-nomic* to refer to this particular kind of possibility.[174] Super-nomic possibility is supposed to be *equivalent* with what is metaphysically possible.

Their suggestion is in short that the metaphysically possible explicitly goes beyond the nomic, but that it is at the same time *firmly* grounded in the properties of the objects existing in the actual world.[175] One argument in favour of such an understanding is that it is supposed to be more interesting than other accounts of metaphysical possibility, which, according to Borghini and Williams, accommodate too much to either be interesting or informative. I agree with this argument, as I firmly believe that the notion of metaphysical possibility should not be just another name for logical possibility or conceivability. We want to know what grounds actual possibility, not what we *consider to be* possible. Still, a closer look at the idea of the metaphysical understood as equivalent to the super-nomic is justified, as there are certain aspects of this interpretation which are unclear at best. This will in turn reveal that although I do agree with Borghini and Williams' view when it comes to their motivation for introducing a dispositional account of possibility, we disagree regarding which consequences such an account will have for our concept of metaphysical possibility.

[172] Borghini and Williams (2008, p. 32)

[173] It should be noted that we find very similar formulations of dispositional accounts of possibility elsewhere. As we shall see later, Vetter's account of possibility has striking resemblances hidden behind slightly different terminology, where *iterated potentialities* refer to much the same as the higher-order dispositions do.

[174] Borghini and Williams (2008, p. 36)

[175] Borghini and Williams (2008, Footnote 3, p. 21f.)

When I claim that certain aspects of Borghini and Williams' account are *unclear*, these unclarities are particularly related to the relationship between a dispositional account of possibility and the laws of nature. We may follow Vetter (2015) and say that there are two conflicting ideas at play in this respect which the dispositionalist needs to address. Firstly, the metaphysical is commonly seen as a wider notion of possibility than the nomic, such that the laws of nature may be perceived as metaphysically contingent. Secondly, it does not seem to be the case that something could have a disposition to violate any actual law of nature.[176] If this latter idea is pointing towards something crucial regarding how dispositions work, one should assume this to be the case also for higher-order dispositions.[177] If so, it seems that the natural thing for the dispositionalist to do is to reject the first idea. If possibility is grounded in dispositions, and no disposition may point beyond what is nomically possible, there is no possibility for happenings which go beyond the actual laws of nature. This entails discarding the common nested view of different kinds of possibility, where the nomic possibilities is a proper subset of the metaphysical ones.

This is not what happens in Borghini and Williams' case. As mentioned, they *explicitly* argue that metaphysical possibility encompasses *more* than just nomic possibility, because the metaphysically possible is grounded in higher-order dispositions—dispositions which may give rise to properties not actually existing in the world. This is fair enough. The manifestation of dispositional properties *could* perhaps bring new properties about. An example of this could be the creation of new synthetic elements, where the possibility of a new element also brings along the possibility that this substance has some dispositional properties that do not presently exist in the world, such as a particular half-life. Nonetheless, such cases are clearly *nomically* possible, so they cannot be examples which would confirm Borghini and Williams' view. We need to ask, firstly, how accepting these higher-order dispositions can give us a notion of metaphysical possibility that is *wider* than what the laws of nature permit. Borghini and Williams actually claim that the set of possibilities they can accommodate through the introduction of higher-order dispositions is not far behind the set of possibilities provided by the genuine modal realist, when it comes to things like admitting the existence of alien properties as genuine possibilities.[178] Secondly, we have to ask how something that is contrary to the actually existing laws of nature can supposedly arise from something which is this-worldly and thus determined by precisely these actual laws of nature. This does not seem to be the way dispositions work.

To answer these questions, we could try to find some property that might serve as an example. Yet as far as I can tell the properties we can think of when asked to exemplify higher-order dispositions will most likely be those which are already existing, similar to

[176]Vetter (2015, p. 281-282)

[177]Note that I do not assume that the intuitions or ideas we have in any way are responsible for this being the case, nor that intuitions might ground any of our knowledge about dispositions. Intuitions can be more or less correct or incorrect and part of our work should be figuring out which is which.

[178]Borghini and Williams (2008, p. 39)

the example Borghini and Williams already provide. Moving beyond this, we surely seem able to *imagine* things contrary to what the laws of nature would allow, but how are we to distinguish between those which are supposedly genuine possibilities, and those which are just figments of our imagination? As Borghini and Williams' account of possibility is supposed to be fully anchored in the actual world and its objects, using imagination in this way does *not* seem to be beneficial to the theory. As mentioned earlier, Borghini and Williams are quite explicit in their dismissal of the use of imagination as a *source* of modal knowledge, holding it as doubtful that conceivability could even be useful as a *guide* to knowledge of the possible.[179] Yet, even though imagination or our ability to conceive of things being possible is neither a source, nor a guide to the metaphysical possibilities, Borghini and Williams seemingly want the set of the metaphysical possibilities to be more or less overlapping with this.

With this as a background, I am not criticising Borghini and Williams for not providing examples of higher-order dispositions giving rise to alien properties, as the act of providing such examples could lead us into a highly speculative terrain. Nor am I criticising the notion of higher-order dispositions in and of itself, but I *am* criticising some of the assumptions made about higher-order dispositions, as well as the lack of explanation of *when* and *how* the jump from the nomic to the super-nomic is supposed to be made.

I acknowledge that the account makes room for far-fetched and unlikely possibilities, and that these are *just as possible* as the ones that are more commonly occurring. This is fine; a theory of possibility should of course not only explain the most common occurrences, but also those which are less familiar. However, going from this to the claim that one can accommodate possibilities defying the laws of nature just does not seem to hold. If we think of this as a branching structure, where the nodes are the manifestation of dispositions, some of which may lead to alien properties existing, we must be able to trace all such alien properties backwards in the structure through all actualized properties, all the way back to some actually existing property. In accordance with [POSS], if it is not possible to trace this backwards and anchor it in an actually existing state of affairs, the existence of the alien property in question is not possible either. Hence, alleged possibilities grounded in that alien property are not really possibilities at all.

I would actually go so far as to suggest that the reason why an explanation of *when* and *how* properties are able to move out of the domain of the nomic possibilities is not provided is that this *cannot be found*. Given how the theory is presented no possible higher-order property would be such that it went beyond the existing laws of nature. I simply do not think any such property may be existing; nomic possibilities may ground other nomic possibilities, but something behaving in accordance with the laws of nature cannot create properties which do not behave according to these laws. If we go back to the idea of seeing such progressions in time as some kind of branching structure, each

[179] Borghini and Williams (2008, p. 38)

point's existence in a graph is a matter of whether a disposition has been manifested or not, but each such outcome will be consistent with the laws of nature. The whole *process* in question is determined by the actually existing laws. Adding more branches and nodes will not help, neither will the iterations Borghini and Williams appeal to. Simply stating that the definition of possibility depends on higher-order dispositions will not give us the result they claim their theory offers.

What is needed for Borghini and Williams' theory to work, are dispositions that lead to different laws of nature. But, as mentioned earlier, no matter how far removed from the actual world we are, no matter the amount of iterations, there will always be some point where a move is made—where we leave the nomic possibilities and move over to the super-nomic. This move needs explanation. For this to be a real possibility, there needs to be an *accessible* point in the future history of the world where things have played out in such a way that there exists a disposition which, if manifested, will go beyond the laws of nature. Borghini and Williams' account is missing the crucial explanation of how this might happen, and as they are the ones claiming their theory supports possibilities going beyond the laws of nature, the burden of proof is on them.

Borghini and Williams are explicit in presenting their theory as an actualistic and naturalistic one. The only available world is the actual one, and the domain of dispositions is limited to just this single world of space and time. There is simply no need for additional worlds.[180] Hence, everything deemed to be possible—and for Borghini and Williams this includes happenings going beyond the laws of nature—will have to be possible by way of dispositional properties existing in the actual world. That is, all dispositional properties that have ever been, are, and will ever be instantiated.[181]

This means, in effect, that all possibilities included in Borghini and Williams' framework can, potentially, happen here (or *could* potentially have happened here, if some different dispositions had been manifested in the past), as this is the only world where possibilities may be realised. According to this framework, we do not have other worlds with conveniently different laws of nature acting as truthmakers for the possibility claims going beyond the nomic. In order for such possibilities to come about, the laws of nature will have to be broken, and they will have to be broken *here*, in this world. This is a far more incredible claim than, say, a generic Humean understanding of possibility and laws of nature—at the very least they introduce *other* possible worlds to do this job, leaving the laws in the actual world the same. It seems that instead of accepting that grounding the metaphysically possible in the actually existing entities of the world entails that the metaphysical possibilities will collapse into the nomic ones, they want to keep stretching dispositionality beyond the domain where it can have any effect. But this seems like little more than wishful thinking.

[180] Borghini and Williams (2008, p. 29)
[181] Borghini and Williams (2008, p. 29)

If we hold that possibility results from actually existing dispositional properties, and we also hold that no disposition can point beyond the laws of nature, then the notion of possibility associated with such an account will be equivalent with the nomic possibilities. Hence, it is in some sense arbitrary which word one chooses to use to denote this particular kind of possibility; the choice will depend on other agendas one might have. I opt for using *metaphysical* possibility to pick out the particular possibility described by the dispositional account. This is, at least in part, motivated by a wish to describe the metaphysical in such a way that is not so easily seen as something unnecessary vague, or as something mysterious which is going beyond the existents of the actual world. The metaphysical should rather be seen as something which is given by the properties existing in the world, by how these properties are disposed to behave.

Borghini and Williams' dispositional theory of possibility aims to explain possibility in terms of actually existing dispositional properties. I have argued that the theory promises more than it can deliver. Dispositions of actually existing things can *perhaps* bring about alien properties, in the sense that we get some property not currently existing in the world resulting from the manifestation of higher-order dispositions, but in no way will any property be such that it has dispositions which, if manifested, may defy the laws of nature.

And with that, let us move on to a theory which is similar to Borghini and Williams' in many ways, but which is presented in far greater detail. The question we want answered at this point is whether the added detail of Vetter's potentiality based account aids us in our understanding of the connections between the disposition-based theories of possibility, and the laws of nature.

3.4 Vetter's potentiality account of possibility

3.4.1 Why potentiality?

It is perhaps not fair to compare one single article to one of the most comprehensive books about dispositionality written recently, so it is obvious that Vetter's monograph gives a substantial amount of detail for which there was no room in Borghini and Williams' article. Apart from this, the most obvious difference between Borghini and Williams on the one hand and Vetter on the other is the use of vocabulary. Diverging from most philosphers in the field, Vetter (2015) develops a notion of *potentialities* as the basic entity in her dispositional framework, instead of starting with *dispositions* or *dispositional properties* as the main concept. The potentialities make up the conceptual base from which possibility and other modal notions are defined. Because of this, we need to take a closer look at both the reasoning behind preferring this terminology, and at what is meant to be included in the potentiality term; that is, how it differs from the dispositions we usually discuss.

The main reason for preferring potentiality as the main term in Vetter's vocabulary is

that she needs a word which may be used in a theoretical and far broader way than what is commonly entailed by the use of the word *disposition*. She seems to think that we have few pre-philosophical intuitions tied to the term *potentiality*, but that we at the same time will have

> a rather firm pre-philosophical grasp on part of its extension. That part will turn out not to be very precisely circumscribed, and I use the term 'potentiality' for whatever is the best and most general precise notion that includes the pre-philosophical extension.[182]

This suggests that while we have few intuitions tied to the term *in itself*, we are supposed to at least roughly understand *its extension*. A potentiality is, according to Vetter, a more general notion of dispositionality, something which far surpasses what is ordinarily thought of as a disposition. The potentialities will basically cover the same area as my redefined dispositions from chapter 2, that is, they will cover a whole spectrum of degrees of dispositionality: from what objects can *barely* do to what they *have to* do. This spectrum is in Vetter's terminology articulated in terms of degrees of possession. A potentiality possessed to maximal degree is something the object *has* to do; it has no potentiality to do the opposite. In Vetter's framework, the notion of maximality and the idea of nomological dispositions—dispositions which in some way are tied to the laws of nature—are closely intertwined. I will return to this in section 3.4.3.

As I have argued earlier, I contend that we can cater to this enormous spectrum without having to introduce new terminology, but rather by simply defining *dispositions* in a more technical way than what has been commonly done. The way Vetter speaks of dispositions may actually be used as an argument for doing this. She notes that the expression 'being disposed to' is not actually used in the same way within the philosophical context as it is outside of philosophy. In ordinary language, this phrase is not commonly applied to concrete inanimate objects—like the fragile vase being disposed to break—but rather "only to agents, animate objects and (often personified) abstracta".[183] This entails that the philosopher's use of the word *disposition* is already somewhat removed from the everyday use of the same term, and as I argued in chapter 2, I see no problem with this concept being even further removed from its everyday use by turning it into a technical term.

3.4.2 Iterated potentialities

We recall that Borghini and Williams' theory has a concept of higher-order dispositions, while Vetter's account features a notion of iterated potentialities, which fills much the same function; they are a way of extending the reach of potentialities.[184] We can use water as an

[182] Vetter (2015, p. 19)

[183] Vetter (2015, p. 66)

[184] Their vocabulary diverges because Vetter (2015, p. 135) wants to reserve the expression *higher-order disposition* for dispositions of dispositions, and not dispositions for further dispositions.

example of an iterated potentiality. Ordinary water does not have the potential to break, but water does have a potentiality to freeze into ice, and ice has a potentiality to break. Hence, water has "a potentiality to acquire (by freezing) a potentiality to break".[185] This is what is entailed when we say that water has an *iterated potentiality* to break.

Potentialities may be extrinsic, and by repeated iteration an object may have potentialities concerning objects entirely distinct from it. There is no limit to the number of iterations, so we might even have cases where by the time the iterated potentiality is manifested the original possessor may be long gone. Hence, we clearly see that the manifestation of the iterated potentiality is not in itself a property of the object. The manifestation may in the end concern something other than the iterated potentiality's possessor in itself. With this machinery in place, it is clear that these iterations greatly extend the reach of the potentialities of any given object, and, as mentioned, these potentialities are such that they may extend far beyond the object in question. Because of this we can say that such potentialities are not potentialities for 'being such that p', but rather simply potentialities *for* p, and even intrinsic iterated potentialities can be such that their manifestations do not concern the possessor of the potentiality at all.[186]

After having introduced iterated potentialities, Vetter is ready to properly define possibility in terms of potentiality:

> [POSSIBILITY] It is possible that p $=_{df}$ Something has an iterated potentiality for it to be the case that p.[187]

This definition allows us to move from the localised to the non-localised; from the potentiality which is always tied to some object, to possibility more generally. All possibilities are as such anchored in some object or other in the actual world, so the main tenets of new actualism is preserved.

An important divergence between Borghini and Williams and Vetter, is that the former tie higher-order dispositions explicitly to the explanation of how the possibility grounded in dispositions may go beyond the laws of nature, while the latter does not. While iterated potentialities are relevant in Vetter's argumentation for why dispositionally founded possibility *may* transcend the laws of nature, her overall argument relating to the domain of the possible is more refined than Borghini and Williams', and depends on other features of potentiality as well. We turn to this topic now.

3.4.3 Nomological dispositions and the notion of maximality

As mentioned in section 3.3.3, we have two common and competing views pertaining to the relationship between dispositional understandings of possibility and the laws of nature.

[185] Vetter (2015, p. 135)
[186] Vetter (2015, p. 139)
[187] Vetter (2015, p. 197)

To recap, we know that it is common to assume that the metaphysically possible includes possibilities going beyond the laws of nature, but at the same time it seems that dispositions are constrained by what is nomically possible, and that nothing could have a disposition to violate an actual law of nature. Vetter states, and I agree, that it is natural to assume that this last point will also encompass potentialities, such that no object can have a potentiality to violate any law of nature. If this also includes iterated potentialities, and I see no reason why it should not, it seems we must reject the idea that metaphysical possibility will encompass more than nomic possibility.

Vetter recognises that one way to solve the conundrum of the relationship between dispositional possibility and the laws of nature is to accept dispositional essentialism, the position I argued for in chapter 2. In that case we can, as Vetter suggests, argue that the view that natural laws are contingent is based upon for example a confusion of metaphysical possibility and conceivability.[188] However, as Vetter is, to put it mildly, not overly enthusiastic about the conditional analysis of dispositions, and as dispositional essentialism depends on this analysis, she is not ready to accept dispositional essentialism as it now stands. Rather, Vetter proceeds to argue that her potentiality account may thrive alongside *both* dispositional essentialism, and other shallower accounts of laws of nature such as more traditional Humean views. Her potentiality view does not commit us to a particular view of the laws of nature, she insists. Hence, her conclusion regarding the relationship between dispositional accounts of possibility and the laws of nature is a refusal to take a stance—she leaves the question *wide open*.[189] In what follows I will question whether this really is a reasonable stance to take.

I have already argued against Borghini and Williams' explanation of how possibility explained in a dispositional way allegedly was supposed to include more than nomic possibility. In doing this I showed that we do not need to appeal to dispositional essentialism in order to argue that dispositional theories cannot account for possibilities going beyond the nomic. However, even though Vetter's account is similar to Borghini and Williams' in many ways, we cannot adopt exactly the same strategy here. The criticism must, in particular, be adapted to encompass Vetter's notion of *nomological dispositions*. Nomological dispositions are, according to Vetter, "the more fundamental dispositions which, in one way or another, encode the laws of nature".[190] Such a concept does not exist in Borghini and Williams' terminology, and it is unclear whether they think dispositions at any level of fundamentality have a role to play in generating the laws of nature.

Even though Vetter does not want to accept dispositional essentialism, she contends that dispositions will exist at all levels of fundamentality, entailing that if there is a fundamental level of properties there will be dispositions among these properties. She does not take a stance regarding whether all properties at such a fundamental or near-fundamental

[188] I return to this question in chapter 7.
[189] Vetter (2015, p. 290)
[190] Vetter (2015, p. 50) She does not specify what she means by *encode*.

level are potentialities, hence she is settling for the weaker claim that *at least some* properties at each level will be potentialities. Among these potentialities, we find the subgroup she refers to as the nomological dispositions. Nomological dispositions will be things like charge, but since she does not notably distinguish between different kinds of properties in terms of their fundamentality, it seems natural to assume that the nomological dispositions will exist at higher levels as well.

The relationship between the dispositions and the laws is not completely clear in (Vetter, 2015), except the fact that the nomological dispositions in some way or another encode the laws. (Vetter, 2018) offers a hint of a clarification of this relation: Vetter uses the well-known example of salt dissolving in water as a case of a non-fundamental disposition entering into a lawful generalisation. She argues that the categorical properties of salt, such as its composition or structure, are not enough to explain this law, even though those properties are also contributing. What is needed in addition is the dispositions of the ions of salt and water. This, in addition to the structural properties of salt and water are all we need to explain the lawful generalisation that salt dissolves in water. This explanation does not seem too far removed from the dispositional essentialist explanation of the same phenomenon, that is, the explanation I favour. In addition, the explanation in Vetter (2018) does not refer to the concept of nomological dispositions at all.[191]

If we return to (Vetter, 2015), an assumed fundamental property such as charge will have to be characterised 'in accordance with Coulomb's Law', but there are still uncertainties in the details of how this is to be spelled out. She does, for example, not address whether the dispositions are relevant for characterising the law, or whether the law is something that will aid our understanding of the dispositions. What we do know is that, in the same way as other potentialities, the nomological dispositions cannot adequately be characterised in terms of conditionals, according to Vetter. They must be characterised in terms of their manifestation alone:

> Because of the quantitative nature of the involved properties (...) we must think of the nomological dispositions as being individuated not by a separate stimulus and manifestation property, but rather by a single, yet complex, manifestation.[192]

I will return to the removal of the stimulus condition and the reasons why this is problematic in section 3.5. First, let us delve into the notion of maximality as a distinct property of the nomological disposition.

What is characteristic for the nomological dispositions, according to Vetter, are their *degree*. Potentialities, hence also dispositions, come in degrees, and while their minimal degree must be very minimal, such as a robust bridge's potentiality to break, the nomological

[191] I am not sure if this reflects the fact that Vetter has changed her mind, or just that there was no room for further details in (Vetter, 2018).

[192] Vetter (2015, p. 284)

dispositions are at the other end of this scale. They are perhaps more akin to necessity, and are always possessed to a maximal or perhaps near-maximal degree, she argues. The suggestion that their possession might be only *near-maximal* is the loophole in Vetter's theory which gives her the opening she needs in order to argue that her potentiality account might indeed co-exist happily with theories advocating the contingency of the laws of nature. I will return to the idea of near-maximality later.

First, we need to ask what *possession of a disposition to a maximal degree* entails? In Vetter's terminology this is a way of addressing the fact that this object does not possess any opposite potentiality. Whereas dispositions in general, in Vetter's framework, are potentialities of a sufficiently high degree, the nomological dispositions are the limiting case, where potentialities are possessed to a maximal degree.[193] If an object is maximally disposed to F, then it will F in all possible cases, at all times. Such an object can do nothing other than to manifest this disposition. Because of this, it will be the case that the nomological dispositions behave in what she calls certain 'law-confirming ways'. I will look at different theories of laws more specifically in the following chapters, but note how her language points in the direction of a more Humean view of laws here, in that these dispositions are in some sense *confirming* the laws. She speaks of laws in general as something working *on* the dispositions, not as something stemming from certain dispositional features existing in the world.

A problem for Vetter is that saying that charged objects have a potentiality in line with Coulomb's Law, and that they have this potentiality to the maximal degree does not tell us what charge *is*. When we try to express what charge amounts to, we have two options according to Vetter.[194]

1. Either, charge is the potentiality to exert a force F whose value stands to other charges q and the distance between them r, in the relation $F = k_e \frac{q_1 q_2}{r^2}$, or

2. charge is the *maximal potentiality* to exert a force F whose value stands to other charges q and the distance between them r, in the relation $F = k_e \frac{q_1 q_2}{r^2}$

The first option allows a variety of degrees. We may say that it is a further determinable property. However, since it is a nomological disposition, we want it to always be possessed to the maximal degree. Thus, if we choose this definition, we need an additional, external, fact about dispositions like charge which explains why they are always possessed to the maximal degree. This fact is not part of its nature. Still, it is the case that only the maximum degree of the potentiality to conform to the law precludes the object from also having the potentiality *not* to conform to it.[195] Because of this, we have to ask why it is

[193] Vetter (2015, p. 285)

[194] Vetter (2015, p. 285)

[195] Vetter (2015, p. 286). Speaking about 'conforming to laws' is another example of Vetter's choice of words on this matter, and yet again it points in the direction of a distinctly Humean way approaching laws.

the case that such dispositions are always maximally possessed if this is not part of its description.

The second option entails identifying the nomological disposition with a "determinate of the potentiality in question, namely, its maximal determinate".[196] Vetter holds that if this is indeed the case—if the identification with the maximal possession of the disposition correctly describes the property of charge—then the law in question will also be necessary. In such a case nothing will have even an iterated potentiality to behave other than in accordance with Coulomb's Law.[197] Nonetheless, we need to ask the reasons why we should adopt this definition of charge, she claims. There must be some good reasons which entails that the maximal-degree potentiality is the correct understanding of electric charge. Vetter states that one possible option in this case is to argue that electric charge expresses a natural property, and that this explains the maximality involved. While this might be the case, this means that we have to ask why the maximal determinate potentiality should be seen as more natural than its determinable, simply the potentiality to exert a force of $F = k_e \frac{q_1 q_2}{r^2}$. Vetter's opinion on this matter is that stating that the one is more natural than the other is simply *ad hoc*.[198]

According to Vetter, dispositional essentialists cannot explain in a satisfactory way why nothing has a potentiality to exert a force of $F = k_e \frac{q_1 q_2}{r^2}$ to any other than the maximal degree, and because of this shortcoming they are not able to decisively conclude that Coulomb's Law (or other similar laws) are in fact necessary. If we cannot explain why the potentiality is always possessed to the maximal degree, we do not have the machinery to conclude in this matter. Because of the maximality problem, dispositional essentialism "cannot simply adopt the present framework for thinking about dispositions and potentialities and then continue on the familiar path", or so it is claimed by Vetter.[199] This seems to entail that until a satisfactory explanation is provided from the dispositional essentialist, the dispositional essentialist view of laws and Vetter's account of potentialities are not completely compatible. Because Vetter is not satisfied with the hitherto existing explanations for why the property of electric charge is as it is, a door is opened which allows her to suggest that the nomological dispositions might in fact only be near-maximal.

If it is the case that some potentialities can be possessed to a near-maximal degree, this entails that the object will generally act in accordance with the potentiality, but that a very weak potentiality for not acting in this way also exists in the object. She claims that when nomological dispositions are near-maximal in this way, it will be inherent to them that they fail to manifest. However, because her view explains possibility without referring to the stimulus condition at all, just the presence of such near-maximal nomological dispositions are enough to make their manifestations genuine possibilities, even though they will not

[196] Vetter (2015, p. 286)
[197] Vetter (2015, p. 287)
[198] Vetter (2015, p. 287)
[199] Vetter (2015, p. 287)

come about.

> [W]e can think of laws as being grounded in potentialities without thinking of them as metaphysically necessary. For clearly there are objects with potentialities not to behave in accordance with the laws, and hence with a (once-)iterated potentiality for the laws to be violated: they are the very same objects which have potentialities to behave in accordance with the laws.[200]

From this discussion we see that while Borghini and Williams rely on higher-order dispositions in order to argue for the contingency of the laws of nature, Vetter's argument relies on the idea of near-maximality of the nomological dispositions.

I am not sure the dispositional essentialist should be overly worried about the challenge from the idea of maximality, however. For example, we see that Vetter mentions charge being a natural property, but she does not mention the other criterion for something being a *power*, namely that the property is essentially dispositional.[201] Ergo, Vetter addresses only one part of what makes a property a power, and according to dispositional essentialism, powers generate the laws of nature. If we argue that certain properties basically *are* what they do, or are disposed to do, there is no room for these speculations about such dispositions being near-maximal.

3.5 The dethroning of the conditional

I will proceed to assert that, in order to argue against Vetter's view we need to do something more than just criticising the idea of near-maximality, and specifying the need for *powers*, rather than thinking we can get by with her notion of nomological dispositions. We also have to scrutinize Vetter's argument that we can explain how dispositions work *without referring to a stimulus condition*. Contrary to her claim that a dispositional approach to possibility should be focused on the disposition's manifestation alone, I hold that dismissing the stimulus condition in this way is not adviceable. For example, we find that certain kinds of cases which make it seem like laws are contingent may be eliminated from the set of genuine metaphysical possibilities if we do not accept Vetter's definition of possibility as something solely tied to the manifestations of dispositions. In this section I will contend that the definition of possibility proposed by Vetter leads to the set of the metaphysically possible encompassing far too much.[202]

We have seen that the expansion of dispositional possibility beyond the domain of nomic possibility can be grounded, as Borghini and Williams do, in the existence of higher-order dispositions, or, as Vetter does, by introducing a concept of near-maximality. I have

[200] Vetter (2015, p. 288)
[201] I am assuming that she by 'natural property' means what I have been referring to as *sparse properties*.
[202] But this is *not* due to the concept of near-maximality.

argued against both of these explanations, but there is a further consequence of both of these accounts of possibility which has not been examined yet. That is, there exists a third way for the dispositional accounts of possibility to provide explanation of genuine metaphysical possibilities going beyond the nomic. The points I will address in the following sections are *compatible with* both Borghini and Williams', and Vetter's accounts. However, in this specific instance I am not certain that the outcome will be viewed as a positive contribution to their accounts. My hope is that the cases discussed towards the end of the current section are seen as sufficiently serious to call for the revision of these dispositional accounts. Even though the conditional analysis has its shortcomings, I argue that not addressing the conditions under which these dispositions will come about, that is, their stimulus conditions, leads to unfortunate consequences. Let us turn to that question now.

3.5.1 Getting rid of the stimulus condition

As was addressed in chapter 1, there are, in general, two ways of tying dispositions to some form of non-localised modality; either via a connection with counterfactual conditionals, or via a connection with possibility. If we analyse dispositions in terms of counterfactual conditionals, we will hold that a disposition is individuated by the pair of its stimulus and manifestation conditions. Such an analysis might be either reductive or non-reductive. A reductive analysis explains the disposition away, and claims that a disposition being present is basically the same as the corresponding conditional(s) being true about the object.[203] This is not the understanding I wish to argue for. Rather, I want to advocate a non-reductive view, where the conditional is meant to illuminate what we are speaking about. We need not even call it an *analysis*, if this seems problematic in itself. I argue that the conditional analysis is a way of encircling the concept we are trying to grasp, but that it might still be a useful approximation at best. That is, we cannot say that there is nothing more to say about dispositions once we have analysed them in terms of conditionals, but the conditional analysis can point in the right direction and aid our understanding.

As we saw in chapter 2, dispositional essentialism is inherently connected with the counterfactual conditional. The conditional analysis, referred to by Vetter as the 'standard conception', has been scrutinized and found faulty by several authors.[204] I presented some of the problems tied to this understanding of dispositions in the preceding chapter, where we saw that the issues with the conditional analysis are mostly due to the fact that the truth-values of the dispositions and the corresponding counterfactual conditional may diverge because of finks and masks. We also saw how the problematic aspects of the conditional analysis arguably are not relevant at the fundamental level where the powers exist, so these issues are seemingly of far greater importance for the more general dispositionalist than they are for the dispositional *essentialist*. To avoid these problems, the two views presented

[203] Vetter (2015, p. 34)

[204] See, for example, (Lewis, 1997), (Bird, 1998), (Vetter, 2011), and (Vetter, 2015) for details.

previously in this chapter focus explicitly on the connection with possibility. That is, the dispositions are defined in terms of their manifestation alone. However, the existence of finks and masks are not the only reasons why Vetter wants to leave the conditional understanding of dispositions behind. In this section, I will focus on what she sees as problems tied to extensional correctness, intuitions, and language use as additional reasons to prefer a 'manifestation only' interpretation of dispositions. I will start looking at her arguments from language usage first, and then turn to the question of intuitions and extensional correctness which will be considered together, as they are closely related to each other.

Vetter's suggestion that we stop worrying about the stimulus conditions altogether, and simply state that a disposition is best understood as 'a disposition to manifestation M', rather than 'a disposition to M when met with stimulus S', entails that the potentialities are directly linked to the notion of possibility without needing to go via the counterfactual conditional, that is, without having to deal with the stimulus condition of the disposition at all. By individuating potentialities (including dispositions) solely by their manifestations we obviously avoid the problems the conditional analysis is faced with, but are we sure that Vetter's possibility centered solution does not generate problems of its own? The way the move towards an analysis centred on the manifestations of dispositions is presented by Vetter, it seems that the route through possibility is surely less problematic. But I argue that what is omitted from the more general debate is a thorough analysis of what we might be *missing* by letting go of the stimulus condition as an important part of our understanding of dispositions. Are we sure we are not removing a crucial part if we simply disregard the importance of the stimulus condition? Are we really able to understand dispositions in an adequate way if this condition is disposed of? I suggest that the answers here are 'no'.

Vetter argues that the preoccupation with conditionals when accounting for dispositions is 'oddly at odds' with how we ordinarily use dispositional terms in our everyday life.[205] She claims that the link between dispositions and counterfactual conditionals is not as strong as many philosophers have thought, and hence that there is room for arguments that the important link between the localised dispositional modality and the more general non-localised modal notions is rather something which goes through the manifestations alone, towards the concept of possibility. Vetter's argument for this shift consists in part of looking at how these adjectives generally are used, as witnessed for example in dictionary entries. Dispositional terms found in dictionaries, such as 'fragility' display mainly two features in this regard:

1. They provide only one half of the putative conditional (the second half), and

2. the most natural paraphrase for the suffixes that go into their formation is not a conditional, but rather 'can' or similar.[206]

[205] Vetter (2015, p. 63)

[206] Vetter (2015, p. 63f). Note that Vetter does not in any way think we can replace philosophy with linguistics, but she assumes that the way language is used may give an idea also about metaphysical

But is this 'can' unconditional? It seems not. It is still conditional on *something* happening. Even though there is no trace of conditionals in our ordinary use of language, or in dictionary entries of particular adjectives, this does not entail that the stimulus condition is not relevant or important. The absence could mean a number of different things. It could, for example, indicate that the stimulus condition can be a whole range of different matters, as is the case for a word like fragility. It would be impractical if our language was expected to reflect this multitude of reasons why something might be broken or shattered. Imagine that we have both a fragile glass and a fragile document. The use of 'fragile' entails that these things may be destroyed if we do not treat them in a careful way, but the term is far too wide to say anything about what kind of actions will lead to the disposition of fragility to manifest in such markedly different objects. This does not entail that these actions are irrelevant, they are just extremely varied. And it is not just the cases where we have complex and diverse stimulus conditions which are relevant here. The fact that the stimulus condition is often omitted could also be seen to reflect that the stimulus condition might be unknown to us, and that quite a few dispositions come about without our knowledge of which stimulus actually made that manifestation occur. In short, we need to acknowledge that our way of using language does not exclusively have the conclusion Vetter wants to draw here.

Another and important question we should ask at this point is the following. Does it really matter how we pre-philosophically *tend to* use dispositional expressions? Is our philosophical theory genuinely worse off if it does not mirror our use of similar concepts or notions in our daily lives? I think not. Our analysis of the terms we use philosophically should not limit itself to elaborations about *what we really mean* when we, in this case, speak of dispositions, abilities, possibilities, and similar. We do not need to find the real meaning of these terms, if this is understood as something that exists out there in the world, specifically in how we tend to use words. We can rather argue for the existence of specific concepts—powers, for instance—and then use things which already exists, like the counterfactual conditional, to explain, and to circle in on the thing we want to have explained in order to use it in a philosophical context. Just like in the sciences, having technical terms is of great use in philosophy, but in order to use the concept of dispositions in a philosophical way we do not have to be able to explain the folk notion of a disposition. What we need to be able to do is to explicate the tool we are using in as precise a way as possible, that is, to explain what the philosophical notion of a disposition entails.

3.5.2 Extensional correctness and the influence of intuitions

According to Vetter, any theory of modality will have to meet three constraints. Extensional correctness, formal adequacy, and semantic utility. In this thesis I will mainly focus on

implications.

the constraint of extensional correctness. Firstly, because this underlies much of Vetter's argumentation, and lays certain premises for her discussion, for example when it comes to deciding which concepts are most important. Secondly, because this is where our main disagreement lies. Both the idea of extensional correctness and the use of intuitions are also key points when it comes to my argument that the laws of nature are, contrary to these intuitions, necessary. This indicates that I will need to weigh the importance of extensional correctness against the arguments I have for assuming the laws to be necessary.

For Vetter the use of intuitions is not only relevant when the question is whether or not our philosophical theorising is concurring with our prephilosophical ideas about modality, it is also something which is actively used *in* our theorising, for example as follows:

> To get our intuitions in focus, let us use the stock examples of dispositions again. Those, after all, provide our best grasp so far of potentiality.[207]

What is referred to as 'stock examples' are the standard examples of dispositions, such as fragility. In addition to speaking about tuning in to our intuitions, we have also seen that Vetter spends a considerable amount of time looking at how people actually use language, in order to be able to employ actual language use as arguments for how we should view dispositions. Both her focus on intuitions, and on actual language use are elements of her arguments for why we should view dispositions as possibility-like rather than counterfactual-like, and for why we should think that a metaphysical theory of possibility needs to be able to explain things like the possibility of a talking donkey.[208]

I have already noted Vetter's notion of extensional correctness before, both in chapter 1 and when addressing Borghini and Williams' theory of possibility. To recap, the idea of extensional correctness which is of relevance here amounts to the following.

1. We have certain 'firm convictions' about what is metaphysically possible and what is not, and

2. These firm convictions should mostly come out true on any metaphysical account of modality.[209]

The first questions that, I argue, will have to be asked here are, firstly, who are 'we' and, secondly, which are these 'firm convictions'? That is, which set of convictions are such that they are correctly classified as the firm ones Vetter is referring to. Moreover, is it correct to assume that a wide interpretation of 'we' is in order here, such that we assume that all humans of all times share some set of intuitions about modality which we should

[207] Vetter (2015, p. 85) in relation to specifying the idea of maximality.
[208] An example Vetter herself uses.
[209] Vetter (2015, p. 15). I used another formulation of hers earlier in the chapter, because of the additional weight put on the aspect of explanation which was relevant at that point. This aspect is not the main point now.

cater to? The assumption that such a set even exists seems overly optimistic on behalf of human beings as a group.[210] In addition, even if such a set *did* exist, why should we make sure that precisely these modal intuitions be validated by our theory of modality? For instance, Vetter states that many of her main objections against a conditional analysis of dispositions stem from its failure in relation to extensional correctness.[211] This entails that Vetter thinks extensional correctness is so important that when other accounts overlap to a lesser degree with prior intuitions, we have good reason to discard them.

I do not think the importance of extensional correctness is anywhere near where Vetter wants to place it, so I do not feel compelled to agree with her rejection of the conditional analysis on this basis. Rather than accepting Vetter's view, and argue that intuitions should be given this kind of weight in our philosophical theorising, I hold that our metaphysical explanations should instead contribute to separate our well-founded and correct beliefs from those beliefs that are wrongfully held. This seems far more interesting than striving to make our metaphysical explanations fit already held beliefs. In addition, I hold that the use of stock examples and intuitions is problematic in itself when the justification for this use is that this, allegedly, will provide our *best grasp* of potentiality. It is problematic because it points in the direction of the given account being, to a large degree, an analysis of *how we use dispositional terms*, and not of what dispositionality itself entails.

We might even go as far as to say that we do not need the folk notion of a disposition at all. We have used the well known idea of a disposition in order to give us a hint of what our philosophical concepts should entail. But in doing so we do not need to pay heed to the way these notions are generally used in natural languages. We use well-known concepts in order to elucidate the things we want to explain—to get an approximate idea of what we are after—but the well-known concepts in themselves need not be incorporated into the philosophical theory.

3.5.3 Too much possibility?

I argue that leaving the stimulus condition out of either the definition, or the individuation of the disposition, does not entail that this condition is no longer relevant. The fact of the matter is that very few dispositions will be manifested without there being *something* making this happen, and that this something is crucial for the disposition being the way that it is; for being exactly that disposition. The stimulus condition lurks in the background anyway. Not addressing it does not make it go away.

In this section I want to present the following thought experiment. What if we assume there to be certain dispositions which are really existing, but which have certain impossible stimuli (as well as possible), and following this also certain impossible manifestations. Which consequences would be seen if we assume Vetter's account to be correct? As far

[210] See (Weinberg et al., 2001) for examples of how intuitions can vary between different cultures.
[211] Vetter (2015, p. 15)

as I can tell, her account is compatible with these cases, but the interesting question is whether she would take them to be further arguments for accepting possibilities going beyond the nomic, *or* whether she agrees that such thought experiments may be used to show serious flaws tied to the dispositionalist project. Another question is whether these flaws are so great that the present, manifestation centred, form of dispositionalism should be abandoned.

In line with my earlier position, I will argue that the latter consequence is the correct one. A dispositionalism disregarding the stimulus condition should be abandoned. I would also further specify that seeing the mere *existence* of dispositions as the criterion for possibility is an unsatisfactory explanation of possibility. Vetter's alternative, manifestation focused, conception of dispositions does not initially seem problematic, but it *becomes* problematic when it is used to explain possibility the way she does. The fear I have concerning this characterisation of possibility is that it will, in the end, give us more possibilities than what we initially bargained for. That is, we may end up concluding that more things are possible than what is actually the case.

If our goal is to explain possibility, and to figure out which things are actually possible, that is, to specify the domain of the possible, this is a serious problem. If we want a correct theory of possibility, but still end up with a set of 'possibilities' which is larger than the set of genuine metaphysical possibilities, something must be wrong with our theory. Of course we can solve this by stating that what we are after is some kind of 'wider metaphysical possibility', but this hardly seems satisfactory. I have already argued that what is metaphysically possible given a dispositional theory of possibility will be exactly those things which are nomically possible, so even though several dispositionalists accept that the metaphysical may outstrip the nomic, I do not. My hope is that the following example will make my position seem even more well-founded.

Let us look at an example of what might happen if we remove the stimulus condition altogether. One problem has to do with the aforementioned question of whether there might be genuine dispositions which have impossible stimuli and hence impossible manifestations. How should we treat such dispositions if we do not consider the stimulus condition to be of importance? If we, as Vetter suggests, view possibility simply as the fact that some potentiality for a particular manifestation exists, how are we to deal with a potentiality for having infinite mass when a material body is accelerated to the speed of light, for example? It seems like this is a genuine disposition. A disposition which is at work at any time when there is a change in some object's mass and velocity, and the specific result—the manifestation—is in this case completely dependent on the stimulus condition of the disposition. This disposition relates mass and velocity in a dispositional way—such and such change in velocity results in such and such change of mass, and as an object approaches the speed of light, the mass approaches infinity. This is an effect of special relativity. If m_0 is the mass of an object in the frame of reference at rest, and u is the velocity of the

object relative to the frame considered at rest, and γ is the relativistic factor $\frac{1}{\sqrt{1-\frac{u^2}{c^2}}}$, then according to special relativity, the mass of the moving object as measured in the frame at rest appears as $m = \frac{m_0}{\sqrt{1-\frac{u^2}{c^2}}}$. This means that if we have an observer at rest and an object accelerated to the speed of light, the mass m, measured in the frame of reference at rest, approaches infinity as the formula shows (γ tends to infinity). This means that an object with mass *cannot reach* the speed of light.

If we understand dispositions in a conditional way, we can explain how having infinite mass is not a genuine possibility, because it is conditional on the object moving at the speed of light. The stimulus condition is not possible, and neither is the related manifestation, as this possibility is dependent on a disposition which is individuated by a set of stimulus and manifestation conditions. However, if dispositions are individuated solely by their manifestation, and if the possibility just depends on the disposition *existing*, then it seems that Vetter must accept infinite mass as a *genuine possibility*. I cannot see how this could be a desired consequence of assuming a dispositional account of modality.

Another problematic issue which needs to be examined when considering a manifestation centred conception of dispositions is that it seems there could exist relevantly different dispositions which will nonetheless have identical manifestations, at least at the non-fundamental level where Vetter mostly operates. Thus, if the individuation of the dispositions are based solely on the background of their manifestations, Vetter's approach will miss these differences, and judge distinct dispositions to be the same based on the fact that their manifestation is identical. Vetter certainly recognises that saying that dispositions are individuated solely by their manifestations is a simplification. Some dispositions may for instance have the same manifestation but differ in degree, or two dispositions may be different if one is extrinsic and the other intrinsic, even if their manifestation is qualitatively identical in these cases. But, she specifies, none of these qualifications will even be remotely similar to a stimulus condition.[212] Reintroducing the stimulus condition in the individuation of dispositions will mean that we can differentiate between such cases, but such a reintroduction at the non-fundamental level also entails that we need to find satisfactory solutions to the problems tied to finks and masks. Thus, we see that *both* the understanding of dispositions as being tied to conditionals *and* the route through possibility are problematic.

What I have been aiming to show in this section is that the missing stimulus condition leads to some very unfortunate consequences. I have also shown how these effects are a separate and independent issue which neither depends on the notion of a higher-order disposition as applied by Borghini and Williams, nor on Vetter's notion of near-maximality. The alleged expansion of the domain of the metaphysically possible based on either higher-order dispositions or near-maximality is an intended part of each account, explicitly argued by their proponents. However, I fear that the effects of the missing stimulus

[212] Vetter (2015, p. 96)

condition explained above, is both an *unintentional* and *unfortunate* consequence which neither Borghini and Williams, nor Vetter, bargained for.

3.6 Dispositional essentialism and metaphysical possibility

So far in this chapter we have seen suggestions of how possibility might be described and understood in a dispositional way. I argue that although these explanations might fare better than a standard possible world centred approach, there are still quite a few problems they face, and I cannot, as the accounts now stand, give my support to any of them. The natural move, then, is to change our attention from the notion of dispositions to the notion of *dispositional essences*.

We should, first of all, question whether or not there is a real demand for dispositional theories of possibility if we already accept dispositional essences at the fundamental level as parts of our basic ontology. Do we really need elaborate accounts of metaphysical possibility in terms of dispositions *in addition to* what we already get from assuming dispositional essentialism? In addition, and particularly in light of the discussion in chapter 2, we need to ask whether the dispositional essences may *legitimately* be used to enlighten us concerning possibility.

I have argued that there are two main reasons for assuming powers to exist, that is, to assume dispositional essentialism about fundamental properties. By doing this, we obtain *both* an account of property identity at the fundamental level *and* an account of laws of nature. As briefly mentioned in the preceding chapter, Bird does mention a third, more speculative, reason as well, namely, that it might be the base for an account of modality more generally:

> A further argument in favour of the ontology of powers is that it may be able to provide an account of possibility and necessity, one with advantages over Lewis's modal realism. Dispositions are linked with counterfactual and subjunctive possibilities. If powers are ontologically fundamental, then this fact about dispositions may be used to ground facts about what is possible.[213]

In line with this quote, and with what I have argued earlier in this thesis, I contend that dispositional essences through their connection with the laws of nature *do* provide grounding for what is metaphysically possible, this means that we can expand the area where powers are of relevance, beyond Bird's account. Thus, it seems that if we already

[213]Bird (2018, p. 250). At this point he is referring to several philosophers who have presented *dispositional* accounts of possibility, such as Borghini and Williams (2008), Vetter (2015), and Jacobs (2010), but none of these have connected possibility with dispositional *essences*. Bird also refers back to his own (Bird, 2007, p. 218) where he *does* suggest a dispositional account of modality could be a possibility, through a dispositional analysis of necessity. This suggestion has not been further developed.

endorse dispositional essentialism, we do not need the broader category of dispositions to provide possibility for us. We should note that when Bird (2018) discusses this topic he assumes that gaining an explanation of modality in general cannot serve as an argument for assuming macro-powers. The idea that powers can provide an account of possibility and necessity was the third point in his argumentation for assuming powers at the *fundamental level*. Just as the two other arguments, the assumption that powers do provide an account of modality does indeed only support the idea that powers exist at a fundamental level.

> For what is possible or not regarding things with non-fundamental properties supervenes on what is possible or not regarding things with fundamental properties. There are no possibilities left unaccounted for by fundamental powers, to account for which we would have to posit macro powers.[214]

As was the case with both the argument from the laws of nature and the argument from property identity, which were examined in chapter 2, the argument from modality too shows powers to be a feature of fundamental metaphysics. However, this last argument from modality seems to have unsuspected consequences for the more general accounts of modality in terms of dispositions as well. If we take the statement from Bird at face value it does in fact suggest that these accounts are not needed in order to explain modality, because there are no possibilities left for which we would need dispositions to provide an explanation.[215]

At the same time we should make sure to ask whether we lose something valuable if we state that there is no need for dispositional accounts of possibility. One of the positive features these accounts have is that they provide a clear and simple way of explaining how and why ordinary happenings at the macro level are (seen as) possible. Possibility, understood as the manifestation of a disposition, is *entailed* in the properties of objects because they are *disposed* to behave in this way. It is a wonderfully simple idea, but what if this explanation is not needed?

It seems that, on a purely metaphysical level, dispositional essentialism gives us everything we need. The dispositional essences of fundamental properties and relations, in addition to the way they are further structured is what gives us the macro-properties, macro-relations, and so on. Vetter (2018) is presenting an idea which seems to resonate well with my thoughts regarding this topic when she states the following:

> Given dispositional essentialism as a thesis about the fundamental properties, it would seem that all it takes to explain macro dispositions is there within the disposition-bearing object itself: its categorical properties plus the dispositions of its parts. Where those parts are themselves complex, we may then go on

[214] Bird (2018, p. 251f.)

[215] They might still be useful for explaining a wide range of other phenomena in non-fundamental metaphysics, of course.

> to explain their dispositions in terms of the nature and arrangement of their parts; but the same reasoning will apply again. And thus we may, in principle, go on until we reach the fundamental level. Given dispositional essentialism, that level is itself dispositional; it's dispositions all the way down.[216]

However, Vetter goes on to argue that this implies that we should reverse the order of explanation between laws and dispositions at all levels. That is, she argues that dispositionality comes first also beyond the fundamental level which is the concern of dispositional essentialism. Rather than focusing on how the laws of nature *limit* the domain of the possible, as I am inclined to do, she suggests bestowing a special status upon dispositionality in general. Following this, it is dispositionality which is the key explanatory factor at *all levels of complexity*, and hence this should be our focal point. Therefore, where I propose that we focus on the existence of particular properties, the powers, and the laws following from these properties, Vetter suggests that the centre of attention be *dispositionality* in itself. Hence, Vetter's focus is more directed towards the explanatory characteristics of dispositionality, whereas I argue from the existence of fundamental powers.

This is in line with (Vetter, 2018, p. 294) where she distinguishes between *explanatory* dispositionalism and *existential* dispositionalism, and further argues that it is not obvious how explanatory dispositionalism must go along with a concern about property existence at all. This question, however, is crucial for the dispositional essentialist. Thus, we see yet another clear difference between Vetter's account and mine. Whereas she holds that dispositionality should come first, and be an explanatory foundation, *at all levels*, I argue that dispositionality should come first at the fundamental level, and that explanations at other levels will have to depend on laws and structural composition as well as dispositions. We should note that these two views are compatible with each other, so we could for instance argue that we have dispositions at non-fundamental levels as an explanatory add-on to dispositional essentialism. As per my earlier statements, I cannot advocate dispositionalism as it now stands. Such a support would presuppose that we are able to repair the problems raised by the stimulus condition of the dispositions.

Furthermore, we need to note that the dispositionality which Vetter wants to give this explanatory role at the non-fundamental level is *already* limited by the laws at the fundamental level, as well as other supervening laws of nature. And, as already noted, at the fundamental level dispositions do come first—they are explanatory prior to the laws. It seems that Vetter would like dispositions at all levels to have the same explanatory power as the dispositions at the fundamental level do. But can mere dispositions take on this task? Regarding this, we need to remember that the powers are not only dispositional, they are essentially so. And it seems it is this idea of a particular kind of *essence* which is at the core of the explanation here, not merely the fact that these properties are dispositional. Given

[216] Vetter (2018, p. 295)

that we do not have essential dispositionality on other levels, I wonder whether dispositions really do have the explanatory power that Vetter wants them to have.

If we go back to the question of what we eventually lose by discarding a theory of general modality in terms of everyday dispositions, such as *fragility*, it seems that the greatest loss is not at the level of metaphysics, but rather at the level of epistemology. We may ask, how do we know that something is possible, and answer that we know about the dispositionality of the objects interacting in the situation, and following this we will know about the related possibility as well. The focus on everyday well-known and named dispositions such as fragility and solubility suggests this is the case. As Vetter says, "If metaphysical modality is based on dispositions, then our ways of knowing about dispositions are, in principle, ways of knowing about metaphysical modality."[217] In addition, we remember that one of her three main reasons for assuming dispositionalism was an epistemic point:

> Dispositionalism, I said, avoids the drawback of a possible-worlds metaphysics by anchoring possibilities in the right kind of objects: actual objects, with which we have epistemic contact. By anchoring them in the dispositions of such objects, dispositionalism promises a plausible story about the epistemology of modality. We clearly have a great deal of knowledge about the dispositions of the individual objects around us (as well as of our own). Such knowledge arises from, and is used in, both everyday and scientific contexts.[218]

Thus, projects like Vetter's are at its core not simply about what possibility, or modality in general, *is*—that is, what constitutes the metaphysical grounding of possibility—but also about *our ways of knowing* about these things. And from this perspective it is clear that a more general dispositional account of possibility at all levels is preferable compared with an account of dispositional essences which must rely on a relation of supervenience in order to explain what goes on at the non-fundamental levels. As my interests are more of a purely metaphysical nature I am not all that troubled by the fact that we might not be able to directly explain every possibility at the macro-level, as long as we can say that all genuine possibilities supervene on, and are limited by, the dispositional essences at the fundamental level.

We should note that the suggestions aiming to connect dispositional essentialism with dispositionalism more broadly presented here are all characterised by being preliminary and vague.[219] This landscape is mostly uncharted waters, and sadly, I will not contribute to specifying a definitive link between the fundamental and the non-fundamental. What I will settle for, however, is to focus on the clearest *limitation* of possibility we can find at the fundamental level, that is, the fundamental laws of nature, and argue that given a

[217] Vetter (2015, p. 10)
[218] Vetter (2015, p. 11)
[219] Bird (2007) hints at the possibility at the very last page of his book, and Vetter (2018) admits she is 'painting with a very broad brush'.

dispositional essentialist account of the laws of nature, we do get the foundation for the domain of the possible. Because of this, the subsequent chapters will address the laws of nature, particularly the dispositional essentialist contribution to the understanding of the laws.

3.7 Conclusion

In this chapter I have shifted the focus from that of dispositional essentialism to dispositionalism more broadly. My main concern has been to specify the domain of the possible, and I have shown how dispositionalists, such as Borghini and Williams and Vetter, argue that dispositional accounts of possibility can compete with the genuine modal realist when it comes to accommodating happenings which may even go beyond the laws of nature. Following this, I have aimed to show how the features of dispositional accounts which are presented as responsible for making such results possible are highly questionable, and that they do not seem to be up to the appointed task. Hence, the claim that dispositional accounts of possibility can accommodate possibilities going beyond the laws of nature does not seem to hold. In addition to this, I have demonstrated how the definition of possibility solely based on the *manifestations* of dispositions opens for a set of 'possibilities' which look unacceptable. Hence, if the definition of possibility based upon the manifestations of dispositions is to be kept, it needs to be modified.

Rather than give my support to any dispositional account of possibility, however, I contend that the possible might in fact be grounded in dispositional essences and laws of nature. Having said that, I do note that this move from dispositions to dispositional essences, firstly, entails a slight loss in the explanatory features of the account, and secondly, entails endorsing an underdeveloped view in need of a substantial amount of work if it is to match the dispositional theories of possibility currently on the market.

Chapter 4

Categorical properties and contingent laws

4.1 Introduction

In chapter 2 I argued that assuming the existence of powers gives us two important advantages. Firstly, we obtain an account of property identity, and secondly, we automatically gain an account of the laws of nature as well. The laws, according to the dispositional essentialist, are metaphysically necessary; moreover, in chapter 3 I argued that also the more broadly *dispositional* accounts of possibility cannot give us genuine possibilities going beyond the laws of nature. However, apart from specifying that the laws of nature, according to the dispositional essentialist, will have to be a matter of metaphysical necessity, I have so far omitted both the details pertaining to an account of laws of nature based on powers, as well as details concerning laws of nature in general.

In fact the subject matter of laws is of such great importance for my overall argument in this thesis that it will be the main focal point of the remaining chapters. In the present chapter, I will start the project of accounting for the laws of nature, by discussing two of the more traditional views of laws which my dispositional essentialist theory will later be compared with. The goal is to show, in chapters 5 and 6, that a view of laws based on powers is superior to these competing views. Note that chapters 4, 5, and 6 should be seen as a unit of the thesis, where chapter 4 plays a preparatory role for the following chapters. As one of my interests is to figure out what makes possible things *possible*, while explicitly tying the notion of possibility to that which is not precluded by the laws of nature, we need to specify these limitations. Hence, a discussion of the laws of nature is an inevitable topic here.

We need to investigate different accounts of laws *even if* we agree with the dispositional essentialist view of properties, and as such already are committed to a particular view of the laws of nature. This is mainly because showing that the dispositional essentialist view of laws is superior to the competing views gives additional weight to our argument that

fundamental properties are powers. However, in order to be able to do this we need to know what we are arguing against. This is the main motivation for including the current chapter, which will, for the most part, be a discussion concerning accounts of laws which are unavailable for the dispositional *essentialist*, but which nonetheless are competing views regarding laws. Even though it might seem redundant to go into an additional debate regarding the laws of nature if we agree with the dispositional essentialist, we nevertheless still need to show that the account of laws based on powers can compete with the best categoricalist alternatives.

In addition, if we want to use the available accounts of laws as further arguments for, or to strengthen our arguments for, dispositional essentialism about fundamental properties, we need an understanding of what laws of nature *are* more generally. This understanding will in turn influence many other philosophical standpoints, as our other standpoints will influence how we understand the laws. Because of this I will include some more general remarks about laws and lawhood in this chapter. Roughly speaking, when discussing the metaphysics of modality, we see that this field is a very tight-woven web of related ideas, where our understanding of the other modal features of the world (say our view on the eventual essential features of certain properties), will be very closely linked to our understanding of the laws of nature. This is the case for all the accounts of laws presented in the current and the following chapters.

The chapter is structured as follows. I will begin in section 4.2, by presenting a brief general discussion relating to what laws of nature are, and why they are so important in the context of this study. In section 4.3 I will discuss the categoricalist's need for accounts of laws, as well as presenting Lewis's *best systems view* of laws of nature. Section 4.4 discusses an alternative view of laws which is also compatible with the assumption that categoricalism about fundamental properties is correct, Armstrong's account of *nomic necessitation*.

4.2 What are laws, and why are they important?

We know that there are lots of regularities in the world, but not all regularities are the same. The set of all regularities can in general be divided into two groups. Some of them are seen as laws of nature, while others are *just* regularities. In order to see what is at stake here, we can have a look at a rather well known example, used in for example (Van Fraassen, 1989, p. 27) as part of his discussion of universality. We may suggest that laws concern "only what is universal and invariable", as Bas van Fraassen phrases it, but universality in itself is simply not enough to make something a law, in the same way that the fact that something is a *regularity* is not in itself enough to guarantee lawhood. We need something more. Consider the following example meant to illustrate this problem.

1. All solid spheres of enriched uranium (U235) have a diameter of less than one mile.

2. All solid spheres of gold (Au) have a diameter of less than one mile.

Both statements are true. Both are also, to the best of our knowledge, universal regularities. But it is *not* the case that both statements represent laws, or lawful connections in nature. There is nothing preventing the existence of a solid gold sphere of this size, save the scarcity of gold, but there *is* something in the very properties and structure of uranium which prevents this element from exceeding a certain mass, and hence also a certain size or volume. Following this, we see that both statements are actually true, but the second one only accidentally so.[220] The first statement, on the other hand, is both true and necessarily so, because of the properties of uranium, and it is as such an example of a *law* concerning uranium.

These kinds of examples point towards the importance of investigating what accounts for this alleged difference, but we can also ask whether it is correct to see this as something which presents an *important* ontological divide at all. That is, we may ask whether it really is the case that there are such great differences between laws and regularities. Might it perhaps instead be the case that laws are just *privileged regularities*, that is, exceptionless regularities, of which are more certain?

In this thesis I argue the exact opposite. There *are* important differences between laws and regularities, and we should strive to develop an understanding of the difference between things that are always the case, but still are *accidental*, and things that not only are always the case but are also *laws*.

There are two reasons for which questions regarding laws of nature are important when dealing with modality. Firstly, because the laws tell us something about which things can, or might, possibly happen—they point towards what we might call the *modal space* of the world—shedding light on the aforementioned question of what makes possible things *possible*. Secondly because reflection on the laws give rise to questions concerning their *own* modal nature. Especially important is the question whether laws *themselves* are contingent or necessary, and if necessary *what kind of necessity this is*. The answers provided to this second question will in turn influence the aforementioned modal space of the world; that is, the grounds from which possibility rises. To be able to answer these questions however, we must first have an understanding of what a law of nature is taken to be, according to the different views.

As mentioned briefly earlier, the concept of law debated in this thesis is a philosophical one, and will as such not be exactly the same as a *scientific* law. This is an important point to note, as it entails that the terms *law of nature* and *scientific law* are not coextensive. I will however argue that they are overlapping at least to some degree.[221] The reason for

[220] Of course, the scarcity of gold is given by the way gold is actually made in nuclear reactions, and as such that too is a nomic fact, and there will be certain limitations to just how big a solid gold sphere could be if we collected all the gold in the universe. However, the point the example refers to has to do with the *structure* of the elements, and the fact that uranium has a critical mass, so we may set this complication aside.

[221] This corresponds to a view of laws of nature stating that we *can* figure out what the laws are, even

distinguishing between these two notions of laws is that while scientific laws can be revised, proved wrong or be inaccurate in some way or another, this is not the case for the *genuine* laws of nature. These genuine laws are the underlying laws we *through science* strive to discover and understand. As such, they are metaphysical and not epistemic entities. This means that when I speak of possibilities going beyond the laws of nature I am not speaking of the discovery of better, more fitting laws in the sciences. Nothing in the laws of nature changed when we realised phlogiston played no role in the process of combustion; our *knowledge about the world and its laws* changed, not the laws themselves.

This is a view which requires that we in some sense be realist about laws. The laws of nature are not just convenient labels for the regularities we observe around us, but in some sense genuine patterns in reality, and central building blocks in the ontological structure of the world. However, even if the terms are not coextensive, we may use the notion of the scientific laws in order to understand what the laws of nature may be.[222] In addition, one can note the following perhaps self-evident but important feature of laws. The fact that something is *called* a law does not entail that it is a law, and something *not* being called a law does not entail that it cannot be a law.[223] Thus, we open for the fact that we may both incorrectly label something as a law, and that there are laws at play in the world of which we have incomplete or indeed no current knowledge. Again, we see that there is this tension between our epistemic access to features of the world we deem to be lawful, and the underlying metaphysical necessities in nature. Thus, when discussing laws of nature as a metaphysical feature of the world, we need to make sure we do not confuse these potentially different entities.

Because of our fallibility when it comes to figuring out what the *genuine* laws of nature are, I will follow several contemporary accounts of laws in arguing that it will not be particularly fruitful to look at all the propositions that are generally referred to as laws, and then try to find some particular unity among them, in order to figure out what it means to be a law of nature. A better suggestion is to have a look at the circumstances that *led to these statements being called laws in the first place*, to see which criteria were involved, and subsequently use this to find a unity to what people call laws. From this the following picture of unity regarding what may be called a law emerges:

> [People] are willing to regard a proposition as asserting a law if, as far as they then know, the proposition correctly states a general and non-accidental relationship among properties, where that relationship plays a fundamental, explanatory role in the relevant scientific domain.[224]

Not all philosophical theories of laws of nature define laws like this, preferring, for

though this might not be the case for all of them. I support this view.

[222] Bird (2007, p. 190) even argues that the fact that many areas of science employ talk of laws gives us a reason to believe that laws exist.

[223] Bird (2007, p. 198), arguing against Stephen Mumfords position of lawlessness.

[224] Bird (2007, p. 203)

example, to understand them just as well defined regularities in the world (and little more than this). And even if one sees laws in an ontologically more substantial way, there are still many different explanations and ways to gain understanding of what laws truly are available. The aim of this chapter is, as already mentioned, to outline two different *categoricalist* answers to the questions presented in the introduction. The next chapter will consist of a specification of the version of dispositional essentialism I find most promising. This means that I will present three main views in these chapters of the thesis.[225] They differ greatly in both their account of what a law is, but also in the degree they accept that a law of nature is *necessary*.

The two accounts discussed in the present chapter, though both being firmly in line with the categoricalist assumptions about the fundamental properties, diverge substantially when it comes to both the question of how laws are grounded, and the question of the degree to which they are necessary. In fact, the metaphysical commitment to the necessity of the laws will be steadily increasing throughout this and the next chapter. The regularity view of Lewis is the weakest, Armstrong's contingent necessity is a bit stronger, and then come the strongest, the different versions of dispositional essentialism we shall meet in chapter 5.

4.3 Categoricalism and the best systems approach

4.3.1 The categoricalist need for accounts of laws of nature

If we argue for some form of categoricalist account of properties[226], the accompanying account of laws will typically have an element of *Humeanism* in it. The main motivations for these theories seems to be twofold. First, to account for laws without locating modality *in* the properties or objects. Second, to provide an understanding of laws that goes hand in hand with the very common intuition that the laws of nature are contingent. It is easy for us to conceive that the laws could have been different, and these theories capture that intuition. This starting point does, however, give us a substantial amount of manoeuvring space, something which entails that the categoricalist is in a more complicated situation than the powers theorist because they have several possible accounts of laws to choose from. As a consequence, a categoricalist has the option of viewing laws as little more than regularities, but they can also embrace accounts which see the laws as something more substantial than this.

In this section of the chapter, and the next, I will present categoricalist views of laws which may be characterised as either fully Humean or semi-Humean. To begin with, I will introduce a regularity-based view of laws grounded in what is commonly known as

[225] Where the dispositional essentialist view presented in chapter 5 also comes in two varieties.

[226] Referring back to chapter 2, the categoricalist holds that the fundamental properties of the world are *not essentially dispositional*.

Humean supervenience. This understanding of laws is largely tied to Lewis, with inspiration going back to Ramsey and Mill. It is also defended, with certain modifications, in later publications, notably by Loewer (1996), Earman and Roberts (2005), as well as Psillos (2014).

I will mainly stick to Lewis's original formulation of the view, partly because it is fairly straightforward and hence easier to use as an example, but also because certain features, and hence certain consequences of the original account, are prevalent for most or all of the different modifications of the theory. All accounts which have Humean supervenience as the starting point will have to recognise the laws as something which supervene on the sum of particular facts in a given world. In addition, all proponents of these accounts depend on possible worlds, which now have to do quite a lot of metaphysical heavy lifting. They will also need a concept of closeness of worlds, of similarity between both worlds themselves and the inhabitants of worlds, and also to propose some idea of what a possible world *is*. As mentioned in the introductory chapter of this thesis, these are not trivial problems to face. In addition, arguing for a Humean view of fundamental properties entails that you need a theory of laws *in addition to* an account of properties.

In line with my discussion in chapter 2, the arguments related to fundamental properties alone are enough to abandon categoricalism and to consider dispositional essentialism instead. When we move from a debate centred on properties to one concerning laws, the categoricalist picture becomes even less tempting to defend. If we are ready to accept the consequences a powers-based theory of fundamental properties comes with, such as the fact that the laws of nature will have to be seen as absolutely (metaphysically) necessary, it does seem like the better overall choice. To spell this picture out clearly, the situation is as follows. Either

1. we accept a theory of properties which is *also* a theory of the laws of nature, or
2. we have a theory of properties which entails the need for a theory of laws in addition.

If we care about parsimony, and are willing to accept the consequences of postulating dispositional essences at the fundamental level, the choice seems easy, and we should settle for option 1.

4.3.2 Lewis's Humean supervenience

One of the more common answers to the questions regarding laws draws much inspiration from Hume and his views on regularities. Because of this the laws become what I have already referred to as 'privileged' regularities, hence these theories may be referred to as *regularity theories*. Hume wrote little on laws, but his views on cause and effect have been a great influence for Lewis. The inspiration from Hume is both explicitly expressed and also visible in most of his work concerning modality and possible worlds, particularly through

the way he in general makes a point of explaining the modal concepts by way of a non-modal, or categorical, mosaic of particular facts. We should of course make it completely clear that defending Humean supervenience in no way implies commitment to other aspects of Hume's philosophy. Rather, it is described by Lewis as follows.

> Humean supervenience is named in honor of the greater 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. Maybe points of spacetime itself, maybe point-sized bits of matter or aether or fields, maybe both. And at those points we have local qualities: perfectly natural intrinsic properties which need nothing bigger than a point at which to be instantiated. For short: we have an arrangement of qualities. And that is all. There is no difference without difference in the arrangement of qualities. All else supervenes on that[227].

According to Lewis, all there is to the world is this vast mosaic—an arrangement of qualities—distributed and related to each other spatiotemporally. The thesis of Humean supervenience states just this, that the whole truth about the world, everything we know and can know, supervenes on the spatiotemporal arrangement of local qualities throughout history. Hence, in worlds like ours, the fundamental relations that exist are the spatiotemporal relations: distance relations, both spacelike and timelike and "perhaps also occupation relations between point-sized things and spacetime points".[228] This is in line with Hume's formulation that "[a]ll events seem entirely loose and separate".[229] We may picture the world as a mosaic floor, or as Maudlin (2007) does, we can compare it to the relationship between pixels in a photograph and the whole picture. Just like these pixels, the small parts of the world have their own properties. Just like the whole picture, composed of a collection of pixels with particular properties and particular placements, so the whole world is made up of these small bits laid out in space and time.[230] The fundamental relations in a Humean world are those that are spatiotemporal. As Lewis puts it,

> [w]e may be certain *a priori* that any contingent truth whatever is made true, somehow, by the pattern of instantiation of fundamental properties and relations by particular things.[231]

The picture that Lewis draws by reference to Humean supervenience is, as he admits, inspired by classical physics, even though the world does not behave according to classical physics.[232] Lewis addresses these problems, both in his article 'Humean supervenience

[227] Lewis (1986b, p. ix-x)
[228] Lewis (1994, p. 474).
[229] Hume (2007, section VII, part II)
[230] Maudlin (2007, p. 51)
[231] Lewis (1994, p. 473)
[232] Lewis (1994, p. 474)

debugged' and also in the introduction to his Philosophical Papers volume II, where he claims that the point of defending Humean supervenience in no way is to support a reactionary view of physics. Rather it is "to resist philosophical arguments that there are more things in heaven and earth than physics has dreamt of."[233] He makes it clear that what he wants to defend is the *philosophical tenability* of Humean supervenience, and assumes that this thesis then can be adapted to any better supervenience thesis that might arise from a future physics.

Lewis does, however, state that Humean supervenience in itself is a contingent matter, and as such it is an empirical issue. It holds in this world, and in *worlds like ours*, but it need not hold. This means that in worlds like ours there is no difference between possible worlds at all without there being some difference in the arrangement of qualities. With the focus on the empirical as a background, one would perhaps assume that he should care more about the fact that the thesis seems stuck in a physics that is not up to date. But as stated above, what is most important for Lewis, it seems, is to fight the specifically *philosophical* arguments against it, and not first and foremost "to take lessons in ontology from quantum physics", as he says.[234]

We should note, however, that certain newer formulations of Humean supervenience avoid the reference to point-like entities entirely, and thus this particular issue becomes less problematic. We find this for example in (Earman and Roberts, 2005), where it is presented and defended as a way of avoiding the problems related to locality in physics.[235] Even though these problems might be avoided by modifying the proposal somewhat, the rest of the issues connected with Humean supervenience remains problematic.

The main thesis of Humean supervenience I will focus on is the idea that the totality of the universe consists of the distribution of fundamental categorical properties and relations throughout all of spacetime.[236] When we move from speaking of Humean supervenience in itself to speaking of accounts of laws which are compatible with this view, it is clear that the most relevant feature of Humeanism in this respect is the idea that *worlds which agree on matters of fact*—the Humean mosaic—*also agree on laws.*

[233]Lewis (1994, p. 474)

[234]Lewis continues: "First I must see how [quantum physics] looks when it is purified of instrumentalist frivolity, and dares to say something not just about pointer readings but about the constitution of the world; and when it is purified of doublethinking deviant logic; and—most of all—when it is purified of supernatural tales about the power of the observant mind to make things jump."(Lewis, 1986b, p. xi)

[235]I will not go into the details regarding the question of the relation between Humeanism and modern physics, mainly quantum mechanics, but Tim Maudlin's article "Why Be Humean?" (published in (Maudlin, 2007)) offers a critique of Lewis and other supporters of Humeanism which is well worth reading. Maudlin focuses on how Humean supervenience completely collides with certain results in quantum mechanics, and contends that the view should be rejected because of this. Lewis (2004) deals with this issue, and proposes an interpretation in line with Everett's no-collapse interpretation of quantum mechanics as a solution.

[236]Loewer (2012, p. 116)

4.3.3 Laws as best systems

There are three key ideas shared by philosophers who want to argue for a neo-Humean perspective on metaphysics, as follows:

1. There are no necessary connections between distinct and separate existences.
2. There are no universals as distinct from classes of resembling particulars.
3. There are no powers as distinct from their manifestations.[237]

When discussing these points, Psillos (2014) agrees with these general claims, and is explicit in his arguments against a powers-based metaphysics—of the kind that I advocate, or indeed any other view deemed to be 'ontologically inflated'. One common way of keeping the commitments to a Humean view of the fundamental entities and relations of the world is to base an account of laws on the notion of *regularities*. Such views will, as Psillos points out, be 'metaphysically light-weight' but they will still be robust enough to ground "at least some of the features/functions attributed to laws in scientific practice".[238] That is, they will be able to ground things like their role in explanations, and the fact that they support counterfactuals.

This is exactly what Lewis does. According to him, the laws of nature are *regularities* and only through the observation of regularities do we get our ideas of causation or of the laws. But, as mentioned earlier, not all regularities are laws, and Lewis agrees with this claim. Hence, it is obviously an important point for Lewis and other supporters of regularity theories of laws to figure out exactly what separates the laws from the accidental regularities. Something can always be the case and be a law, and something can always be the case and be an accidental regularity. But how do we tell the difference between these two things?

A response to this problem in line with seeing laws as regularities, ties the notion of a law to *deductive systems*, more specifically the true deductive systems. This is what Lewis argues we should do. In addition to tracing the view back to Hume, a reference to F. P. Ramsey's take on laws is also needed, where laws are explained as the 'best deductive system' available.

> I adopt as a working hypothesis a theory of lawhood held by F. P. Ramsey in 1928: that laws are 'consequences of those propositions which we should take as axioms if we knew everything and organized it as simply as possible in a deductive system'.[239]

[237] Psillos (2014, p. 12)
[238] Psillos (2014, p. 13)
[239] Lewis (2001a, p. 73). Because of this the view is in some cases referred to as the Ramsey-Lewis view.

According to Lewis, to find this *best system* we consider two virtues—*strength* and *simplicity*—and strive to find as good a balance as possible between them. If we look at all deductive systems with true theorems, we'll see that some of them can be formulated with very few basic principles, are easy to grasp, and better systematised than others, while some include many particular facts and thus are more informative. Of course we can have simple systems that have very little information, and also informative systems that are rather messy. Because of this, we must strive to get as good a balance between these factors as truth will allow. This means that a contingent generalisation of some sort is in fact a law of nature *if and only if* it appears as a theorem in each of the true deductive systems that achieves the best balance of simplicity and strength. The same goes for every other possible world; a generalisation is a law at world w if and only if it appears as a theorem in each of the best true deductive systems at w.

This account is able to explain quite a few issues regarding laws. It does, for example, give us an explanation of how and why lawhood is a contingent property; one world may make some generalisation a law, while the very same generalisation is not a law in another world. This is simply because it is a theorem that alongside other theorems make up the best system in one world, but this is not the case in the other world. By tying the laws explicitly to *systems*, we also see that no regularity *by itself* can be regarded as a law.[240] Regularities which are *outside* the best systems are accidental, and thus we also get an explanation of the difference between the laws and the accidental regularities as well.

In addition, the account provides an explanation of how we may know that something is a generalisation, but not yet know if it is a law. Also, it gives us tools to see that being regarded as a law is not the same as being a law, as we might make mistakes by taking something wrongly to be a law. Lewis claims that the best systems account also explains why we have good reason to take theorems of well-established scientific theories provisionally as laws, as the aim of science is to approximate laws as defined here, that is to move towards the true deductive systems, with the best combination of simplicity and strength. It also gives us an explanation of why lawhood has seemed such a vague and difficult concept—it seems vague because it *is* vague—that is, because our standards of simplicity and strength are only roughly fixed. With this definition and explanation of laws at hand, we are equipped to conclude that the laws in a given world are the generalisations that are highly informative about the very world they are at work in. It makes a tremendous difference which generalisations have the status of laws in the different worlds, and this is especially important for Lewis since it affects the overall similarity of worlds, which is an important concept for his general theory of modality.[241]

By explaining laws in this way Lewis is not violating the metaphysical assumptions that

[240] Psillos (2014, p. 17). Psillos goes on to refine Lewis's regularity view by putting additional weight on the notion of a pattern, such that a law of nature, for Psillos, is a regularity that is characterised by the unity of a natural pattern (p. 24).

[241] See e.g. Lewis (2001a)

lie in Humean supervenience. As we have seen, a Humean based ontology greatly restricts what kind of properties may be seen as existing, so we have no reference to essentially modal properties in objects. The modal features of the world, for example which dispositions certain objects possess, or the way certain properties act, are not essential features of the world; properties cannot themselves bring about change, or have essences that can do modal work.[242] The Humean restrictions mean that we have nothing that can make laws necessary, except in a rather weak sense, which seems to be what Lewis is interested in. The fact that the regularities that are laws are distinguished from other regularities by the roles they play in our theorising entails that there is no metaphysical reality over and above the mosaic of the world that Lewis describes; the laws are just the theorems of the best system, nothing more than this. These theorems underlie causal explanations, they support counterfactuals, and they and their consequences are, in Lewis's own words, *in some good sense* necessary.[243]

4.3.4 Problems tied to the regularity view of laws

This is clearly a metaphysically *thin* picture of laws. Even though we are supposed to gain a distinction between laws and accidental regularities by focusing on the simplicity and strength of the best systems, it might be argued that the *human component* in this picture is far too great, that is, that we are not able to single out what is *genuinely* simple and strong, only what *appear to us* to be simple and strong. Problems tied to this anthropocentrism are presented by John W. Carroll (1994), who worries that the relational nature of simplicity, strength, and best balance might be troublesome precisely for this reason. It seems that *we* have to be the "persons the judgments of simplicity, strength, and best balance are relative to".[244] Lewis is aware of this, and he suggests in his (Lewis, 1994) that it does indeed appear that the standards of simplicity, strength, and balance come from us.

However, this need not be as bad a problem as it could be portrayed to be from the opponents of the view, Lewis holds, if nature is *kind to us*. That is, if nature is kind, the best system will be *robustly* best. This entails, for Lewis, that this system is so far ahead of all the rival systems that it would come first under *any* standards of simplicity, strength, and balance. Lewis admits that we have no guarantee that nature is kind in this way, but that it is *a reasonable hope* that it should be. Because of this, our standards of simplicity, strength, and balance are "only partly a matter of psychology".[245]

Both the view that the laws are only 'in some good sense' necessary, and the fact that their lawhood is 'only partly a matter of psychology' are pretty substantial problems in

[242]This is one of the reasons why reference to possible worlds are indispensable for Lewis.
[243]Lewis (1994, p. 479)
[244]Carroll (1994, p. 53)
[245]Lewis (1994, p. 479). I fail to see how Lewis's hope that nature is kind is to be a valid philosophical argument, but I will not go into details regarding this issue in this thesis. See for example (Massimi, 2017) for a suggestion of how the Humean can provide a better answer to this challenge.

my opinion. In addition, we find several other problematic aspects of this account of laws debated in the literature. Among these Carroll's thought experiment *The Mirror Argument* (which is rephrased and simplified in (Bird, 2007)) is of particular importance. This thought experiment aims to show that Lewis's account will allow for worlds which are alike in matters of fact to *still* differ when it comes to the laws of the worlds. Hence the thought experiment is meant to be a counterexample to the thesis of Humean Supervenience, that the laws in a world supervene on the totality of local matters of particular fact, and that these *local matters of particular facts* are depending on the totality of instantiation of *categorical properties*.[246] Let us, briefly, look at Bird's reformulation of this though experiment.[247]

- We have two worlds: U_1 and U_2. Both have x-particles and y-fields in them. X-particles move steadily in one direction until they meet a y-field.
- These have laws L_1 and L_2
- L_1 in U_1: When the x-particles meet the y-fields, they go spin-*up*
- L_2 in U_2: When the x-particles enter a y-field, they go spin-*down*
- In U_1 the y-field exists in an experimental set-up where the access to the region is controlled by a door, and when the door is open (which it is) the particles will go through the field.[248]
- The same is the case in U_2

Now, consider two additional worlds: U_1* and U_2*. These worlds are just as the first two worlds, that is, U_1* is just like U_1 and U_2* is just like U_2, except the doors are closed.

Now, compare U_1* and U_2*

- As regards matters of particular fact, they are the same.
- U_1 and U_2 differ from each other because of the different spin of the x-particles when entering y-fields
- But in U_1* and U_2* both doors are closed and no particle enters any field.
- Now consider the laws of U_1* and U_2*:
  - U_1* is like U_1 except for the closed door and its consequences. Hence, it seems likely that it shares the same laws as U_1, that is L_1.

[246] Bird (2007, p. 82)

[247] See (Bird, 2007, p. 82ff.) and (Carroll, 1994, 60ff.), but see also (Beebee, 2000) for arguments that the thought experiment rests upon certain wrongful presuppositions regarding the Humean laws.

[248] This is where Bird diverges from Carroll

  - U_2* is like U_2 except for the closed door and its consequences. Hence, it shares the same laws as U_2, that is L_2.

- Conclusion: U_1* and U_2* are alike when it comes to particular facts, but differ with respect to their laws.

- This is meant to be a counterexample to an account of laws based upon Humean supervenience.

At this point, what needs to be noted, from the perspective of a dispositional essentialist, is that the starting assumptions in the argument are in fact *not* genuine possibilities. Carroll's argument clearly presupposes the laws being contingent as well as external to the properties of the particles and fields, an assumption I hold to be mistaken. This means that for the dispositional essentialist, the possibility of worlds differing in the manner that U_1 and U_2 do is not available. Carroll's assumption is that *the same particle* and *the same field* can be governed by different laws in different worlds, and hence give us the differing spin as a result.

The dispositional essentialist cannot accept this condition, but we can still, however, regard Carroll's argument as a *reductio* of the categoricalist regularity account of laws, such that it highlights what we may call "a counterintuitive commitment of that thesis."[249] That is, it seems the regularity theories would deem both worlds like U_1 and U_2 and U_1* and U_2* to be possible, since they hold laws to be contingent, and since there are no intrinsic properties of the particles or fields preventing the experimental set-up being as it is. However, this entails that the example allows something which is contrary to the main tenet of Humean supervenience, that the laws supervene on the totality of the instantiation of categorical properties in the world. Is there any answer the regularity theorist can give in this case? One possibility is to deny that U_1* is like U_1 and that U_2* is like U_2 when it comes to their laws. It is this which leads to the counterintuitive result:

> If the laws are contingent and supervene on the distribution of matters of particular fact, then altering (across worlds) the distribution of matters of particular fact ought on some occasions to alter the laws. In particular a law can be removed just by preventing certain interactions. This seems to be a damagingly absurd consequence of a theory of laws.[250]

Furthermore, it seems clear that supporters of the regularity view of laws have a hard time showing how it may be the case that laws explain. The laws are supposed to explain the regularities we find in the world, but how can laws do this if they themselves are *regularities*? We find a criticism of this shortcoming of the regularity account of laws in (Armstrong, 1983, p. 40f). Here he asks us to assume that a number of *Fs* have been

[249] Bird (2007, p. 84)
[250] (Bird, 2007, p. 84)

observed, and that all of them are a *G*. We have not observed any *F* which is not a *G*. One plausible explanation of this situation is that it is a *law* that *Fs* are *Gs*. But what if laws are merely regularities? In this case we are trying to explain the fact that all observed *Fs* are *Gs* by appealing to the hypothesis that all *Fs* are *Gs*, Armstrong states. And this hypothesis cannot have such an explanatory function. Let us see why. 'All *Fs* are *Gs*' is a complex state of affairs which is partly constituted by the fact that all *Fs* are *Gs*. Armstrong specifies that we can rewrite 'All *Fs* are *Gs*' as 'All observed *Fs* are *Gs and* all unobserved *Fs* are *Gs*.'. Thus, the explanation we are trying to give contains that which is supposed to be explained. We are trying to explain a fact by, partly, referring to *that very fact*. Armstrong goes on to present a view of laws of his own which is also consistent with seeing the fundamental properties as categorical. Let us turn to his view now.

4.4 Categoricalism and nomic necessitation

4.4.1 Contingent necessity

We now move to a position which we may describe as viewing laws to be *contingently necessary*, a term which may in itself seem slightly strange as it refers to something being, in a sense, *both* contingent *and* necessary. The view discussed in this section represents some form of middle ground between Lewis's fully Humean view of laws, and the anti-Humean view I argue for. The accounts falling into the landscape between the Humean and the anti-Humean are, as already mentioned, referred to as being *semi-Humean*, because they keep the Humean spirit, while they at the same time manage to insert a more robust sense of necessity than what is found in the regularity based views. The view in question is often referred to as the Dretske-Tooley-Armstrong view (sometimes abbreviated to DTA) in the literature, as these three have provided rather similar accounts that construe laws as being contingently necessary.[251] I will focus mainly on Armstrong's description of the account, primarily from *What is a law of nature?*

We should note that Armstrong's account is according to some (e.g. Helen Beebee), referred to as being *anti-Humean*, as it rejects the idea of Humean Supervenience, and sees laws as capturing a sort of necessity working between universals.[252] Hence, it is clear that everything is definitively no longer 'loose and separate' when we move from a general Lewisian view to a view along the lines of Armstrong's. The *contingent necessity* in question refers to the imposing of a relation of necessity upon the universals which are related in a particular law. This is a second-order relation which is such that even though *it* bestows necessity on a relation between universals the relation *itself* need not be imposed in all

[251] Armstrong, as well as both Fred Dretske and Michael Tooley, see (Dretske, 1977) and (Tooley, 2004), published works on this very subject in the 1970's, but they arrived at their conclusion independently of each other.

[252] Beebee (2000). This classification is also found in (Shumener, 2019).

possible worlds, and hence the necessitation in itself is contingent.

Nonetheless, it is clearly the case that there are Humean assumptions lurking in the background of Armstrong's account. If we think of the properties which are governed by this second-order relation, those properties are, just as for Lewis, the categorical ones, that is, properties which are not essentially dispositional. This means that there are no necessary relations *between* properties, and that, in turn, entails that properties are free to be combined in ways which far outstretches what is possible according to dispositional essentialism. Hence, even though Beebee stresses that Armstrong rejects the complete lack of necessary connections of Lewis's best systems account, the necessity imposed on the laws according to his own view is *not* strong enough that we may safely refer to it as *anti-Humean*. The necessity accepted by Armstrong is still a very restricted form of necessity, located *outside* the properties themselves; moreover it is still distinctly Humean-flavoured. Hence, the classification of Armstrong's view as *semi-Humean* seems appropriate.

There are two important points that make this view quite attractive, both of which are related to letting us keep what seems to be important intuitions regarding laws. We *both* get a sense of the necessity of laws that seems more satisfactory than what regularity theory can provide, and *at the same time*, we may keep the idea that the laws could possibly have been different. However, we need to ask whether it really is the case that we can cater to these two seemingly conflicting intuitions at the same time, and in addition get a *satisfactory* account of the laws of nature. In order to answer this query, we turn to the details of the account.

4.4.2 Universals

Compared to Lewis' account of the laws of nature, we note that Armstrong's understanding is radically different in several ways. The most notable difference is perhaps the fact that the sense of necessity attributed to the laws is substantially stronger, but it also differs because it is an account that not only allows, but in fact *needs* the concept of a *universal* to take an essential place in the explanation.

What we seek to understand is still the same. Why and how is it the case that the truth of a statement like 'it is a law that *Fs* are *Gs*' can be distinguished from the mere accidental regularity that all *Fs* just happen to be *Gs*, as in our example with gold and uranium. We cannot just analyse 'It is a law that *Fs* are *Gs*', as equivalent to 'All *Fs* are *Gs*', although this is about as far as regularity theory can get us. To have a law, according to Armstrong, we need to have *some sense of necessity* involved, either physically or logically. That is, we may understand it as

1. It is physically necessary that *Fs* are *Gs*, or
2. It is logically necessary that *Fs* are *Gs*[253]

[253] Armstrong (1983, p. 77)

Statement 1) is what we may refer to as a *contingent necessity*, Armstrong claims, because it is limited to the physical domain, and to the physical properties existing in a given world. It is clearly stronger than the statement 'All *Fs* are *Gs*', while at the same time being weaker than the logical necessity of statement 2). To attribute logical necessity to it is to say that it is true in all possible worlds (so to speak), and this seems too strong for the formulations of this theory. Hence the relevant notion for Armstrong is that of a physical necessity, that is, the first interpretation.

However, he does remark that in order to argue for any of these two, we need to recognise the reality of *universals*. That is, in order to tie the purported necessity to reality, this necessity needs to be grounded in something, and universals are fit for this job. We get the connection through the notions *what it is to be an F* and *what it is to be a G*. This does, of course, demand that we accept universals as a respectable metaphysical entity. If we do not, perhaps because of a strong belief in nominalism, it seems the only available solution is to resort to some form of regularity theory, or as Armstrong puts it, to be "nailed to Hume's cross".[254]

Thus, we see that even though Armstrong's view is rooted in certain Humean assumptions about the world and its properties, there is also *substantial* criticism of Lewis's Humean Supervenience to be found in Armstrong's work. With the introduction and acceptance of the concept of universals we are going *beyond* the individual *Fs* and *Gs*, and over to more general considerations; we may say to *F-ness* and *G-ness*. To be able to do this, we must realise that there is something that is identical in every F, *that which makes it an F*, and this is of course the case for every universal. They all have something which makes them the universal they are. In addition, we should note that the universals that Armstrong is willing to accept are what we may refer to as 'Aristotelian'; they must obey a principle of instantiation, and thus be either a property of real particulars, or a relation that holds between real particulars.

This means that I agree with Armstrong when it comes to *both* the idea that we need universals as a crucial ingredient in our ontological toolbox, *and* that these universals should in some sense be Aristotelian. However, the way these universals are further characterised in my account will differ considerably from Armstrong's account. The discussion of what it is to be a certain universal, in terms of a specific description of the property, will, for Armstrong, have to be limited to the particular world of which we speak. The universals will be the repeatable features of the possible worlds, but the identity of said properties *between* worlds is still the primitive form of identity discussed in chapter 2. That is, these properties are not in any way precluded from differing *substantially* between worlds, because they are *quiddities*.[255] Armstrong's universals will, as a result, not have the essential modal properties I argue they have. As I have specified earlier, this does not entail that

[254] Armstrong (1983, p. 78)
[255] Armstrong (1989, p. 44, 59)

dispositional properties do not exist in Armstrong's account. The restriction regarding the universals has to do with the *essential* features of these properties, and Armstrong will not allow dispostionality to be an essential feature of universals. For him it is rather the case that the ontological grounds for any attribution of dispositions or powers to any parts of the world must be found in the categorical properties of the objects involved.[256] For Armstrong, dispositionality does not go all the way down.

When we move from the idea that there are universals to the thought that there are laws of nature which in some sense are necessary, we are introducing some kind of *relation* which binds these universals together in lawful ways, such that we will be able to speak of statements along the lines of 'being an F necessitates being a G'. It is this kind of statement which we can view as a prototype of such a lawful connection. When we start speaking in this way, we are clearly moving beyond the realm of simple regularity theory, and far beyond the realms of Humean Supervenience. The necessitation involved in the natural law 'being an F necessitates being a G' is a relation between universals and hence a relation of a *higher order* than the relations which exist between the things in the world. At the same time we see how this relation *between* universals secures that the properties involved in the relations are not *themselves* the sources of this necessity. As the relation is added on from the outside, so to speak, it ensures that the universals do not display any unwanted dispositional features.[257] The related properties are 'respectable' categorical properties.

To make formulations of the principles behind this account easier both to write and to comprehend, we introduce the following convention for notation. The phrase 'being an F necessitates being a G', will be symbolised *N(F,G)*. This expression means that it must be the case that each F is a G, but *the holding of the necessity relation*, N, is a contingent matter, as it depends upon the actually existing laws of nature in the given domain. Formulated in terms of possible worlds, this just indicates that even though *N(F,G)* is true in one world, there will exist possible worlds where *N(F,G)* does not hold. Due to this necessitation existing between universals we may also refer to this view as *nomic necessitation*.

4.4.3 Armstrong's laws

Now that we have the framework of nomic necessitation in place, we may proceed to the question of how we should advance in order to acquire an account of the laws of nature with this relationship between universals as a starting point. The basic idea that Dretske, Tooley and Armstrong arrived at can be summed up as follows.

- We are supposing that '*Fs* are *Gs*' is a law.
- We also assume that *F-ness* and *G-ness* are universals.

[256] Armstrong (1983, p. 9)
[257] That is, unwanted from Armstrong's point of view.

- In order to make the relationship between *Fs* and *Gs* a proper law rather than just a generalisation, it is postulated that a *second-order* relation of necessity, *N*, holds between *F-ness* and *G-ness*.
- This relation of necesitation is of a *non-logical* or *contingent* kind (described as physical necessity above).
- Given that the holding of the relation *N* is an contingent matter, there will be possible worlds where this relation does *not* hold between these universals.
- Hence, we ensure that our intuition that the laws of nature could have been otherwise can be upheld.

When the *N*-relation holds between universals, it *entails* what Armstrong calls the corresponding Humean or cosmic uniformity *all Fs are Gs*, that is, the generalisation which we also get from regularity theory. If we were limited by the restrictions of regularity theory, we would start out with this generalisation but not get much further than that. Now, however, the regularity in itself is coming from the nomic necessitation. This entails that Armstrong's explanation *includes* the generalisation which is offered by the regularity view. It also means that his account is moving *beyond* the space that the fully Humean theories are confined to. Because of this, the assumption is that we get an additional layer of explanation of *what laws are*.

If we read the arrow as 'entails', we have:

$$N(F, G) \rightarrow \forall x(Fx \supset Gx)$$

This guarantees that whenever we have $N(F, G)$ we also have the corresponding regularity, but the entailment does not hold the other way around. If we have the case that all *Fs* are *Gs*—that this is some kind of regularity present in our world—this does not entail that *F-ness* and *G-ness* are related by *N*:

$$\forall x(Fx \supset Gx) \not\rightarrow N(F, G)$$

Through this postulated asymmetry between regularities and lawful relations, the account is supposed to clearly distinguish between those regularities that are lawful and those that are not; we are precluded from wrongfully concluding that something is a law simply because it is a regularity without exceptions. Lawhood demands there to be something more in place, something that separates the laws from the accidental regularities, and this is the relation *N*.

By the introduction of the necessity relation, *N*, in the explanation of laws, it is hoped that we get some advantages, particularly in comparison with Lewis's regularity theory. As we saw, it was arguably the case that even with the inclusion of strength and simplicity as markers of the set of lawful regularity, Lewis's account does not really give a satisfactory

answer to the question of how to properly distinguish laws from regularities. According to Armstrong, this problem is solved by the introduction of *N*, and by viewing laws as links between universals, as follows.

> [I]t is very natural to think of laws as linking properties. It seems natural to say that all *Fs* are *Gs because* being an *F* necessitates being a *G*. (...) distinguishing between 'accidental' cosmic uniformities and those which are genuine manifestations of a law, is automatically solved.[258]

If we accept this, we seemingly have a solution to one of the most pressing problems faced by regularity theory, the question of whether or not such regularities really *explain* the laws. We can say that since laws are *something else* than simply generalisations on this view, the problem of whether or not the laws are able to *explain* also seem to disappear if we adopt the account based upon nomic necessitation. The laws postulated by Armstrong's and other similar accounts are such that they have sufficient ontological distance from the things they are supposed to explain, so we are not in danger of having something explaining itself.

Additionally, we see that the relation of nomic necessitation, as proposed by Armstrong, manages to give answers to further aspects which were problematic for the regularity theorist to answer. We remember that there was a worry that strength and simplicity, as well as the balance between them, were too closely tied to *our* standards of strength, simplicity, and balance on Lewis's view. Contrary to this, Armstrong's account is definitively mind-independent. Hence, the lawhood is not something which might be imposed upon relations by us. In addition, the problems raised by Carroll, and later by Bird, regarding the way lawhood is supervening on local matters of particular fact, can no longer be an issue here, as Humean Supervenience is denied.

Unfortunately this view is not without problems of its own, and particularly with regard to the *N*-relation's own identity. It is unsettling that the very relation which is supposed to ensure that we are able to distinguish between laws and regularities seems so mysterious. Because of this, we simply cannot accept this view without asking what *N* itself *is*, and this question needs a *satisfactory answer* if the account is to be helpful at all. In his 'Laws and symmetry', van Fraassen refers to the issue concerning the *N*-relation—what exactly this law-making relation holding between universals is supposed to be—as the *identification problem*. Coupled with what may be referred to as the *inference problem*—the question of what information the statement that one property necessitates another gives us about what happens and what things are like—these two issues are at the core of van Fraassens critique of Dretske, Tooley, and Armstrong's view of laws.[259] Van Frassen thinks that these problems are related to each other in such a way that solving one of them renders the

[258] Armstrong (1983, p. 86)
[259] Van Fraassen (1989, p. 96)

other one insoluble. Particularly the question of the identity of the N-relation is so serious that if we are *not* able to satisfactorily answer it this should point to the need for another account of laws.

Armstrong states in an answer to van Fraassen that a uniformity, like 'all *Fs* are *Gs*', holds because something's being *F brings it about* that something becomes a *G*—that is, we can hypothesise that this is the case. If so, this is supposed to be an 'atomic fact' (though a *higher order* atomic fact) which holds between the universals F and G. This, Armstrong claims, solves the identification problem.[260] He goes on to state that the relation at play here is the usual causal relation, the very same relation which is at play when one billiard ball hits and causes to move another billiard ball. The difference is that the relation is now hypothesised to relate *types* rather than *tokens*. Armstrong concedes that there is no available proof showing this to be the case, but holds that we should go along with this resolution because of its *explanatory power*. He further contends that if we find this answer satisfying, then we will also have a solution to the inference problem.

> For if a certain type of state of affairs has certain causal effects, how can it not be that the tokens of this type causes tokens of that type of effect?

That may well be the case, but Armstrong is in this case in need of an explanation of this causal relation, which cannot be grounded in the properties themselves, as these are to be categorical. In addition, his explanation of the identity of the N-relation seems circular, like little more than what has been said before, albeit in slightly different worlds. It seems justified to say that this relation itself is still unclear after the explanations provided in (Armstrong, 1993). Another option, however, may be to focus on the idea that this relation is perhaps *theoretical*.

> (...) theoretical statements, though not analyzable in terms of observation statements, are analyzable in terms of statements that contain nothing beyond observational, logical and quasi-logical vocabulary.[261]

Can this specification contribute to N becoming less mysterious and problematic? I do not think so. Even if we may analyse N as some kind of theoretical entity, it is important to note that this theoretical entity is thought of *realistically*. This entails that it has to have *a nature of its own*, and that the theory should provide some understanding of what this nature is. The relation's inexplicability seems to be something we are simply forced to accept, and this is an obvious problem with the account.

We note that, there is a problem tied to the notion of necessity when it comes to relation N. It is clear that Armstrong wants to capture the fact that laws appear to have *some* modal force and that this should be reflected in the account proposed. The question is whether the

[260] Armstrong (1993, p. 422)
[261] Tooley (2004, p. 674)

'soft' necessity compatible with the laws of nature being contingent really does work in this respect. Can we have worlds with no real modality in the basic components, but which still have some kind of modality tied to the laws? Lewis solves this problem by allowing possible worlds to take a central place in the explanation of the laws of nature, but Armstrong rejects any but the actual world, subscribing instead to a version of fictionalism.[262]

If we reject an ontology of powers but take the modality associated with laws seriously, *and* we are at the same time reluctant to employ a notion of non-actual possible worlds, in one form or another, then the proposed 'soft' modality of Armstrong is not really a genuine option.[263] Remember that both the modality of the laws and the modality related to the proposed *causal relations* which are supposed to explain the N-relation needs to be grounded in *something*, but the properties of the actual world cannot provide this on Armstrong's view, as they are explicitly stated to be categorical. Hence, the available solutions is to either agree with the dispositional essentialist that there *is* something providing this modality existing *in* the properties of the actual world, in which case the relation N is superfluous, *or* you need to allow for a framework of possible worlds. I will briefly address some of the problems associated with the latter choice before turning to dispositional essentialist accounts of laws in the following chapter.

Having to adopt a framework of possible worlds can be seen as yet another reason to consider *other* accounts of laws of nature than the categoricalist alternatives presented so far. This is a reason which goes beyond the specific inadequacies connected with each of these accounts. It would be preferable if we left the assumption that fundamental properties are categorical behind, because this assumption entails that the accompanying accounts of modality and laws *demand* additional possible worlds in order to work, and as the discussion in chapter 1 revealed, there are several reasons why modal metaphysics without possible worlds would be preferable. Remember that I argue that Armstrong's account cannot find support even for his limited nomic modality in the actual world, given that the properties of this world are seen to be fundamentally categorical; his account needs possible worlds, in *some form or another*, in order to provide the correct modal status to the laws of nature.

If we look at some commonly held views about modality and laws from the categoricalist viewpoint, it becomes clear that if one agrees with these points, one needs, as Vetter says, to 'outsource' modality to other possible worlds.

a) Modal features of the world is something that needs to be accounted for, and

b) we want well functioning theories of laws, and

[262]In (Armstrong, 1989, p. 49) he argues that what is needed is an 'Actualist, one-world account of fiction'. An interesting question to ask in connection with this is whether the fictionalist understanding of possible worlds advocated by Armstrong is capable to deliver a satisfying explanation of the modal features of the world he needs explained, but I will set this question aside for now.

[263]Bird (2007, p. 96) argues that nomic necessitation actually *contradicts* categoricalism.

c) there are no modal features essentially tied to the objects or properties of the actual world.

Agreeing with the above points leads to the need for something outside the given world's domain in order to capture the modal features of reality. That is, the categoricalist needs possible worlds in order to make sense of the modal features the world clearly seem to have. Both accounts of laws presented here are built upon properties which are categorical, and any dispositional elements a world would be seen to have are in turn grounded in those categorical properties. Thus, at the most fundamental level, there is no modality located *in* properties, and hence no fundamental modality in the world as such. Because of this, Vetter argues as follows.

> If the Humean is to find modality at all, she must look beyond the mosaic, to other possible worlds. The anti-Humean has no need to 'outsource' modality in this way; she will find it in the features of this world.[264]

We remember from the very first chapter of this thesis that one of my main goals is to make a contribution to the project which centres around the idea that *removing* possible worlds from its duty as provider of metaphysical facts would be a positive thing. As specified there, this entails that the possible worlds should no longer do what we may refer to as important metaphysical work, such as providing truthmakers for modal claims. However, the possible worlds are destined to have to keep doing this work if we are to argue that the fundamental properties of the world are categorical. Furthermore I maintain that *if* the possible worlds are to do the metaphysical work the categoricalists want them to do in a satisfactory way, we *need to know* what a possible world is. And that debate is, as we saw in chapter 1, not settled.

If we, on the other hand, *deny* that the fundamental properties are categorical, we will find ourselves in a position where we are also able to deny the possible worlds playing an important role in metaphysics. The possible worlds can in this case retain their role as a useful heuristic tool, in the sense that we may still use them to create examples, to illustrate, and to make things easier to grasp. If we deny that the fundamental properties are categorical, when categorical is understood as *not essentially dispositional*, this will entail that we view the fundamental properties as essentially dispositional, that is, as powers. In the following chapter I will discuss accounts of laws which take precisely this assumption as a starting point. We remember how one of the main reasons to assume a powers based account of fundamental properties is that this gives us an account of the laws of nature 'for free', and without the need for additional possible worlds as parts of the explanation.

[264] Vetter (2011, p. 743)

4.5 Conclusion

If we are persuaded that the fundamental properties in a world are categorical, that is, that they lack dispositional essences, our options regarding accounts of laws are limited to those which are *in some sense* Humean. I have presented two such options here; one fully Humean account attributed to Lewis, and one which has Humean roots, but which at the same time invokes a stronger sense of necessity (Armstrong's). I have tried to keep this presentation brief in order to give more space to the positive arguments of the dispositional essentialist, while at the same time trying to offer enough background and detail to set the stage for the next chapter.

I have already acknowledged that the most important battleground for the dispute between the categoricalist and the dispositionalist will be in the domain of the fundamental properties, while the discussion regarding laws will hopefully be able to give further arguments for our preliminary conclusion. If we are able to show that the dispositional essentialist understanding of properties is superior to that of the categoricalist, much of the motivation for Humean theories of laws disappear. If the fundamental properties themselves are not categorical, but rather *powers*—essentially dispositional, sparse properties—an account of laws automatically follows. In that case, coming up with other theories of laws *in addition* is superfluous. From my starting point as a dispositionalist regarding fundamental properties, the accounts of laws presented so far do not provide arguments which will weaken my initial standpoint. In fact, they may instead be used to weaken the belief that a categoricalist view of fundamental properties is a good starting point, once we are able to show that the accounts themselves, or their consequences, are unfortunate.

In this chapter I have started the important discussion about laws of nature by, firstly, looking at some more general remarks about laws and lawhood, and how these concepts are typically understood. Secondly, by looking at two accounts of laws of nature open for the categoricalist (because they are compatible with the fundamental properties of the world being *not necessarily dispositional*). I have argued that the regularity view proposed by Lewis is problematic. This is so *both* because the account is based upon Humean Supervenience, *and* because, according to this view, the laws are simply too close to being just as other regularities; that is, the explanation of lawhood is unsatisfactory. Armstrong's view fares better when it comes to the distinction between laws and regularities, but depends on a relation, N, which seems mysterious and hard both to satisfactorily explain and to grasp. In addition, I have argued that categoricalist views of laws seem to *depend* on a notion of possible worlds in order to bestow the, albeit limited, nomic necessity upon the laws. I have pointed to some of the issues a possible worlds based view of modality and laws are faced with both here and in chapter 1, and I hold that if we are able to explain the metaphysics of modality *without* resorting to possible worlds, this will be a positive contribution to these debates.

Chapter 5

Dispositional essentialist accounts of laws of nature

5.1 Introduction

In this chapter I will take a few important steps towards establishing the positive argument regarding the laws of nature based on powers. The powers based accounts differ greatly from the two preceding examples, both in regard to how the laws are grounded and regarding the degree to which the laws are necessary. We recall from chapter 2 that one of the arguments for accepting a powers based ontology was that it gave us an account of laws of nature as well as of property identity. But, as I mentioned in chapter 4, if the fact that we get an account of laws 'for free' is to be one of the reasons for accepting fundamental powers as a part of our ontology, we should make sure that the explanation of laws on offer is able to compete with the main contenders we have just examined. To show this is the goal of the present chapter.

The main point of the powers based account which I will argue for here is that the fundamental laws of nature are grounded in the dispositional essences of fundamental properties. That is, in what I have defined as *powers* earlier in this thesis. As a result, dispositional essentialism entails an even stronger sense of necessity than the contingent necessity of Armstrong's theory, while it is at the same time a view that is realist about laws. Even for Armstrong, the necessity bestowed upon the laws is something which relies on an understanding where their modal properties—their necessity—is imposed on the properties related in the laws from the outside, so to speak. Hence, the properties themselves have no modal powers, no essential modal features. Armstrong's view is clearly realist, but I have argued that it is still deeply entrenched in Humean assumptions about the world, such as the need for explaining the laws in terms of something which itself is non-modal in character. That is, his view does not allow for necessary connections in nature. In what follows, however, I will depart completely from the Humean assumptions, and argue that the laws stem from properties which are essentially modal.

If we already hold that dispositional essentialism is the preferred way of understanding fundamental properties, the theories of laws of nature already presented are not really available, or at least not *particularly attractive* accounts for us to argue for. Still, it should be noted that if the account of laws based upon dispositional essences is deemed *not good enough*, this should make us revise our view of properties, because a viable explanation of the laws of nature has been promised to be a significant part of the reasons why we would want to accept a powers theory of properties to begin with.

The chapter will proceed as follows. Firstly, in section 5.2, I will outline the general view of laws following from assuming dispositional essentialism, focusing in particular on the necessity of the laws—a consequence which we have to accept if we are to have a powers theory of laws, but which is often seen as counterintuitive. Section 5.3 focuses on Bird's account of laws, where the laws follow directly from the dispositional essences of the fundamental properties. Apart from some important discrepancies when it comes to the understanding of the universals, this is the account of laws I will argue for. Section 5.4 examines Ellis's view of laws, as well as the distinctions between his account and Bird's, focusing mainly on the fact that Ellis's account depends on the concept of a natural kind in addition to the assumptions included in dispositional essentialism already presented. In section 5.5, I will examine recent criticism from within the dispositionalist camp. Jennifer McKitrick (2018) argues that the assumption that the laws are necessary need not be accepted even when dispositional essentialism is postulated. I argue that her critique might to some degree affect Ellis's version of dispositional essentialism, but not the version I defend.

5.2 The laws of nature are truly necessary

5.2.1 Letting go of intuitions

Holding a dispositional essentialist view of fundamental properties entails holding that the laws of nature are necessary. This is an inescapable and explicitly stated feature of the view, and at the same time perhaps the feature which is most problematic to accept. Since this part of the account is controversial—the laws of nature are commonly assumed to be contingent—we need to make sure that we are able to present a coherent explanation of laws based upon dispositional essences which is able to compete with the best categoricalist accounts of laws of nature. In chapter 3 I briefly discussed a point found in (Vetter, 2015, p. 247) which is articulated even clearer by E. J. Lowe, that if we are to argue against, or depart from, our intuitions, we need good reason to do so:

> [W]e would need to be given good reasons for thinking that these intuitions are mistaken, as well as some explanation for our possession of those intuitions

> despite their being mistaken ones.[265]

Thus, we see that when arguing for dispositional essentialism, we have to depart from the intuition that the laws of nature are contingent, and hence we are in one of those situations when we need to respond to the claim from Lowe. It is clear that in the case of the laws the categoricalists have got the most common intuition on their side. However, *if* we are able to present a superior account of the laws of nature this will be a *further argument* for accepting a powers view of fundamental properties. Let us first look at the background assumptions underpinning my view.

In line with my earlier arguments, I will in the present chapter explicitly argue that the world is not consisting of just a vast landscape of separate entities that are being pushed and pulled around by some *external* laws of nature that work upon the (otherwise passive) physical entities in the world, a description which is particularly fitting for Armstrong's account of the laws. The world is rather essentially *active*. It is full of entities with properties that make them act and react to and with each other. What we refer to as a law of nature is not some *obscure entity working in-between* things, but rather something which is *driven from the things themselves*—the laws are embedded in the very fabric of the world, mainly in the essences of the fundamental properties themselves. With this as my starting point, I will also have to argue that the laws are not contingent, but necessary, and that the version of necessity involved here is stronger than what most theories advocate. This means that we cannot truthfully claim that the laws of nature could have been otherwise, even if this is a strong intuition.

My argumentation in the present chapter follows directly from the discussion in chapter 2 centred on the domain of the powers. Whereas Bird has departed from his earlier view, and now holds that powers may be found also at certain non-fundamental levels, I argue that a restriction of the domain of the powers, in line with Bird's earlier account still has merits. That is, I hold that a restriction of the powers to the fundamental level of metaphysics, in line with that of (Bird, 2016), is still defendable (contrary to what Bird now seems to believe), and this restricted domain will be the foundation on which my account of laws will be built. Such a restriction is also automatically an argument against the mixed view, and, following this, also an argument against Ellis's optimism regarding what plausible work powers can do. (This is so because Ellis's assumptions regarding the usefulness of powers demand that powers exist also at certain non-fundamental levels.[266])

The fight against categoricalism is not only of importance when discussing fundamental properties, but will also be an important issue when discussing laws. We remember that the categorical properties are those which are not essentially dispositional. The view of laws following from such an understanding of properties is explained by Bird as follows:

> Categoricalism about properties goes hand in hand with the view that the laws

[265] Lowe (2006, p. 142)

[266] See for example (Ellis, 2002, Chapters 7 and 8).

> of nature are contingent and tell the properties what to do (or describe the patterns of regularity they happen to be a part of).[267]

Assuming a categoricalist view of properties—which implies that laws and properties are clearly separated entities and that the former somehow control or influence the latter—makes it easy to picture that the laws that happen to govern our world could have been different. The very properties and things that exist could just as well be pushed and pulled around by *other* forces than the ones we actually have, and, in addition, the forces we do have could have been altered. It is perhaps even easier to imagine the laws being different if one holds some form of regularity view of laws, where it can be discussed whether the laws govern at all. Regardless of which particular account of laws is advocated, it is clear that assuming the laws to be contingent is a very common view to have. Ellis actually goes as far as to state that "[t]here is probably no more deeply entrenched philosophical thesis than that the laws of nature are contingent."[268] I would probably not express this in such strong words myself, but it is clear that the assumption that the laws of nature are in some sense contingent is generally seen as a common intuition to have, and that this is an intuition which it is valuable to keep when we are moving from pre-philosophical thoughts to a philosophical account of laws and lawhood. In chapter 3 I discussed how keeping this intuition is seen as so important that even certain *dispositional* accounts of possibility are either actively accommodating it (Borghini and Williams, 2008), or at least not excluding it (Vetter, 2015).

We should note that accepting this account of properties and laws does not only entail having to accept that the laws of nature are necessary, but it also entails a substantial rewriting of the standard way of viewing the different kinds of modality and their relationship to each other. It is common to assume that the metaphysical possibilities encompass more than the physical or nomic possibilities. That is, the prevailing view is to assume that what we are dealing with when it comes to the different kinds of possibility is a nested structure with (at least) three categories which may be envisioned as circles encompassing one another, where the innermost one is the circle which includes the physical or nomic possibilities. The next circle is usually taken to be the metaphysical possibilities, which includes the nomic possibilities as a proper subset but which also adds some further possibilities which go *beyond* the laws of nature to its domain. Outside the metaphysical possibilities we find the logical possibilities which encompass these possibilities, and more still.[269]

I reject this understanding of the relationship between different kinds of possibility. Opposing this, I will claim that the dispositional essentialist view of laws (and ideally all dispositional views of properties and laws) has as a consequence that the category

[267] Bird (2007, p. 44)

[268] Ellis (2002, p. 4)

[269] See for example (Vaidya, 2016) for a useful illustration. I will not discuss logical possibility in this thesis.

of metaphysical possibility collapses into the category of nomic possibilities. I will argue that this is *not* a bug or a 'bullet to bite', but rather an *attractive feature* of my view. Nevertheless, we need to be aware of the fact that accepting dispositional essentialism entails a willingness to make the sacrifice of parting with some of our intuitions regarding laws. This is such a substantial issue that I will devote a whole chapter to the debate regarding what impact our intuitions may be seen to have. This means that the current chapter will deal only with the question of which theories of laws are available to us as dispositional essentialists, while the question of the role of intuition, and which part it may be permitted to play, is saved for chapter 7.

In this chapter I proceed to give an account of the dispositional essentialist view of laws, or rather, the dispositional essentialist *views* of laws. Because even if we do agree on the powers based view of fundamental properties, we still have important choices to make when it comes to the *specifics* of our explanation of laws. There are two main options to choose from: Bird's more direct explanation, and Ellis's view which involves in addition the concept of a *natural kind*. This is perhaps the most striking difference between the two positions, but we should also note, as already mentioned, that Ellis' account also differs from Bird's in that it invokes the mixed view and that it remains far more positive regarding the usefulness of dispositional essences in other areas of philosophy.[270] Given my arguments for the restriction of the powers ontology to the fundamental level of metaphysics, it seems clear that it is the first point—either the rejection of, or inclusion of, natural kinds in our explanation of these laws—which is the most relevant for the current topic. Both Bird's and Ellis's accounts are quite correctly seen as *dispositional essentialist* accounts of properties and laws, but because of this classification the differences between them are often, perhaps inadvertently, glossed over and not given sufficient attention.

If we already accept a powers-based account of fundamental properties, our choice of which explanation of laws to endorse will depend *both* on the importance we are willing to give to a categorisation in terms of natural kinds, *but also* on our views about fundamental properties—whether we endorse dispositional monism or some form of the mixed view. Even though the take on the importance of the natural kinds is the most relevant distinction between Bird and Ellis in the context of the present chapter, it is clear that our view of properties more generally will also be of importance. That is, our choice when it comes to the role played by the natural kinds will also be related to the discussion of sparse fundamental properties from chapter 2. As such it should be clear that our stance on the metaphysical status of fundamental properties influences our choices when it comes to most other debates in the field of modal metaphysics. As I advocate dispositional monism, and since I restrict the powers to the fundamental level only, it seems that an account of laws which is not invoking the additional concept of the *natural kind* will be most beneficial. As we shall see, the view based upon natural kinds entails that there are dispositional essences

[270]See for example (Ellis, 2013) and (Bird, 2016)

also at non-fundamental levels, that is, we need to argue for a form of the mixed view, or at least accept macro-powers, in order to give the natural kinds this explanatory role. I will suggest that natural kinds, even though they are an important ontological category, are *not* vital to the explanation of laws.[271] Hence, when it comes to this, I will follow Bird's version of the dispositional essentialist view of laws.

5.2.2 The explanation of laws

By now it should be clear that when we depart from categoricalism and want to explain laws by arguing that they are intimately related to the dispositional essences of properties, the assumption that there *could have been* different laws of nature is no longer a viable option. This is due to the fact that we ground the laws in just those properties that *could not have been different*. If we subscribe to this form of essentialism, the properties in the world, and thus the objects having these properties, can no longer be seen as passive things that the laws are affecting—the properties themselves are active, and they are *essentially* so. Things behave as they do, not because of laws that are external to them and which could have been otherwise, but because they (the objects) are intrinsically disposed to behave in certain ways under certain circumstances. Hence we see why it is the case that thought experiments like Carroll's mirror argument, discussed in the previous chapter, start with assumptions which are illegitimate to make from the dispositional essentialist starting point. For us, the particles and fields of the example cannot be controlled by different laws of interactions in different possible worlds, not if they are supposed to be *the same* particles and fields we have in this world. The properties that exist in the actual world, and the essential relationships between different properties, determine the laws, rather than laws dictating how these things must behave. Thus, the main claim of the dispositional essentialist should be that the laws of nature are those fundamental, general explanatory relationships which are supervening upon the essential natures of the fundamental properties.[272]

Talking about the *essential natures* upon which the general explanatory relationships will supervene is another way of referring to what I have labelled as *powers* in this thesis. That is, essentially dispositional sparse properties existing at the fundamental level of metaphysics. My position when it comes to the laws of nature depends on the claim that there *are* real powers at work in the world, and that these powers represent the features of the fundamental level of the world which *could not have been otherwise*, given the properties that actually exist. Furthermore, given that these essential properties are dispositional—they are in some sense pointing towards some possible action for the property—the *relationships between properties* at the fundamental level will also be absolutely necessary. We need to include the *relationships between fundamental properties* as parts of their essential features. Hence, the fundamental properties existing in a world will—through their

[271] I will return to this question in chapter 6, section 6.2.2.
[272] Bird (2007, p. 201)

relations with other such properties—give the fundamental laws of that world, which are, in turn, the laws that all other laws supervene on. I find Bird's description of the laws of nature understood in this way useful:

> If properties have a dispositional essence then certain relations will hold of necessity between the relevant universals; these relations we may identify as the laws of nature.[273]

If we accept this, we need nothing more than what the properties themselves provide in order to have an explanation of the laws. As argued in chapter 2, by assuming these dispositional essences we are able to explain how and why things behave as they do, but we are also able to explain how things *will* behave, or how they *would* behave, given certain circumstances. This means that we are equipped to explicate two important features of laws; the fact that they make us able to both make predictions and to talk about counterfactuals. Given the assumption that dispositional essences exist at the fundamental level, we are afforded a much more substantial notion of laws than what is provided by a regularity theory. At the same time we avoid having to resort to a notion of external laws of nature which are in some sense *added on*, and to which the properties are *obedient*. External laws of nature—something beyond the powers of the properties themselves—become obsolete on this view. Accepting dispositional essentialism means we automatically have an account of laws without accepting any further entities, different from the ones we already have in our ontology.

There are several positive features related to such an account of laws. For example, it is clear that by avoiding laws that are external to the properties related in them, we also avoid the problems related to the laws' identity conditions presented in chapter 4. Where Armstrong's theory is struggling with a notion of laws depending on a relation of necessitation which is seemingly quite mysterious, the dispositional essentialists have no such problems. The fundamental laws are those laws which are entailed by the dispositional essences of the fundamental properties. In addition, I will argue that the higher-order laws supervene on the fundamental laws *as well as* on the structural compositions of the objects involved in the laws. This entails that the dispositional essentialist view of laws I defend is not committed to argue that we are able to derive laws from dispositions at every level of complexity. This is so because I hold that non-fundamental *dispositions* cannot play such a role. And, as argued in chapter 2, I do not accept non-fundamental powers. The explanation of the higher-level laws is, as we shall see later, one of the points where my account differs notably from Ellis's view of laws.

I have already argued that the dispositional essentialist view of property identity is superior to the categoricalist one. Now, I will proceed to show that the account of laws

[273]Bird (2007, p. 43). This is not a novel idea. A proposal seeing laws as involving necessary relations between properties was, for instance, proposed by Swoyer (1982).

which is promised 'for free' if powers are accepted is not, like many cheap offers, too good to be true, but rather a viable explanation of laws. This means it has sufficient strengths of its own to compete with the best categoricalist accounts. Its perhaps most attractive feature has been addressed several times in this thesis already: compared to its rival accounts, dispositional essentialism is remarkably parsimonious. The fact that an account of laws follows *directly* if powers is assumed, means that the dispositional essentialists have no need for a theory of laws *in addition to* their theory of fundamental properties, in the sense that we need no additional assumptions about the world, in order to express what laws are. Hence it is more parsimonious than the competing views. A second attractive feature of this view is simultaneously also what has been seen as its *most problematic feature*. Accepting it entails that we also have to hold that the laws of nature are absolutely necessary. As is clear, however, I embrace this feature wholeheartedly.

5.3 Laws as relations between powers

5.3.1 Universals

In (Bird, 2007) Bird presents the most comprehensive version of his view of laws based upon dispositional essentialism. So far we have seen how the assumption that there are powers—the essentially dispositional sparse properties at the fundamental level—entails the additional premise that there are necessary relationships *between* these powers, and that these relationships are what we know as the fundamental laws of nature. If essences—what could not have been different— also depend on, and influence, relations, then these relations *cannot fail to hold*, and so the necessity of the laws is guaranteed. The only way these laws might fail to hold is if the properties themselves did not exist; and this is a possibility I will return to in the next section. Given *these* properties and *these* essential relations, we cannot have any other laws of nature than the ones we in fact have. It is *this* necessity that I define as metaphysical necessity. As we have already seen, this is not an option if one is of a categoricalist persuasion, because in that case the properties related in lawful ways *could have been* related in other ways. That is, *these very properties* could have been radically different and played very different roles given a categoricalist understanding of fundamental properties. I have already argued that this is an unsatisfactory way of understanding properties, and that the accounts of laws available for the categoricalist are also problematic.

The dispositional essentialist view of laws is a theory about universals. The laws are certain relations that will hold of necessity between the relevant properties, and the properties in question are universals. Hence, as for Armstrong's theory, we must be willing to accept universals as entities in our ontology, but these universals have slightly different roles to play for Bird than they have for Armstrong. We remember how the universals for

Armstrong mainly were a way of pinpointing the repeatable features of a world, whereas the identity *between worlds* was of a more primitive kind. For Bird, however, the universals will have certain essential features necessarily, that is, also *across* possible worlds (if one prefers talking in those terms).[274]

Because of this, we can clarify why it is the case that the dispositional essentialist is in a better shape than Armstrong when it comes to specifying the identity conditions of the laws, as already mentioned. If we subscribe to dispositional essentialism, we can be, to borrow Bird's words, *reasonably relaxed* about the question of what exactly the laws of nature are.[275] Specifying exactly what the laws are is obviously a problem for any philosopher claiming that laws are something which *control* what happens in the world. The reason why this is not a problem for us is that we do not claim that laws impose *external control*. What does the heavy metaphysical lifting is not external laws of nature telling the properties what to do in this particular world, but rather the dispositional nature of the *properties themselves*. Given how the fundamental properties themselves are, and how they are related, the laws of nature stem directly from this. This entails that the dispositional nature of the fundamental properties is *ontologically prior* to the laws.[276] Let us look at some additional details of the relationship between the fundamental properties and the laws of nature.

As discussed in chapter 2, I accept an understanding of dispositional essences specified in terms of the *counterfactual conditional*, as follows.

$$\Box(D_{(S,M)}x \leftrightarrow Sx \boxdot\!\!\rightarrow Mx)^{277}$$

The main claim of dispositional essentialism, that an object possessing the power P is disposed to yield M in response to stimulus condition S is specified as the following statement.

$$\Box(Px \rightarrow D_{(S,M)}x)$$

Taking these two statements as a starting point will make us able to derive the universal generalisation $\forall x((Px \wedge Sx) \rightarrow Mx)$, and *given* the existence of the related properties, this generalisation will necessarily be so.[278] This means that we have a universal generalisation, which seems to express a law of nature, derived from a claim about the essence of the power

[274]Thus, when it comes to this particular point, Lewis seems to be better off than both Armstrong and the dispositional essentialist in terms of parsimony, given that he does not need universals. However, as discussed in chapter 4, Lewis's account of properties and laws has other issues which makes it an unsatisfactory choice, even though it is certainly parsimonious in *this* respect.

[275]Bird (2007, p. 47)

[276]That is, the laws stem from the essential features of the properties, rather than assuming that the properties behave in particular ways because they are connected by particular laws; the laws depend on the dispositional essences, not the other way around.

[277]Bird (2007, p. 45). Where $D_{(S,M)}x$ expresses 'x is disposed to manifest M in response to stimulus S', and $\boxdot\!\!\rightarrow$ is understood to be the subjunctive/counterfactual conditional

[278]Bird (2007, p. 46)

P, and the general truth of the conditional analysis of dispositional essences. Starting with the dispositional essence of a property we are able to get to a non-accidental generalisation, that is, a generalisation which is such that it expresses a lawful connection in nature. This is the core of the dispositional essentialist explanation of laws.

Given the aforementioned collapse of the metaphysical into the nomic, we also see why it is the case that this view automatically identifies metaphysical possibility and necessity with nomic possibility and necessity. As mentioned, this is in general seen as a disadvantage of the view because it goes against our intuitions that the laws of nature could have been different. Contrary to this, I have stated that this feature can be seen as an *advantage* instead. But how can something *counterintuitive* be turned into a positive feature of a philosophical view? Firstly, I claim that there is no real need for *more than one kind* of possibility and necessity, the logical modalities aside. Hence, there is not need for a further specification of the distinctions between nomic and metaphysical modalities. We have no need to classify something as being, for example, *metaphysically but not nomically possible*; something is either possible or it is not.[279] We do not have any reason, intuition aside, for admitting several different notions of modality regarding what may or may not happen in the world; and our arguments based on intuition are, I hold, simply not enough.[280]

Secondly, as is often presented as an argument for assuming dispositionalism in the first place, tying the view closely to the physical sciences makes metaphysics less mysterious. By explaining laws in the way it is done here, the laws are closely related to the actual properties existing in the world (studied by science), and at the same time these laws are in themselves nothing over and above what the properties themselves contribute. The identity conditions of the laws are given by the identities of the properties and their relationship to each other. Hence, we also see that the laws are not identical to the powers, but they are *absolutely dependent* on these properties.[281] In order to get access to an account of the laws of nature which requires no further theoretical assumptions than the ones we have already made about the fundamental properties, there is really only one thing we need to do; we need to recognise that those fundamental properties are *essentially dispositional*. This assumption entails the additional advantage that—given that metaphysical possibility is nothing over and above nomic necessity—we are also left with a notion of necessity which is easier for us to deal with. We disregard the notion of nomic necessity, and are left with the more familiar notion of metaphysical necessity.[282]

Thus I suggest that we, by advocating a powers based view of laws, are getting rid of

[279]This is in line with (Bird, 2007, p. 48) where he also concedes that he does not, in fact, regard logical necessity as a kind of necessity. I will not address this question in my thesis.

[280]For details pertaining to this claim I refer to chapter 7 of this thesis.

[281]This is in contrast with Mumford (2004) and his claim that once we have accepted the existence of powers, there is no real need for laws of nature in addition. See (Williams, 2019, p. 217ff.) for a discussion of the disagreement between Bird and Mumford.

[282]I briefly discuss the choice between nomic and metaphysical necessity and possibility also in chapter 3, section 3.3.3.

a *surplus notion* of possibility and necessity. Nomic necessity is, I argue, a notion we did not need in the first place. In addition, it might also be maintained that this notion had created a good deal of confusion already.

5.3.2 Necessity specified

Regarding the question of the necessity of the laws of nature, I argue that this should be formulated as follow.

> **NECESSITY** *Given that* the fundamental properties of this world are what they are, its laws could not have been different.

I contend that this claim entails that if the fundamental properties had been different it would no longer have been 'a world like ours'—not a way for our world to be, and as such not something which is relevant for modal questions regarding things happening in our world at all. It would be an *alien world*.[283] It seems to me that prohibiting the existence of such worlds is too strong a statement to make, because it would entail that the universals which exist in our world, in *some way or another*, must have necessary existence. I am not willing to accept that as a consequence of my view. An important point which is related to this is that *even if* we, like I do, opt in for a view which is compatible with the idea that universals may or may not exist in different possible worlds, this does *not* mean that we can allow change in the fundamental properties of a world, and hence have contingent laws. Rather, the qualification of the statement is made to avoid that we pose the universals as necessarily existing entities.

However, we cannot avoid this topic, and I hold that there is a further question to address which should be asked in relation to this issue. Do we really *need* the qualification 'given the fundamental properties we have'? Or could the laws in fact be necessary *simpliciter*? This question can, as I have already hinted, be rephrased as a question about universals, their instantiations, and whether they (according to some understanding of dispositional essentialism) may be said to have necessary existence. If the universals are *not* necessarily existing, it does indeed seem that there might be worlds where the universals related in the laws of our world do not exist, but of course none where they *do* exist but are otherwise related. Following from this complication we see that we may, also in the context of dispositional essentialism, speak of a somewhat *weaker* and *stronger* sense of necessitarianism, as argued by Bird (2007, p. 49ff.). The form of necessitarianism we are willing to defend will depend on whether or not we are willing to accept universals which are allowed some kind of *necessary existence*. Importantly, it does seem like Bird is willing

[283] Chapter 6 explores how the concept of being *a world like ours* can be a part of an explanation of global laws of nature. At the present moment, however, I use this expression as a way of separating *modally relevant worlds* from those which are *modally irrelevant*.

to accept universals of this sort. As a consequence, when it comes to laws, this is where my view and Bird's depart from one another.

I hold that it would be preferable to refer to these versions of necessitarianism as something other than them being 'weak' and 'strong'. I suggest that using the expressions *conservative* and *radical* necessitarianism might be more beneficial. The 'weak' variety makes it seem like the necessities described as such are somehow *less necessary* than those advocated by the strong necessitarian, something which is not the case. By changing the vocabulary we might avoid these kinds of misunderstandings.[284] The big issue is in this case not the strength of the necessity of the laws, but rather something which concerns our ontological commitments to universals, and to a degree whether we interpret them in a largely Aristotelian or a Platonic way. My understanding is of the Aristotelian kind; the universals will have to be instantiated in order to be seen as existing.[285]

The view I will defend, namely that laws do indeed depend on universals, but that the universals do *not* have necessary existence, takes a lot of inspiration from Kripke, and can be explained by analogy with the way he speaks about *identity* and his way of explicating rigid designators. We may say that Kripke's famous example of the identity between Erik Blair and George Orwell, and the specification of how the statement $\Box$(Erik Blair = George Orwell) is consistent with there being worlds where this particular individual does not exist is at the core of this understanding. At the same time, we need to point out that worlds where the individual does not exist are *not* counterexamples to the statement $\Box$(Erik Blair = George Orwell). The same is the case for laws, so the argument can be used in much the same way in order to argue for conservative necessitarianism.[286] If we have the power P, and *L(P)* is a law concerning this property, then a world without P is no counterexample to the claim that *L(P)* is necessary. $\Box L(P)$, on the other hand, rules out there being any worlds where P *exists but is not related to the law* L. This view of metaphysical necessity is what I will be referring to as the *conservative* variety of the view, and it requires only that *L(P)* holds in all worlds where the property P exists.[287] Following this, the accompanying view of the necessity of the laws may be referred to as *conservative* necessitarianism. Bird (2007, p. 51ff.), on the other hand, argues for something which may be referred to as the *radical* necessitarian view of laws.

It is important to note that the conservative view is *implied by* dispositional essentialism, while the radical view is *not* something we must agree with as dispositional essentialists. However, it is still clearly *consistent with* the view. If we hold the radical view, we have to say that all universals exist no matter what, or in all worlds. And, following from this, that all actual laws of nature hold in absolutely all possible worlds. This entails that there are

[284]Bird mentions both pairs, but he uses *weak* and *strong* most of the time.
[285]Bird (2007, p. 51ff.) recognises this and briefly discusses the Aristotelian versus the Platonic view of universals. This topic is outside the scope of my thesis.
[286]Bird (2007, p. 49)
[287]Bird (2007, p. 49)

no possibilities of other properties existing (in other worlds), and no possibility that some properties may fail to exist either. All possible worlds are nomologically identical. Thus, if we borrow the terminology of possible worlds, the distinction between the different kinds of necessitarianism would mean that the proponent of radical necessitarianism argues for the *nomological identity* of possible worlds, whereas the conservative necessitarian argues for the *nomological compatibility* of possible worlds.[288] This latter case entails, as argued above, that we will never have a case of counterexamples to the laws of nature. Accepting dispositional essentialism does not automatically give us an answer as to which one of these we should support. So, in order to settle this question it is not enough to simply consider our support for dispositional essentialism.

Bird evaluates radical necessitarianism and shows it to be consistent with his overall view. He argues that the strongest reason why we are unwilling to accept the radical view is that it is colliding violently with our intuitions about universals. I disagree. Rather, the strongest reason for not holding this view at the present moment is that we do not have enough information about the world we live in. Pending answers from science, I hold that the best choice as of now is to refrain from taking a stand regarding this. That is, we should accept the conservative view, but remain agnostic when it comes to radical necessitarianism.[289]

The way I see it, the main argument against the strong view is not its relationship to our intuitions, but rather the following. As contended earlier in this dissertation, the existence of sparse properties, and hence of universals, seems to be a contingent matter (at least for some of them). If this assumption is correct, we have to settle for conservative necessitarianism. Of course we may claim that this is just another intuition we have about universals, and that intuitions should not be given significant philosophical weight. I note that Bird seems to think we have already departed from intuition by accepting dispositional essentialism in the first place, and that we basically can just 'keep going'. But this is not a good argument. What we are doing when we settle for conservative necessitarianism is not giving arguments based on intuitions inappropriate amounts of weight, rather it is stopping at a point where we still have strong independent arguments for our claims. We *have* independent and convincing arguments for accepting weak necessitarianism. That is, we have arguments for accepting a dispositional essentialist theory of properties. But this only entails the weak version, as mentioned. So, if we are to accept radical necessitarianism, we need good independent arguments for it, too.

[288]But see (Bostock, 2003) for an argument that necessitarianism actually is committed to take all possible laws to be actual laws.

[289]Even though we should acknowledge that for now it is better to await further results from science before concluding, it is not clear whether this is something we will be able to answer conclusively, given that we are now moving towards topics involving entities (like multiverses) whose existence are untestable.

5.3.3 Non-fundamental laws

The discussion of laws according to the dispositional essentialist has so far remained firmly placed in the area of fundamental metaphysics, but there are clearly important laws of nature which are not fundamental in this sense, and these laws still need explanation. However, it is not the case that an account of the laws of nature is committed to explain every single law of nature in the same way, which for my part would have been the way described in section 5.3.1. This description tells us how the *fundamental laws* of the world come to be. We have to assume that the non-fundamental laws *supervene* on the fundamental laws described. Another, and related, question we should ask is connected to the fact that the laws are seen as something which concern universals; the question is whether this connection with the laws is something which will pertain to *any* universal (that is, to any sparse property), or whether there will be universals which do not generate laws. Following my argument from chapter 2, it seems to be the case that there exists sparse properties which are not essentially dispositional, given that we hold the scientific conception of sparse properties.[290] Such universals may surely *participate* in laws, but what generates these laws are not the dispositional essences of, say, the elements of the periodic table, because as I have argued earlier in this thesis, these entities do not seem to have dispositional *essences*, although they clearly have dispositional features. The non-fundamental laws are *supervenient* laws; they supervene, firstly, on the fundamental laws, and secondly, on the structural composition of the non-fundamental properties. This structure does not seem to contribute with anything 'new', ontologically speaking, given that the composition of these non-fundamental entities will be dependent on the fundamental laws.[291] Chris Swoyer states the following in this regard:

> Necessary connections among properties are most plausibly thought to exist, I think, at very fundamental levels involving properties of elementary particles or the like. But since such particles constitute all physical things, then unless there are genuinely emergent properties, the properties and relations of fundamental particles are responsible for all other physical properties and relations as well.[292]

Thus, our account of the non-fundamental laws will depend on our view of emergent properties. As mentioned in chapter 2, I am committed to a view stating that there are no possibilities left to be accounted for by entities like macro-powers, or other entities at non-fundamental levels.[293] Thus, it might be the case that the structural features are relevant for us, that is, for our understanding of the laws, but they are not relevant from an ontological point of view, because they supervene on the fundamental properties. Thus,

[290] See e.g. (Schaffer, 2004) for a survey.

[291] This kind of dependence does not entail reductionism, but this debate is outside the scope of my thesis.

[292] Swoyer (1982, p. 215)

[293] Bird (2018, p. 251f.)

we may say that it is not the case that the laws of, for example, chemistry depend on chemical powers, that is, the dispositional essences of the different chemical elements. I am not claiming such powers exist, in line with my arguments in chapter 2.[294]

This is in stark contrast to Ellis's view which we shall turn to shortly. It means that we cannot look at a law of, say, chemistry, and claim that it is the dispositional essences of e.g. the chemical elements which are doing the work, simply because we do not seem to have dispositional essences at that level of complexity. Again, I argue that it is useful to look to Vetter's argument in (Vetter, 2018) as inspiration for a view about properties and laws at the non-fundamental level. She claims that "all it takes to explain macro dispositions is there within the disposition-bearing object itself: its categorical properties plus the dispositions of its parts."[295]

Vetter's claim is not only relevant in order to explain dispositional features of macro-objects and macro-properties, but this could also be a way for us to understand macro-, or non-fundamental laws. If we stick to the example of chemical laws pertaining to certain molecules as an example, the molecular structure and the dispositions of the elements of that structure explains the disposition of that molecule. But the disposition is not the essence of these macro-objects, or the property of being such an object; we need the particular structure the element has as well. Following this, we get that laws of nature at the non-fundamental level supervene on lower-level laws, that is, relations between fundamental powers, as well as the structural properties of the macro-entity at play.

We have to take into account that Vetter uses this to propose a view of dispositions and laws (and the order of explanation between them) other than mine, but I still hold that we can use her idea here to argue for a view which is otherwise in line with the dispositional essentialism found in Bird's earlier work. My general view does not support his later work nor Vetter's general view of dispositions and laws.

5.4 Essences, natural kinds, and laws

5.4.1 Introducing kinds

As we have seen, a simple account of laws of nature based upon dispositional essences is available if we assume powers as part of our ontology. However, as I have mentioned already, Ellis argues that the laws of nature should not be explained in the way just described, and that an account of laws making use of *natural kinds* in order to derive laws directly at each

[294]When it comes to the question of non-fundamental laws it is important to bear in mind the reflection presented earlier, that not everything referred to as laws are in fact laws, and that some 'laws' (rather, rules or theorems) in certain fields even though they are referred to as laws, are not possessing the features necessary for actually being laws. Thus, certain features of the world which are accidental may still be *referred to as* laws, for example Benford's law, or 'the law of anomalous numbers', stating that the leading digits in collections of numbers are likely to be small.

[295]Vetter (2018, p. 295)

level of complexity where they occur is preferable.

This might be accomplished by denying dispositional monism about fundamental properties, the thesis I argue *for* here, and rather advocate the *mixed view*, because if laws are to be explained more directly at each level of complexity—while the explanation is to remain dispositional essentialist—we need to assume the existence of macro-powers. The mixed view allows for powers *and* categorical properties to be present both at fundamental and non-fundamental levels of metaphysics, and it is advocated by Ellis (and more recently by McKitrick (2018)). When it comes to explaining the laws of nature he adds yet another feature—the natural kind—which makes us able to explain the laws *directly* at the level where they occur, be they fundamental or not. The advantage of this approach is that we no longer have a problem relating to the explanation of non-fundamental laws—we have direct explanations of all laws at all levels, from the most basic laws to laws which take the whole world as their object. An obvious disadvantage now is that the view is a less parsimonious version of dispositional essentialism, because we need yet another ontological category—the natural kind—in order for it to work.

In relation to this introduction of additional entities in the explanation of laws, we have to ask the following two questions. Firstly, are natural kinds *necessarily involved* in the laws of nature? Secondly, is the cost of introducing yet another concept in out analysis outweighed by the benefits? I will argue that the answer to both questions is no. Introducing natural kinds seems *ad hoc*, and we are not able to claim that natural kinds are necessarily related to laws in a successful way. I will return to the critique of Ellis in the next chapter, as a part of the examination of some of the problems the dispositional essentialist will have to solve. Let us first have a closer look at how this explanation of laws is supposed to work.

When we speak of dispositional essentialism as presented by Ellis, the notion of an *object* becomes important again after having been basically absent both in the chapter so far, but also in the thesis in general (especially when presenting dispositional *essentialism*). That is, dispositional essences have been introduced as something which relates to properties only, through the notion of a *power* understood as a sparse, fundamental property with a dispositional essence. However, if we want to explain laws in a dispositional way following Ellis, we need additional conceptual apparatus. We need to speak of objects belonging to natural kinds. Whereas Bird thinks the laws stem from the powers of the fundamental universals, Ellis holds that we need something additional in our framework, because the laws are *not* tied to essences of universals, according to him, but rather to the *essences of the natural kinds*.[296] In order to understand Ellis's position, we need to specify his notion of a natural kind.

[296] As will be addressed in the next chapter, it might seem like the natural kinds and powers are more closely connected than they are. That is, it might be tempting to ask whether we could demand that every natural kind should pick out a sparse, fundamental property. In such a case the introduction of natural kinds would seemingly just be an additional way of seeing the powers we already have accepted as parts of our ontology. Sadly this is only seemingly the case; if we look at, for example, the property of negative charge, even the class of all negatively charged objects is far too diverse to be a natural kind.

5.4.2 Strict natural kinds specified

If we think of the concept of a kind, it is easy to picture that at least the idea of a biological species will be included. However, we need to note that Ellis's concept of natural kinds is more restricted than most, and in order to highlight this I will refer to his conception as *strict* natural kinds. He is for example explicit in his *exclusion* of biological classifications as natural kinds. This entails that when I am describing Ellis's theory of a relationship between natural kinds and laws, I am excluding all biological cases. There is disagreement in the literature whether biological species should be seen as natural kinds or not. Seeing biological entities as outside the strict scope of natural kinds is in line with Ellis' argumentation, while Bird accepts biological kinds.[297]

The reason biological species are excluded lies in the definition and criterion specified by Ellis for the existence of these kinds. He specifically holds that "Natural kinds exist if and only if there are objective mind-independent kinds of things in nature" that are "divided naturally into categorically distinct classes".[298] The important words are *mind independent* and *categorically distinct*. The classifications that are natural kinds are such that they would exist as distinct entities no matter what. They are not relative to our, or anyone's, epistemic perspective. This, alongside the discreteness of these kinds give us a natural borderline between what may be seen as natural kinds and what may not, and this border lies between the chemical and the biological kinds. Both the requirement of mind-independency and of the discreteness of the natural kinds are not met when we speak of biological kinds. Even if we could free the biological classifications completely from human influence, both the evolution of species over time, and also the lack of borders between them, lead us to believe that biological classifications are not clear and absolute.

There are largely two possible ways to construct an explanation of laws where natural kinds are of importance. Either the natural kinds are taken as an additional primitive, or the essences are seen as primitive, and hence the natural kinds are defined in terms of these essences. Option two seems the most promising one. If we assume the dispositional essences of properties, the natural kinds can be assumed to automatically follow from this. If we settle for this option, there is no need for something additional to be able to speak of natural kinds really existing, and there is also no need to take them as primitives.

Different natural kinds are distinguished from one another by their intrinsic properties. Just as there is a set of properties that makes you *you*, there is a distinctive set of properties in virtue of which a thing is of the kind it is. This is referred to as the objects *real essence*.[299] A real essence refers to what it is to be that particular kind of thing. Some important points regarding the modality in question, of particular interest to our topic are the following.

[297] See for example (Bird, 2015) and (Ellis, 2002), but note that since Bird's account of laws does not give natural kinds a central part in the explanation, accepting certain biological divisions as kinds will not have the same consequences for him as they would for Ellis.

[298] Ellis (2009, p. 57)

[299] Ellis (2009, p. 58)

1. It is grounded in the properties of the objects in the real world, and given that the objects exist and given that they have certain essential properties, what follows from this will be necessary.

2. An essence has to be discovered by us, by scientific exploration, this means that it is an *a posteriori* necessity.

3. It is a metaphysical concept, rather than an epistemic one, so we may be mistaken about what essence a given object has. The fact that our knowledge of the essences are revisable does not make them any less necessary.

These three points are in agreement with my view as presented so far. The crucial difference between my view and Ellis's is that, for him, it is the essences of the natural kinds which gives us the laws of nature. From Ellis's point of view, the lawful patterns in the world are, in short, determined by the natural kinds. But we still need to ask whether we actually *need* natural kinds in order to have laws. In order to answer that question in a satisfactory way we should give some additional details of Ellis's account of laws. Of particular interest is the way he sees the world as a hierarchical structure which reflects the hierarchical structure of the laws. This is what gives his account a rather elegant way of explaining laws on every level of complexity.

5.4.3 Hierarchies of natural kinds and laws

In order to present the complete hierarchy of natural kinds, and further tie these natural kinds to the laws, or vice versa, Ellis needs more than just the substantive kinds—those which exist as substances. He also needs natural kinds of processes, which are referred to as *dynamic* natural kinds. Ellis is, I believe, correct in assuming that both natural kinds and laws of nature have hierarchical structures. However, I highly doubt his claim that there is a hierarchy of natural kinds—where each kind has a distinctive *dispositional* essence—which corresponds to, and which *explains* or *grounds* the laws of nature.[300]

The dynamic natural kinds are crucial to Ellis's understanding of the processes which lies behind the laws of nature. As there are clear limitations to the way that the natural kinds of substances can act and interact with each other, and as this behaviour is essential to the kinds, we see that there must also be restrictions regarding what kind of processes or events may happen in the world. That is, in order to understand the laws in this way, there must also be a *dynamic structure* of the world. Instead of seeing this dynamic structure of the world as something which is given by the essences of fundamental powers, as I do, Ellis needs to introduce the category of dynamic natural kinds into his account, to be able to explain the same thing. These natural kinds of processes, for example the many different chemical processes, are absolutely distinct from all other kinds of processes, and they also

[300] I will return to this in chapter 6, section 6.2.2.

have a hierarchical structure. The importance of these notions is seen when these structures are tied together with a corresponding hierarchy of laws of nature. In the presentation of this hierarchy of kinds, I will use Ellis' description of what the most general and most specific kinds are.[301]

The most general *substantive kind* is the class of all physical systems. This is what we may call a global kind, and it includes all other substantive kinds as species. The most general *dynamic kind* is the class of all physical events or processes. This is also a global kind, and it includes all other dynamic kinds as species. These global kinds are supposed to unify all of the other natural kinds in its category. Generic natural kinds in every category are ontologically more fundamental than the species it contains. This indicates that it would be logically possible for the natural kind to exist without the particular subgroup or species, but that this does not hold the other way around.

At the other end of the scale, at the base of each hierarchy, we have the most specific substantive and dynamic species. These are kinds without subkinds, and Ellis refers to them as the *infimic* species. Examples of infimic substantial species are fundamental particles, like the electron or the photon. The class of electrons is, as far as we know, such an infimic species among our fundamental particles, while the class of fermions is not infimic, as this includes further species of particles — it can be divided into smaller classes, and is therefore a *generic* substantive kind. The class of all fundamental particles would be a further generic natural kind. The same sort of structure is supposed to be found among the dynamic kinds. Infimic dynamic species may be exemplified by the electron-positron annihilation, and this would be a subspecies of the dynamic kind 'annihilation process'. Other such infimic dynamic processes will be the different kinds of radioactive decay, while such decay in general will be a more encompassing kind in this hierarchy.

One important thing to note when we look further and further down in our hierarchy, is that we go from objects having a clear structure—they are built up of smaller parts—to a level where we find no relationship between parts any longer; in fact, there seems to be no structure at all at the most basic level. This is in line with my earlier description of fundamental properties, which in the same manner are devoid of structure. This absence of known structure has one very important consequence, which is also in line with what has been discussed earlier, namely that substances like the elementary particles are not essentially distinguishable by their structural properties, because there is no such structure to be distinguished by. Rather we state that they are distinguishable by their dispositional properties. This in turn indicates that the essence of an elementary particle is not some structural or categorical property, but that it rather depends on what it *does*, and what it is *able to do*: how the particle acts and reacts in different situations.

But where there is similarity between Ellis's account and the one I favour when it comes to how the most basic elements of reality are described, the difference between the

[301] See (Ellis, 2002, Chapter 5) and (Ellis, 2009, p. 57-62)

two essentialist positions emerges when Ellis argues that *at every level* in the hierarchy there is a distinctive *real essence*, and that this essence is *dispositional*. This means that for each and every generic natural kind there is a unique set of intrinsic properties and structures that makes these objects the kinds of things that they are.

Let us exemplify how this hierarchical distinctive essence is supposed to work by looking at one of the chemical elements. Fluorine, as any element, has some specific ways of behaviour that is unique to it, and the things that a fluorine atom can do are constrained by the essential properties it has. This means that properties like having nine protons, being very light, and being very electronegative, in combination with other essential properties, leads to behaviours particular to fluorine. Moving further up in the hierarchy, we see that fluorine is part of the halogens, along with for example chlorine and bromine, and this natural kind also has particular behaviour that is determined by the kind essence. The tendency to bind in such a way that different salts are produced may be seen as one such behaviour. If we move even further up (perhaps skipping some steps) to the kind that is all the chemical elements, the whole periodic system, there are also particular behaviour that separates these entities from all other kinds of entities. This even though the elements are very different from each other. The constraints on behaviour is much weaker at this level than on the level of the essence of each and every element.

Whereas I argue that the dispositional essences of fundamental powers ground the fundamental laws of nature, and that other laws will *supervene* on this, Ellis takes the dispositional essence to be something which refers to the dispositional properties of natural kinds *at any level*. If we want to make a description of a dispositional essence following Ellis, we must be able to describe what the entity having the essence *as a kind* is disposed to do in different possible circumstances. Another, and even more important, assumption which has to be made at this point is that the essences, at any level of a hierarchy of natural kinds, are *dispositional*. This is the key property which is supposed to tie the hierarchy of laws to the hierarchy of natural kinds. But, as I argued in chapter 2, it is far from trivial to assume that the essences at higher levels of complexity really are dispositional. Recall that this would entail that the identities of all these natural kinds would be what they are *disposed to do*. If we go back to our fluorine atom and its behaviour, I note that this behaviour will be determined by the parts of the atom, their dispositional essences, as well as the way they are combined to form the atom. However, for Ellis the dispositional essence of fluorine would include how this element is related to other chemical elements and other structures, and how other things are related to the fluorine. To make such a description complete we will include the relevant intrinsic properties and structures of the objects interacting with the given atom, and also the spatiotemporal relations between the different objects in question, where this is relevant. This is radically different from the view advocated by Bird and myself.

When the concept of a natural kind is analysed in the way I have presented here, it is

done under the assumption that it may be used to expand our understanding of the laws of nature, and that it may also be used to explain the hierarchical structure of these laws. To be able to do this however, we must assume that natural kinds and their essences can be taken as more basic than laws, and that the laws are in fact grounded in the essences of the natural kinds. To be able to tie the laws to the natural kinds, we go back to look at the hierarchical structure that the natural kinds falls into. As we have already seen, natural kinds may be very general and include a lot of subspecies, or they may be very specific. The same is true of laws, Ellis claims; they are not all of the same kind. Some laws apply to all things or all processes, and some that are more specific and apply only to some kinds of things or processes. To distinguish between the different kinds of laws, we need to look at their scope and their generality.[302]

According to Ellis's framework, laws are straightforward descriptions of the essential properties that things must have in virtue of being the *kinds of things* they are.[303] Since the laws are supposed to be correlated with the hierarchies of the natural kinds, we get distinctions along the following lines:

1. *The most general symmetry principles.* They apply to all things in the global category of substances, and to all processes and interactions. An example may be different conservation principles.

2. *The most general structural principles.* These laws define the spacetime structure of the world. They say something about what kind of states must exist, and which states that cannot coexist. An example may be principles of special relativity, and principles of quantum mechanics, such as Pauli's exclusion principle.[304]

3. *Laws that are concerned with the essential natures of more specific kinds of substances or fields.* They concern the properties of things like particles, chemical substances and the electromagnetic field.

4. *Causal and statistical laws.* These tell us how various kinds of things are disposed to behave, or disposed to interact with each other. They apply to specific kinds of events and processes. These laws will for example be the ones involved in various chemical interactions, where the interactions are limited by just which chemicals are involved in them.[305]

Of these categories, the first and the second are clearly the most problematic. If we think of a framework based upon natural kinds and their essences, it is very hard to figure out which natural kind is responsible for these global laws, although I will return

[302]Ellis (2001)
[303]Ellis (2001)
[304]That two identical fermions cannot occupy the same state.
[305]Ellis (2001, p. 67-76) Ellis (2002, p. 81-88)

to one proposed solution in chapter 6. However, it is equally hard to see how these laws may be seen as manifestations of *powers*. This entails that when it comes to global laws we seemingly run into problems no matter which version of dispositional essentialism we subscribe to.

The problems tied to the most general laws of nature are of such size and complexity that I will use the next chapter to consider whether the proposed solutions to these problems are satisfactory, or whether the global laws and related issues present complications so great that they are endangering the whole project of giving an account of laws in terms of dispositional essences. I will, however, suggest that these global principles might not, rightfully, be seen as laws, and if this is the case we are under no obligation to account for them in the same way as we account for the ordinary laws of nature.

In addition, I will delve into the discussion of whether adding natural kinds to our account is something which can be defended successfully. If, for example, explaining laws in terms of the essences of natural kinds gives us an account of laws which is able to provide a unified account of all laws of nature, even the problematic global ones, adding this extra notion seems a small price to pay. However, to do this, we need to show that natural kinds are *needed* in order to have laws at any level, and this does not seem to be the case. In chapter 6, I will go on to argue that the natural kinds resemble more and more an unnecessary add on to our theory.

5.5 Dispositional essentialism without necessitarianism?

Even though dispositional accounts of several different features of the world have become increasingly popular lately, it is still the case that the dispositional *essentialist* demanding that the laws of nature be necessary is in a considerable minority even inside the dispositionalist camp. We recall how both Vetter and Borghini and Williams present their accounts of possibility in such a way that these accounts are at least *compatible* with the contingency of the laws of nature. However, none of them accept dispositional essentialism, and even though I have argued (in chapter 3), that dispositional accounts of possibility too become problematic when they assume contingent laws of nature to be a real possibility, the necessity of laws is not an *explicit* feature of their accounts. An even more recent example, attempting to reconciliate dispositional *essentialism* with the contingency of laws is found in (McKitrick, 2018). Now I want to respond to some of her criticism of the necessitarian attitude, although this is also relevant for my discussion in chapter 7.

McKitrick acknowledges that powers are *sparse, fundamental dispositions*, and she agrees that at least some properties are essentially dispositional.[306] Thus, it seems we

[306]McKitrick (2018, p. 211). She does hold that powers, dispositions, potentialities, all these dispositional features of the world, are instantiated by *objects*, not properties, but this does not seem too relevant in

have at least some common ground. Nevertheless, she argues that it is possible to have this dispositional essentialist general attitude while still rejecting necessitarianism of any sort, conservative or radical. In addition, she argues that the necessitarianism advocated by the essentialist is less revisionary than what we portray ourselves to be, and that in some cases the difference between our necessary laws and her contingentism is merely a verbal dispute. In her chapter 'Against Necessitarianism', McKitrick lists five ways of being a dispositional *realist*—which (on McKitrick's account) seems to entail accepting that *at least some* properties are essentially dispositional—without being a necessitarian at the same time. I will only address two of these; the two which are relevant for the topics discussed in this chapter.

First of all we have an objection coming from the standpoint of *property dualism*. Property dualism is the same as what has been referred to as the *mixed view* above, the view that essentially dispositional *and* categorical properties exist at both fundamental and non-fundamental levels. Hence, this criticism will be pertinent for Ellis, but not for advocates of Bird's view. If we claim that some properties, even at the fundamental level, have no dispositional essence this will have certain consequences for what may be seen as possible or not according to the view. Armstrong has pointed out the following problem with this view.

> Either every factor involved in a causal action is a power, (...) or else there are non-powers involved. If non-powers are involved, then their causal contribution is contingent. And the effects will not be necessary.[307]

Because of this it seems not entirely clear that Ellis's property dualism is consistent with his necessitarianism. In addition it seems that assuming the mixed view to be correct may be a way of sneaking contingent laws into the essentialist picture.[308]

Another way of incorporating contingent laws into a general essentialist picture, is by allowing some form of *loose essentialism*.[309] This view shares some similarities with Vetter's concept of near-maximality discussed in chapter 3, and entails that there could be variation, or 'wiggle-room' in the precise nature or magnitude of either the manifestation or the stimulus condition of the dispositional essence, and that because of this *slight possibility* for difference, the laws could also have been *somewhat* different.

I think this objection seems just as *ad hoc* as Vetter's notion of *near-maximality*, but the idea that essentialism need not be *absolute* points forwards to McKitricks more substantial criticism of necessitarianism as being less revisionary than we make it out to be. In Ellis's case, the critique in relation to this is tied to his way of presenting the metaphysically possible worlds in line with those worlds which are deemed (or ideally deemed) possible

relation to the topics I am discussing here.

[307] Armstrong (2001, p. 170)

[308] McKitrick (2018, p. 219)

[309] McKitrick (2018, p. 222)

by science. He states that "[s]cientific essentialists hold that one of the primary aims of science is to define the limits of the possible".[310] Thus, McKitrick notes, other worlds become "irrelevant to his project".[311] Because of this, it seems that Ellis's view might be seen to reflect little more than his decision to use 'metaphysically possible' where most philosophers use 'physically possible'.[312] This entails that what seemed at first to be a substantial metaphysical disagreement can, seemingly, be reduced to a mere verbal dispute. Before I answer McKitrick, we should note that she thinks the situation is much the same for Bird as well, and given that my view of the laws is inspired by Bird's, this is also a direct critique of my view. Let us see if this objection can be met.

First of all, it should be noted that when I speak of the dispositional essences at the fundamental level, there is no such 'wiggle-room' allowed. Nor will it be the case that, since these essences are on the fundamental level only, there might be room for dispositional essentialism being consistent with different laws of, for example, chemistry, as McKitrick suggests.

> If we have yet to discover fundamental properties, then all of the properties and laws discovered so far are derivative. If these laws and properties are contingently derived from the true fundamental properties, then other possible worlds could differ quite drastically from the actual world, and the sense of contingency about the accepted natural laws will largely be preserved.[313]

It is clear that *if* the laws were *contingently derived*, we would be able to preserve the 'sense of contingency' McKitrick describes. However, there is no talk of non-fundamental laws being *contingently derived* according to any version of dispositional essentialism.

In addition to this, it seems that McKitrick goes back to the aforementioned 'wiggle-room' when arguing that some of the consequences of assuming dispositional essentialism to be the way I have described them in this thesis are problematic as well as counter-intuitive. Hence we, as dispositional essentialists, apparently hide behind language which is necessitarian while at the same time allowing possibilities which would be in line with accepting loose essentialism. These are assumptions which are at the core of the claim that there is little more than verbal dispute between McKitrick's view and mine. She notes that a dispositional essentialist arguing the way I do will have to say that an entity which is like an electron, but with a slight change of mass, is *not* an electron, or that a particle travelling slightly slower than the speed of light (through empty space) cannot be a photon. For McKitrick these entities are just slightly different electrons or slightly different photons, leading to their respective worlds being nomically *slightly different* worlds, a possibility secured by the contingent laws of nature. For the dispositional essentialist, these worlds will

[310] Ellis (2001, p. 241). Ellis refers to his branch of *dispositional essentialism* as *scientific essentialism*
[311] McKitrick (2018, p. 227)
[312] What I have mostly referred to as *nomically* possible in this thesis.
[313] McKitrick (2018, p. 225)

have to be seen as *alien worlds*, and those entities also have to bee seen as *alien entities*. Hence, where McKitrick sees a world where the speed of light is only slightly different, I see a world where nothing can correctly be referred to as 'light' or as a 'photon'. Thus, the dispositional essentialists are in a situation where the laws we postulate as existing will never be violated because we (illegitimately according to McKitrick) pose that worlds where the fundamental properties are only slightly different are *modally irrelevant worlds*. This might, at first glance, seem like a predicament for my account of laws.

The main problem with McKitrick's argument in this case is her assumption that the changes she postulates really *are* small because they *seem* small to us. However, I doubt that this is a correct assessment of the situation. I argue that McKitrick does the following problematic manoeuvres in her argument.

1. She overestimates how similar to our world these alternative worlds would be.

2. She does not take into account the interconnectedness of the dispositional essentialist world.

Let us begin by looking at the second point. Recall how the laws, as described in this thesis, arise from *necessary connections between powers*. This entails that changing one of them will influence many or indeed all of the others. The main thesis of dispositional essentialism is not only that there are essences at the fundamental level making the laws absolutely necessary, but also that these necessary laws are grounded by a web of necessary relations, such that no change can be made to a single part of it without there being consequences for the rest of this web.

When it comes to the first point, the overestimation of the similarity of the resulting worlds, the response I will give is closely related to some of the arguments against conceivability-based accounts of possibility, which are the main topic of chapter 7. The gist is this. Changes to the nomic structure of the world, also small changes, must come from somewhere. Thus, in order to have the change we postulate, whatever makes this thing the way it is must also be adjusted. And not only that. Everything *depending on* the changed entitiy will also be modified. It seems highly unlikely that a world with an otherworldly electron—otherwise identical to our electron, but with a different mass—will be only a *slightly adjusted* version of our world. I argue that the result of such a change will not be something the dispositional essentialist mistakenly and misleadingly pose as an 'alien world'. It will truly be an *alien world*.

As discussed in section 5.3.2, I do not take a stand regarding the question of whether or not there could be such worlds existing, but rather argue that we at present do not have enough knowledge to *disprove* their existence.[314] What I *do* argue, however, is that such worlds, whether they exist or not, remain *modally irrelevant*, in the sense that they do not

[314]The answers we are waiting for would be coming from cosmology, not from philosophy.

contain anything which has an effect on the modal status of the entities in our world. And this is a far more substantial statement than the proposed verbal dispute of McKitrick. I do not attempt to sneak contingency back into my account hidden by my vocabulary. When I claim that the laws of nature are absolutely, metaphysically, necessary, that is *exactly* what I mean.

5.6 Conclusion

In this chapter I have presented two versions of dispositional essentialist accounts of laws of nature. One of these, Bird's version, is describing laws as something which follow directly from the dispositional essences of the fundamental properties existing in the world. Basically, the fundamental laws spell out the necessary relations between such fundamental properties, whereas the non-fundamental laws supervene on this fundamental structure of interrelated powers. The second alternative, Ellis's version, adds an additional feature, the natural kind, to his account of the laws. This means that at the cost of simplicity, we are able to explain laws *directly* at the level of reality where they occur. This entails that rather than seeing the laws of chemistry as based upon the dispositional essences of the relevant fundamental powers plus the structures at the level of higher complexity, we see these laws as reflecting irreducible essences of the chemical *kinds*. Ellis's view, I argued, is problematic for at least a couple of reasons. Firstly, we add another element, the natural kind, into the theoretical foundation of our account, and we need to show that this is a *necessary* feature of laws. Secondly, we need to argue that there are dispositional essences also at non-fundamental levels. That is, powers exists not simply as a feature found in fundamental metaphysics, but also at the levels of, for example, atoms or molecules. I have earlier argued that the existence of powers, as defined in this thesis, is a feature of fundamental metaphysics; thus, Ellis's explanation of laws is not readily available for me, and I thus embrace, by and large, Bird's view (despite some important reservations). I have also addressed the fact that for the dispositional essentialist like me, the laws of nature are absolutely, metaphysically necessary. This is the case even though we might have strong intuitions to the contrary. In relation to this I have argued that the recent criticism from McKitrick poses no challenge to my overall project.

Chapter 6

Global laws, fundamental constants, and resistance to nomic change

6.1 Introduction

Laws which have the whole universe as their scope, and which apply to all events and all processes may be referred to as global laws, and the most common examples are the conservation and symmetry principles, such as the conservation of mass-energy and of angular momentum, and the fact that all inertial frames are equivalent in special relativity. In this chapter I will go through some of the problems such laws create for the dispositional essentialist, as well as explore two different approaches to such laws. The main question is the following. How are we supposed to understand global laws if our goal is to remain firmly rooted in dispositional essentialism? Another problematic aspect tied to the dispositional essentialist understanding of laws is how we are to understand the fundamental constants, and whether these constants might open the door for contingent laws after all.

In chapter 2 I argued that we get mainly two advantages from assuming fundamental properties with dispositional essences. Firstly, this gives us a theory of property identity. Secondly, we gain a theory of the laws of nature. However, the laws classified as being, in some sense, *global* do not seem to fit the description of laws offered in the preceding chapter of this thesis. It is not obvious how we are supposed to tie them to any particular essentially dispositional properties existing in the world. Following this, we are left with three main options. First, we can admit that it appears we cannot give an adequate account of global laws given the dispositional essentialist framework, and because of this we may reject the theory. This is a last resort, if no other solution is found. Another option is to state that we can operate with separate theories of laws at different levels. This is not a particularly satisfying solution either. The third option is making our theory fit the landscape, particularly by understanding the landscape better. This is the route I intend to take, and it inevitably leads to the question of whether the global laws are correctly understood as *laws*.

Proponents of dispositional essentialism have already been trying to solve this problem in various ways, depending on their general understanding of how dispositional essentialism works. There are, for example, suggestions that the global laws may be understood as laws governing the whole world, maybe even, as proposed by John Bigelow, Brian Ellis, and Catherine Lierse, as properties of the world understood as a member of a natural kind.[315] Another option is a solution presented by Bird, which involves redefining these global laws as symmetry principles, which are then seen as meta-statements about laws, not as proper laws in themselves. Both suggestions have problematic aspects, or problematic consequences.

This chapter will proceed as follows. I will start by discussing the conservation laws, and the problems we face when we interpret them in a dispositional essentialist framework. I will argue that the suggestion from Ellis, that we ought to see the world as belonging to a natural kind is less than ideal, given that I have already contended that we do not need natural kinds in order to have laws. The approach presented by Bird is more in line with my overall understanding of laws, but with an important difference: where his suggestion involves interpreting symmetries in an epistemic way—primarily as reformulations of conservation laws—I suggest interpreting them in an ontological way. That is, as something substantial in the structure and fabric of the world. Section 6.3 deals with problems tied to fundamental constants, which in my opinion is the most underdeveloped part in the literature on dispositional essentialism. In section 6.3.2 I consider the room for manoeuvre in the nomic structure of the world, and I will argue that this room is substantially smaller than what has commonly been assumed, given that we accept the conditions given by dispositional essentialism. I also propose, in section 6.3.3, an understanding of the relational aspect of dispositional essences in terms of graphs. By explicating the power-based account of properties in this way, the restrictions on the possibility of change made in the nomic structure of the world becomes even more apparent.

6.2 Conservation laws and symmetry principles

We may take conservation laws as a clear example of the problematic cases which will be discussed in this chapter. These principles tell us something about which events or processes that are possible, because it is the case that some particular quantities (energy, angular momentum etc.) must be conserved in all self-contained events and processes. Bigelow et al. (1992) presents a general form of a conservation law, formulated negatively, as "[e]vents and processes which are not x-conservative are impossible".[316] They go on to state that the conservation laws have a special kind of universality tied to them:

> They are universal in the sense that the antecedent or reference class is a

[315] Bigelow et al. (1992)
[316] Bigelow et al. (1992, p. 385)

> broad ontological category. They do not apply to particular kinds of events or processes, but (when compensation is made for external influences) to *all* events and processes.[317]

Such a relationship is not naturally seen as a relationship between powers, as it is difficult to see which universals one would be referring to in that case. It is deeply problematic to try to explain these cases by referring to either of the versions of the dispositional essentialist frameworks as they have been presented so far in this thesis, that is, it is hard to see them as describing essential properties of *parts* of the world. Whether or not we are putting additional weight on the concept of a natural kind does not initially seem to make a big difference here.

It does actually seem like making sense of conservation laws is easier if you have, say, an Armstrongian view of laws. It is not overly problematic to picture some extra principle which controls the way N is permitted to relate the Fs and the Gs. This situation is radically different for the dispositional essentialist. We have *already* argued that the laws are necessary, and that this necessity stems from the properties themselves—that is, from their dispositional essences. This means that there is, in reality, no room for an additional necessity on top of this. However, the question remains; how are we supposed to explain what seems to be an extra layer of necessity on top of something which is already necessary? In addition to the fact that such global laws are problematic for the dispositional essentialist, it should be mentioned that laws which are only tied to and applicable on the universe itself might be seen as a problematic idea *per se*. This is explained by G. F. R. Ellis as follows:

> [A]ccording to the usual conception of a law, a law is a generalization that applies to all members of some class of entities, with a variety of different members. If a law applies only to one thing, it's not a law, it's a description of one specific instance.

and further

> [I]f such laws do exist, there is no conceivable way we can test them: how do we prove they are a *law* (whether descriptive or prescriptive) that is applicable to different entities, rather than just the way things turned out to be? They will remain hypothetical untestable laws forever, no matter what we do.[318]

It is obviously problematic to refer to *laws* governing one single object, but as we have seen earlier, essentialistic accounts of laws does not focus on single objects, but rather on either *universals* or on *kinds* of objects, *kinds* of properties and processes and so forth.

[317] Bigelow et al. (1992, p. 384f.)

[318] Ellis (2014, p. 18) I will in general refer to G.F.R Ellis as just that, to distinguish him from Brian Ellis.

This entails that we need to examine whether such entities may be used to ground also the global laws.

6.2.1 The world as one of a kind

In what follows I want, firstly, to focus on the proposal presented by Bigelow, Ellis, and Lierse, which depends on natural kinds in order to solve the conundrum of global laws. Secondly, I will investigate whether it is possible to gain a proper understanding of such laws if we are *unwilling* to accept natural kinds as an important part of our ontology when it comes to laws.

If we want to explain laws by reference to the essences of natural kinds, we are still faced with considerable problems when we turn to these global laws or principles, because it is very unclear what *natural kind* they might be referring to. Bigelow, Ellis, and Lierse argue in much the same fashion as Ellis does in his later works. They see laws of nature as being concerned with natural kinds, in the sense that they in some cases even just describe the essential properties of the natural kinds. It is argued that this is true even for the most fundamental laws there are, which means that what we refer to as global laws or global principles are concerned with *the kind of world* this is. When discussing conservation laws, Bigelow, Ellis, and Lierse make it clear that global principles are *not* best understood as pointing to essential properties of particular parts of the world:

> It is not essential to the category of events that they should be energy-conservative, or angular-momentum-conservative, or conservative in any other respect.[319]

This means that these conservation principles are not grounded in events happening *in* the world, and that happenings which are not in accordance with these conservation principles would still be events. But if we move on to look at the universe as a whole, this is no longer the case:

> A universe in which the forbidden changes did occur sufficiently often would not be our kind of universe.[320]

With this in mind, Bigelow, Ellis, and Lierse conclude that conservation laws should not be seen as describing properties of *parts of the world*, but rather as ascribing properties to the *world as a whole*. Hence, the statement 'the world as one of a kind', used in Bigelow et al. (1992), does not refer to our world being special or unique, but rather to the idea that the world is of a specific *world nature*; it is a specific *kind* of world. They are expanding the idea of natural kinds so as to include the whole world, with the result that it is possible for us to speak of *world natures* and *world properties*. This means that in the same way that the specific laws are tied to the more specific natural kinds—such as the laws related to

[319] Bigelow et al. (1992, p. 385)
[320] Bigelow et al. (1992, p. 385)

Fluorine is tied to that specific natural kind—there are some laws that are tied to the kind that is the world. The global laws are thus also grounded *in* the world, but their concern is with *the kind of* world it is.[321]

Ellis also argues for a similar view in his later works, for example by stating the following.

> In the case of the global kind, the distinctive properties will be those that distinguish how the substances of this world, as opposed to those of any alien worlds (if such worlds should exist), are intrinsically disposed to behave, and the distinctive structures will include all those that are possible in worlds like ours.[322]

One potential worry with the view of the world as one of a kind is that it is seemingly sneaking the possible worlds back into an ontology which was supposed to be explicitly based on the actual world only. However, as we see in the quote above, and generally when this account of global laws is discussed, the existence of eventual other worlds are never presented as a commitment behind this expansion of the natural kinds based view of laws of nature. The suggestion is that the world should be seen as a member of a natural kind *even if* there are no other worlds existing. It could be the only member of its kind, and there might not be other kinds of worlds, but our world would be a member of a natural kind none the less. We may as such keep the assumption that other possible worlds are either non-existent or modally irrelevant. As Bigelow et al. (1992) states:

> We are not asserting that there are any such disconnected worlds. Nor do we assert that there are none. There is at least one world; and it's a member of a natural kind whether or not there are any others of its kind.[323]

In line with the above quote, we may remain agnostic regarding the question if there are several worlds or just this one. The account is not depending on this. In line with what I have argued so far in this thesis, I hold that modality is *not* best understood or explained by reference to other worlds, of any kind, and that the existence of other worlds is irrelevant to the understanding of modality. This attitude may be kept while still agreeing that, firstly, the world is one of a kind, and, secondly, that this explanation of the global laws is in line with the idea of grounding the laws, and the necessity associated with them, in the actual world, while at the same time avoiding having to bring in causally inaccessible possible worlds. Ellis is in general dismissive of the possible world-centred approach, and argues that an understanding of necessity grounded in possible worlds, of the categorical type, like the Lewisian worlds, is *not* providing necessitation:

[321] Bigelow et al. (1992, p. 373) do not present a complete theory of what a natural kind is, but they aim to show the consequences that will follow *given* the ontological priority of essences and natural kinds over laws.

[322] Ellis (2002, p. 36)

[323] Bigelow et al. (1992, p. 371)

> What does it matter how the actual world is related to other possible worlds if all the possible worlds are in themselves non-modal? If natural necessities exist, then they must be grounded in the actual world, and this world must itself have modal properties.[324]

When it comes to the question of what kind of world we live in, we may be able to tie down some of the essential properties that our world has. Being conservative with respect to several quantities has already been mentioned; its causal structure and certain global symmetries may also be seen as such essential properties. These properties are all related to the laws of our world, and they put significant restrictions on the kinds of changes and happenings that are possible; they also limit the kinds of things that may exist in the world. With this in mind, the restrictions on the laws are perhaps more severe than what intuition may tell us:

> A law of nature is not just something which is true of the actual world but which could have been otherwise *in this very world*; rather, it is something which could not have failed to hold *of this world* without this world ceasing to be, and another world altogether existing instead – another world of a different natural kind with a different nature from the one we are in.[325]

The important question to ask at this point is the following. Are the arguments for seeing the global laws as reflecting the essence of a world-wide kind sufficiently strong that we should accept that laws of nature are closely related to the natural kinds, even though I have so far argued otherwise?

6.2.2 Do we really need natural kinds?

In line with my arguments so far, I hold it to be an advantage if we were able to obtain a workable account of all laws of nature *without* having to resort to natural kinds. Hence, my goal is to be able to explain also the problematic global laws without introducing natural kinds as a supplementary entity. The most important reason for this is that, in addition to being a less parsimonious account, an account of laws based upon natural kinds is radically different than the view I have given my support to, based upon powers. It is not an option to keep the framework as presented this far, and add natural kinds on top. The difference between the two dispositional essentialist accounts of laws discussed in this thesis is far greater than it seems at first glance. Hence, an attempt to combine them in order to solve the problem of global laws would presumably fail. Let us look at why this is the case.

One particularly striking difference between the two views is the distinction between the entities responsible for there being laws in the world; the powers on the one hand, and

[324] Ellis (2002, p. 118)
[325] Bigelow et al. (1992, p. 373)

the essences of the natural kinds on the other. Perhaps this difference could be overcome if we demanded that every natural kind was picking out a sparse, fundamental property? In such a case the introduction of natural kinds would seemingly just be an additional way of seeing the powers we already have accepted as parts of our ontology. I argue that this is only seemingly the case; if we look at the most typical example of a sparse property which is also in general seen as a power, the property of electric charge, and more specifically that of negative charge, such a property does *not* form a natural kind.[326] The class of all negatively charged objects is far too diverse to be a natural kind. Thus, we see that even if we do concede that every natural kind correspond to to natural properties, we still end up facing problems.

If we let go of the question of the connection between sparse properties and natural kinds, and move on to the question of whether the natural kinds really are connected to the laws in the way Ellis claims them to be, we find problems here as well. Instead of considering the case of charge, we may focus on one of the entities having such a property, for example, the electron. It does indeed seem like 'being an electron' would qualify as being a sparse property, and it is definitively a natural kind, even by Ellis's strict standards. But does it generate laws? It does not seem like that is the case. The laws which we associate with electrons are not only derivable from the given entity, the electron, because they can also be derived from more basic laws which have to do with, for example, their negative charge and other powers. That is, the property of charge, and other fundamental properties which are essentially dispositional are responsible for the behaviour of the electron, not for the fact that the electron belongs to a particular natural kind.

It is part of the essence of the electron that it is negatively charged, surely. However this is not a law of nature, it is just an essential fact about electrons. Just in the same way that there is no law stating that ordinary table salt is *NaCl*—this is just an essential fact about its constitution—it tells us simply what table salt *is*. Hence, even the laws concerning things like electrons are *derivative* laws, not fundamental ones. They are grounded in more fundamental properties, *not* in the natural kind the given entity belongs to. For the derivative laws, say the laws of chemistry, Ellis ties these to the essences of the chemical kinds, but, as discussed in chapter 2, we do not need to pose dispositional essences at this level of complexity. We can explain these higher-level laws because they supervene on underlying laws which hold in virtue of the properties they relate to. Hence, it seems disadvantageous to introduce yet another entity, the natural kind, in order to *directly explain* the laws we can already account for through supervenience.

Nevertheless, we might still ask ourselves whether these more fundamental laws could be grounded in *fundamental natural kinds*. If this was the case, we could introduce the natural kinds at the fundamental level, and subsequently refer to natural kinds both at

[326]Quine (1969) however, holding natural kinds to be sets, has a view which is consistent with the set of all negatively charged particles being a natural kind.

the fundamental and the global level. However, stating that natural kinds are *fundamental* is problematic in itself, and we find quite forceful arguments claiming natural kinds to be some form of *complex* universal rather than just a simple universal.[327] Instead of asking whether fundamental laws *could be* explained by fundamental natural kinds, let us ask the following question. Do we need natural kinds in order to have laws? What if we picture a world in which there is just one uniform substance; a gunk world. Presumably, such a world would still have laws—perhaps several different laws depending on how the gunk behaves. The division of substances into natural kinds is not a *necessary condition* for there being laws.[328] In the gunk world case, it is solely the essentially dispositional properties of the gunk which leads to there being laws also in such limited worlds.[329]

6.2.3 World properties or pseudo-laws?

Thus, we are back where we begun; if we do not need natural kinds in order to explain the laws of nature in general, how are we supposed to understand the global laws, such as conservation and symmetry principles? If we reject natural kinds as a source of laws in general, it seems strange to reintroduce them in order to get an explanation of a set of particularly problematic laws, while denying them this role elsewhere. Hence, we are in a situation where it is clear that these laws do not appear to reflect dispositional essences of fundamental properties, and if we deny the suggestion by Bigelow et al. (1992) as well, which options are left?

A possible alternative to arguing that the world is the (perhaps sole) member of a natural kind, is to propose that there is a *property* which is corresponding to the proposed kind. This would entail claiming that there exists a property of *being a world with certain essential dispositions*, such as being energy conserving in response to any event.[330] If this is the case, the global laws simply reflect the possession of this property.

This solution is, in my opinion, a non-starter. Simply rephrasing the solution presented in (Bigelow et al., 1992) such that we speak of properties rather than natural kinds while keeping the rest of the proposed solution is *ad hoc*. It might of course be argued that the solution provided by Bigelow et al. (1992) is already *ad hoc*, and reformulating it in this way certainly does not improve this impression. It only glosses over the fact that we do not have a good answer. In addition, these laws seem to be working on a 'system level' and hence the property they eventually would correspond to have to be some sort of macro property, which is not the kind of property that generate laws according to dispositional

[327] See for example (Hawley and Bird, 2011).

[328] Bird (2007, p. 209)

[329] Saying that natural kinds are not needed in order to explain the laws of nature is not the same as saying natural kinds are not important of course. They are an important part of our ontology which we probably cannot do without, but they are not needed in this context.

[330] Bird (2007, p. 213) presents this suggestion, but he does not endorse it, and even states that it is not a good solution.

essentialism. Let us leave this approach behind.

There is yet another problem at play when we consider things like conservation laws. Quantities are not only conserved at a global scale, they are conserved at *all scales*, hence the suggested solution tying these laws to either world kinds or world properties does not capture every aspect of these laws. Does this mean that we might not find a satisfactory answer to these questions? That we just have to settle for the idea that these things are mysterious indeed? As Bird states "[t]here is no reason why the fundamental nature of universe should be even comprehensible, let alone intuitive."[331] But even though that seems to be correct, it seems unsatisfactory at the present moment to simply conclude that this is something we might never get a proper answer to, or that we have to await further answers from science before concluding. In some cases this would be the correct way to conclude, but in this case there are other options to consider before eventually going back to this option.

In the final sections of 'Nature's Metaphysics', Bird points towards a plausible way of understanding conservation laws and symmetry principles *without* making compromises regarding how dispositional essentialism explains the laws of nature, something which entails that we can get at least a bit closer to an acceptable answer to this problem. Rather than accepting world natures or world properties, we need to scrutinise the proposed laws, and ask whether they are correctly understood as *laws*. What if this is not the correct way to perceive them? Bird suggests that it is not, and that they should more correctly be viewed as *pseudo-laws*.[332] This assumption is based on certain aspects of the global laws which we have not yet touched upon; the relationship between the conservation laws and the symmetry principles.

6.2.4 The relationship between conservation laws and symmetry principles

So far, the proposed solutions to the conundrum of global laws have been deemed unsatisfactory. Both the argument from world natures and the one from world properties rely on something we *add* to our theory without there being sufficient reasons for doing so (apart from trying to solve the problem at hand). Maybe it is time to seriously consider why these global laws seem so diferent from the other laws of nature. Could it be the case that they *seem* different because they *are* different? If this is the case, what we have considered to be global *laws* are in fact something which is slightly different than the other laws of nature. This is an important point, because if the global laws are not correctly seen as *laws*, we are no longer committed to account for them in the same way we account for other laws

[331] Bird (2007, p. 213)

[332] Bird (2007, p. 214). We should note that Bird's treatment of this issue in 'Nature's Metaphysics' is short and introductory in style, as it is a part of the section of the book which points towards the need for more research.

of nature.

An important feature of conservation laws and symmetry principles not yet touched upon is the way they are closely connected to each other. This is a point which is missing from the account of Bigelow et al. (1992), but it is briefly mentioned in (Bird, 2007). According to Noether's theorem, the conservation laws may be derived from the symmetry principles.[333] This is convenient because it means we can change our focal point from speaking of 'conservation laws and symmetry principles' to concentrating solely on the symmetries, as these may be seen as the more fundamental principles. This makes our account more parsimonious.

However, as Livanios (2010) points out, we should be careful not to imply that conservation laws and symmetry principles are *equivalent*. The way Bird addresses these things, it seems the symmetry principles are simply alternative *formulations* of conservation laws, and that symmetries perhaps most of all say something about our way of understanding the world. That is, he holds what Livanios refers to as the *epistemic viewpoint* of symmetries, formulated as follows:

> [T]he presence of symmetries in physical theories is related to general conditions of physical knowledge or to some limits inherent in our way of describing the physical world.[334]

However, simply saying that conservation laws may be formulated as symmetry principles does not seem to give us entities which are easier to handle as dispositional essentialists. If the symmetries are laws in some sense or another, we still need to be able to ground them in some dispositional essence, something which does not seem doable. This is the starting point Bird is arguing from when he asserts that the symmetry principles are perhaps not best viewed as laws in themselves, but rather as meta-statements *about* laws. This understanding entails that these law-like background structures are something we should aim to eliminate, as being "features of our form of representation rather than features of the world".[335]

Distinguishing symmetry principles from laws seems in line with how they are spoken of in general; they are described more as *properties of laws* than as laws themselves. This could be seen as pointing us in the direction of not viewing these principles as *laws*, although the fact that we tend not to speak of these features of the world as laws is not conclusive evidence for anything.[336] Bird's suggestion is to view the symmetries as pseudo-laws. This might be correct, given that I assume that the term *pseudo-law* is supposed to say something

[333]Noether (1971). It is Noether's first theorem which is of relevance here, the fact that for every continuous global symmetry of the Langrangian there is a conservation law. I do not go into details regarding symmetries here, but see (Bangu, 2013) for an introduction to this topic.

[334]Livanios (2010, p. 296)

[335]Bird (2007, p. 214)

[336]In the same way as our everyday use of dispositional phrases might not be overly relevant for our philosophical understanding of dispositions, as argued in chapter 3.

along the lines of the following: Even though symmetry principles behave nomologically, they are not really laws after all; even if they seem to us lawlike, their identity is not the same as the laws. This is a fair point to make, but it does not give us any information about what the symmetry principles *are*, just what they are not. We are not offered any positive explanation by accepting them being pseudo-laws. Hence, something more must be provided.

We also need to note that it is not unproblematic to argue that the conservation laws might be *reformulated* as symmetry principles. If they are simply alternative formulations of conservation laws they cannot really ground any explanation of the existence of the conservation laws, they are just stating their existence in a different vocabulary. We need to ask how plausible the epistemic viewpoint of symmetries really is, that is, how plausible is it really that symmetry principles are simply alternative *formulations* of conservation laws? If this is supposed to imply equivalence, this seems to be far too strong a claim:

> [S]ymmetry principles are conceptually related to (and constitute an explanatory basis for) a lot of issues that are entirely independent from conservation facts. So, the alleged equivalence with the conservation laws does seriously downgrade their significant role.[337]

6.2.5 Symmetries and the identity of fundamental properties

For the dispositional essentialist, the problems tied to symmetry principles unfortunately do not end there. Recall how the identity of fundamental properties is explained exhaustively by their powers, and that this is one of the two main reasons to accept dispositional essentialism. What if the identity of fundamental properties can be explained by taking an alternative path, that is, by way of *symmetries*? Livanios points out that symmetries actually *can* be used to identify things like fundamental properties.

> [T]wo fundamental properties, rest mass and spin, that according to dispositional essentialists are dispositional features of elementary particles, can be identified via a symmetry-based procedure independent of their causal role.[338]

Such a symmetry-based determination of the identity of fundamental particles might be used as arguments against the identity-thesis of the dispositional essentialist, Livanios claims. That is, according to Livanios, there is a serious conflict between symmetry-based explanations of property identity and the dispositional essentialist's explanation of that same thing.[339] This seems, at first glance, like an even bigger problem for my account than the fact that the symmetry principles are hard to account for from the dispositional

[337] Livanios (2010, p. 304)
[338] Livanios (2010, p. 300)
[339] Livanios (2010, p. 301)

essentialist viewpoint. I do believe this critique can be met, though, particularly by pointing out that Livanios fails to recognise the important difference between 'being able to identify' something, and 'being the identity' of the same something. What he addresses is the ability to *identify* something as a fundamental property, that is, an epistemic concept. What I, and other dispositional essentialists, address when speaking of a property's identity is its *essence*, and that is an ontological concept. *Being able to identify* and *being the identity of* do not have the same meaning. Hence, I cannot see that Livanios's critique is as damaging as he intends it to be.

The symmetry principles in themselves remain problematic though, and we have to ask ourselves which other options are available. I suggest that we should acknowledge that the connection between conservation laws and symmetry principles entails we should focus more on symmetry principles, but nevertheless not go along with Bird's epistemic route. In this case, we can argue for an *ontological* understanding of the symmetry principles—rather than an epistemic one—in which case they are viewed as real aspects of the world. Both the suggestion from Bigelow et al. (1992) and the initial world-property suggestion from Bird (2007) already seem to interpret symmetries as features of the world, but as already stated, both of these suggestions may be classified as *ad hoc*.[340] The fact that symmetry principles have a much wider scope than simply being other ways of formulating conservation laws seems to support the ontological interpretation. If we are to adopt this position, and deny Bird's epistemic interpretation, we need to find better ways of incorporating this alongside dispositional essentialism than the existing alternatives already discussed.

Livanios argues that viewing symmetries in this ontological way might be an interesting way to proceed for the dispositional essentialist. He also notes that much further work is needed in order to figure out what exactly the relationship between the symmetries and the dispositional essences are, and what influence the fundamental symmetries actually have on our theory. If we are to argue that an ontological understanding of symmetries is superior to the epistemic version, we should at least make a proposal regarding what symmetries are.

One possible approach is to consider symmetries as *meta-properties* of a special kind. That is, to view them as properties of all properties, relations, and processes. If that is the case, it seems like the existence of these symmetries is a precondition for the world being like it is, or maybe even for there being a world at all. These principles are at work no matter what is present, whereas the actual laws of the world are *conditional* on things like charge, mass, spin, and so on. According to this understanding, symmetry principles are unconditional. Hence, by assuming this to be the case, we would also obtain some information about the difference between laws and symmetry principles.

[340]Livanios goes as far as to call them poor, but he also presents Bird's world properties approach as a more substantial suggestion than what was intended from Bird, it seems. Bird (2007, p. 213) classifies the explanations based on both world kinds and world properties as 'somewhat *ad hoc*'. Still, it is presented as a serious contender by Livanios.

Is something gained by viewing these principles not as pseudo-laws but rather as meta-properties? It seems that if they are properties in this sense, they are not simply background structures, but rather something which is potentially active and reactive. This is positive, as contemporary physics in general seek background free theories, and it might be argued that philosophers should follow the lead of the physicists here.[341] This will entail that certain features of the world, such as spatial and temporal properties, which we intuitively view as the 'stage' where things happen, are rather seen as participants in the happenings themselves.

> Over the years, people have realized that the great lesson of general relativity is that a good theory of physics should contain no geometrical structures that affect local degrees of freedom while remaining unaffected by them. Instead, all geometrical structures—and in particular the causal structure—should themselves be local degrees of freedom. For short, one says that the theory should be *background-free*.[342]

As mentioned in chapter 2, what initially seemed like static backgrounds for happenings may themselves be subject to causes and effects. If we subscribe to this view, we cannot so easily claim that such features are categorical. We may say that eliminating background structures from physical theories in this way favours an account of physical quantities which sees them as powers.

Regarding the symmetry principles, it seems that the solution is tied to accepting an ontological view of symmetries. For the time being, this is but a suggestion; for the details of such an account to be developed, further research is needed.

6.3 Fundamental constants, and resistance to nomic change

6.3.1 Are fundamental constants really fundamental?

If we move from speaking of global laws to addressing fundamental constants, yet another problem presents itself for the dispositional essentialist. If we think of the laws of nature which involve fundamental constants, it seems fairly unproblematic to assume that it is possible to have a world, very similar to ours, where these constants were altered slightly. It seems intuitively right that very small differences in the fundamental constants would not require that the *properties* related in the relevant law be any different. This is yet another example where the dispositional essentialist, rather than adjusting the account to fit these intuitions, should investigate whether there is a sensible essentialist explanation available

[341] See e.g. (Bird, 2007, p. 161-6).
[342] Baez (2001, p. 6)

for the problem at hand, even if this means going against our intuitions. Let us first take a look at what is at stake for the dispositional essentialist regarding this issue.

The fundamental constants create problems for the dispositional essentialist in two separate ways. Firstly, I have already argued that the laws of nature are necessary in a metaphysical sense, but if the fundamental constants could possibly change, this generates a loophole which entails that the laws are not absolutely necessary after all. Secondly, how are we to account for fundamental constants in a dispositional essentialist framework? If these constants are *truly fundamental*, they are not dependent upon anything else, so they do not depend on any powers, but they cannot easily be seen as powers in themselves either. Hence, certain nomic facts about the world appear not to be justified according to the framework presented.

Consider the following example. When we speak of the law of gravity, we say that the force of gravitational attraction between two entities is directly proportional to the product of their masses and inversely proportional to the square of the distance between them. The facts about the proportionality in question can clearly be said to reflect the dispositional nature of gravitational mass, but it does not seem to be an essential property of gravitational mass that the gravitational constant G has the exact value it actually has. If it is the case that what we speak of as fundamental constants really are fundamental, we open for the scenario where the *same properties* that exist in our world may enter into a law where the relevant constant is slightly altered. This option is only available if the constants are indeed fundamental. Hence, the first question we should ask is whether what we refer to as *fundamental constants* truly are fundamental, or whether this is an assumption which is reflecting incomplete knowledge.

What would the consequences be if the law of gravitation was not a fundamental law, contrary to appearances? If it is not fundamental but somehow dependent on deeper and more fundamental laws, then it could turn out that G is constrained in a way we have yet to figure out.[343] This would have a crucial consequence for the dispositional essentialist, because if this is the case, if such constants are truly *constrained* in some way, the value of the constants would *necessarily* be precisely as they actually are; the necessity of the laws would no longer be threatened. The situation is of course the same for other constants which appear to be fundamental. If a constant appears to us as fundamental, but is not actually fundamental, then changing this constant will in all likelihood have serious consequences for laws existing at a lower level of fundamentality. This is an important point for both the present chapter and the next. It is fairly easy to present thought experiments posing *minimal changes* being made in the nomic structure of the world, and to claim that these changes represent genuine possibilities, but I will argue that the result often is a far more substantial change being made to the world than what was originally intended.

However, when it comes to the question of how the dispositional essentialist should

[343]Bird speculates that this might be the case in both (Bird, 2005, p. 365) and (Bird, 2007, p. 212).

deal with the constants at play in current physical theories the situation is still unresolved. It seems that the knowledge science can presently give us does not enable us to draw a conclusion. This entails that when it comes to the dispositional essentialist understanding of fundamental constants in general, our best move is not to make further speculative and bold philosophical claims, but rather to wait patiently for more detailed answers from science. When further scientific evidence is obtained, we can proceed and use it. This, I'm afraid, is the case, even though it is not particularly philosophically satisfying.

6.3.2 Eliminating the possibility of the world being 'just a little bit different'

As mentioned above, *if* the fundamental constants are restrained in ways we have yet to figure out, they pose no threat to the dispositional essentialist claim that the laws of nature are necessary, in a metaphysical sense. This goes against the common intuition that fundamental constants are not essential features of the laws; that is, it seems intuitively right that we may have a world with exactly the same fundamental properties as in our world, but where the fundamental constants are very slightly altered. But is this intuition correct? Let us take this assumption seriously, and see whether small alterations to fundamental constants give the expected results—that is, that these very small changes in the values of the fundamental constants have *minimal changes* for the world in general as a result.[344] This discussion is related to my arguments against McKitrick (2018) in chapter 5, and it also foreshadows the more general debate about the role of intuition and conceivability in the following chapter.

Let us assume that at least some of the fundamental constants at play in the actual world firstly, are *fundamental*, and, secondly, that they *could have been* altered very slightly. What would happen? I will use an example from (Bird, 2007) in order to show that what appears to be fundamental might not actually be so. His argument aims to show how something which is not fundamental may still *appear* to be fundamental to us, in that it resembles the way the fundamental constants behave. Thus, we get the idea that appearance of fundamentality might perhaps reflect *our knowledge of the world*, rather than reflecting the world itself. The same example may also be used to show how our intention of making an incredibly small change to the world fails:

> The intensity of light from a constant and uniform source falling on a unit area decreases in inverse proportion to the square of the distance from the light source. This law could have been discovered experimentally. One could imagine someone thinking the exponent of the displacement, -2, is a fundamental constant. There might be a very similar possible world in which the

[344] Remember that the fundamental properties are supposed to remain unchanged through this, so the expected change will have to be small.

> light intensity is proportional to $d^{-2.000001}$. However, the fact that the intensity is proportional to exactly d^{-2} is derivable from the law of the conservation of energy. So a world in which the intensity is proportional to $d^{-2.000001}$ is not at all similar to ours; it is one where energy (or mass-energy) is not conserved (and it is not clear to me that such a world is genuinely possible).

Bird continues.

> Newton's law of gravitation is also an inverse square law, and its similarity to the law of luminosity encouraged many to think that it too must be explicable as reflecting some deeper law that would show why the force of gravity is proportional to d^{-2} rather than to $d^{-2.000001}$. Einstein eventually showed that they were right. It is thus an epistemic possibility that scientists will find that G is not a fundamental constant either.[345]

In much the same way as was the case when the topic was global laws, when it comes to the fundamental constants we are also in a situation where we do not have enough information about the world to infer anything substantial about the fundamental constants' metaphysical constitution based upon examples like this. In addition, we cannot, as will be shown in chapter 7, conclude that something is metaphysically possible based on the fact that it is epistemically possible. However, apart from opening at least the *epistemic* possibility of G not being fundamental, such examples give us insight into the fact that there might be quite a distance between the change we *intend to impose* on a world in an example, and the result we get. *Surely* we did not intend to postulate a world where mass-energy is not conserved when we claimed a small change in the proportionality of light intensity.

Let us return, then, to the more general intuition that some nomic features—not only fundamental constants—of the world could have been slightly altered, and the assumption that the resulting world would have been a genuine possibility; a way the world *could have been*. I have argued that given the fundamental properties and relations of the world, a world where the laws of nature are even just a little bit different is *not* possible. However, we are still able to speculate counterfactually about several things, and such speculations might in some cases give us the impression that the given scenario is actually possible. Some such counterfactual statements are clearly not statements of genuine metaphysical possibility, but rather thought experiments seeking to give us increased knowledge about a particular limited feature of the world. However, in some cases statements of the kind 'if we changed this thing, *and the rest of the world remained (more or less) unchanged*, what would happen?' are intended to express a counterfactual situation which is presented as a *genuinely possible scenario*.

[345] Bird (2007, p. 212)

Thinking that these kinds of counterfactual thought experiments represent genuine possibilities seems to me overly naive. However, we may still think that *if* we can consistently imagine a scenario, then it is in some sense possible (we find this all the way from Humean understandings of modality, to Vetter's argumentation for extensional correctness). However, if we choose to take counterfactual claims about the nomic structure of the world to entail possibility, the following is in general lacking. *Firstly*, a consideration of where the change is coming from; we need to consider what produces the change, and what is grounded in, that is, which currently existing properties would have to be altered for the counterfactual situation to come about. *Secondly*, we need to recognise which effects this change would have on the rest of the world (not just the small part of the world actually mentioned in the scenario).

If we take those two points into consideration, we will see that most, if not all, counterfactual statements pertaining to nomic features of the world are such that the clause that the rest of the world be unaffected by the altering is all but impossible. This points back to how the world according to the dispositional essentialist is not a collection of loose facts, but rather an interconnected *web* of properties and relations. These kinds of thought experiments might still be enlightening, meaningful, and easy to make, but this does not entail that they represent real possibilities. Let us have a closer look at how this *relational* structure may be understood.

6.3.3 Identity determined relationally

We remember from chapter 2 that for the dispositional essentialist, the essences and hence the identities of the fundamental properties are not simply a matter of their intrinsical dispositions, but also something which is essentially *relational*. These essential relations between the fundamental properties are the fundamental laws of nature, on which the rest of the nomic structure of the world supervene. Following the argument put forward thus far in this thesis, the identities of fundamental properties is not a primitive matter, as it is for the categoricalist. The categoricalist is free to argue that each property is primitively self-identical but that there are no necessary relations at play in the world. Because of this it is easy to postulate the change of *one single property* without this influencing the world in the way it will for the dispositional essentialist.

If we think of the common illustration of Humeanism where the properties of the world are represented by a mosaic floor, we can argue that changing one single tile in the whole image does not influence the other tiles in the floor. In addition, the whole image is changed only *very moderately*—perhaps not even noticeably. However, these kinds of changes are *not* genuine possibilities for the dispositional essentialist. Our view of the fundamental properties and how they are related to each other is a *holistic* view. We depend on a whole pattern of manifestation relations, and cannot simply change one single property. In fact, the structure of the *set* of fundamental properties is actually a part of what determines

the identity of each property.[346] If we take this claim seriously, we see that dispositional essentialism comes as a whole package—a cluster of fundamental properties woven together in a web—not just singular fundamental properties which could have been combined in many different ways. Where Humean supervenience often refer to the Humean *mosaic* in order to illustrate their view, dispositional essentialism can refer to their view as a *web*. If you change one tile in a mosaic floor the rest of the floor remains the same. However, if you remove a thread from a *web*, the whole thing unravels.

This kind of web-like structure is commonly referred to as a graph. And, if it is the case that the whole structure of the graph can give or contribute to give the identity of the singular elements—the nodes—we see the problem with thinking it unproblematic to allow small changes in the nomic structure of the world. By changing one element, we change the structure, and so we change most or even *all* other elements in it as well. This means that on the fundamental level, the whole web contributes to the identity of the singular properties.

We can find examples from cosmology pointing in this direction. That is, cosmologists urge that there are clear cases where profound connections between properties demonstrate the quite specific limitations at play in the world. Certain relations between different entities are such that if we change their relation—and only it, disregarding for now the relations to the rest of the fundamental structure of the world—we end up with a world which is radically different. Two of G. F. R. Ellis's articles, (Ellis, 2006) and (Ellis, 2014), discuss the philosophy of cosmology, and present several such examples. His focus is on the laws and lawful regularities which ensures a universe where life can potentially exist, but his examples can also be used as a more general description of how the world is extremely reluctant to change.

If we, for example, return to the question of gravity, and what would happen if gravity was ever so slightly different, we first have to note that such speculations can be answered in a number of different ways, depending on how the situation is interpreted. If we, for instance, speculate about our experience of gravity on a celestial body with different mass than the earth, this does not seem problematic in any sense, and we can get several interesting answers. But if we ask how we would experience a world where gravity, or whatever grounds gravity, *in itself* was altered in some way or another, the answer would in most cases be that we would not be around to experience it. As G. F. R. Ellis points out, the gravitational force must have certain properties in order for there to even be the *possibility* that someone is existing and able to experience anything at all. It must be such that it leads to the creation of planets, which potentially can be the habitat for life, and also the stars. Without gravity being such that sufficiently large stars can be made we do not only loose the potential for life, but also the means for creating most of the chemical elements. For the creation of stars to be possible, the gravitational force must be very weak relative

[346] Bird (2007, p. 141)

to the electrical forces; the ratio between them must be close to the observed value.[347] From this and similar examples, we see traces of great interconnectedness between the properties of the world which the dispositional essentialist argues for.[348]

Even though this example speaks of the force of gravity in relation to conditions having to be in place for life to exist, it is not unreasonably anthropocentric. Here is why. It is clear that without the formation of stars we would not have a world with the means to create most of the chemical elements, so the consequences are more substantial than solely the absence of living beings, but this is not the main point. The point is that we need to consider what changes would have to be made on a more fundamental level in order for stars not to form. For the world to behave in this radically different way, *something* on a more fundamental level must have changed. So, the question about gravity and the formation of stars is not essentially a question of whether a world without stars is a way our world could have been, it is the question of whether a world with *whatever change is made at the more fundamental level ensuring gravity to be different* is a way that our world could have been. And given my arguments so far, the answer will be *no*. Again, we should remember that the considerations mentioned towards the end of section 6.3.2 should always be taken into account when we discuss the possibility of changing the nomic structure of the world. That is, we need to think about *where* the change comes from, that is, what fundamental properties or relations would have to be different in order that the proposed change could happen, and *which consequences* the change at the more fundamental level will have for the rest of the world. I will return to this 'down-and-up structure' in chapter 7.

In addition to providing examples showing the likelihood that the entities of the world are deeply connected with one another, we also need to show the philosophical tenability of this thesis. That is, we need to ask whether the identities of individual powers really can supervene on these kinds of patterns. If the relations between the fundamental properties are essential, they at least *contribute* to the identity of the property. We may separate two claims of different strength here. *Either* these essential relations contribute to the identity of the powers (the weaker view), *or* these essential relations *give* the identity identity of the powers (the stronger view). As dispositional essentialists we are committed to holding at least the weaker view, and that is also what I will argue for.

The biggest problem with identifying properties by the relations they bear to other properties is that we seem to end in regress. Since each property's identity is determined by relations with other properties, which again are determined by relations with other properties and so on, there seems to be no way out of regress, or at least circularity, here.

[347]Ellis (2006). I am aware that the example is described in outdated Newtonian terms, and as such not exactly correct, but describing it like this makes it conceptually easier to grasp. However, it should be mentioned that the current view of gravity as a geometric effect, i.e., a change in the *spacetime curvature* is more in line with the overall dispositional essentialist view that spacetime is not a stage where things unfolds (a 'background'), but rather something which is itself *active*.

[348]See (Ellis, 2006), (Ellis, 2014), and also (Rees, 2000) for more examples and more details.

Hence, it is natural that we ask whether the identity really can be determined in this way after all. That is, whether it is plausible to claim that a set of elements organised in particular relations to each other can suffice to determine the identities of the elements thus related.

Let me spell this out. We picture that we have a set of elements (the fundamental properties) which are all related through a manifestation relation (which holds between a property and its manifestation property), and ask whether the identity and distinction of the elements of the set supervene on the instantiations of the relations between them. This question can be reformulated as a question about graphs, which makes it easier to tackle. Following Dipert (1997) we ask; can graphs depicting the fundamental structure of the world be *asymmetric*? In asymmetrical graphs the identity of the vertices will depend on the structure of the whole graph, hence these are the graphs which will be expressing the structures we are after.[349] Symmetry, in this context, amounts to graphs where there exists a non-identical permutation of its vertices, and where this leaves the graph invariant. This means that a graph is seen to be symmetric if the group of its automorphisms has degree greater than 1. A graph which is *not symmetric* will be called *asymmetric*.[350]

We have two kinds of distinctness at play here. The first applies to graphs as a whole. They are distinct if and only if they contain features that structurally distinguish them. That is, an *internal distinctness* for each graph taken as a whole. The second applies to the vertices themselves, as well as to subgraphs. The vertices have no internal structure, so they will have to be distinguished by something *external* or contextual. That is, if they are structurally related to other entities in a unique way, *this* is what gives them their identity.[351] Hence, we see that the similarities between the identification of the vertices in these kinds of graphs, and the identification of the fundamental properties according to the dispositional essentialist are *substantial*. Given the asymmetrical graphs, it is possible to give unique, purely structural descriptions for each vertex, and this should entail that we also have graphs that can represent possible structures of powers.

Given this relational understanding of the powers, the assumption that we can allow even small changes in the nomic structure of the world while being dispositional essentialists is shown to be even more problematic than it initially seemed to be. We recall from chapter 5 how McKitrick (2018) argues that dispositional essentialists *can* accommodate contingent laws of nature, but given this *relational web of powers* at the fundamental level it seems even clearer than before that holding a dispositional essentialist view of fundamental properties and laws entails, absolutely entails, that the laws of nature are *necessary*.

This is good news for the dispositional essentialist, but one serious problem remains. Are we supposed to simply disregard the fact that the laws of nature intuitively seem to be contingent? Should we ignore what Vetter refers to as extensional correctness? We

[349] It seems Bird also leans towards the directed graphs picture.
[350] Erdős and Rényi (1963, p. 295)
[351] Dipert (1997, p. 346)

remember from chapter 3 how Lowe argued that we need *good reason* if we are to depart from theories which intuitively seem to be correct. Hence, I will have to address the problem of the apparent contingency of the laws of nature in far greater detail than I have done so far. I will devote the next, and last, chapter solely to this issue.

6.4 Conclusion

In this chapter I have addressed problems related to the global laws and fundamental constants, and I have shown that the complications associated with the global laws cannot be resolved by adding natural kinds to our framework. Hence I conclude that the natural kinds are a redundant addition to a dispositional essentialist account of the laws of nature. Not all issues connected with the global laws have been resolved, however, and there is an obvious need for further research in this field. The situation is even more in need of analysis when it comes to the dispositional essentialist understanding of the fundamental constants, where our best option at present is to await further answers from science. When it comes to these problems, dispositional essentialism is, at present, in a somewhat difficult position, but not completely hopeless.

The positive results found in this chapter are tied to the notion of resistance to nomic change, which, I argue, is at play in the world. I illustrated this briefly by way of graphs, and suggest that the relationship between the fundamental properties should be pictured as a *web*. We have seen that the actual world does not work in the same way as the theoretical possible worlds might be expected to work; nomic change comes at costs *far greater* than what we might intuitively picture when we present counterfactual situations as genuine possibilities. This entails that if we aim to explain modality with the radical actualism I begin with, we need to be ready to let quite a few intuitions go.

Chapter 7

Intuitions, conceivability, and the laws of nature

7.1 Introduction

In this chapter I will consider the relations between intuitions, conceivability, and possibility, particularly when it comes to the case of the laws of nature. So far I have argued that the laws as understood by the dispositional essentialist will have to be absolutely, metaphysically, necessary. That is, there is no room for any genuine possibilities going beyond that which is allowed by the laws of nature. This is perhaps the most controversial feature of the dispositional essentialist account of laws, because it entails that we need to accept that the consequences of our philosophical standpoint is not in line with the most common, intuitive, attitide to have towards the laws of nature, namely, that they in some way or another are *contingent*.

We remember from chapter 3, how even dispositionalists like Vetter refers to extensional correctness—the ability of our account of modality to match our prephilosophical ideas about what is possible and not—as something dispositionalists need to take into account when crafting their view. Vetter has no explicit account of laws, but both she and Borghini and Williams specify how the possibilities for which their views can account are seen to go beyond the limitations the laws of nature impose.[352] Borghini and Williams are explicit in their dismissal of seeing conceivability as a guide to possibility, but they still want to keep the intuition that the laws of nature could have been different. Following this, the main issue at stake in this chapter is the question of whether or not the fact that we are able to conceive of a state of affairs also implies it is possible. A related issue which is also relevant is the question of how much weight our intuitions should be seen to have in our metaphysical accounts.

[352]As specified in chapter 3, Vetter does not want to make any explicit conclusion about the laws of nature, but keeps the door open for the idea that her potentiality based account of possibility can accommodate possibilities going beyond the laws of nature.

It is hard to exactly define what an intuition, or an intuitive judgement, is supposed to entail, but we may follow (Gopnik and Schwitzgebel, 1998, p. 77) in at least specifying that intuitive judgements are not made on the basis of some kind of explicit reasoning process we can consciously observe. The intuitions rather grow out of an 'underground process', so to speak, which cannot be directly observed. However, as (Kornblith, 1998, p. 130) notes, even though it may be the case that any characterisation of the phenomenon, in one way or another will be contentious, there is no difficulty in giving examples of the way intuitions are *used* as parts of philosophical arguments.

For the purpose of this chapter, however, the topic should be narrowed down considerably. We may specify these issues to the case of the laws of nature, as follows:

1. Is it the case that the fact that we can conceive of, or imagine that, the laws of nature being different implies that the laws are contingent, that is, the *possibility* of the laws being different?

2. Is it the case that the fact that our intuition that the laws of nature are contingent should entail that our accounts of laws of nature and of possibility should reflect this intuition?

There is clearly a substantial amount of distance between the more common view that the laws of nature are contingent and my dispositional essentialist view, and hence this is a question which needs to be addressed. I will argue that the connection between conceivability and possibility is weaker than what it might seem to be, and also that we should be careful when assuming that intuitions can be used as guidelines for which philosophical position we should hold. I will argue that we cannot get knowledge of the possible simply by considering what we are able to conceive of. That is, I will deny that there is an implication going from *conceivable* to *possible*. I will, right away, also dismiss the implication going the other way, that if something is possible we should be able to conceive of it, that is, to visualise it. This idea may be dismissed by looking at almost any example from modern physics at the micro-level. However, the idea that conceivability implies possibility is harder to dismiss.

We should note that the notion of possibility in question is the same as in the preceding chapters, that is, a form of metaphysical, or genuine, possibility, while the conceivable is, I argue, a form of epistemic possibility.[353] We may see conceivability as the ability that each and every one of us have to *picture* some scenario, some situation, or world; in short, to construct something in the mind which involves the *appearance of possibility*. The central question regarding the relationship between conceivability and possibility is whether what we may conceive of or imagine can point towards what is really possible. Some

[353]There is disagreement in the literature regarding this. Gendler and Hawthorne (2002, p. 4) argues that conceivability is not a general guide to epistemic possibility, whereas David Chalmers (2002) claims that conceivability *is* a guide to epistemic possibility.

philosophers argue that there seemingly is an important connection between conceivability and possibility, such that conceivability may give some evidence for possibility, or, the strongest claim; that it will entail possibility. The relevant kind of possibility in question may very well be metaphysical possibility.

In this chapter I shall argue, firstly, that some states of affairs, even if they are easily imaginable, are still not *possible*. Hence, using conceivability or imaginability as a starting point does not give us an answer to the question of what is really possible. It only tells us what we are able to consistently imagine.[354] Secondly, I will argue that intuitions, for example about the laws of nature, do not indicate or give evidence for metaphysical possibility.[355] However, as Lowe has remarked, if we are to *discredit* intuitions as a source of our knowledge about modality, we need to show both how it may be the case that our intuitions are wrong, as well as showing how and why it may be the case that we are able to conceive of things which are nonetheless impossible.[356]

The chapter will proceed as follows. In section 7.2, I look at how conceivability may be seen as a guide to possibility by referring to Hume, and how these views have been further adapted and developed in Lewis' theory of possibility. Section 7.3 explores our intuitions regarding laws. I focus particularly on how their epistemic contingency alongside our ability to imagine them otherwise may be the source of our intuition that the laws are metaphysically contingent. In section 7.3.2, I argue against Alan Sidelle's claim that *a posteriori* necessities are less interesting than they are seen to be in the tradition after Kripke. Section 7.3.3 addresses the apparent need for a separate category of necessity tied to the laws of nature.

Section 7.4 gives a response to Lowe's remarks that we both need good reason to depart from intuition, and that we need an explanation for why we have intuitions which are mistaken. Section 7.4.1 looks at a concrete example aiming to show that our intuitions when it comes to certain laws are not trustworthy. In section 7.4.2, I go into the details which makes the example work. Section 7.4.3 argues that even though some of our intuitions are clearly useful, this usefulness is limited.

7.2 Conceivability as a guide to possibility

7.2.1 A Humean approach

As discussed in chapter 4, when we look at the different accounts of the laws of nature available there are certain philosophical views, such as those which are either fully Humean

[354] I will take the notions of imaginability and conceivability to be largely equivalent terms. Investigating details in the distinction between them is outside the scope of this thesis.

[355] I will use the laws of nature as an example throughout this chapter. Recall that these laws are not equivalent with the scientific laws, that is, the best laws of current scientific practice.

[356] Lowe (2006, p. 142)

or inspired by Humeanism, which will allow the conceived contingency of the laws of nature to be something which implies that the laws of nature *really are contingent*. That is, that possibilities going beyond the laws of nature are seen as genuine possibilities by these accounts. However, as noted earlier in this thesis, we actually find this tendency in explicitly anti-Humean accounts of possibility as well. I want to focus on the Humean reasoning behind this assumption first.[357]

Phrased in the language of possible worlds, the Humean will claim that there exists possible worlds with laws of nature different from ours, because laws of nature are seen as, for example, contingent universal generalisations about how things actually behave. The inspiration from Hume particularly relates to the fact that we are able to imagine various things, contrary to what really is the case. This is used as an argument to support the view that causal connections are not strictly necessary, and that if the human mind is able to conceive of something, we cannot assume this to be impossible.

> 'Tis an establish'd maxim in metaphysics, *that whatever the mind clearly conceives includes the idea of possible existence*, or in other words, *that nothing we can imagine is absolutely impossible.*[358]

We note that the quote is parted in two by 'in other words', something which, according to (Gendler and Hawthorne, 2002, p. 17), indicates that the two linked phrases are equivalent. However they do differ in some important respects, and as Stephen Yablo points out, "As often when Hume takes himself to be saying the same thing twice, he seems here to be saying two quite different things".[359] The first part of the quote concerns conceiving and something *seeming to be* possible, while the second part concerns imagining and something *being* possible.[360] As mentioned already, I will, as Hume seems to be doing, treat conceiving and imagining as equivalent things in this chapter, hence I hold that that particular difference is not especially important here. However, something *seeming* possible and something *being* possible are two very different things, something which makes the second part of the quote the most relevant. Accepting this as a true statement entails holding that the laws of nature *cannot* be absolutely necessary, since we are able to imagine other laws being the case. What is necessary and possible is, according to this view, *mind-dependent*.

As we saw in chapter 4, one of the philosophers declaring his view to be Humean is David Lewis, and through his thesis of Humean supervenience he is able to account for a very wide understanding of possibility. We recall how the so-called Humean mosaic underpinning his view can be described as "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",[361]

[357]Borghini and Williams (2008), as discussed in chapter 3, is an example of anti-Humeans who still advocate a view of the metaphysically possible as something going beyond the laws of nature.
[358]Hume (2007, p. 26)
[359]Yablo (1993, p. 4)
[360]This too is pointed out by both (Gendler and Hawthorne, 2002, p. 17), and (Yablo, 1993, p. 4).
[361]Lewis (1986b, p. ix)

and how this was the base for a particular view of laws. Now we need to specify further details about how the room of the possible becomes so vast according to this view. This might be done by giving two further principles which are presented and defended by Lewis and which relate to possibility more specifically. He states that, firstly, absolutely every way a world could possibly be is a way that some world is, and, secondly, that absolutely every way that a part of a world could possibly be, is a way that some part of some world is.[362]

These two principles seem to tell us that worlds are abundant in some sense, and that we as a result of the principles will have 'possibilities enough', according to Lewis's view.[363] However, concluding this is too rash. The consequences of these principles are *solely reliant on the notion of possibility invoked*. In fact they might very well be satisfied by just *one* world existing, given that all other worlds are then impossible, which is basically what the dispositional essentialist argues, after all. This point is also noted by Lewis, and it is one of the reasons why these principles must be supplemented with something giving us what we might initially have thought were entailed; possibilities enough. In addition to this we also need the logical space to be complete, such that there are no "vacancies where a world might have been, but isn't".[364]

7.2.2 The principle of recombination

Lewis suggests that we look to Hume's denial of necessary connections of distinct existences in order to get these results, and with this in mind he introduces what is called the principle of recombination, a principle which follows from Hume's view. By doing this Lewis takes the Humean views about laws and causation, and subsequently use them to create a thesis about possibility. The main point is this: Because any existence is completely independent of any other, if we have *any* adjacent objects A and B, A can exist without B and vice versa. Following from this we find that objects may also be combined in any way:

> Roughly speaking, the principle is that anything can coexist with anything else, at least provided they occupy distinct spatiotemporal positions.

And further:

> Likewise, anything can fail to coexist with anything else.[365]

Even though Lewis operates with these very broad definitions giving us a notion of the possible that is far wider than the understanding I argue for, he still explicitly states that we cannot without problems infer anything about possibilities from what we can imagine:

[362]Lewis (1986a, p. 86)
[363]The question of whether we have enough possibilities is also what drives the expansions of Borghini and Williams's and Vetter's theories of possibility which was discussed and rejected in chapter 3.
[364]Lewis (1986a, p. 86)
[365]Lewis (1986a, p. 88)

> We imagine a horse, imagine a horn on it, and thereby we are persuaded that a unicorn is possible. But imaginability is a poor criterion of possibility. We can imagine the impossible, provided we do not imagine it in perfect detail and all at once. We cannot imagine the possible in perfect detail and all at once, not if it is at all complicated.[366]

According to this passage, Lewis presents the fact that we may imagine impossibilities as reason for the unreliability of imagination. He holds that there are cases where our ability to imagine will be problematic for *both* possible and impossible scenarios, and thus that arguing for a direct and complete link between the conceivable and the possible is ill-advised. However, even though he is not referring to imaginability as a *criterion* for possibility, he still argues that there is *some kind of link* between the conceivable and the possible, and that this link is an important one:

> We get enough of a link between imagination and possibility, but not too much, if we regard imaginative experiments as a way of reasoning informally from the principle of recombination.[367]

Thus we see that the connection between imagination and possibility is not obtained by considering solely our imaginative abilities, but rather by looking at what he calls *imaginative experiments*. These experiments involve, as the quote states, some form of informal reasoning from the principle of recombination. This means that rather than just loosely picturing the imaginary horse and the horn, we are imagining a unicorn and *inferring its possibility* because it is made by a horse and a horn, and we know that both those two things are possible, because they are actual. By the principle of recombination, we know that these things can then be brought together in the imagined way, thus giving us the image of a unicorn. We can, of course, ask whether this is significantly different from just imagining things to be the case, but it seems clear that it is at least one step removed from pure imagination; imaginative experiments are *acts of reasoning*, not simple acts of imagining.

Lewis's principle of recombination is not only meant to have validity for the things we are more or less familiar with, i.e. the everyday stuff that surrounds us, it should also have validity on scales which are more alien to us, like the scale of the very small for example. This means that he is also able to talk about recombinations of point-sized things, spacetime points, and point-sized bits of matter or fields.[368] As we, by speculating in this way, are moving towards the size scale of the fundamental particles that exist, we see that this principle is also relevant for the laws of nature. This is explicitly stated by Lewis, as a part of his argumentation of why the laws of nature are not necessary:

[366]Lewis (1986a, p. 90)
[367]Lewis (1986a, p. 90)
[368]To borrow the terminology he uses when presenting Humean supervenience in (Lewis, 1986b, p. x)

> Another use of my principle is to settle—or as my opponents might say, to beg—the question whether laws of nature are strictly necessary.[369]

The laws cannot in general be seen as necessary while still holding on to this principle, as the entities connected by the laws have no necessary relations to each other, and can be combined in any way. If we look at a concrete example, we get some idea of just how large the room of the possible is in Lewis's modal metaphysics. In *On the Plurality of Worlds*, he speculates that positive and negative charge might not be, strictly speaking, incompatible, but that we may picture that this is something that has happened by accident or by contingent law in our world.[370] In this example we are no longer talking about objects, but of properties, but the principle remains the same: the properties are completely independent of each other—anything can coexist with anything else—and following from this we get the result that properties which are incompatible in our world *need not be* so. That is, we might conceive of something which is indiscernible from an electron, for example, but which has both positive and negative charge at the same time. Even if this is precluded by the actual laws of nature, that does not mean that such combinations of properties are impossible.

By presenting such a case, Lewis is able to argue that we can have certain kinds of possible alien individuals, for example an elementary particle that has both positive and negative charge, grounded in the principle of recombination, and taking only actually existing properties into account. The particle from the example will as a result be alien in *some* sense, but it will still have no alien properties, as both properties exists in our world as realised possibilities, they are just combined in a new way.

However, creating alien individuals from this-worldly properties is *not* enough if we are to have a framework of possible worlds and individuals which is satisfactory according to Lewis. In addition to these individuals which are made from duplicates of actually existing parts of things, his theory also makes room for the principle of recombination to apply in such a way that in some possible worlds there will also exist individuals who are made up of parts that are *not* existing in our world. Worlds with alien individuals will be alien worlds, and the principle of recombination also applies to these. Since the alien properties, like any other properties, may be combined in *any old way*, there must be a lot of alien worlds, as well as worlds which have both this-worldly and alien properties instantiated. Hence, the room of the possible according to Lewis's theory is quite enormous.[371]

[369] Lewis (1986a, p. 91)

[370] Lewis (1986a, p. 92)

[371] However, it should be noted that Lewis (1986a, p. 114) does state that we are *not* entitled "just to make the truth be one way or another by declaration. Whatever the truth may be, it isn't up to us." It should be added that it seems to be *highly problematic* to answer the question of how we are to get any sort of knowledge of these alien worlds and alien objects, but this is outside the scope of this thesis.

7.3 Intuitions regarding laws, and arguing against them

7.3.1 From epistemic to metaphysical contingency?

We have several intuitions about laws. One of the more common intuitions is that things contrary to the laws of nature, metaphysically speaking, could happen.[372] As mentioned both in the introduction to this chapter, and also elsewhere in the thesis, accepting dispositional essentialism entails that we also have to accept that our account of laws of nature might be colliding with our *intuitions* about those laws. In order to make sense of this situation it is useful to try to figure out from where our intuitions about the laws of nature come.

One suggested explanation, found in for example (Ellis, 2001), focuses on how the laws are clear examples of something which is epistemically contingent, and that we *because of this* make the mistake of classifying them as *metaphysically* contingent as well. That is, the epistemic and the metaphysical possibilities seems to get mixed up when we assume that knowledge of possibility may be gained from the fact that something is conceivable:

> The imaginability test of possibility thus confuses what is really possible with what is only epistemically possible. It purports to be a test of what could, really could, occur in some given circumstances, when in fact it tells us only what we are able consistently to imagine happening to things that are superficially like those that exist in these (or in superficially similar) circumstances.[373]

According to Ellis, what happens in these cases is that something (in this case the laws of nature), is epistemically contingent, and because of this we conclude that this something must therefore *also* be metaphysically contingent. As a result we end up with some form of confusion of terms, where the domain of epistemology and that of metaphysics are not separated from each other as they should be.[374] However, I want to point out that this explanation is a bit too simple if it is supposed to be a general answer to the question of why people take the laws to be metaphysically contingent. In addition, stating that your opponents are mixing up the domains of epistemology and metaphysics is quite a serious accusation. At the very least we can be pretty sure that this will not be the case for *all* proponents of the contingency of the laws of nature, and because of this we should investigate whether some other explanation could give a better analysis of the situation.

We find a slightly different explanation in (Bird, 2007), where he argues that the fact that the laws are epistemically contingent does not suffice as an explanation for why we commonly see the laws of nature as metaphysically contingent as well. That is, arguing that this is a confusion of domains is not enough:

[372] This is referred to as the 'traditional view' in (Bird, 2007), and as the 'standard view' in (McKitrick, 2018).

[373] Ellis (2001, p. 233)

[374] This argument is also in line with Saul Kripke's general claims in (Kripke, 2005) and (Kripke, 1981).

> [A] direct inference from epistemic contingency to metaphysical contingency is too poor to be, as it stands, a convincing explanation of apparent metaphysical contingency.[375]

Bird holds that if we are to explain what he refers to as *the illusion of nomic contingency* we need to focus on how this illusion is created from our ability to *imagine* the laws being different. This point must *also* be included if we are to understand this properly, and it clearly goes beyond arguing that we are inferring metaphysical contingency because something is epistemically contingent. The intuitions that result from this ability to imagine are, it should be noted, influenced and limited by our prior knowledge, and also by our beliefs about the laws of nature. We cannot imagine things without having *some* ideas about what may or may not be possible already, that is, we need a certain amount of knowledge about the relevant substances or ideas involved in what we are imagining as a starting point from which we may begin to conceive of further happenings.

In the case of the laws of nature, this could be knowledge of the natures of the substances involved in a law, experience of how they tend to behave, knowledge of their essences, and so on. By using this knowledge, or apparent knowledge, as a starting point, we are able to picture things that may happen to the substance in question, but the picture we are capable of making is *determined* by our prior knowledge about the subject. Thus, the epistemic possibilities we gain from being able to imagine things might be in such a position that they are overly coloured by the highly fallible ideas we already have. They depend on us, our knowledge, and our history. What we refer to as metaphysical or real possibility, however, depends on what *really is the case*. These possibilities, I argue, depend on the dispositional essences of the properties of things, and they are also limited by these essences. Hence, there will be cases where what is really possible collides with what *seems possible to us*.

We may say that it was easier to postulate the laws of nature as contingent before the argumentation for the necessary *a posteriori* was presented by Kripke and Hilary Putnam.[376] However, after the discovery of such necessities, which are neither analytical nor *a priori*, this claim became harder to make.[377] We note that the *a posteriori* necessities are such that we may be able to conceive of their falsity, while it is at the same time the case that this falsity is *absolutely impossible*. When the *a posteriori* necessary truths were shown to be a real thing, such that our intuitions regarding these statements had to be wrong, this made it problematic to argue that we can establish possibility in general by conceiving of things. We may be able to conceive of the situation where Clark Kent is not Superman, while we at the same time know that the identity between Clark Kent and Superman is absolutely necessary. The question we need to ask is whether it could be the case that the laws of nature are in the same situation? Recall the comparison between laws

[375] Bird (2007, p. 179)

[376] See (Putnam, 1979) in addition to (Kripke, 2005) and (Kripke, 1981).

[377] We note that if all and only *a priori* truths were necessary truths, then conceivable truths *would have been* possible truths. (Gendler and Hawthorne, 2002, p. 32)

of nature and identity statements between names in chapter 5; this is yet another situation where the two cases are similar. In that case we would be able to conceive of the laws of nature being different even if this is impossible, something which makes the idea that the laws of nature should be seen as contingent less robust.

Sidelle (2002), however, argues that while there *are* necessary *a posteriori* truths, they are not necessary in any *interesting* sense, and they are also unconvincing as an argument against the use of imagining or conceivability as a way to gain modal knowledge. The laws of nature are, much in the same way as the necessary *a posteriori* truth, necessary in a sense that is not as interesting as it may seem like at first glance, he claims.[378] Thus Sidelle argues along the lines of what is in general known as *rationalist* theories of modality, which are grounded in the idea that even though *a posteriori* necessities exist, we may acquire significant modal knowledge through *a priori* means, such as conceivability.[379]

7.3.2 'Playing the role of'

As an example of a statement that seemingly reflects deep metaphysical facts about the substance in question but which should nonetheless be seen as not having such implications, Sidelle focuses on the fact that water is H_2O. The statement 'Water is H_2O' is, according to him, derived from a combination of, firstly, some analytic principle of individuation, and, secondly, some particular empirical finding. In this case the analytic principle is that nothing counts as water in any situation unless it has the same deep explanatory features as the stuff *we* call 'water', and the empirical finding is that the deep explanatory feature of water is that it is being composed of H_2O.

This indicates that these kinds of identities, rather than being metaphysically interesting because they are saying something about the necessary constituents of a substance, are just examples of some kind of analytic principle of individuation.[380] The modal force of *necessary a posteriori truths* are thus, according to Sidelle, best understood as something *analytical*. That is, as something that is representing linguistic conventions as opposed to revealing metaphysical features of reality. There is disagreement in the literature regarding whether statements like 'Water is H_2O' are laws or if they are just stating facts about the composition of the substance in question.[381] I see no reason to stretch the concept of laws such as to include statements of necessary composition, but this is not of particular relevance here, as Sidelle's arguments are the same for *a posteriori* necessities as they are for laws. The way he portrays these things, it is the same kind of convention-based necessity which is established both by laws and other *a posteriori* necessary truths.

[378] Sidelle (2002, p. 310)
[379] Vaidya (2016)
[380] Sidelle (2002, p. 319ff.)
[381] Armstrong would for example not see such statements as laws. This is briefly discussed in (Bigelow et al., 1992, p. 382), where they argue that the distinction does not matter, and that these kinds of statements dealing with necessary composition can be referred to as 'laws'.

To illustrate that statements like this will only show us how the scientists *use* the terms, and that the necessity is only based in analyticity, Sidelle claims that even though we cannot have any worlds where water, as defined by us, is not H_2O, there *are* worlds where some other stuff than H_2O *plays the role of water*:

> [T]here are worlds in which stuff other than H_2O does basically what water does, and occupies the roles that water does here.[382]

This means that we are supposed to imagine something that looks like water and plays the *actual* water-role, and that the term 'water' is used to pick out *this* substance rather than H_2O.[383] However, in this case we need to ask what the phrase *the role of water* is supposed to mean. We also need to be clear about what the statement 'doing basically what water does' is supposed to encompass. This is not clearly specified in Sidelle's argumentation, but we can try to carve out a couple of possible interpretations. First of all, the statement 'doing basically what water does' can be seen as pointing to a substance doing *sufficiently many* of the things water does, but this is remarkably vague, and leads into a discussion of how many and which properties of water are the relevant ones for this otherworldly water to possess and which are not. Who is to be the judge of this? How do we know when the otherworldly water is *sufficiently* like our water to actually be able to play that role? This interpretation does not seem very fruitful, as it creates a whole set of new, and hard, questions to answer.

We could, instead, assume that 'doing basically what water does' means that the otherworldly water should fill *all* the functional roles that our water fills, and see if this helps the situation somewhat. If this is our starting point, the circumstances are at least substantially less vague, but there are still a couple of questions which need answering, independent of which interpretation we settle with. Firstly, we need to ask if there is even a possibility of some other substance playing the role of water if we are limited by the same chemistry as we have in the actual world. That is, could some other mix of the chemical elements produce something which was able to play the functional role of water, or is this statement in effect also assuming the possibility of a completely different chemistry to ours?[384]

Secondly, if we agree that in order to have *something else* behave as water we need a completely different chemistry to be in place, we must ask whether it is indeed possible that this completely different substance can enter into all the roles water enters into, in order to fully behave as water. For example, is the *otherworldly water* potentially life-sustaining

[382] Sidelle (2002, p. 319)

[383] This seems to be in line with Chalmers's two-dimensional semantics, which suggests that there will be different answers to the question if water could have been something else than H_2O, depending on how the question is interpreted. Answering yes will indicate that we are thinking about what 'water' would have picked out in a world of the kind Sidelle describes here, where something else plays the water role. Going into details regarding two-dimensional semantics will be outside the scope of this thesis. See (Chalmers, 2004) for details.

[384] A different, but related, question is if a completely different chemistry is possible at all.

in the same way our water is? It seems to me to be the case that *if* we postulate that some other substance is playing the role of water, this other substance must also *be able to* play the same role water does in the creation and sustaining of life. Would we agree that something was *playing the role of water* if this part of the water-role was left out of the picture? I think not. Following this, we also need to ask whether we should also assume some radically different lifeforms living in this world, as the life we have in this world is completely dependent on H_2O, and not on some substitute substance. If this is the case, it seems that we, by postulating *otherworldly water* are also postulating a world so far removed from ours that it would definitively not count as a way *our world* could have been? After all, this is a world with a completely different basic structure than our world, it would have to be if we are to have a *completely different* chemistry supervening on it. Because of this I hold that this is a world that is *at the very least* irrelevant for modal questions in our world.[385]

If we think about the roles that water plays in our world, it actually seems that something supposedly *playing the role of water*, while not actually being H_2O, will have problems entering into the roles the substance is supposed to have according to the stipulation. It seems like this *otherworldly water* cannot easily enter into most of the roles that water has in our world, except that it *might* be able to look like water, keeping things afloat like water, and interact with some parts of the environment like water, that is, it might be able to, for example, dig out a valley in the same way as our water does. Thus, if we assume that 'playing the water role' entails that the substance in question should enter into *all* the roles that H_2O enters into, then *only* H_2O will be able to do this.

In order for something else to play this role, there needs to be some restrictions regarding how the 'role of water' is to be understood. The understanding needed must in a sense be *less rich* than '*everything* water does'. One could, for example, argue that we should only include the knowledge we had about water *before* we knew anything about its chemical structure, or that we should restrict it to strictly phenomenal aspects of water. But then we will again be faced with the problem of *vagueness* mentioned earlier. No matter how we try to restrict this it is hard to find good arguments in favour of one particular restriction rather than another. There does not seem to be any reasons for just *how* restricted this should be, nor good reasons for why we should settle for a particular restriction rather than another.

Sidelle, however, seems to hold that the only thing ruled out by the *a posteriori* necessity that water is H_2O, is that the stuff playing the water role in other worlds is such that, given the rules of English, we cannot call it 'water'. He sees it as misleading to speak of essences and natures as if they were more than semantically determined. This entails that appealing to the *essence* or *nature* of something as an argument for why we cannot simply assume

[385]Referring back to the discussion of conservative versus radical necessitarianism in chapter 5, section 5.3.2, it seems that someone like Bird might actually go so far as to deem such worlds impossible.

the possibility of other things playing the roles of these substances in other worlds will not work, according to Sidelle, as the essences we are appealing to are just reflecting the meaning *we* associate with them.[386] Nevertheless, even though it is a conceivable scenario that experiments in some world might some day show evidence that water is not H_2O, seeing this as a genuine possibility, by referring to linguistic conventions seems far-fetched. This is also addressed by Gendler and Hawthorne as follows:

> [T]he loose and inaccurate statement that water might not have been H_2O is a faulty attempt to convey the perfectly acceptable thought that there might have been a community that was an epistemic duplicate of our predecessors that rigidly denoted some stuff other than H_2O by 'water'.[387]

If we compare Sidelle's position with the one I have been defending in this thesis, it is clear that the arguments he puts forward are in stark contrast with the essentialist explanation I favour. Opposing his suggestion I hold that the fact that water is composed of H_2O is something which is metaphysically necessary, and the only thing fully able to play the role of water is water itself.

7.3.3 Nomic necessity as a middle ground

Another example of how the conceivable may be tied to the possible, in the case of the laws of nature, is found in (Chalmers, 2002). He argues that it does indeed seem conceivable, *and thus metaphysically possible*, that something could travel faster than light, even though this is clearly not physically possible. In the following quote we find argumentation for the metaphysical contingency of the laws of nature explained with reference to *both* our ability to conceive of them being different *and* our intuitions about metaphysical possibility:

> This case may be metaphysically possible, however, since there might well be metaphysically possible worlds with different laws. If we invoke an intuitive conception of a metaphysically possible world as a world that God might have created, if he had so chosen: it seems that God could have created a world in which an object travelled faster than a billion meters per second. So in this case, although conceivability does not mirror natural possibility, it may well mirror metaphysical possibility.[388]

This quote exemplifies the fact that it is common to supply the view that conceivability points towards metaphysical possibility with argumentation for the need of a *separate*

[386] Sidelle (2002, p. 332)
[387] Gendler and Hawthorne (2002, p. 37)
[388] Chalmers (2002, p. 146). Gendler and Hawthorne (2002) also notes that conceivability has typically been taken to point towards the metaphysical possibilities, although they are not talking specifically about laws.

form of necessity, a particular necessity regarding laws. As discussed earlier in this thesis, particularly in chapter 4, this kind of necessity is usually referred to as *nomic* or *natural* necessity, because we also have a, perhaps equally strong, intuition that the laws should have *some form* of necessity tied to them. Chalmers is apparently managing to cater to both of these intuitions in the passage which is quoted, by clearly separating the metaphysical from the natural possibilities. The form of necessity associated with laws is seen as weaker than metaphysical necessity, hence fewer things will be seen as nomically or naturally possible than metaphysically possible. This view is also held by Fine (2002), who argues that none of the main forms of necessity (metaphysical, natural, and normative) can be reduced to any of the others. We also recognise this view as being similar to Armstrong's nomic necessitation discussed in chapter 4 of this thesis. Hence, we see that there are several different philosophers arguing, quite forcefully, that there *is* a need for more than just the one kind of necessity I argue for.[389]

However, we recall from chapter 5, the dispositional essentialist view of laws entails a kind of collapse, where the domain of the metaphysical possibilities and necessities ends up being exactly the same domain as that of the nomic possibilities and necessities. That is, there are no possibilities going beyond the laws of nature according to the view I give my support to. Because of this, I have aimed to show, throughout this dissertation, that getting rid of the category of nomic necessity *is* defensible. Not only that, but I also hold that the identification of the natural necessities and possibilities with the metaphysical ones is a *positive* feature of the account of properties and laws I support—it makes it more parsimonious. As proposed and defended in chapters 2 and 5, this will follow from understanding the laws as determined by the dispositional essences of properties. To recap, this is because this explanation, with its focus on properties, gives a picture of the laws as metaphysically necessary, *de re*. As a result, there is no need for a separate form of necessity for the laws, as the natural necessities are already seen as being reducible to metaphysical necessities.[390] What is important to note, however, is that when the laws are understood in this way, the question regarding the possibility of different laws of nature is not merely a question regarding some restricted form of necessity, the natural necessity, but rather a question about *genuine metaphysical modality*.

It is clear that we cannot argue against the fact that it is quite easy for us to imagine the laws being different, and we cannot argue against people having certain intuitions about the laws and their metaphysical status.[391] In addition, our intuitions seem to be strengthened by the fact that laws are seen to be the product of more or less reliable empirical investigations. That is, throughout history our view of what the correct laws of

[389]Logical necessity aside.

[390]Or *vice versa* of course. I address one of the reasons why we might want to speak of metaphysical rather than nomic possibility and necessity in these cases in chapter 3, namely the wish to describe the metaphysical in a way that makes it less mysterious and less vague, as well as tying the metaphysical to actual properties in the actual world.

[391]Recall that the laws of nature discussed are not the scientific laws we have today.

nature are have been revised over and over again, and because of this it *seems like* they are not absolutely necessary. All of these features taken together may well be viewed as something that ground our intuition that the laws of nature could have been different than what they actually are. This means that if we wish to argue that the laws are necessary in the strongest sense, we have to argue *against* our intuitions. It also means to say that in certain philosophical debates intuitions should not be allowed to play a significant role, *even though* they may be strong intuitions. This may be seen as problematic:

> [M]any philosophers have strong intuitions that natural laws are not necessary in the strongest possible sense—that a natural law which obtains in this, the actual world, need not obtain in every possible world.[392]

Intuitions like these, which many philosophers have, are often seen as pointing towards the idea that the laws of nature are providing some weaker form of necessity than metaphysical necessity, as mentioned above. However, it appears that the highlighting of the role played by intuition is often not backed by argumentation strong enough to show that the intuitions may indeed be allowed to play this particular part. For example, in Lewis's case, there *are* clear arguments for why we should let conceivability play a restricted role in our explication of possibility. The question is whether we are willing to accept these arguments, as well as the further philosophical framework related to them more generally (in the case of Lewis's metaphysical framework).

At other times, as in the Lowe quote above, we are just presented certain suppositions, where it seems to be implicitly assumed, though not explicitly argued for, that conceivability should have *some* importance when it comes to judging what is and is not possible. So while we cannot argue against the fact that this is a common intuition to hold, it should still be investigated whether this intuition should be given any significant role when it comes to our judgements about the laws of nature. That is, we should be more sceptical that the intuitions are suitable to play this role.

In chapter 3, we saw how Borghini and Williams explicitly argue for a notion of metaphysical possibility which goes beyond the laws of nature. Also, we saw that Vetter does not want to reach a conclusion about this, but keeps the door open for this being the case. Thus, giving intuitions substantial influence on philosophical theories is not something which is limited to those accounts I have categorised as more or less Humean. Whereas Borghini and Williams do not present specific details regarding this issue, Vetter is putting *considerable weight* on intuitions when it comes to figuring out what should be seen as possible according to her view. We recall how there are conflicting intuitions at play when it comes to the relations between dispositional accounts of possibility and the laws of nature. This was so, firstly, because the metaphysically possible is commonly seen as a very wide category of possibility—encompassing more than what is possible according to the laws of

[392]Lowe (2006, p. 142)

nature—whereas it does *at the same time* not seem to be the case that something could have a disposition to violate an actual law of nature.[393]

This is, particularly for Vetter, grounded in *extensional correctness* which can be explicated by the following two points:

1. We have certain 'firm convictions' about what is metaphysically possible and what is not[394], and

2. these firm convictions should mostly come out true on any metaphysical account of modality.[395]

Whereas one can argue that we should not allow intuitions such a role in philosophical theorising, we cannot deny that the intuition that the laws of nature are contingent is a common intuition to have. Hence, if we are to argue that the laws of nature are necessary, it is important to figure out how and why it may be the case that we, in this circumstance, seem to have strong intuitions that point towards making wrong conclusions regarding possibility. In the next section I will present an example showing how our intuitions, although seeming sensible, can be shown to be wrong.

7.4 Showing intuitions to be mistaken

As mentioned in chapter 5, both Vetter (2015, p. 247) and Lowe (2006, p. 142) specifies that we need to be able to come up with good reasons if we want to argue for philosophical standpoints which goes *against* what our intuitions tell us. Since it is well established that the dispositional essentialist claims that the laws of nature are necessary, and that the domain of the metaphysically possible is identical with that of the nomically possible, it would follow that the burden of proof is on the essentialist side of the table. They are the philosopher that so clearly have the commonly held intuitions against them. Recall the following claim made by Lowe:

> [W]e would need to be given good reasons for thinking that these intuitions are mistaken, as well as some explanation for our possession of those intuitions despite their being mistaken ones.[396]

[393]Vetter (2015, p. 281-282)

[394]Note that it is not always the case that we intuitively judge too much to be possible. If we stick to the idea that intuitive judgements are those which are not being made on the basis of an explicit reasoning process, we can say that one such 'firm conviction' could be that we cannot make lead into gold. We've heard about the failed alchemy experiments, and the endeavour has been portrayed as ridiculous, so we might settle with the conviction that this is impossible. However lead, bismuth and mercury have all been successfully turned into gold, although at an astronomical cost economically. See, for instance, (Aleklett et al., 1981).

[395]Vetter (2015, p. 15). I take these 'firm convictions' to largely correspond to what has been referred to as *intuitions*.

[396]Lowe (2006, p. 142)

This entails that we *both* need to examine where our intuitions may come from, and that we *also* have to investigate whether we have any reasons for giving them any evidential significance, or if we have stronger arguments for accepting an account of laws and properties which goes against our intuitions. We have to ask ourselves if our intuitions and our ability to imagine the laws being different than they actually are should be seen to reflect their modal status, or if this puts the human cognitive ability in a position it should not be in.

7.4.1 An example: salt dissolving in water

In this section I will give a response to Lowe's claim. I have already noted that there are two different things addressed in the quote, and I will focus on them in turn. Firstly, he asks for good reasons to abandon the strong intuitions we have, and secondly he demands an explanation of how we have come to hold erroneous beliefs regarding possibilities. The second part of the claim has already been discussed to some extent in section 7.3 of this chapter, but I will return to this question in section 7.4.3 as well. In order to address the first part of the remark, I present a concrete example, discussed in the literature, aiming to show that our intuitions are not trustworthy when it comes to at least some of the laws of nature.[397] If we are able to establish that some laws which were initially viewed as contingent can be shown to *still* actually be necessary, we are in effect undermining the conceivability grounding their contingency. If we are able to do this, we are also responding to the first part of Lowe's remark, that we need good reason to abandon our intuitions. It should be noted that if our quite strong intuitions may be shown to be wrong in *this* respect, this might be seen as an argument not to trust our intuitions blindly in other cases as well. In fact, one of my aims in this section is to show that we are not just dealing with a single counterexample in this case, but rather with a *more general argument*.

So far in this chapter I have presented reasons to assume that the laws of nature are contingent; we have the force of intuition, our ability to imagine them being different, and the fact that they are epistemically contingent. This entails that in order for our examples to be effective in showing that our assumptions about the modal status of the laws of nature are often mistaken, we need to find cases which are clearly imaginable, but which are also epistemically contingent and *a posteriori* as well. If we are able to find such examples, they will undermine the reasons for assuming the contingency of laws presented in this chapter. A successful counterexample will give us reason to argue that those plausible groundings of the claim that the laws of nature are contingent are unreliable. In short, a successful argument would mean that we should be very careful regarding what work we assume our intuitions are able to do in modal metaphysics.

Let us now turn to the salt example. To make sure that this example has consequences

[397] This example is discussed in, for example, (Bird, 2001), (Psillos, 2002), and (Beebee, 2002).

for the advocate of a Humean or generally categoricalist view of modality, the example is presented as a thought experiment, where the fundamental laws considered are assumed to be *contingent*. In addition, there are no parts of the argument that rely on us having a dispositional essentialist view of modality (or laws, or properties). This means that even if our most basic laws should prove to be contingent, we can show that some supervening laws will *still* be necessary, in a non-trivial way. No matter what starting point we have regarding the modal status of the fundamental laws, we end up with some important laws being necessary. That is, the thought experiment shows that there are two situations we can be in, as follows.

1. The fundamental laws are *necessary*, and the supervening laws will *also* be necessary.
2. The fundamental laws are *contingent*, but some important supervening laws are *still* necessary.[398]

The law in question in the example is the supervenient, or higher-level, law that salt dissolves in water. It is supervenient in the sense that it depends on several lower-level conditions being the way they are; notably the chemical structure of salt, the chemical structure of water, and the particular relationship between these two substances that ensures that the one dissolves in the other, especially Coulomb's law of electrostatic action. In addition, we note that it is clearly conceivable that salt could fail to dissolve in water, so an important part of the thought experiment is to consider what would have to be in place in a world where the law that salt dissolves in water turns out to be false. That is, we wonder which features of the world are different in this case, leading to the wanted result.

In the *actual world*, *NaCl* and H_2O are related by Coulomb's law through the electrostatic attraction, a force of attraction which supervenes on Coulomb's law. The very existence of *NaCl* depends on a set of lower-level laws, and Coulomb's law is a part of this set. A surprising claim is that *if any of the laws in the set are false, then NaCl necessarily does not exist*.[399] When we assumed that it could be possible for salt not to dissolve in water, this was clearly not the kind of result we anticipated. In order to see how this result might still be the case, let us look at the details of the argument.

I have already described how it is the case that the law that salt dissolves in water supervenes on Coulomb's law of electrostatic action, and that this lower level law is *sufficient* to make salt dissolve in water. If we claim that the laws of nature are contingent, we will assume there to be some world where it is not the case that salt dissolves in water. However, for this to be the case it turns out that Coulomb's law must *also* be false in that world, as this is one of the more fundamental laws *responsible* for the fact that salt

[398] Bird (2001, p. 267f.)
[399] Bird (2001, p. 272)

dissolves in water.[400] Given what salt is constituted of, and the ionic binding between the atoms in the molecule, the force of electrostatic action is *sufficient* for the salt's sodium and chlorine ions to dissolve in the water. Hence it is the case that a world where it is *not* the case that salt dissolves in water is a world where the electrostatic force as described in Coulomb's law does not exist either. In order to ensure that salt not dissolve in water, we have to make sure we remove that in virtue of which salt actually dissolves in water.

This world, without Coulomb's Law, contains another important fact as well. If we look at the compounds of common salt, *Na* and *Cl*, and the binding between them, we note that it is precisely the electrostatic force that is responsible for keeping the ions together. So the force we have just stipulated as non-existent, as a result of salt not dissolving in water, is responsible for keeping the ions of the salt molecule together. This means that a world without the force keeping *Na* and *Cl* together, is *a world without salt*.

Hence, we can draw two important conclusions from this thought experiment. Firstly, we may say that *if the law in question is false*, then *at least one* of the substances related by the law does not exist. Secondly, we can state that *if the substances related in the law exist*, then the law in question is *true*, and *must be true*. This means that we also have the biconditional that the law is true *if and only if* the substances in question exists; there will be no possible case where we have the substances but do not have the relevant laws. A further consequence in this case is that *even if* some of the fundamental laws grounding Coulomb's Law should prove to be contingent, it is *still* necessary that salt dissolves in water:

> The law is necessary in the current manner because of the subtleties of the way in which it supervenes on the lower-level laws. Those subtleties tend to escape the attention of even those among us who knows what is going on beneath the surface (one rarely engages in physical chemistry and modal metaphysics at the same time).[401]

The features that make the important contribution to how this example works are, as Bird points out, hidden completely for those of us who do not know the chemistry. It seems naive to assume that this is the only such case. The main feature of interest here is the fact that it is the same lower level law and the same force which is responsible *both* for salt dissolving in water *and* for salt actually existing as a composite substance. This means that there is no metaphysical possibility that salt could fail to dissolve in water. At the same time, note that the situation is clearly epistemically contingent.

There are some important things to remark about this thought experiment. First of all it is *not*, and is not meant to be, an argument for the necessity of the laws of nature

[400] I specify 'lower level' and 'more fundamental' because even though Coulomb's law is a law operating on a considerably *more* fundamental level than many other laws, Coulomb's law *in itself* also depends on more fundamental features of the world.

[401] Bird (2007, p. 178)

in general, because it does not capture all laws. It captures only some of them, and these are not the fundamental ones, so we cannot rightfully use it as a general reason. It may, however, be used as an argument in favour of *not trusting our intuitions blindly* when it comes to the laws of nature. If we take this example seriously, arguing that our intuitions regarding the contingency of laws should always be followed does not carry a lot of weight. Thus we may also infer, as Bird does, that "the force of intuition is a very weak argument against the dispositionalist claim that all the laws of nature are necessary".[402] Since our intuition can be so wrong in this particular case, we should not assume it to be correct when it comes to the fundamental laws either.

7.4.2 Objections and the down-and-up structure

Bird's article 'Necessarily, Salt Dissolves in Water' has been met with criticism from, among others, Beebee and Psillos.[403] Both of them suggest that the conclusion that salt *necessarily* dissolves in water is wrong, but they use different strategies to get this point across. Beebee suggests that in another possible world, Coulomb's law could be a *disjunctive* law, that is, most of the time it will be identical to Coulomb's law in the actual world, but not always, and when it operates in the alternative way, salt will *not* dissolve in water.[404] Beebee's title 'Contingent Laws Rule' suggests that she thinks the contingency of the laws of nature is a prevalent feature of them, and not something which relates to this example alone.[405] I am not persuaded by Beebee's point.

What is particularly troubling about Beebee's argument is, firstly, the way she assumes that in the situations when Coulomb's law fails to hold—when the alternative law holds instead—there is no particular *reason* for this happening.[406] Her example is simply postulating a *significantly different world* without there being any particular circumstances leading to this difference in Coulomb's law operating (the fact that it is a *disjunctive* law in this world): it just happens for no particular reason, so it seems *ad hoc*. Secondly, she just assumes this stipulation to represent a metahysical possibility, with no further qualification for *why* this would be the case except stating that she sees "no reason to suppose that it is not a possible world".[407]

No dispositional essentialist would agree with Beebee's way of seeing laws as brute facts which can just happen to be one way or another, but her view of the laws and of properties entails that she will be able to make such claims, because the parts of a world are much looser connected to each other on her view.[408] Assuming that a law which is

[402]Bird (2007, p. 179)
[403]Beebee (2002), Psillos (2002)
[404]Beebee (2002, p. 253-254) The details of the alternative equation is not important.
[405]This is in line with (Beebee, 2000), which was mentioned in chapter 4.
[406]Beebee (2002, p. 253f.)
[407]Beebee (2002, p. 253)
[408]See chapter 4 for a discussion of different views of laws compatible with this general categoricalist view of the world.

saying something about charge can be disjunctive, and that it can be like this without any particular reason can, for example, be seen to entail that one variety of the law might be fundamental—not depending on anything else—whereas the other version might not be. But in the actual world Coloumb's law *does* depend on other features of the world having to do with charge. This means that if we propose to change Coloumb's law, other things will have to change too.[409] Coulomb's law and charge do not exist independently of each other.

Psillos's reply is different, and does not deal with Coulomb's law and salt as a composite substance. He suggests instead that water possibly could have been structured in a slightly different way, thus making it less polar, enough to strip it of its role as a solvent, while still retaining its identity as water.[410] Thus, Psillos is able to avoid stirring the features of the argument making it work the way it does, namely the relationship between the truth of Coulomb's law and the existence of salt. This relationship is left the way it is. Because water can plausibly still be seen as water even after this change has been postulated, Psillos holds it to be "perfectly possible (metaphysically) that there is a world w in which water does not dissolve salt".[411] Yet again, we see that it is assumed that metaphysical possibilities can be made possible simply by way of statement. In this case it should be clear that it is defensible that the substance in question might still, rightfully, be seen as water *without* this entailing that the world described is a *possible* world.

I will avoid debating whether or not the substance in question is to be classified as water or not, because in this case we can argue against Psillos even if the changed substance is correctly ascribed to be water. In order to show this, we need to look at some more general mechanisms which lie behind the situations described in these examples. We will return to Psillos's concrete case later. What should be noted about *both* these replies, however, is that they attempt to find counterexamples, but they both fail to see the bigger picture which lies *behind* the example. This might be because Bird himself pays too little attention to this when presenting the example (in his (Bird, 2001)), focusing instead on the details making it work. This is rectified in (Bird, 2002), where he is replying to both Beebee and Psillos. There he is examining the more general tendencies *underlying* the case of the salt and water. Let us examine this topic now.

As noted earlier, I hold that dispositional essentialism is a *holistic view* of properties and laws. This is an important feature of it, when compared with the other views discussed in this thesis. One way of seeing this is by noting what Bird (2002) refers to as the down-and-up structure of laws. An important consequence of this structure is that the example about salt and water, although being particularly clear and simple, is not *unique* in any way. What is described in the example are general tendencies manifested in the relationship between higher-level laws and lower-level laws, or between these sets of laws and properties

[409] Recall the holism discussed in chapter 6, and the dispositional essentialist *web* of properties.
[410] Psillos (2002, p. 255-256)
[411] Psillos (2002, p. 256)

or phenomena. The more general point is this. Certain (perhaps all) higher level laws of nature might turn out to be necessary because of the way they supervene on the lower level laws. And certain substances, such as salt, might necessarily have certain properties because of the same relationship. In the salt and water example this was extremely clear because it was *the same law* being responsible for both the fact that salt exists *and* the fact that salt dissolves in water. All other examples may not be as clear as this, but it is the same relationship between higher and lower level laws which is at play. Here is the structure I have in mind:

1. Higher level law L concerns substance S
2. The identity and existence of S entail that one of a family of closely similar lower level laws $\{C_i\}$ must hold.[412]
3. At the same time, L supervenes on the lower level laws in such a way that if any of $\{C_i\}$ holds, then L would also hold.
4. Hence: The existence of S entails that L holds, and so there is no world in which S exists but L fails to hold of it.[413]

To show how this would work also for cases which are perhaps slightly less striking than the one just discussed, Bird (2002, p. 259) briefly proposes yet another example showing that the same structure is in play when it comes to the behaviour of the elements of the periodic system. These elements are also composed of more fundamental entities, and because of this they display certain lawful behaviour which reflect non-fundamental or higher level laws. One such behaviour is that the elements, when heated to incandescence, emit light radiation at distinct *discrete* wavelengths. This emission spectrum is one of the 'signatures' each element makes, that is, each element has a particular spectrum which can be used to identify it, for example when we want to know what a particular star is made of.

However, we can ask whether this emission spectrum is a necessary feature of the elements. It is easy for us to imagine that the emission spectrum of Hydrogen, for example, was not those discrete and distinct four lines but rather *continuous*, similar to when light pass through a prism. Thus, we might also have the idea that this is a *metaphysical* possibility. In light of the reply arguments from Beebee and Psillos I cannot see that this statement is in any worse condition than the statements they propose as possibilities in their replies to Bird. What we need to ask in this case, and what both Beebee and Psillos *fail to ask* is two questions. 1) Where is the change in question is supposed to come from? and 2) Which consequences will this counterfactual change have for the world in total?[414]

[412] In the case of the salt and water example, all of these laws would be such that if they allowed the existence of salt, they would also lead to salt dissolving in water.

[413] This captures (Bird, 2002, p. 258)

[414] This was also discussed in chapter 6, section 6.3.2.

A world where Hydrogen, or any other element, emits a continuous spectrum would have to be a world where the behaviour of the electrons were not quantized, that is, it would be a world without quantum mechanics. And even if some of the building blocks of our world could *perhaps* exist in a world without quantum mechanics, the atoms of our world could not.[415] As discussed in chapter 6, there are certain things we need to take into account when picturing counterfactual situations in these kinds of examples (where we postulate what seems like a small change in the behaviour of a small part of the world). We *always* have to take into account *what would lead to this change being present*. Then, in turn, we have to take into account what *those* changes would mean for the rest of the world. Postulating that small *ungrounded* changes to the world actually could be made seems *highly unlikely* given what we know about the close-knit structure of the most fundamental entities we know the existence of. Because of this closely interconnected structure of the microscopic world, we should realise that a world with atoms, built and structured in the way our atoms are, is also a world with quantum mechanics, and, hence, also a world with discrete emission spectra. There is no room for change here, and thus we see, also in this case, that the proposed difference at a higher level leads to some change on a lower level. *This change* will in turn influence both the laws and the entities at the higher levels. This is what the down-and-up structure amounts to.

There is, however, an element of uncertainty here. We have to acknowledge that how big an influence such changes will have depends on the number of fundamental laws in our world, something we presently have no complete knowledge of. If our world has only *one* fundamental law, this down-and-up structure will be *pervasive*; or, if the world has a small number of closely integrated laws, the down-and-up structure will at least be a *common feature* of the world.[416] In the latter case, where there are these closely interconnected laws at the fundamental level, the adjustment of just one higher level law will have to have significant consequences for many of the fundamental laws. Because of the interconnectedness in such worlds, this will entail that there will also be significant consequences for many or all of the higher level laws, as well as for the existence of substances and phenomena which depend on them.

This is the same structure which was represented by a graph in chapter 6, and in much the same way we are also in this case seeing the same effect: the consequences of our postulated *minor* change to the world have themselves many unexpected consequences. Regarding the current example, we see that assumptions which entail we are in a world without quantum mechanics has to take into account that this will influence all higher level

[415]Note that the question of whether or not certain building blocks of the world, say quarks, could possibly exist in a world without quantum mechanics is not a question for philosophers to answer. No amount of *a priori* speculation can give us this answer, and we need to trust the scientists to do this kind of work.

[416]Bird (2002, p. 266). Of course we do not know which of these situations we are in, but current science suggests that our universe represents one of these two possibilities, and the philosophical assumption that is dispositional essentialism is in line with this.

laws, phenomena, and substances which depend on quantum mechanics. If we are correct about this, the world will be ripe with examples of how seemingly innocent assumptions about small differences in the world will have consequences far beyond what was intended by the assumption.

If we take the down-and-up structure into account we see that the point is not that there is some particular feature tied to the existence of salt and water which is at stake here. The point is that this structure is postulated to reflect a general tendency at play in the world. This makes it much harder to truthfully assume changes in the nomic structure of the world as real metaphysical possibilities. If we look at Psillos's argument again—posing that the actual water be replaced with a less polar alternative—we cannot get away with simply asking whether such a substance could *rightfully be seen as water*. Even if it could, we must also ask whether the proposed substance could *exist at all*. For there to be a difference in the structural composition of water, making it less polar, *something must be different at a lower level*. And this something will not only be tied to the existence and properties of water, but also to several other substances and phenomena, as well as higher level laws.[417]

From these examples we see, in line with what has been stated earlier in this thesis, that the dispositional essentialist cannot accept as possible any suggestions of *slight* nomic change to the world. The focus on the down-and-up structure shows that these changes which might appear small to us are, perhaps contrary to our intuitions and expectations, leading to *substantial* changes having to be made to the rest of the world. These changes might even, as in the example with salt and water, entail that substances participating in the *changed* situation are no longer possible entities.

7.4.3 The limited use of intuitions

If we go back to Lowe and his claim regarding our intuitions, the salt example as well as the general down-and-up structure at play, provide an answer to the issue raised in the first part of the quote. (Namely, that we should have good reason for thinking that our intuitions are mistaken.) The second part of Lowe's remark, focusing on the need for some kind of explanation for why it is the case that we are possessing such mistaken intuitions, is nevertheless not answered by the example. I turn to this question now.

Even if it seems to be the case that we have quite good arguments why we should be sceptical of our intuitions regarding laws, we should still be careful not to discredit *all* the intuitions we have. Being able to perform modal judgements is important and plays a significant role, for instance when it comes to deciding what to do in a given situation. If our abilities to conceive of things had little or no connection with what is really possible,

[417] A minor point regarding Psillos's example is that it entails water would no longer be liquid, so it might not even be the case that it represents a proper counterexample, if we demand that both liquid water and salt be present for it to be seen as a well-functioning counterexample.

this would be a very confusing activity, to put it mildly. It does not seem to be too bold a statement to assume that we do have the ability to conceive of things for a reason, and that having intuitive ways of acting in certain situations has proved to be a useful skill to have throughout evolution. Being able to sense that some situation may be dangerous despite not having been in an identical situation before could be life saving, and it is as such a trait which might be handed down through the generations.

These useful intuitions will, I suggest, typically revolve around things existing on the same size scale as us—what Austin refers to as 'moderate-sized specimens of dry goods'.[418] An example can be the ability to imagine that the shadow in the bushes is a predatory animal, and act accordingly in response to that. These situations may be seen as examples of cases where our intuitions and the things we are able to conceive of, are, to a rather large degree, overlapping with the things that are in fact possible. There is a genuine possibility to be attacked by animals when walking in the woods at night (at least in some woods), hence it is useful to be able to conceive of such possibilities.

In addition, it should be noted that essentialists like myself should be very careful not to argue for dispensing of all kinds of intuitive reasoning, because much of the background for the essentialist arguments also stem from intuitions. One may for example argue that assumptions presented in (Kripke, 2005) and (Kripke, 1981) lie in the background of essentialist views like my own, and Kripke appeals to intuitions on several occasions in these works. Both the thought experiments regarding the essential properties of objects, and his ideas about the necessity of origin may be sees as fuelled by arguments ultimately based on intuitions. Because of this, we may argue that intuitions, at least *to some extent*, are of importance also for the dispositional essentialist view of properties. Assumptions made by advocates of such a view are *not* completely freed from the influence of intuitions (and perhaps nothing in philosophy is). Hence, claiming that arguments from intuitions are all bad, would effectively mean an undermining of my own view. This indicates that there *are* times where the use of thought experiments involving conceivable situations or intuitions could be defended, but that we should be careful to recognise the limitations such arguments will have. We still have to ask where such a limitation should be placed, and it seems clear that the answer to this will have to be somewhat vague.

One relevant limitation in the present context is that there is no reason to assume that we should be able to intuitively picture real or relevant possibilities when we move beyond the size scales we are familiar with. That is, as soon as we move from those ordinary middle-sized things we fill our everyday life with, and start to look at the very big or the very small, we no longer seem to have any advantage of being able to picture relevant possibilities. This means that both when we deal with things on an atomic scale, and when we are speaking of things on a scale of, say, planets, solar systems, or galaxies, our intuitions are no longer relevant in the same way as they are when we are going about our everyday

[418] Austin and Warnock (1962, p. 8)

lives. It may still *seem* to us that we can correctly picture things on those scales, that we have intuitions also there, but one need only look at a few examples from contemporary physics to see that nature outstrips our imaginative abilities on these scales on a regular basis.

The same will be the case when it comes to time scales. We may be able to consistently conceive of things happening on the scales of minutes, hours, days, or years, but we are not, it seems, capable of doing the same when it comes to things happening in either very short or very long time spans. We may hear about the separation of the strong force at 10^{-35} seconds after the Big Bang, but I argue that we have no sense of what this really means; we cannot picture in our minds what 10^{-35} seconds really is. And, in the same way, we cannot properly conceive of how much time will pass before the sun will die, because the time scales for such events are too far removed from the one where the human life takes place. So, while intuitions may often be useful—this is part of the reason why we have them—this usefulness is limited to those time and size scales which are similar to those where we lead our life.

There are, arguably, good reasons why we would be able to conceive of relevant possibilities on these familiar scales, but we should note that there is no reason to assume that our ability to conceive of things and the real possibilities are *completely* overlapping even here. We do not, however, find *any* reasons why we should have similar success when evaluating things like the laws of nature. There is no need for us to be able to intuitively say anything about the modal status of the laws. Being able to this does not give us any advantage at all.

I suggest, in general, that the set of the things we are able to conceive of and the set of all real possibilities are overlapping to a greater or lesser degree depending on how far removed the situation is from the scale on which we live our lives. We have a significant overlap when it comes to our daily middle-sized affairs, less so when we move away from this. In addition, it is important to specify that the possible and the conceivable are best seen as sets that are *overlapping*, not as the possible being a subset of the conceivable. We should acknowledge *both* that we are able to conceive of things which are not possible, *and* that the possibilities of the world may outstrip our imagination.

7.5 Conclusion

I have argued that the fact that something is conceivable does not permit inferring that this something is also possible. Even when things *seem* intuitively possible for us, because we are able to consistently picture it in the mind, we should be very careful not to assume that this gives us any real insight into the modal status of things. I find the question of the modal status of the laws of nature particularly interesting in this respect, as our ability to conceive of them being different is a vital part of the explanation for why it is so common

and easy to assume the laws to be contingent. But neither this, nor the fact that the laws are epistemically contingent and *a posteriori* permits us to make this inference.

Some of the notions used to defend the view that the laws may be contingent are unclear at best. As a concrete example I looked at the idea of something other than H_2O 'playing the role of' water, and argued that if *all* roles of water should be covered in such a case, then arguably *only* H_2O can play this role. If one assumes a less rich understanding of the notion of 'playing the role of', it is very unclear how this should be restricted, and what this role should be seen to entail. Even more important is the insight that although we may easily conceive of laws as contingent, there are examples showing that such assumptions may have consequences we do not initially see. The example presented in this chapter shows that even though we may assume that the law that salt dissolves in water is contingent, the result of the thought experiment is the insight that if salt exists in a world, it will necessarily have the property of dissolving in water. The laws of nature are so closely tied to the natures of the things that exist in the world that we cannot simply assume something with regard to the laws without this having effects on the properties of the things that exist in that world as well.

I did, however, note that we should be careful not to go too far in our rejection of the influence of intuitions. They may still have a role to play both in our day-to-day life, as well as in philosophical thought experiments. What should be noted is their limited usefulness when it comes to scales beyond those on which we lead our lives. This means that when it comes to the scales where the laws of nature are grounded, we should not expect the human ability to conceive of things to be able to accurately single out what is and what is not possible.

Conclusion

This thesis has defended *dispositional essentialism* about fundamental properties. I have argued that our basic ontology should include the category of *powers*—sparse fundamental properties which are essentially dispositional. Assuming powers to exist gives us, *firstly*, an account of property identity at the fundamental level, *secondly*, an account of the fundamental laws of nature which follows from the relations between the fundamental properties, and *thirdly*, a way of grounding possibility in the actual world. A central idea driving the arguments here was the intention to firmly locate the powers in the area of *fundamental* metaphysics. This does not entail that there cannot be any non-fundamental powers existing in the world, but we do not have strong enough arguments for this claim to be made at the present moment.

According to a powers-based account of laws of nature, the fundamental laws are reflecting the dispositional essences of fundamental properties. That is, they are grounded in essential relations between these powers. As they are grounded in relations which could not have been different, the laws of nature are absolutely, *metaphysically*, necessary. This is usually viewed as the most problematic aspect of dispositional essentialism, because the laws of nature are generally assumed to be contingent. The view that the laws of nature *could have been* different is an intuition so deeply rooted in us that even some prominent *dispositionalists* (whether essentialist or not) actively try to accommodate this into their accounts of modality. I have argued, to the contrary, that even those dispositional theories of possibility which are not essentialist cannot accommodate possibilities in tension with the laws of nature.

The more common strategy of tying possibility to something which is dispositional is not by going through the dispositional essences, but rather through the dispositional features of ordinary objects, such as certain glasses being *fragile*, hence *disposed to break*. This disposition supports the claim that the glasses could *possibly* break. The *dispositionalist* accounts of modality discussed in my thesis see dispositions like fragility as something which is connected with *possibility* rather than with the *counterfactual conditional*, because the conditional analysis of dispositions has been shown to be inadequate on several occasions.

However, as it turns out, the analysis in terms of possibility has some serious issues too. I have, in particular, shown that the missing stimulus condition in the definition of dispositional possibility leads to the unfortunate consequence that the domain of the

possible will include certain happenings which should rather (and quite uncontroversially so) be deemed *impossible*. This entails that the dispositionalist accounts of possibility are not able to single out all and only those happenings that are *possible*. I conclude that when it comes to accounting for dispositions, both the route through possibility as well as the one going through counterfactuals are problematic. Interestingly—as we recacll—both Borghini and Williams and Vetter argue that their account of possibility could either actively accommodate possibilities going beyond the laws of nature, or at least keep the door open for such possibilities. However, I have shown that the features supposed to deliver these kinds of possibilities are not working in the desired way.

I have suggested that if what we are after is an explanation of metaphysical possibility, there is no need to base our explanation on *mere dispositions*, thus avoiding the problems tied to the definitions of such dispositions altogether. My proposal instead is that an explanation or a determination of the possible in *powers* and the laws of nature is a viable option. Due to the laws of nature being metaphysically necessary, the domain of the possible resulting from such an explanation will be considerably smaller than what other accounts argue for. The hope is that it will also be more *correct*.

However, given that the view that the laws of nature are necessary is so controversial, we need to make sure that the dispositional essentialist account of laws can compete with those based upon categoricalism about fundamental properties. After all, the categoricalists have intuition on their side in this case. Thus I have articulated the dispositional essentialist account of laws such that it is able to do better than accounts based upon either Humean supervenience, or nomic necessitation. We are able to explain the instances of laws (which is problematic for the proponent of regularity theory), and we have no problem explaining what laws are (which is a problem for the advocate of Armstrong's account).

Nevertheless, the dispositional essentialist account is faced with serious problems of their own both when it comes to the so-called global laws, and when it comes to the fundamental constants. Regarding the global laws, the solution I explored relies on a re-examination of *our understanding* of these laws or principles. If these principles are not correctly seen as laws but rather as some kind of meta-principle or similar, it will not be correct to demand that they be analysed in the same way as the laws. When it comes to the fundamental constants, we need additional results from science before we are able to conclude. However, some important considerations should be made regarding the way we think about these constants. They might, firstly, not actually be fundamental but rather depend on something else themselves. In that case they cannot so easily be changed as we might think. This part of the dispositional essentialist account clearly needs more research. However, the way I have presented these issues still points towards the laws being robustly necessary; neither global laws nor fundamental constants will pose a threat to this.

In addition, I have argued that the way the fundamental properties, according to dispositional essentialism, are related to each other entails that this is a *holistic* view about

fundamental properties. That is, the world, at this level, is a *web*. If we take this thought of a web of properties a little further, by including some ideas from graph theory, we see that in certain graphs (the asymmetrically ones) the whole structure of the graph contributes to the identity of the nodes. I have suggested that this is one plausible explanation of the relationship between the properties at the fundamental level. This means that tiny changes to the nomic structure of the world, often presented as genuine possibilities, are *not* possible according to dispositional essentialism. We need to take into account that what is, by us, postulated to be small changes made to a world, often entail far more substantial changes than what was intended, and the result will often be that the world becomes so different that it ends up being modally irrelevant. I have referred to this as *resistance to nomic change*.

Nevertheless, even though we are able to argue convincingly for the necessity of the laws of nature, we have to fave the fact that the contingency of the laws appears to many a very common intuition, namely that the laws of nature *could have been* different. This requires a discussion of both the role that intuition can be allowed to have, and the connection between conceivability and possibility. I have shown, through examples, that our intuitions when it comes to the laws of nature are not trustworthy, and thus, that using arguments based upon intuitions or conceivability more generally is not advisable when it comes to these kinds of questions. This does not mean that intuitions are without value. When the domain of discussion is close to the scales on which we live our everyday lives, both intuition and the ability to conceive of possible happenings is of value to us. However, the fundamental laws of nature are far removed from this domain, thus we should concede that when it comes to questions concerning the laws, our intuitions can safely be disregarded.

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