

Critique of Rationalism in the Epistemology of Modality

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A thesis submitted for the degree of
Doctor of Philosophy

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For my parents

Declaration

I, Heejin Kwon, confirm that the work presented in this thesis is my own. Where information has been derived from other sources, I confirm that this has been indicated in the thesis.

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Abstract

In this thesis, I critically discuss rationalism in epistemology of modality. Rationalism claims that our a priori intuition or conceivability gives us knowledge about metaphysical possibility. I examine this claim by considering Bealer's moderate rationalism and Chalmers's modal rationalism. In particular, I argue that Bealer's moderate rationalism is not successful in responding to Kripke's and Putnam's counterexamples which sever the link between a priori intuition and modal knowledge. Also, it is argued that given Chalmers's modal rationalism, our a priori conceivability entails more than metaphysical possibility from the perspective of our world. After providing some preliminary points in Introduction, I assess Bealer's moderate rationalism in Chapter 2. Specifically, I argue that our a priori intuition about epistemic possibility concerning property-identities does not give us knowledge about metaphysical possibility. In arguing this point, Russellian and Fregean theories of phenomenal content are discussed. Also, a priori unknowability of necessary properties of a substance is examined. In Chapter 3, I discuss an issue untouched by Bealer's moderate rationalism: a priori knowability of metaphysical possibility concerning property-possession of a substance. I argue that given Bealer's moderate rationalism, our a priori intuition does not give us knowledge about metaphysical possibility concerning that. In arguing this point, categoricism and dispositionalism about the nature of properties are discussed. I examine Chalmers's modal rationalism in Chapter 4 and argue that our a priori conceivability can entail metaphysical possibility from perspectives of other worlds. Then, I derive a claim that we must be cautious not to commit a modal

error of regarding what is not metaphysically possible from the perspective of our world as possible when we depend on a priori conceivability to know metaphysical possibility.

Impact Statement

This thesis contributes to debate in epistemology of modality. My arguments have an implication for how to improve rationalism about modal knowledge as they show problems of rationalism. For the same reason, researchers may find a motivation for non-rationalism in my arguments.

This thesis argues that a certain way of thinking about metaphysical possibility does not give us knowledge of metaphysical possibility and another way can lead us to commit a modal error. In doing so, it provides a guide to thinking about metaphysical possibility and avoiding a modal error.

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1. Introduction

In this introduction, I will present main claims of this thesis and provide some background information. Also, I will offer an overview of each chapter. I strongly recommend readers to read the overviews in advance as they will help understand main arguments of this thesis, which involve many technical terms.

1.1. Rationalism and Putnam's Twin-Earth Case

We have many pieces of modal knowledge. By 'modal knowledge', I mean knowledge about metaphysical possibility and necessity which is distinct from knowledge about other kinds of modalities such as nomological possibility and epistemic possibility. For example, we know that mathematical theorems such as Fermat's Last Theorem are metaphysically necessary. Also, we know that it is metaphysically possible that the earth does not exist. If we set aside the strong necessitarian view about the laws of nature to the effect that our laws of nature hold in every possible world, we can say that we know that different laws of nature are metaphysically possible.

Given that we have modal knowledge, an important epistemological question arises as follows: How can we know metaphysical possibility and necessity? Or what is the source of our modal knowledge? A number of theories trying to answer this question have been offered, e.g., rationalism, counterfactualism, non-

rationalism, etc.¹ Among them, the view that has been traditionally accepted by many philosophers and is currently the most influential is rationalism. In this thesis, I will focus on rationalism, in particular, Bealer's moderate rationalism and Chalmers's modal rationalism.

Rationalism in a pure form is roughly a claim that if modal propositions are knowable at all, they are knowable absolutely on the basis of employing a priori means such as intuition and conceivability without using empirical evidence. This idea has been endorsed by philosophers such as Kant.² However, after Putnam (1975) and Kripke (1980) persuasively argued for a posteriori necessary truths, pure rationalism became no longer viable.

Putnam argues for a posteriori necessary truths by using his twin-earth case. Since this case will appear frequently in my thesis, I need to explain it in advance. Consider the following passage by Putnam (1975: 223):

Twin Earth is very much like Earth; in fact, people on Twin Earth even speak *English*. In fact, apart from the differences we shall specify in our science-fiction examples, the reader may suppose that Twin Earth is *exactly* like Earth. He may even suppose that he has a *Doppelgänger* – an identical copy – on Twin Earth, if he wishes, although my stories will not depend on this.

[...] One of the peculiarities of Twin Earth is that the liquid called 'water' is not H₂O but a different liquid whose chemical formula is very long and complicated. I shall abbreviate this chemical formula simply as XYZ. I shall suppose that XYZ is

¹ For this classification of theories in epistemology of modality, see Vaidya (2015). For a general introduction and survey of epistemology of modality, see Evnine (2008) and Vaidya (2015). For rationalism, see Bealer (2002), Chalmers (2002a), Ichikawa and Jarvis (2012), Lowe (2012), Nimtz (2012), Peacocke (1999). For counterfactualism, see Hill (2006), Kroedel (2012), Williamson (2007b). For non-rationalism, see Fischer and Leon (2017).

² Bealer (1987: 290) summarises Kant's claim concerning our knowledge about necessity by the following thesis: "if it is possible to know that a given proposition is necessary, then it is *possible* to know this absolutely [sic] *a priori*; no empirical evidence is needed."

indistinguishable from water at normal temperatures and pressures. In particular, it tastes like water and it quenches thirst like water. Also, I shall suppose that the oceans and lakes and seas of Twin Earth contain XYZ and not water, that it rains XYZ on Twin Earth and not water, etc.

As explained above, Putnam's twin-earth is a duplicate of the Earth except that the superficially identical substance to water on the twin-earth has as its microstructure XYZ rather than H₂O. In my thesis, by 'Putnam's twin-earth world', I will refer to a world containing Putnam's twin-earth instead of the Earth.

From the twin-earth case and our intuition about natural-kind substances, Putnam draws a claim that necessarily, water is H₂O.³ Since it is only knowable a posteriori that the microstructure of water is H₂O, we can say that the claim is an a posteriori necessary truth. (In my thesis, I will simply say that something is knowable a posteriori rather than saying that something is knowable only a posteriori. Unless indicated otherwise, I will say the former intending that it implicitly involves 'only', i.e., that the former is understood as the latter.)

Given the a posteriori necessary truth, we can see that it is not generally the case that our a priori method such as intuition and conceivability gives us knowledge about metaphysical possibility. For example, suppose that one conceives Putnam's twin-earth world. But one's such conceiving does not give one knowledge about a metaphysical possibility that water is XYZ. This is because given that necessarily, water is H₂O, such a metaphysical possibility does not hold.

A posteriori necessary truths raise a problem for rationalism in the pure form. Pure rationalism claims that if modal propositions are

³ I will discuss Putnam's theory in detail in Section 3.1.

knowable at all, they are knowable absolutely a priori. But the above a posteriori necessary truth provides a counterexample since the modal proposition that necessarily, water is H₂O is, although knowable, not knowable a priori.

Although pure rationalism is problematic, the spirit of rationalism is still compelling. In particular, when it comes to most modal knowledge that is untouched by the counterexamples offered by Putnam and Kripke, rationalism has a strong intuitive appeal. Also, even with regard to knowledge about a posteriori necessary truths, rationalists think that the modal feature of such truths is knowable ultimately on the basis of our a priori means.

Given the strong intuitive appeal of rationalism and in the absence of compelling alternative theories, it is no surprise that current leading theories in epistemology of modality follow the spirit of rationalism. But rationalists had to impose qualification or modification on pure rationalism to accommodate the counterexamples. One of the two prominent ways of doing this was to weaken pure rationalism by narrowing the applicability of it to certain types of concepts. The other was to sustain pure rationalism with semantic qualification. The latter strategy is represented by Chalmers's modal rationalism that will be discussed in Chapter 4. The former strategy is embodied in moderate rationalism, the topic of Chapter 2.

An important common feature of the above two theories is that even though our a priori intuition or conceivability in general does not entail metaphysical possibility, a certain sort of a priori intuition or conceivability entails metaphysical possibility and such metaphysical possibility is knowable a priori. As will be discussed in this thesis, according to Bealer's moderate rationalism, a priori intuition about epistemic possibility concerning property-identities entails metaphysical possibility (of a true counterpart proposition) and the

latter possibility is knowable a priori. In the case of Chalmers's modal rationalism, ideal primary conceivability as a priori conceivability entails metaphysical possibility and the latter possibility is knowable a priori.

However, I will argue against moderate rationalism in Chapter 2 of my thesis by claiming that a priori intuition about epistemic possibility concerning property-identities does not give us a priori knowledge about metaphysical possibility. Also, it will be argued in Chapter 4 that ideal primary conceivability is not the only a priori conceivability as there is another sort of a priori conceivability, i.e., ideal two-dimensional conceivability. Given my argument, a priori conceivability entails not only our metaphysical possibility but also metaphysical possibility from perspectives of other worlds. Thus, when we depend on a priori conceivability to know metaphysical possibility, we must be cautious not to commit a modal error (which is not discussed by Chalmers) of regarding what is not metaphysically possible from the perspective of our world as possible.

In the meantime, in Chapter 3, I will discuss an issue which is untouched by Bealer's moderate rationalism, i.e., a priori knowability of metaphysical possibility concerning property-possession of a substance, by considering two main views about the nature of properties, categoricism and dispositionalism. Then, I will argue that we cannot know a priori whether it is metaphysically possible for a given substance to have (or lack) a certain property. Also, it will be argued that in most cases, our a priori intuition about epistemic possibility concerning this matter does not give us knowledge about metaphysical possibility. I will argue that even in exceptional cases, Bealer does not provide sufficient resource ensuring a priori knowledge about metaphysical possibility.

In my thesis, I do not make a strong claim that rationalism must be

rejected. Rather, my claim is as follows: Although Bealer's moderate rationalism is plausible in a priori domains such as philosophy and mathematics, it is not successful in responding to counterexamples against rationalism. Also, although Chalmers's modal rationalism is successful in responding to such counterexamples, given his theory, we must be cautious not to commit a modal error when we depend on a priori conceivability in order to know metaphysical possibility.

1.2. An Overview of Each Chapter

As my arguments in main chapters are complicated and involve many technical terms, I think that an overview of each chapter in plain words may be helpful although it can be rough and incorrect in some details. Suppressing technical terms and convoluted details as much as I can for the sake of readability, I provide an overview of each chapter as follows. (Note that the following overview is not a faithful summary as I will omit arguments that are structurally similar to ones dealt with in the overview.)

Chapter 2

In this chapter, I criticise Bealer's notion of full understanding, in particular, focusing on its epistemic possibility condition. Bealer tries to explain our modal knowledge in terms of intuition. According to him, intuition is evidence so that it provides justification for our modal knowledge. In order to explain his claim that intuition is evidence, Bealer offers the notion of full understanding of concepts and propositions. Then, he claims that full understanding constitutes a basis for our intuition to count as evidence. In this respect, full understanding is a basis for our intuition as evidence and hence for our modal knowledge based on our intuition.

Bealer provides three conditions for full understanding, but the main focus of this chapter is on his second condition, i.e., the epistemic possibility condition, as follows:

(b.i) p is true *only if* it is possible for x to settle with a priori stability that p has a counterpart that is true. (for property-

identities p) (Bealer (2002: 106))⁴

This condition roughly says that if a property-identity proposition p is true, x can know a priori that there is a metaphysically possible counterpart world where a proposition corresponding to p is true. Here we can understand a counterpart world roughly as a variant of Putnam's twin-earth world and a proposition corresponding to p as a twin-earth proposition. In what follows, I will discuss the condition by using an example for the sake of plainness.

Given that the proposition that water is H₂O is true, the condition says that x can know a priori the metaphysical possibility of a variant of Putnam's twin-earth world in which a substance playing a role of water is H₂O. (Although this twin-earth world is the actual world, x cannot know a priori that it is so. From x's a priori perspective, conceiving this world and conceiving Putnam's original twin-earth world are on a par.) This is equivalent to saying that x can know a priori the metaphysical possibility of a variant twin-earth world in which a twin-earth proposition that water_c is H₂O is true where water_c is a twin-earth counterpart of the concept of being water.

In the above explanation, a counterpart relation between a proposition and its counterpart is understood in terms of a variant twin-earth world. But according to Bealer, in order for the counterpart relation to hold, the variant twin-earth world must satisfy two conditions which can be understood as follows: (1) A subject x_c in the variant twin-earth world is a phenomenal duplicate of the original

⁴ The condition (b.i) is Bealer's response to a posteriori necessary truths that are regarded as the counterexample against a priori knowability of modal propositions. According to him, although it is not knowable a priori that necessarily, water is H₂O, it is knowable a priori that it is epistemically possible that water is H₂O. Bealer analyses epistemic possibility in terms of a counterpart relation and claims that epistemic possibility entails metaphysical possibility of a counterpart world.

subject x . And (2) x believes that water is colourless, odourless, etc. if and only if x_c truly believes that water_c is colourless, odourless, etc. For the sake of argument, let us assume that the variant twin-earth world satisfies these conditions.

Given the discussion so far, the condition (b.i) is understood as follows:

If a proposition that water is H_2O is true, x can know a priori the metaphysical possibility of a variant twin-earth world in which x 's phenomenal duplicate x_c truly believes that $\text{water}_c (= \text{H}_2\text{O})$ is colourless, odourless, etc.

I do not raise any objection to the metaphysical possibility of the variant twin-earth world because it is obvious that the world is possible since it is in fact the actual world. My objection is that x cannot know a priori the metaphysical possibility of such a world.

For the sake of argument, let us assume the following two theses: (1) It is not knowable a priori what property a substance necessarily has. (2) x_c in the variant twin-earth world has the same perceptual condition as x . The first thesis will be justified in Chapter 3. With regard to the second one, I will provide a weakened thesis which Bealer must accept later in this chapter.

By the second thesis, I mean that if x_c 's experience has the same phenomenal character as x 's experience, x_c 's experience represents the same physical property as x 's experience. For example, suppose that in x 's world, x 's experience of colourlessness, i.e., x 's experience having a phenomenal character $c_{\text{colourless}}$, is caused by and represents some physical property $p_{\text{colourless}}$. Also, suppose that x 's experience with c_{yellow} is caused by and represents p_{yellow} . Given the second thesis, it follows that x_c 's experience with $c_{\text{colourless}}$ (or c_{yellow}) is caused by and represents $p_{\text{colourless}}$ (or p_{yellow}).

Given the above two theses, it can be argued that x cannot know a

priori the metaphysical possibility of the variant twin-earth world. As claimed above, in the variant twin-earth world, x 's phenomenal duplicate x_c truly believes that water_c is colourless, odourless, etc. Thus, in the variant twin-earth world, H_2O has the properties of being colourless, odourless, etc. because x_c who applies the concept of being water_c to H_2O truly believes that water_c has the properties of being colourless, odourless, etc. Also, x_c experiences H_2O as colourless, odourless, etc. because x_c is a phenomenal duplicate of x . Then, by the second thesis concerning the same perceptual condition, it follows that H_2O has $p_{\text{colourless}}$, $p_{\text{odourless}}$, etc. Given this discussion, the above understanding of the condition (b.i) can be recast as follows:

If a proposition that water is H_2O is true, x can know a priori the metaphysical possibility of a variant twin-earth world in which H_2O has $p_{\text{colourless}}$, $p_{\text{odourless}}$, etc.

Now suppose that necessarily, H_2O has the property of being yellow, i.e., p_{yellow} (such as the colour property of beer). Then, the variant twin-earth world will not be metaphysically possible because it is impossible for H_2O to have $p_{\text{colourless}}$. My point is not that the supposition is true and the variant twin-earth world is metaphysically impossible. (In fact, the supposition is false and the world is metaphysically possible.) Rather, my point is that x cannot a priori rule out the supposition and hence the metaphysical impossibility of the variant twin-earth world.

Given the first thesis we are assuming, it is not knowable a priori what property H_2O necessarily has. Thus, x cannot rule out a priori the case that it turns out that necessarily, H_2O has p_{yellow} . Thus, x cannot rule out a priori the supposition to the same effect. Meanwhile, if it is necessarily the case that H_2O has p_{yellow} , it is impossible that

H₂O has $p_{\text{colourless}}$ and hence the variant twin-earth world where H₂O has $p_{\text{colourless}}$ is impossible. Thus, given that x cannot rule out a priori the supposition, x cannot rule out the impossibility of the variant twin-earth world. This is just to say that x cannot know a priori the metaphysical possibility of the variant twin-earth world and this entails that the consequent of the above understanding of the condition (b.i) is false. Given that the antecedent is true, the above understanding of the condition (b.i) is false and this provides a counterexample against the condition (b.i).

As I mentioned above, the first thesis concerning a priori unknowability of necessary properties of a substance will be justified in Chapter 3. In this chapter, I present an objection to the second thesis, and in response to the objection, I provide a weakened thesis that Bealer must accept.

In order to present the objection, suppose that in another variant twin-earth world, x_c 's experience having $C_{\text{colourless}}$ is caused by and represents a different physical property $X_{\text{colourless}}$ (rather than $p_{\text{colourless}}$) due to perceptual conditions different from x 's world. Also, suppose that in this world, H₂O plays the role of water just as in the original variant twin-earth world. In supposing the new twin-earth world as above, the second thesis concerning the same perceptual condition is rejected because x_c in the new twin-earth world has a different perceptual condition concerning the property of being colourless.

Given the new twin-earth world, it can be shown that my argument does not hold. First, note that according to Bealer, in order for the counterpart relation to hold, the new twin-earth world must satisfy two conditions which can be understood as follows: (1) A subject x_c in the new twin-earth world is a phenomenal duplicate of the original subject x . And (2) x believes that water is colourless, odourless, etc. if and only if x_c truly believes that water_c is colourless, odourless, etc. For

the sake of argument, let us assume that the new twin-earth world satisfies these conditions. Then, the condition (b.i) is understood as follows:

If a proposition that water is H₂O is true, x can know a priori the metaphysical possibility of the new twin-earth world in which x's phenomenal duplicate x_c truly believes that water_c (= H₂O) is colourless, odourless, etc.

According to this condition, H₂O has the properties of being colourless, odourless, etc. in the new twin-earth world because x_c who applies the concept of being water_c to H₂O truly believes that water_c has the properties of being colourless, odourless, etc. Also, x_c experiences H₂O as colourless, odourless, etc. because x_c is a phenomenal duplicate of x. Then, by the supposition about the new twin-earth world, it follows that H₂O has X_{colourless}, p_{odourless}, etc. Given this discussion, the above understanding of the condition (b.i) can be recast as follows:

If a proposition that water is H₂O is true, x can know a priori the metaphysical possibility of the new twin-earth world in which H₂O has X_{colourless}, p_{odourless}, etc.

Now suppose that necessarily, H₂O has p_{yellow}. But unlike the original variant twin-earth world, this supposition will not make the new twin-earth world metaphysically impossible. This is because H₂O is not required to have p_{colourless} but only an arbitrary property X_{colourless}. Thus, given the supposition, x can suppose that X_{colourless} is p_{yellow} and conceive a perceptual condition allowing x_c's experience with C_{colourless} to be caused by and represent p_{yellow}. Then, x_c will still be a phenomenal duplicate of x and truly believe that water_c is colourless, odourless, etc. In this way, if the second thesis concerning the same perceptual condition is rejected, my argument trying to show that x

cannot rule out an impossibility case a priori does not hold.

However, given Bealer's notion of semantically stable concepts, we can respond to the objection. Semantically stable concepts are roughly concepts that are not twin-earthable. Or we can say that semantically stable concepts are concepts such that the actual concepts and their twin-earth counterparts are identical. For example, the concept of being a prime number is such a concept. Also, the concept of being spherical is roughly a semantically stable concept.

Given the notion of semantically stable concepts, we can see that x_c in any variant twin-earth world has the same perceptual condition with x concerning properties to which semantically stable concepts are applied. In the above, it was explained that in a variant twin-earth world as a counterpart world, x_c is a phenomenal duplicate of x and x_c has a true belief corresponding to x 's belief. For example, if x believes that water is spherical in a certain condition such as zero gravity, x_c truly believes that $water_c$ is spherical in that condition. Given that the concept of being spherical is semantically stable, x_c 's concept of being spherical is identical to x 's concept. Thus, the former is applied to the same property as what the latter is applied to. This entails that x_c 's experience with a phenomenal character $C_{spherical}$ represents the same physical property $p_{spherical}$ as x 's experience with $C_{spherical}$ represents. Thus, x_c has the same perceptual condition as x with regard to $p_{spherical}$ to which the semantically stable concept of being spherical is applied.

We can generalise the above discussion and get the following weakened thesis: x_c in any variant twin-earth world has the same perceptual condition as x with regard to properties to which semantically stable concepts are applied. Given this weakened thesis, my argument holds with regard to those properties and this is enough for arguing that the condition (b.i) does not hold.

Chapter 3

In this chapter, I discuss modal knowledge concerning property-possession of a substance by considering two main views about the nature of properties, i.e., categoricism and dispositionalism. In particular, I argue that given each view, it is not knowable a priori whether it is metaphysically possible for a given substance to have a new non-fundamental property. Also, it is argued that our a priori intuition about epistemic possibility concerning property-possession of a substance does not give us a priori knowledge about metaphysical possibility.

As I argue the above point by considering Armstrong's categoricism and Bird's dispositionalism, first, I need to explain Armstrong's view. And in order to explain Armstrong's categoricism and provide some preliminary points relevant to my argument, I need to briefly present his ontological view about properties, natural-kind substances and natural properties.

According to Armstrong's ontology, a world is a totality of states of affairs. Each state of affairs is constituted by properties or relations which Armstrong regards as universals and particulars in the way that a particular instantiates a property universal or a relation is instantiated by particulars. For example, if F is a property universal, R is a relation universal, and a and b are particulars, Fa , aRb , $Fa \& aRb$ are states of affairs.

With regard to our discussion, Armstrong's notion of complex universals is important because natural-kind substances and natural non-fundamental properties are analysed in terms of them. A complex universal is roughly a universal that has other universals as its

constituents. For example, consider a complex universal E of being an electron. Electrons form a natural kind and each electron has only the following three properties: a certain value of mass, a certain value of charge, and a certain value of spin. If universals M, C, and P correspond to those properties and a is a particular, we can represent a single electron by the following state of affairs: $M\&C\&P\&a$. Given this state of affairs, we get the following complex universal E of being an electron by getting rid of the particular a: $M\&C\&P$. As another example, consider a complex universal S of being salt (i.e., sodium chloride). Salt is a natural-kind substance and has NaCl as its microstructure. If N is a universal of being a sodium atom, C is a universal of being a chloride atom, B is a bonding relation, and a and b are particulars, we can represent a single salt molecule by the following state of affairs: $N\&C\&B\&a\&b$. Then, we get a complex universal S of being salt by getting rid of a and b.

In Armstrong's ontology, the property of being a natural-kind substance is identified with a complex universal representing the microstructure of a substance. Also, a natural non-fundamental physical property (which has more fundamental properties as its microscopic base) is identified with a complex universal (which has universals corresponding to more fundamental properties as its constituents).

Given Armstrong's ontological account, we can explain his view about the nature of properties and laws of nature. Armstrong claims that properties have a self-contained nature and do not have powers to affect other things. Thus, laws of nature cannot flow from properties themselves. Rather, according to Armstrong, laws of nature are contingent external relations between universals. For example, if a nomic relation holds between universals F and G, we can say that a law of nature holds between F and G. Since this nomic relation is a

contingent relation external to F and G, F can be related to other universals across nomologically different possible worlds. This yields different possible laws of nature concerning F.

The contingency of laws of nature has an implication for property-possession of a substance. In the above, it was claimed that the property of being a natural-kind substance is identified with a complex universal representing the microstructure of a substance. Then, if laws of nature governing constituent universals (constituting the complex universal) are different in a possible world, the substance having the complex universal will have different non-fundamental properties in that world due to different causal interactions between constituent universals. Let me explain this claim by considering the complex universal of being salt. According to the above discussion, the complex universal S of being salt consists of universal N of being a sodium atom, universal C of being a chloride atom, and universal B of a bonding relation. If laws of nature governing these universals are different in a possible world (or if laws of nature governing more fundamental universals constituting N, C, and B are different in a possible world), salt having the complex universal S will have different properties in that world. For example, given different laws of nature in nomologically different possible worlds, salt in these worlds will be different from salt in the actual world with regard to many non-fundamental properties such as its colour, taste, boiling point, electrical conductivity, etc.

As discussed so far, categoricism allows a substance to possibly possess different non-fundamental properties by allowing different laws of nature. Given this idea, it might be claimed that it is possible for a substance to have any non-fundamental properties. It seems not implausible that there are infinitely many nomologically different possible worlds so that there are infinitely many different laws of

nature. Then, one might claim that given an infinite number of laws of nature, constituent universals of a complex universal can causally interact in infinitely many ways so that there is no limit to the non-fundamental property a substance possibly possesses. Let me call this idea 'a liberal metaphysical idea about property-possession'.⁵

The liberal metaphysical idea has an implication for epistemology of modality. If it is true and we can know it a priori, we can know a priori that it is possible for a given substance to have an arbitrary property. For example, suppose that one conceives transparent gold. If one knows the liberal metaphysical idea a priori, one will know a priori that it is possible that gold is transparent because one will know that among infinitely many nomologically different possible worlds, there is a world whose laws of nature make gold transparent. This does not mean that one can know a priori in which possible world gold is transparent. But at least one can know a priori that there is such a world among infinitely many possible worlds.

I think that the liberal metaphysical idea can be shown to be false given empirical information. But, at least, without relying on empirical information it can be argued that the liberal metaphysical idea is not knowable a priori. And this argument entails that it is not knowable a priori whether it is metaphysically possible for a given substance to have a new non-fundamental property.

For the sake of argument, consider the following case: Suppose that one conceives acidic salt. According to the above discussion, the property of being salt is identified with the complex universal S. Suppose that S consists of universal S_{A1} of being a certain atom,

⁵ Someone might object to this idea by claiming that there may be a non-fundamental property which cannot come from any causal interaction between constituent universals. Also, it can be claimed that the idea entails an unintuitive result concerning property-possession of a substance. But rather than discussing these issues, I focus on the implication that the liberal metaphysical idea has for modal epistemology.

universal S_{A2} of being another certain atom, universal S_R of a certain relation and no other. (In fact, S consists of universals N , C , and B . But in order not to rely on empirical information, let us make the above supposition.) Then, salt necessarily has S_{A1} , S_{A2} , and S_R . With regard to the property of being acidic, suppose that it is a natural non-fundamental property and identified with a complex universal P . Also, suppose that the property of being acidic has among its more fundamental properties the property of being a certain atom different from those corresponding to S_{A1} and S_{A2} . (In fact, the property of being acidic has the property of being a hydrogen atom among its more fundamental properties.) If P_{A1} is the universal of being such an atom, the complex universal P necessarily has P_{A1} .

Given the above case, acidic salt is impossible. This is because if salt has the property of being acidic, it has, among the constituent universals of the complex universal S , P_{A1} of being a certain atom which is necessarily contained in the complex universal P of being acidic. But if salt has P_{A1} , it is no longer salt because the property of being salt is identified with the complex universal S and S consists of S_{A1} , S_{A2} , S_R and no other. (Given empirical information, we can say that salt cannot have the property of being acidic because if sodium chloride gains a hydrogen atom necessarily contained in the property of being acidic, it is no longer sodium chloride.)

The acidic salt case does not show that the liberal metaphysical idea is false. This is because the case is conceived a priori and not based on empirical information. Thus, it might turn out that the case does not hold in reality and what the case says are not metaphysical facts. Since the idea concerns metaphysical facts, the acidic salt case does not provide a counterexample against the idea.

However, the acidic salt case provides a counterexample against a priori knowability of the liberal metaphysical idea. Since we cannot

rule out a priori the case where acidic salt is impossible, we cannot know a priori whether it is possible that salt has the property of being acidic. This is a counterexample against a priori knowability of the idea to the effect that it is knowable a priori that it is possible for a substance to have any non-fundamental property.

Meanwhile, the acidic salt case is sufficiently arbitrary so that similar cases can be constructed for other substances and other non-fundamental properties. Thus, from our discussion, we can (roughly) draw a conclusion that it is not knowable a priori whether it is possible for a given substance to have a new non-fundamental property.

In response to my argument, one might claim that our a priori intuition about epistemic possibility concerning property-possession of a substance gives us a priori knowledge about metaphysical possibility. To explain this claim, suppose that one has a priori intuition about an epistemic possibility that salt has the property of being acidic. According to Bealer, such an epistemic possibility is analysed in terms of a variant of Putnam's twin-earth world satisfying the following two conditions: (1) A subject x_c in the variant twin-earth world is a phenomenal duplicate of the original subject x . And (2) x believes that salt has the properties Pr_1 , Pr_2 , and not Pr_3 if and only if x_c truly believes that a counterpart substance $salt_c$ has the properties Pr_1 , Pr_2 , and not Pr_3 . (For the sake of argument, suppose that Pr_1 , Pr_2 , Pr_3 , and the property of being acidic in the variant twin-earth world are identical to their actual counterparts. A case rejecting this supposition is discussed in Chapters 3 and 4, but I will not deal with it in this overview.)

Given the above conditions, the variant twin-earth world is a world in which $salt_c$ has Pr_1 , Pr_2 , and not Pr_3 because x_c in this world has a true belief to this effect. Also, the variant twin-earth world is a world in which $salt_c$ has the property of being acidic because it is a world

indicated by the epistemic possibility that salt has the property of being acidic. Thus, the variant twin-earth world is a world in which salt_c has Pr₁, Pr₂, the property of being acidic and not Pr₃.

According to the response we are explaining, given that x has a priori intuition about an epistemic possibility that salt has the property of being acidic, x can know a priori that the variant twin-earth world is metaphysically possible. But I argue that this claim does not hold. To provide a counterexample against a priori knowability of the metaphysical possibility, suppose that the property of being acidic and Pr₃ are natural properties. Also, suppose that they are two non-fundamental properties that are identified with the same complex universal. (According to Armstrong (1997: 26), the property of being gravitational rest mass and the property of being inertial rest mass are identified with the same complex universal.) Given this case, it is metaphysically impossible for salt_c lacking Pr₃ to have the property of being acidic. Therefore, given the case, the variant twin-earth world is impossible.

The above case is an a priori conceivable case that x cannot rule out a priori. Thus, x cannot know a priori whether the variant twin-earth world is metaphysically possible. This entails that x's a priori intuition about the epistemic possibility does not give x a priori knowledge about metaphysical possibility.

The above case is based on the supposition that Pr₁, Pr₂, Pr₃, and the property of being acidic in the variant twin-earth world are identical to their actual counterparts. If we reject this supposition, there might be a case where our a priori intuition about epistemic possibility gives us a priori knowledge about metaphysical possibility. But since Bealer does not provide enough resources to establish the case, his analysis of epistemic possibility by itself does not make the case hold.

(In this overview, I omit arguments based on dispositionalism because they have a broadly similar structure to arguments based on categoricism. Also, in this overview, I omit my justification of the following thesis assumed in the argument of Chapter 2: It is not knowable a priori what property a substance necessarily has.)

Chapter 4.

In this chapter, I discuss Chalmers's modal rationalism. But rather than providing an objection to his theory, I assess a priori conceivability based on it and claim that a priori conceivability entails more than our metaphysical possibility. In particular, I provide intuitively conceivable statements which Chalmers's notions of conceivability cannot accommodate and argue that the intuitive conceivability of such statements is identified with ideal two-dimensional conceivability (which can be derived from Chalmers's epistemic two-dimensionalism). Then, it is argued that although ideal two-dimensional conceivability concerns our statements and our terms, it does not entail our metaphysical possibility. Given that ideal two-dimensional conceivability is a priori conceivability, one should not regard a priori conceivability as a guide only to our metaphysical possibility. In this respect, one must be cautious not to commit a modal error of regarding what is not metaphysically possible from the perspective of one's world as metaphysically possible when one depends on a priori conceivability to know metaphysical possibility.

Chalmers's main modal epistemological claim is that ideal primary conceivability entails primary possibility. In order to understand this claim, I need to explain his notions of primary and secondary conceivability and primary and secondary possibility.

According to Chalmers, secondary possibility is counterfactual possibility. For example, 'water is XYZ' is not secondarily possible just as it is not counterfactually possible. Secondary conceivability is conceivability concerning how the world could have been. Roughly, we can say that one can secondarily conceive a statement 'water is XYZ' if and only if one can imagine some world W such that when W is considered as counterfactual, 'water is XYZ' is true. Chalmers claims that secondary conceivability is idealised if and only if it is based on ideal rational reflection and sufficient empirical information about the actual world. And he claims that ideal secondary conceivability entails secondary possibility. Given this claim, the above secondary conceivability of 'water is XYZ' is not ideal because 'water is XYZ' is not secondarily possible.

On the other hand, primary conceivability concerns how the world turns out to be rather than how the world could have been. For example, one can primarily conceive a statement 'water is XYZ' just in case one can conceive that water actually turns out to be XYZ. Then, suppose that one primarily conceives that water is XYZ. One can conceive this by imagining Putnam's twin-earth world and considering it as actual. If the twin-earth world is considered as actual, the transparent odourless tasteless drinkable substance filling lakes and oceans in the actual world will be XYZ rather than H₂O. Then, one will rationally conclude that 'water is XYZ' is true. Given this account, we can say that roughly, one can primarily conceive a statement S if and only if one can imagine some world W such that when W is considered as actual, S is true.

According to Chalmers, primary conceivability is a priori conceivability depending only on rational reflection. This is just to say that one can a priori imagine some world W such that it is a priori that when W is considered as actual, S is true. Here I need to explain what

it means to say that it is a priori that when W is considered as actual, S is true. Consider again the above primary conceivability of 'water is XYZ'. Given that the a priori imagined twin-earth world is considered as actual, one will be able to know a priori that the transparent odourless tasteless drinkable substance filling lakes and oceans is XYZ. Meanwhile, as far as one is an ordinary adult, one's term 'water' has many associated properties such as the properties of being transparent, odourless, tasteless, drinkable, etc. Then, given that the twin-earth world is considered as actual, one will be able to know a priori that a substance satisfying the associated properties of 'water' is XYZ so that one will be able to know a priori that water is XYZ. In this way, one will be able to know a priori that if W is actual, then 'water is XYZ' is true.

With regard to primary possibility, Chalmers claims that a statement S is primarily possible if and only if there is some metaphysically possible world W such that if W is considered as actual, S is true. For example, 'water is XYZ' is primarily possible because the twin-earth world is metaphysically possible and if it is considered as actual, 'water is XYZ' is true.

Now we can understand Chalmers's claim that ideal primary conceivability entails primary possibility. Given the above account, we can regard this claim as roughly saying the following: if on ideal rational reflection, one can imagine some world W such that if W is considered as actual, S is true, such a world W is metaphysically possible.

As I said at the beginning of this overview, I think that there are intuitively (a priori) conceivable statements that Chalmers's notion of primary conceivability cannot accommodate. In order to provide an example, suppose that X is an ordinary adult having average scientific knowledge. Just as many ordinary adults, X knows that

there are many chemical elements of which X does not know even their names. Of some other elements, X knows their names but has no idea about their properties. Iridium and rubidium are among such elements. Of still other elements such as lithium and gold, X has familiarity in varying degrees.

Then, consider the following statement S_1 : 'iridium has 70 protons and there is no sentient being.' Since necessarily, iridium has 77 protons, S_1 is metaphysically (i.e., secondarily) impossible. But S_1 seems intuitively conceivable a priori. If 'water is XYZ' is conceivable a priori, there seems no reason not to think that 'iridium has 70 protons' is conceivable a priori. And we can conceive a priori a world where there is no sentient being. Also, there seems no reason to think that the truth of one conjunct makes the other conjunct false.

However, although S_1 is conceivable a priori, it is not ideally primarily conceivable. In order to explain this claim, first, note that X has no idea about the properties of iridium. Thus, whatever world W turns out to be actual, X will not be able to determinately pick out a substance in W as a referent of 'iridium' based on its appearance. Contrast this case with the case in which water is XYZ. In the latter case, one's term 'water' has many associated properties such as the properties of being transparent, odourless, tasteless, drinkable, etc. and they allow one to determinately pick out XYZ having such properties as the referent of 'water' in the twin-earth world. But in the case of 'iridium', this sort of reference-fixing is not viable.

Nevertheless, X can still fix the reference of 'iridium' in some world considered as actual. This is because although X has no idea about the properties of iridium, X at least associates with 'iridium' a metalinguistic property of being called 'iridium' by chemists in X's community. Thus, if Putnam's original twin-earth world is considered as actual, X will be able to pick out a certain substance called 'iridium'

by chemists as the referent of 'iridium'.

However, for every world W , if X can fix the reference of 'iridium' based on the metalinguistic property in W considered as actual, W will contain language users so that it will contain sentient beings. Then, given that S_1 is 'iridium has 70 protons and there is no sentient being', the second conjunct of S_1 will be false in W . On the other hand, for every world W , if there is no sentient being in W considered as actual, X will not be able to fix the reference of 'iridium' so that the first conjunct will be indeterminate. Thus, whatever world turns out to be actual, S_1 will be false or indeterminate. Since this entails that on ideal rational reflection, X cannot imagine some world W such that if W is considered as actual, S_1 is true, S_1 is not ideally primarily conceivable. Thus, the intuitive conceivability of S_1 is not explained in terms of ideal primary conceivability.

One might think that the intuitive conceivability of S_1 is explained in terms of prima facie (i.e., not-ideal) primary conceivability. But I think that rational reflection involved in intuitive conceivability is ideal and this explains the intuitiveness or a robust sense of intuitive conceivability.

Also, S_1 is not ideally secondarily conceivable. According to Chalmers, ideal secondary conceivability entails secondary possibility. But S_1 is secondarily impossible. Thus, S_1 is not ideally secondarily conceivable.

Then, how should we understand the intuitive conceivability of S_1 ? A plausible attempt is to understand it in terms of prima facie (i.e., not-ideal) secondary conceivability and, in fact, this is the only remaining option among Chalmers's notions of conceivability. As explained above, secondary conceivability is ideal if and only if it is based on ideal rational reflection and sufficient empirical information about the actual world. Then, prima facie secondary conceivability

can be understood as secondary conceivability lacking ideal rational reflection or empirical information or both. I think that the intuitive conceivability of S_1 can be understood in terms of prima facie secondary conceivability lacking empirical information but involving ideal rational reflection.

In order to argue my point, I need to explain how one secondarily conceives a statement. Consider secondary conceivability of 'water is XYZ'. As explained above, to say that one can secondarily conceive this statement is just to say that one can conceive that it could have been that water is XYZ. And this is equivalent to saying that for some substance m which is supposed by one as the actual referent of 'water' and for some world W , one finds it conceivable that if W is considered as counterfactual, m is XYZ in W . Note that if one is given empirical information that m is H_2O , one will know that W is impossible because one will know that it is impossible that m (i.e., H_2O) is XYZ. But since one lacks relevant empirical information, one can secondarily conceive the secondary impossible statement 'water is XYZ'.

We can understand secondary conceivability of S_1 in the same way. When X can secondarily conceive 'iridium has 70 protons and there is no sentient being', for some substance m which is supposed by X as the actual referent of 'iridium' and for some world W , X finds it conceivable that if W is considered as counterfactual, m has 70 protons and there is no sentient being in W . Although S_1 is secondarily impossible, X can secondarily conceive S_1 because X lacks empirical information that iridium has 77 protons.

The problem of understanding the intuitive conceivability of S_1 in terms of secondary conceivability lacking empirical information is that it does not explain how X can suppose some substance m to be the actual referent of 'iridium'. Also, it does not explain how rational

reflection involved in secondary conceivability of S_1 can be ideal. These problems can be properly responded by introducing the notion of two-dimensional conceivability. (Although Chalmers does not provide this notion, we can draw it from his epistemic two-dimensionalism.)

Two-dimensional conceivability consists of primary conceivability and secondary conceivability. Let me explain this by using a statement 'water is a red explosive substance'. Suppose that W_1 is Putnam's twin-earth world and W_2 is a world in which XYZ is a red explosive substance. Then, one can two-dimensionally conceive 'water is a red explosive substance' by primarily conceiving W_1 and secondarily conceiving W_2 . First, by primarily conceiving W_1 (i.e., by conceiving W_1 and considering it as actual), one can pick out XYZ as the referent of one's term 'water'. Given that W_1 is considered as actual, 'water' designates XYZ in every world considered as counterfactual. Then, by secondarily conceiving W_2 (i.e., by conceiving W_2 and considering it as counterfactual), one can conceive a world such that when it is considered as counterfactual, water is a red explosive substance.

We can understand two-dimensional conceivability of S_1 in the same way. First, by primarily conceiving a variant twin-earth world where a substance m having 70 protons is called 'iridium' by chemists, X can pick out m as the referent of 'iridium'. Then, by secondarily conceiving a world where m exists and there is no sentient being, X can conceive a world such that when it is considered as counterfactual, S_1 is true.

Note that two-dimensional conceivability can be ideal. First, its primary conceivability of a world W_a can be ideal because rational reflection can be ideal. And its secondary conceivability of a world W_c can be also ideal because every piece of information about the actual

world is given by primary conceivability of W_a and rational reflection can be ideal. Thus, two-dimensional conceivability explains ideal rational reflection involved in prima facie secondary conceivability of S_1 and hence that involved in the intuitive conceivability of S_1 .

Also, note that two-dimensional conceivability is a priori conceivability. In primarily conceiving W_a , one depends only on rational reflection. And although in secondarily conceiving W_c , one depends on empirical information about W_a as well as rational reflection, such empirical information is provided by one's primary conceiving of W_a . Thus, it is provided by one's rational reflection. In this way, two-dimensional conceivability depends only on rational reflection.

Given the above discussion, the intuitive conceivability of S_1 is best identified with ideal two-dimensional conceivability of S_1 . Then, what sort of possibility is entailed by ideal two-dimensional conceivability and hence by intuitive conceivability? In order to answer this question, consider the above case involving the statement 'water is a red explosive substance'. Given that ideal primary and secondary conceivability entail primary and secondary possibility, ideal two-dimensional conceivability of that statement entails a counterfactual possibility that water being identified with XYZ is a red explosive substance. In other words, the ideal two-dimensional conceivability entails a counterfactual possibility of twin-earth water. In the same way, ideal two-dimensional conceivability of S_1 entails a counterfactual possibility of twin-earth iridium (which has 70 protons rather than 77 protons). In this way, ideal two-dimensional conceivability of a statement consisting of our terms entails metaphysical possibility related to different terms such as twin-earth ones rather than that related to our terms (or our metaphysical possibility).

The above argument reveals a source of modal error. It shows that ideal primary conceivability is not the only a priori conceivability as ideal two-dimensional conceivability is also a priori conceivability. Thus, it is wrong to claim that our a priori conceivability entails only our metaphysical possibility. In this respect, when one depends on a priori conceivability to know metaphysical possibility, one must be cautious not to commit a modal error of regarding what is not metaphysically possible from the perspective of one's world as metaphysically possible.

2. Moderate Rationalism and Epistemic Possibility

Moderate rationalism argued by Bealer (1987, 1996, 1999, 2002, 2004) tries to elucidate our modal knowledge in terms of intuition. According to Bealer, intuition is our primary source of knowledge about metaphysical necessity and possibility because intuition provides all pieces of evidence for most such knowledge. In other cases of modal knowledge where other kinds of evidence are required, intuition plays a crucial role of justification by providing evidence for the modal feature. In this sense, our modal knowledge is based on intuition.

In this chapter, I will assess Bealer's moderate rationalism, in particular, focusing on his notion of full understanding. This notion is important because his idea of intuition as evidence is based on it. Bealer offers three conditions for full understanding of concepts and propositions. What is specifically relevant to this chapter is his second condition concerning epistemic possibility. According to this condition, given full understanding, our a priori intuition about epistemic possibility concerning property-identities gives us a priori knowledge about metaphysical possibility. I will argue against this claim and show that his second condition does not hold.

(This chapter proceeds as follows: In Section 2.1, I will provide an exposition of Bealer's moderate rationalism. First of all, I will explain Bealer's view about the relation between modal knowledge and intuition. Then, it will be explained how full understanding of concepts confers an evidential status on intuition. Also, I will provide Bealer's account of how his notions of full understanding and epistemic

possibility can accommodate apparent counterexamples raised by Putnam and Kripke. In the meantime, I will present his weaker version of full understanding which will be the main focus of the subsequent sections of this chapter. In Section 2.2, I will provide an objection to Bealer's formulation of full understanding, focusing on its condition concerning epistemic possibility. In particular, I will argue that this condition does not hold when the following two theses are assumed: (1) Identical macroscopic perceptual condition to the effect that a counterpart's perceptual condition concerning macroscopic properties is the same as that of an original subject, and (2) a posteriori macroscopic necessity to the effect that it is knowable a posteriori what macroscopic properties a substance necessarily has. I will show how these theses lead one to reject one's intuition of epistemic possibility concerning property-identities. In Section 2.3, I will discuss my assumption of the thesis of identical macroscopic perceptual condition by considering a possible reply to my objection and responding to it. According to the reply, one is not required to accept the thesis if one is sympathetic to the Fregean theory of phenomenal content. In response to this reply, I will argue that given Bealer's notion of semantically stable concepts, the thesis holds with regard to semantically stable properties. Then, I will propose a weaker version of the thesis which Bealer has to accept and show that this thesis is enough to get my argument off the ground. The argument for the thesis of a posteriori macroscopic necessity will be offered in the next chapter.)

2.1. Bealer's Moderate Rationalism

In this section, I will provide an exposition of Bealer's moderate rationalism, in particular, focusing on his notion of full understanding. First of all, in Subsection 2.1.1, I will explain Bealer's idea about the relation between modal knowledge and intuition. Then, I will introduce Bealer's notion of intuition as evidence and explain how full understanding of concepts confers an evidential status on intuition. In Subsection 2.1.2, I will show how Bealer responds to apparent counterexamples against his formulation of full understanding by employing the notion of epistemic possibility. After providing his response, I will present his weaker version of full understanding that will be the main focus of the subsequent sections of this chapter.

2.1.1. Full understanding

To begin with, consider the following argument that summarises Bealer's main claim about modal knowledge:

- (1) Modal knowledge is itself a priori knowledge or is based on a priori knowledge.
- (2) All a priori knowledge is knowable only on the basis of intuition.^{6,7}

⁶ Bealer (2002: 73) claims as follows: "Intuition is the source of all a priori knowledge". However, as he warns, this is not quite right because stipulative knowledge also counts as a priori knowledge. The following formulation by him (2002: 74) resolves the problem: "x knows p a priori iff x knows p and this is direct intuitive knowledge or stipulative knowledge or is based wholly upon such knowledge and/or intuitional evidence". For the simplicity of discussion, I will ignore this complication and focus only on non-stipulative a priori knowledge.

⁷ Bealer (1999: 30-31) claims that intuition is intellectual seeming just as experience is sensory seeming. Also, he regards intellectual seeming as a primitive propositional attitude.

- (3) Therefore, modal knowledge is knowable only on the basis of intuition or is based on knowledge knowable only on the basis of intuition.

As alluded to by this simple argument, the crucial part of arguing moderate rationalism consists of clarifying and defending the premises (1) and (2). First of all, let me explain the premise (2). (The premise (1) will be discussed in the next subsection.)

The premise (2) depends on Bealer's claim that intuition is evidence. Given that knowledge requires justification as a necessary condition, Bealer thinks that intuition as evidence provides the requisite justification for a priori knowledge. Thus, in order to argue for (2), he should show why intuition is evidence.

The evidential status of intuition is given by modal reliabilism together with the truth-based theory of evidence. According to modal reliabilism (Bealer (1999: 35-36)), there is a strong modal tie between the deliverances of our intuitions and the truth. For example, if you have an intuition that two is the smallest prime number (in a sufficiently good cognitive condition), necessarily, you have this intuition if and only if two is the smallest prime number. When modal reliabilism is combined with the truth-based theory of evidence to the effect that a type of propositional attitude having a strong modal tie to the truth counts as evidence, intuition counts as (a basic source of) evidence.⁸ This indicates that the evidential status of intuition depends on the strong modal tie that intuition has to the truth. Therefore, the main task of establishing intuition's evidential status amounts to the task of establishing the modal tie.

⁸ The truth-based theory of evidence is not apt for non-basic sources of evidence because such sources can count as evidence even if their deliverances are largely false. See Bealer (1999: 34-36). For the claim that intuition is a type of propositional attitude, see Bealer (1999: 30-31). Also, for the truth-based theory of evidence, see Bealer (1987: 319).

The strong modal tie Bealer has in mind is a possibility that is actualised when cognitively ideal circumstances hold. According to him (1987: 322), “cognitively ideal circumstances are those achieved at the end (versus the beginning) of philosophical dialectic or at the end of the theoretical systematization of one’s intuitions, where throughout the process of dialectic or theoretical systematization there is sufficient distinctness, clarity (attentiveness), intelligence, memory (and perhaps desire).”

To see Bealer’s point, consider some simple examples. Suppose that a person fully understands the concept of being a prime number. But because of her cognitive malfunctioning, she has an intuition that -3 is a prime number. This example does not show that her intuition does not have a modal tie to the truth because when cognitively ideal circumstances hold, she will have a truth-tracking intuition that -3 is not a prime number.

As another example, suppose that a person fully understands a very difficult concept in mathematics. Despite her full understanding, applying the concept correctly requires nearly ideal cognitive circumstances. Thus, her intuition involving this concept is unreliable in ordinary cognitive circumstances. But this does not show that there is no modal tie between the deliverance of her intuition and the truth because when ideal cognitive circumstances hold, her intuition involving the concept will track the truth.

As in the examples, the modal tie between the deliverances of intuitions and the truth holds in cognitively ideal circumstances *on the assumption that* concepts involved in intuitions are fully understood. In fact, Bealer (1999: 41) regards fully understanding a concept as a categorical base of possibility of the modal tie.

To briefly summarise the above discussion, the premise (2) depends on the claim that intuition is evidence. And this claim

depends on the claim that there is a strong modal tie between the deliverances of intuitions and the truth (together with the correctness of the truth-based theory of evidence). Finally, the latter claim is based on the claim that fully understanding a concept constitutes the categorical base of the modal tie. Therefore, explicating the evidential status of intuition and defending the premise (2) require explaining full understanding of a concept.

According to Bealer (2004: 19-20), full understanding⁹ is a mode of understanding that has the following features:

Full understanding = the natural mode *m* of understanding such that, necessarily, for arbitrary noncontingent [proposition] *p* and arbitrary subject *x* who understands *p* *m*-ly, *p* is true iff it is possible for *x* to settle with a priori stability that *p* is true.

x settles *p* with a *a priori stability* iff (i) after suitable improvement in *x*'s cognitive conditions (intelligence, etc.) and growth in *x*'s conceptual repertory, *x*'s best a priori theory deems *p* to be true (or not true); (ii) necessarily, no further improvement in cognitive conditions or growth in *x*'s conceptual repertory leads to an a priori theory rendering a different verdict on *p*, and (iii) throughout the entire process *x* continues to possess *m*-ly the concepts involved in *p*.

The a priori stability roughly means that once *x* achieves a certain level of cognitive conditions and conceptual repertory, *x*'s intuition concerning *p* remains the same even when *x* achieves any higher level of them. Given the meaning of a priori stability, Bealer's notion of full understanding expresses an idea that given a certain (i.e., the lowest) level of cognitive conditions and conceptual repertory

⁹ In other papers (1987, 1999, 2002), Bealer calls this mode of understanding a concept "determinately understanding a concept" or "determinately possessing a concept". "Fully understanding a concept" is a relatively recent terminology offered in Bealer (2004).

required for a priori stability, necessarily, x's intuition yields a verdict that p is true iff p is true and it is possible for x to reach such a level. This explains the modal tie between the deliverances of intuitions and the truth that holds in cognitively ideal circumstances. Such circumstances hold when x reaches the lowest level of cognitive conditions and conceptual repertory required for a priori stability, and once x reaches such a level, the modal tie (or the necessary relation in the formulation of full understanding) between x's intuition and the truth is established. And the modal tie (or the necessary relation) is possible because the ideal circumstances (or the lowest level for a priori stability) are possible.

Finally, given the explanation of full understanding of a proposition, we can say that x fully understands a concept iff x fully understands a proposition involving that concept (assuming that the other concepts involved in the proposition are fully understood).

However, the account of full understanding has a serious problem of ignoring the counterexamples forcefully argued by Putnam and Kripke. In response to this, Bealer weakens his condition of full understanding.

2.1.2. Epistemic possibility and scientific essentialism

In this subsection, I will explain how Bealer's notion of epistemic possibility provides a response to counterexamples against his formulation of full understanding. Also, I will explain his distinction between semantically stable concepts and unstable ones. Finally, his weaker version of full understanding will be presented.

For the sake of exposition, let me provide some preliminary points made by Bealer. Bealer (2002: 77-81, 2004: 16-17) distinguishes

various epistemic uses of 'could' relevant to modal epistemology. Among them the particularly important use with regard to full understanding is his use of 'could'-of-qualitative-evidential-neutrality. This use is closely related to apparent intuitions against a posteriori necessary truths.

Putnam and Kripke whom Bealer calls 'scientific essentialists' claim that there are a posteriori necessary truths knowledge of which requires empirical evidence. Propositions expressed by 'necessarily, water is H₂O' and 'necessarily, Hesperus is Phosphorus' are well-known examples of such truths. As shown by their philosophical method of arguing, their claim about them is based on intuitions concerning hypothetical cases such as Putnam's Twin-Earth case. However, it seems that we also have a counter-intuition to the effect that it could have turned out that water is XYZ (\neq H₂O). Kripke (1980) responds to this apparent intuition conflict by claiming that the latter kind of intuition concerns mere epistemic possibility rather than genuine metaphysical possibility.

The use of 'could'-of-qualitative-evidential-neutrality captures Kripke's treatment of epistemic possibility. Consider the following truth condition offered by Bealer (2004: 17): (In what follows, $\diamond_{\text{qual-evid-neut}}$ corresponds to the use of 'could'-of-qualitative-evidential-neutrality.)

The proposition that $\diamond_{\text{qual-evid-neut}} p$ is true iff it is possible for there to be a population c with attitudes toward p and it is possible for there to be a population c' whose epistemic situation is qualitatively identical to that of c such that the proposition p' , which in c' is the epistemic counterpart of p in c , is true.

Let me explain this with an example. Suppose that p is a proposition that water is XYZ and c is the group of us, the Earthlings. Also,

suppose that c' is the group of Twin-Earthlings in Twin-Earth. Then, $\diamond_{\text{qual-evid-neut}} p$ is true (or the proposition that it could have turned out that water was XYZ is true) iff Twin-Earthlings apply the counterpart of the concept of being water to XYZ.

Based on the truth condition of $\diamond_{\text{qual-evid-neut}} p$, Bealer (2002: 80) claims that $\diamond_{\text{qual-evid-neut}} p$ as an epistemic possibility entails a metaphysical possibility of the counterpart proposition p' . This means that the epistemic possibility that it could have turned out that water was XYZ entails the metaphysical possibility that it could have been that the twin-earth counterpart of the concept of being water was applied to XYZ.

The discussion about epistemic possibility naturally leads to the distinction between semantically stable propositions and semantically unstable ones. A semantically stable proposition is a proposition that is constant throughout qualitatively identical epistemic situations. Given the above truth condition, a proposition p is semantically stable iff p and its epistemic counterpart proposition p' are identical. In the same way, a proposition p is semantically unstable iff p and p' are not identical. An important point about semantically stable propositions is that the epistemic possibility of p entails the metaphysical possibility of its epistemic counterpart proposition p' and consequently the metaphysical possibility of p because p and p' are identical. Bealer (2002: 72) thinks that this feature of semantically stable propositions allows these propositions not to be subject to the Twin-Earth style thought experiments and hence to be immune from scientific essentialism.

Based on the distinction between semantic stability and unstability, Bealer (1987: 295, 2002: 107) distinguishes our concepts into two tiers. The first tier consists of semantically stable concepts. They are semantically stable because when a proposition includes exclusively

these concepts, it is semantically stable. Bealer distinguishes the first tier into two sub-classes, category and content concepts.¹⁰ Examples (Bealer (1987: 295)) of the former are “the concepts of stuff, compositional stuff, functional stuff, substance, quality, quantity, action, artificial, natural, cause, reason, person, etc.” and those of the latter are “familiar phenomenal qualities (pain, itchiness, tingling-sensation, etc.) and basic mental relations (knowing, perceiving, deciding, loving, etc.).” The second tier consists of semantically unstable naturalistic concepts such as being water, gold, etc.

Now we are in the position to weaken the formulation of full understanding so that it can accommodate the counterexamples offered by scientific essentialists. Consider again the following formulation (Bealer (2004: 19-20)):

Full understanding = the natural mode *m* of understanding such that, necessarily, for arbitrary noncontingent [proposition] *p* and arbitrary subject *x* who understands *p* *m*-ly, *p* is true iff it is possible for *x* to settle with a priori stability that *p* is true.

The problem raised by a posteriori necessary truths (i.e., the counterexamples against the above formulation) is that the following conditional does not hold: *p* is true only if it is possible for *x* to settle with a priori stability that *p* is true. For example, when *p* is a proposition that water is H₂O, although it is true, it is *not* possible for *x* to settle with a priori stability that it is true that water is H₂O because this proposition is knowable a posteriori. However, that conditional can be weakened by requiring *x* to only have an intuition about the twin-earth style epistemic possibility of *p* (i.e., $\diamond_{\text{qual-evid-neut}} p$) (or an intuition about the metaphysical possibility of the counterpart

¹⁰ The motivation for this distinction is provided by the two kinds of our basic evidence: intuition and phenomenal experience. See Bealer (1999: 47).

proposition p'). The idea is that although it is not possible for x to have an intuition that p is true, it is possible for x to have an intuition that $\diamond_{\text{qual-evid-neut}} p$ or an intuition that it is metaphysically possible that p' . For example, when p is the proposition that water is H_2O , it is not possible for x to have an intuition that water is H_2O . But it is possible for x to have an intuition that it is metaphysically possible that one of the populations (including our population) whose epistemic situation is qualitatively identical to us applies the counterpart of the concept of being water to H_2O . Meanwhile, in order to have such a twin-earth intuition, x must grasp the relevant category of water (i.e., a substance). Thus, according to Bealer (2002: 105), full understanding of the concept of being water requires x to grasp the relevant category of water and this point is generally applied to other naturalistic concepts.

In order to accommodate a posteriori necessary truths, the left-to-right conditional of full understanding was weakened so that it only requires x to have twin-earth intuitions about true propositions. However, weakening the conditional raises a problem concerning naturalistic concepts. The problem is that it allows x to have full understanding of a naturalistic concept even when x has only poor knowledge about the entity to which the concept is applied. For example, x can have a twin-earth intuition concerning a proposition that jadeite is $NaAlSi_2O_6$ even when x only knows that jadeite is a kind of mineral. Since x can have a twin-earth intuition concerning the proposition, given the weakened condition for full understanding, x fully understands the proposition and hence the concept of being jadeite.

However, according to Bealer (2002: 105-106), x 's understanding of the concept of being jadeite cannot count as full understanding. This is because it does not allow x to gain knowledge about jadeite

by empirical investigation. Suppose that x is given a sample of jadeite. Then, given x's poor understanding of the concept of being jadeite, x will not be able to know that the sample is jadeite. Also, even if x finds out that the sample has certain properties after investigating the sample thoroughly, x will not know that jadeite has such properties. According to Bealer (2002: 106), in order to have full understanding of the concept of being jadeite, "[w]hat x needs is, roughly, enough information to 'begin doing the science' of" jadeite. Thus, by having sufficient true beliefs about jadeite's various properties, x's deficient mode of understanding of the concept of being jadeite can be improved to full understanding.

Now let us summarise the above discussion by the following formulation offered by Bealer (2002: 106):

[Full] understanding = the mode m of understanding such that, necessarily, for all x and all p understood m-ly by x,

(a) p is true *if* it is possible for x to settle with a priori stability that p is true.

(b.i) p is true *only if* it is possible for x to settle with a priori stability that p has a counterpart that is true. (for property-identities p)

(b.ii) p is true *only if* it is possible for x to believe m-ly that p is true. (for p believable by x)¹¹

At the beginning of the previous subsection, it was claimed that modal knowledge is itself a priori knowledge or is based on a priori knowledge. Now we are in the position to explain this claim. First, if a

¹¹ Since Bealer (2004) does not provide the above formulation in terms of full understanding, I quoted the formulation of determinate understanding in Bealer (2002) and rephrased it for terminological consistency. There is no substantial difference between the notion of determinate understanding in Bealer (2002) and that of full understanding in Bealer (2004). Meanwhile, in this chapter, I will focus only on the conditions (a) and (b.i).

modal proposition includes exclusively semantically stable concepts, it is knowable a priori on the basis of intuition originating from full understanding of the concepts involved. Second, if a modal proposition includes naturalistic concepts, there are cases where empirical evidence is required to know the proposition (e.g., our modal knowledge that necessarily, water is H₂O).¹² However, even in such cases, knowing the modal proposition crucially depends on a priori knowledge about general categorial principles such as the following: “if a sample of a given purely compositional stuff has such-and-such composition, then, necessarily, all other samples of that purely compositional stuff also have that composition.” (Bealer (2002: 107)) Since general categorial principles contain only semantically stable concepts, they are knowable a priori. In general, knowledge about a posteriori necessary propositions depends on a priori knowledge because the modal aspect of them is knowable through a priori knowledge about general categorial principles.

¹² But there are other cases where empirical evidence is not required. For example, a proposition that necessarily, water is a substance is knowable a priori.

2.2. The Problem of Full Understanding

In this section, I will assess the conditions (a) and (b.i) of full understanding and argue that the condition (b.i) does not hold given two plausible theses. After providing an argument, I will justify one of the theses in Section 2.3 and the other in the next chapter.

2.2.1. Condition (a) of full understanding

In this subsection, I will show how the condition (a) of full understanding is satisfied by propositions involving naturalistic concepts. This discussion will allow us to explain Bealer's notion of theoretical systematisation of intuitions that will play a role in my argument.

To begin with, let us consider the condition (a) as follows:

(a) p is true *if* it is possible for x to settle with a priori stability that p is true.

This condition is trivially satisfied by most propositions containing naturalist concepts.¹³ For example, if p is the proposition that water is H_2O , x cannot settle with a priori stability that p is true. This is because in order to settle that, x need empirical information to the effect that water is H_2O . Since the antecedent of the condition (a) is not satisfied by p , the whole conditional is trivially satisfied by p .

But do the following propositions satisfy the condition (a)?

¹³ But not by all propositions because there are propositions containing naturalistic concepts that satisfy the antecedent of the condition (a). For example, the proposition that water is a substance is such a proposition.

p_1 : It is metaphysically possible that water is H_2O .

p_2 : It is metaphysically possible that water is XYZ.

At first glance, it seems that the condition (a) is nontrivially satisfied by p_1 . This is because it seems to be possible for x to have an intuition that p_1 is true and p_1 is in fact true. Let us call this intuition “a *prima facie* intuition”.

However, the claim that x has a *prima facie* intuition that p_1 is true leads to the claim that x also has a *prima facie* intuition that p_2 is true. This is because from x 's *a priori* perspective, there is no reason to treat p_1 and p_2 differently. A difference between p_1 and p_2 is an *empirical* difference that p_1 contains empirically correct information while p_2 does not. Such a difference is not knowable *a priori*. There is another difference between them, i.e., a modal difference that the metaphysical possibility expressed by p_1 holds while that expressed by p_2 does not. However, it is not knowable *a priori* which metaphysical possibility holds since from x 's *a priori* perspective, x is neutral between p_1 and p_2 . Only with empirical evidence can x tell that p_1 contains empirically correct information and the metaphysical possibility it expresses holds. Therefore, if x has a *prima facie* intuition that p_1 is true, x also has to have a *prima facie* intuition that p_2 is true. However, if x has a *prima facie* intuition that p_2 is true, the condition (a) is not satisfied because the consequent (that p_2 is true) is false while the antecedent is true.

Bealer's notion of theoretical systematisation of intuitions provides a resource for precluding apparent counterexamples. According to Bealer (1996: 122), the theoretical systematisation of intuitions consists of dialectical processes of picking out correct intuitions and

rejecting wrong ones among one's prima facie intuitions.¹⁴ As an example of the dialectical process, suppose that you have an intuition that it is possible that water is XYZ, and also have an intuition that necessarily, a substance has its chemical composition. Then, given your knowledge that water is a substance having H₂O as its chemical composition, you can reject the former intuition by a dialectical process of competing both intuitions.¹⁵ Often, cases are not as easy as this. In some difficult cases, one needs to construct a theory by systematising one's intuitions and test a target intuition against the theory. But it remains the same that the theoretical systematisation is our a priori processes of picking out correct intuitions.

Let us return to our case about p₁ and p₂. As I claimed above, if x has a prima facie intuition that p₁ is true, x also has a prima facie intuition that p₂ is true. But this is problematic because the latter intuition does not satisfy the condition (a).

Given the notion of theoretical systematisation of intuitions, we can respond to the problem by rejecting the prima facie intuition about p₂ (and this also leads to the rejection of the prima facie intuition about p₁).¹⁶ Before x considers the propositions p₁ and p₂, x has an intuition

¹⁴ Bealer (1996: 122) offers the following picture about a priori justification that involves the theoretical systematisation: "(1) canvassing intuitions; (2) subjecting those intuitions to dialectical critique; (3) constructing theories that systematize the surviving intuitions; (4) testing those theories against further intuitions; (5) repeating the process until equilibrium is approached."

¹⁵ For more examples, see Bealer (2004: 32-34).

¹⁶ Bealer does not discuss this issue explicitly. But there is a consideration for attributing this response to Bealer. While discussing the evidential status of intuition from the perspective of scientific essentialists, Bealer (1987: 337-338) claims as follows: "Do we have any intuitions one way or another about the *metaphysical possibility* of a puddle of water with no hydrogen in it or the *metaphysical possibility* of a hot thing with no rapidly moving microscopic parts? The answer, it seems, must be this. When one suppresses all auxiliary [sic] empirical beliefs that might contaminate one's intuitions (e.g., the empirical beliefs that water = H₂O and that heat = mean kinetic energy), one does not really have an intuition one way or the other about such matters. Most scientific essentialists I have asked take this line about their own intuitions." Although Bealer does not explicitly say that he accepts this, I think he is sympathetic to it.

that for an arbitrary chemical composition c , the proposition that water is c is necessarily true or necessarily false. But x cannot settle with a priori stability what particular chemical composition makes the proposition necessarily false because settling this issue requires empirical information. Therefore, x cannot a priori rule out the case where the proposition that water is H_2O turns out to be necessarily false. In the same way, x cannot a priori rule out the case where the proposition that water is XYZ turns out to be necessarily false. This implies that x cannot settle with a priori stability that p_1 (it is metaphysically possible that water is H_2O) is true or p_2 (it is metaphysically possible that water is XYZ) is true. Therefore, the theoretical systematisation of x 's intuitions leads x to reject the prima facie intuitions concerning p_1 and p_2 . Given this result, (a) is trivially satisfied because the antecedent of (a) is false.

2.2.2. Condition (b.i) of full understanding: Preliminary points

In this subsection, I will provide some preliminary points for my argument. In particular, I will offer a condition for the metaphysical possibility of a counterpart proposition and make clear the notion of the same epistemic role of a counterpart concept.

To begin with, let us consider the condition (b.i) of full understanding.

[Condition (b.i) of full understanding] p is true *only if* it is possible for x to settle with a priori stability that p has a counterpart that is true. (for property-identities p)

Bealer claims that even though x lacks a priori intuitions concerning true a posteriori property-identities such as one that water is H_2O , x

has twin-earth intuitions concerning them. The condition (b.i) is intended to capture this idea. In what follows, I will assess Bealer's claim using the following proposition:

[Proposition p₃]: The property of being water is identical to the property of being H₂O.¹⁷

As discussed in the previous subsection, p₃ trivially satisfies the condition (a) of full understanding. Also, it seems that p₃ satisfies the condition (b.i). First of all, it seems possible for x to have a twin-earth intuition to the effect that there is a counterpart world where the counterpart of x's concept of being water is applied to a substance having H₂O as its microscopic structure. If we have an intuition that Putnam's original Twin-Earth is possible, there seems no reason to claim that x cannot have that twin-earth intuition. Also, if we regard the former intuition as correct, there seems no reason to regard the latter intuition as incorrect. However, as will be shown below, this impression is wrong. In particular, I will argue that if two plausible theses are given, theoretical systematisation of x's intuitions will lead x to refuse x's above twin-earth intuition as incorrect. (But the theses will not lead us to reject our intuition about the possibility of Putnam's original Twin-Earth.)

For the sake of argument, let p_{3c} be a counterpart of p₃, x_c a counterpart of x and a concept of being water_c a counterpart of x's concept of being water. (In what follows, I will use the subscript 'c' to indicate a counterpart.) Given Bealer's notion of the counterpart of a proposition whose definition is nearly the same as the truth condition for $\diamond_{\text{qual-evid-neut}} p$,¹⁸ the following condition for the counterpart of the

¹⁷ For this property-identity proposition, see Bealer (2002: 105).

¹⁸ Consider the following definition offered by Bealer (1999: Footnote 34): "The

concept of being water can be given: x_c 's concept of being water_c is a counterpart of x 's concept of being water if and only if x_c 's epistemic situation is qualitatively identical to that of x and the concept of being water_c plays the same epistemic role in x_c 's cognitive life as the concept of being water does in x 's cognitive life.¹⁹ Given this condition for the counterpart concept, we can construct the following condition for the metaphysical possibility of p_{3c} :

[Metaphysical possibility of p_{3c}] p_3 has a true counterpart p_{3c} if and only if there is a counterpart world where x_c applies the concept of being water_c to H_2O .²⁰

notion of counterpart is defined as follows: p' is a counterpart of p iff_{def} it is possible that there is a population C such that it is possible that, for some population C' which is in qualitatively the same epistemic situation as C , p' plays the same epistemic role in C' as p does in C ." This is different from the truth condition for $\Diamond_{\text{qual-evid-neut}} p$ only in that while the truth condition for $\Diamond_{\text{qual-evid-neut}} p$ requires p' to be true, the definition of the notion of counterpart does not require this.

¹⁹ For some points related to this formulation, see the first paragraph of the next footnote.

²⁰ Bealer (2004: Footnote 15) provides the following paraphrase of the consequent of the condition (b.i): "it is possible for x to settle with a priori stability that, possibly, for some community c , p plays a certain role in the cognitive life of c and, possibly, for some community c' whose epistemic situation is qualitatively identical to that of c , there is a proposition p' which in c' plays the same cognitive role as p plays in c and p' is true." A difference between Bealer's formulation and mine about the metaphysical possibility of a counterpart proposition is that Bealer's is formulated in terms of the epistemic role of propositions while mine in terms of the epistemic role of concepts. But this difference is superficial because the epistemic role of propositions can be defined in terms of that of concepts and vice versa. Another difference is that my formulation involves an actual epistemic role of the concept of being water while Bealer's only involves a possible epistemic role of a proposition. But this difference does not affect my argument because my argument can equally be constructed in terms of Bealer's formulation although it will be more complicated. Bealer rejects the metalinguistic approach employing twin-earth words and languages in his analysis of epistemic possibility. I follow this line in my formulation.

One might claim that p_{3c} must be a proposition that the property of being water_c is identical to the property of being $H_{c2}O_c$ (where H_c and O_c are counterparts of H and O) rather than a proposition that the property of being water_c is identical to the property of being H_2O . We can respond to this claim given the notion of semantically neutral expressions. This notion is offered by Chalmers (2002a: 166) as follows: "a semantically neutral expression might be seen intuitively as one that behaves the same way in epistemic and subjunctive evaluation, so that it is not susceptible to Twin Earth thought experiments [...]." In the same way, we can introduce the notion of semantically neutral concepts as each semantically neutral expression

expresses its corresponding semantically neutral concept. Then, if the concept of being H_2O is semantically neutral, the property of being H_2O and the property of being $H_{c_2}O_c$ will be identical. But if the concept of being H_2O is not semantically neutral, H_2O can be described using only semantically neutral microphysical concepts because if we ignore some complications irrelevant to our current topic, a world is completely described using only semantically neutral expressions according to Chalmers (2006: 86-89). Let us say that such a microphysical description is N . Then, by replacing H_2O in p_3 with an entity satisfying N , we can avoid the problem raised by the above claim. Also, my argument below equally holds given this replacement.

However, given the argument offered by Bealer (2002: 116-120), one might think the above picture is problematic. To roughly summarise his argument, if a natural-kind entity has a certain hidden property, there can be a case where it is not defined in terms of semantically neutral concepts. But it is controversial whether a property can be hidden while it exists. More importantly, even if there is some hidden property so that a natural-kind entity cannot be defined completely in terms of semantically neutral concepts, we can partly describe the entity in terms of such concepts. (Bealer (2002: 121-123) accepts this idea, and it is in fact a crucial element of his argument concerning the mind-body problem.) If U is a semantically non-neutral concept and N is a microphysical description using semantically neutral concepts, a natural-kind entity can be identified with an entity e to which U is applied and which satisfies N . Let me express this by ' $e(U, N)$ '. For example, an electron can be roughly identified with an entity to which the concept of being a particle of the actual world is applied and which satisfies the following description: an entity having certain values of mass, charge, spin, etc. (For the sake of argument, I am assuming that the concepts involved in the description are semantically neutral.) Given this idea, H_2O can be identified with $e(U, N)$ for certain U and N . Also, a counterpart of H_2O can be identified with $e(U_c, N)$ where U_c is a counterpart of the concept of U . Then, we can replace H_2O in p_3 with $e(U, N)$ and H_2O in the thesis of metaphysical possibility of p_{3c} with $e(U_c, N)$. My argument below equally holds given this replacement. For the sake of simplicity, I will not make the replacements discussed above and stick to the original formulation, assuming that the concept of being H_2O is semantically neutral.

So far, I have responded to the claim that p_{3c} must be a proposition that the property of being $water_c$ is identical to the property of being $H_{c_2}O_c$ (rather than the property of being H_2O), assuming that the claim is true. However, there is some independent consideration against the claim. Consider the sentence 'it could have turned out that water was H_2O '. According to Bealer (2002: 79, 2004: 20), this sentence expresses the proposition that $\diamond_{\text{qual-evid-neut}} p$ where p is that water is H_2O . According to our opponent's claim, the counterpart proposition p_c is that $water_c$ is $H_{c_2}O_c$. Then, given our discussion in the main text, the proposition that $\diamond_{\text{qual-evid-neut}} p$ is analysed as the claim that there is a counterpart world where the counterpart people apply the concept of being $water_c$ to $H_{c_2}O_c$. But there seems to be some case where that analysis is not the correct analysis of the sentence 'it could have turned out that water was H_2O '. For example, suppose that x knows that water consists of elements in x 's world. Then, when x utters the sentence, x might have no interest in $H_{c_2}O_c$ which might be a compound consisting of elements not found in x 's world such as schydrogen and schoxygen. Rather, x might be interested in whether water could have turned out to have two hydrogen atoms and one oxygen atom of x 's world. Then, in this case, the correct analysis will be that there is a counterpart world where the counterpart people apply the concept of being $water_c$.

Note that since the concept of being water_c is the counterpart of the concept of being water, the right-hand side of the biconditional requires as a necessary condition that the concept of being water_c play the same epistemic role in x_c 's cognitive life as the concept of being water does in x 's cognitive life. Let me express this point explicitly by the following thesis:

[Necessary condition for the metaphysical possibility of p_{3c}]

If there is a counterpart world where x_c applies the concept of being water_c to H_2O , the concept of being water_c plays the same epistemic role in x_c 's cognitive life as the concept of being water does in x 's cognitive life.

I need to clarify the consequent that the concept of being water_c plays the same epistemic role in x_c 's cognitive life as the concept of being water does in x 's cognitive life. Given that x and x_c are in a qualitatively identical epistemic situation, I understand the same epistemic role as making the following condition hold: (In the following condition, ' $p[\text{water}/\text{water}_c]$ ' means a proposition obtained by substituting every occurrence of the original concept 'water' in p by the concept ' water_c '.)

If x_c 's concept of being water_c plays the same epistemic role with x 's concept of being water, then, for every proposition p , x believes p if and only if x_c believes $p[\text{water}/\text{water}_c]$.²¹

to H_2O . And the counterpart proposition will be that the property of being water_c is identical to the property of being H_2O (rather than the property of being H_cO_c). I do not think that this consideration has much weight. But at least, it indicates that the opponent's claim is not automatically true.

²¹ The same epistemic role might be strengthened as follows: If x_c 's concept of being water_c plays the same epistemic role with x 's concept of being water, then, for every proposition p and every propositional attitude φ , x has φ towards p if and only if x_c has φ towards $p[\text{water}/\text{water}_c]$. But I do not need to discuss this issue because the weaker version is enough for the purpose of my argument.

For example, if x_c 's concept of being water_c is a counterpart of x 's concept of being water so that it plays the same epistemic role with x 's concept, then x believes propositions p that water is colourless, q that water is the same as ethanol in colour, and r that water is not metallic if and only if x_c believes propositions $p[\text{water}/\text{water}_c]$ that water_c is colourless, $q[\text{water}/\text{water}_c]$ that water_c is the same as ethanol in colour, and $r[\text{water}/\text{water}_c]$ that water_c is not metallic.

But if x_c has another counterpart concept in addition to the concept of being water_c , the above formulation does not hold. For example, suppose that x and x_c have the same concepts except that x has the concepts of being water and ethanol while x_c has the concepts of being water_c and ethanol_c . (Imagine a variant of Putnam's twin-earth case which includes not only the counterpart water (XYZ) but also counterpart ethanol.) According to the above condition, if x_c 's concept of being water_c plays the same epistemic role with x 's concept of being water, then x believes a proposition q that water is the same as ethanol in colour if and only if x_c believes a proposition $q[\text{water}/\text{water}_c]$ that water_c is the same as ethanol in colour. But x_c cannot believe $q[\text{water}/\text{water}_c]$ because x_c does not have the concept of being ethanol. We can fix this problem by replacing $q[\text{water}/\text{water}_c]$ with a proposition $q[\text{ethanol}/\text{ethanol}_c, \text{water}/\text{water}_c]$ that water_c is the same as ethanol_c in colour.

As another example, suppose that x and x_c have the same concepts except that x has the concepts of being water and being colourless while x_c has the concepts of being water_c and being colourless_c. Given that x_c 's concept of being colourless_c is a counterpart of x 's concept of being colourless, from the condition for the counterpart concept, it follows that x_c 's epistemic situation is qualitatively identical to that of x . Thus, x_c 's experience about something colourless_c in x_c 's world has the same phenomenal

character as x 's experience about something colourless in x 's world. But while x 's experience about something colourless is caused by and represents a physical property p_{r1} in x 's world, it is possible that x_c 's experience about something colourless_c is caused by and represents a different physical property p_{r2} in x_c 's world if x_c 's perceptual condition is different from x .²² In the same way, while x 's concept of being colourless is applied to p_{r1} , it is possible that x_c 's concept of being colourless_c is applied to p_{r2} . Given this case, the above condition for the same epistemic role is problematic. According to the condition, if x_c 's concept of being water_c plays the same epistemic role with x 's concept of being water, then x believes a proposition p that water is colourless if and only if x_c believes a proposition $p[\text{water}/\text{water}_c]$ that water_c is colourless. But x_c cannot believe $p[\text{water}/\text{water}_c]$ because x_c does not have the concept of being colourless. We can avoid this problem by replacing $p[\text{water}/\text{water}_c]$ with a proposition $p[\text{colourless}/\text{colourless}_c, \text{water}/\text{water}_c]$ that water_c is colourless_c.

We can apply the above discussion to a case where every concept possessed by x_c is the counterpart of x 's concepts.²³ For example, in

²² This presupposes a controversial position that an experience of colour represents a physical property. If one does not accept this position, one can replace the experience of colour and the represented physical property with an experience of a spatial property such as being spherical and a physical property of being spherical since the position that an experience of spatial properties represents spatial physical properties is much less controversial. Of course, it is not easy to conceive a case where two veridical spatial experiences with the same phenomenal character are caused by and represent different spatial properties, but I will introduce this case in the next section while discussing the Fregean theory of spatial phenomenal content argued by Thompson (2010). Since using spatial experiences and spatial properties as an example requires discussing the Fregean theory of spatial phenomenal content, I will stick to colour experiences and represented physical properties of them. But my argument does not depend on the position presupposed.

²³ Note that among x_c 's counterpart concepts, there are semantically stable concepts which are identical to x 's original concepts. For example, x_c 's concept of number_c is identical to x 's concept of number. See Subsection 2.1.2 for the distinction between semantically stable concepts and semantically non-stable ones.

this case, if x_c 's concept of being water_c plays the same epistemic role with x 's concept of being water, then x believes that water is colourless, odorless, tasteless, non-metallic, non-flammable, etc. if and only if x_c believes that water_c is colourless_c , odorless_c , tasteless_c , non-metallic_c , non-flammable_c , etc. In general, if every concept possessed by x_c is the counterpart of x 's, every proposition believed by x_c consists only of x_c 's counterpart concepts. From this, it follows that for every proposition containing the concept of being water_c believed by x_c , all other concepts constituting such a proposition are x_c 's counterpart concepts.²⁴ In my argument below, I will discuss the condition (b.i) of full understanding by supposing the last case because this strengthens Bealer's argument that I am trying to criticise.

Given the above discussion about the same epistemic role, we can see that the counterpart belief possessed by x_c is true (or is conceived to be true). In order to explain this point, let us consider the following example: if x_c 's concept of being water_c plays the same epistemic role with x 's concept of being water, then x believes that water is colourless if and only if x_c believes that water_c is colourless_c . (As

²⁴ In order to formulate a condition for the same epistemic role holding in the second, the third and the last cases, let me define a function as follows: $p[\forall(c/c_c)]$ is a function yielding a proposition that is obtained by substituting every occurrence in p of every original concept c having a counterpart c_c by c_c . Also, let $p[\forall(c\neq a/c_c)]$ be a function yielding a proposition that is obtained by substituting every occurrence in p of every original concept c having a counterpart c_c other than the original concept a by c_c . For example, suppose that x and x_c have the same concepts except that while x has the concepts of being water, being colourless, being tasteless, and being non-flammable, x_c has the concepts of being water_c , being colourless_c , being tasteless_c , and being non-flammable_c . If a is the concept of being water and p is a proposition that water is a colourless odorless tasteless non-metallic non-flammable liquid and ethanol is a colourless non-metallic liquid, then $p[\forall(c\neq a/c_c)]$ is a proposition that water_c is a colourless_c odorless_c tasteless_c non-metallic_c non-flammable_c liquid and ethanol is a colourless_c non-metallic_c liquid. Given the function, we can formulate a condition for the same epistemic role as follows: If x_c 's concept a_c plays the same epistemic role with x 's concept a , then for every proposition p , x believes p if and only if x_c believes $p[\forall(c\neq a/c_c)][a/a_c]$.

explained above, x_c 's experience of something colourless_c has the same phenomenal character (being achromatic) as x 's experience of something colourless but is caused by and represents a different physical property in x_c 's world.) Then, the metaphysical possibility of p_{3c} requires as a necessary condition that x_c 's belief that water_c is colourless_c be true. Consider the following argument:

- (1) From the thesis of metaphysical possibility of p_{3c} , it follows that if the counterpart proposition p_{3c} is metaphysically possible, x_c applies the concept of being water_c to a substance having H₂O as its microscopic structure (or a H₂O substance for short) in some counterpart world.
- (2) If x_c applies the concept of being water_c to the H₂O substance in some counterpart world, the H₂O substance looks achromatic to x_c . (Otherwise, x_c would not apply the concept of being water_c to the H₂O substance because x_c believes that water_c is colourless_c so that it looks achromatic.)
- (3) If the H₂O substance looks achromatic to x_c , it has the property to which the concept of being colourless_c is applied.
- (4) From (2) and (3), it follows that if x_c applies the concept of being water_c to the H₂O substance in some counterpart world, the H₂O substance has the property to which the concept of being colourless_c is applied.
- (5) If the H₂O substance has the property to which the concept of being colourless_c is applied, x_c 's belief that water_c is colourless_c is true. (This is because the H₂O substance to which the concept of being water_c is applied has the property to which the concept of being colourless_c is applied.)
- (6) From (1), (4), and (5), it follows that if the counterpart proposition p_{3c} is metaphysically possible, x_c 's belief that water_c is colourless_c is true.

Or, equivalently, in order for the counterpart proposition p_{3c} to be metaphysically possible, x_c 's belief that water_c is colourless_c must be

(conceived to be) true.²⁵

Meanwhile, the above point is applied to x_c 's other counterpart perceptual belief about water_c. Thus, we get the following condition:

[The same epistemic role] If the concept of being water_c plays the same epistemic role in x_c 's cognitive life as the concept of being water does in x 's cognitive life and if x has a perceptual belief that water is colourless, odorless, etc., x_c has a true belief that water_c is colourless_c, odorless_c, etc.²⁶

As a final preliminary point, I need to apply the condition (b.i) to the proposition p_3 as follows: p_3 is true *only if* it is possible for x to settle with a priori stability that p_3 has a true counterpart p_{3c} . Given this condition and the thesis of metaphysical possibility of p_{3c} (that p_3 has a true counterpart p_{3c} if and only if there is a counterpart world where x_c applies the concept of being water_c to H₂O), the following holds:

[(b.i) applied to p_3] p_3 is true *only if* it is possible for x to settle with a priori stability that there is a counterpart world where x_c applies the concept of being water_c to H₂O.

2.2.3. Argument against the condition (b.i) of full understanding

In this subsection, I will argue that the condition (b.i) of full understanding does not hold if two theses are assumed. After providing the argument, I will justify one of the theses in Section 2.3 and the other in the next chapter.

²⁵ For a detailed discussion and formal characterisation of this point, see the appendix of this chapter.

²⁶ The consequent of this thesis implicitly presupposes the claim that the counterpart proposition p_{3c} is metaphysically possible. But as will be shown in the next subsection, this is not problematic because the thesis will appear in my argument together with an antecedent that p_{3c} is metaphysically possible.

To begin with, let me offer the two theses that I will assume throughout my argument in this subsection as follows:

- (1) **[Identical macroscopic perceptual condition]** x_c 's perceptual condition concerning every macroscopic property is the same as x 's.
- (2) **[A posteriori macroscopic necessity]** It is knowable a posteriori what macroscopic properties a substance necessarily has.²⁷

The thesis of identical macroscopic perceptual condition says that if x_c has a veridical experience with the same phenomenal character as x 's veridical experience, x_c 's experience is caused by and represents the same macroscopic property as x 's experience. For example, if x_c has a veridical experience with a phenomenal character $C_{\text{colourless}}$ that x 's veridical experience has when x looks at something colourless and if x 's veridical experience with $C_{\text{colourless}}$ is caused by and represents a physical property $p_{\text{colourless}}$, x_c 's veridical experience is caused by and represents the same physical property $p_{\text{colourless}}$.

The thesis of identical macroscopic perceptual condition also says that x_c 's perceptual condition is identical to x 's with regard to every macroscopic property. But as will be shown in the next section, my argument only requires a weaker version to the effect that x_c 's perceptual condition is identical to x 's with regard to some macroscopic properties to which semantically stable concepts are applied. I think that Bealer must accept this weaker version. Since offering the weaker version requires discussing the Fregean theory of phenomenal content and semantic stability of concepts that I will

²⁷ As will be shown below, Bealer must reject this thesis since it leads to a problematic result of the condition (b.i) of full understanding. But in the next chapter, the truth of the thesis will be argued.

deal with in the next section, I will stick to the original version of the thesis throughout this section and provide the weaker version in the next section.

The thesis of identical macroscopic perceptual condition has some plausibility, in particular, if one is sympathetic to the Russellian theory of phenomenal content. According to this theory, necessary, two phenomenally indiscernible experiences represent the same property.²⁸ Since, by hypothesis, x and x_c are in qualitatively the same epistemic situation, their experiences have the same phenomenal character. Given the Russellian theory of phenomenal content, this implies that the properties represented by x_c 's experience are identical to those represented by x 's experience. From this, the thesis of identical macroscopic perceptual condition follows. (Although the Russellian theory of phenomenal content is sufficient for the thesis of identical macroscopic perceptual condition, it is not necessary because the thesis is consistent with the Fregean theory of phenomenal content. Thus, assuming the thesis does not imply assuming the Russellian theory.)

With regard to the thesis of a posteriori macroscopic necessity, first of all, I need to provide some preliminary point before explaining the thesis. It should be noted that there are some macroscopic properties which it is knowable a priori that a substance has. As explained in Subsection 2.1.2, according to Bealer (1987: 349), categorial mastery is a necessary condition for having a naturalistic concept. Therefore, if one has a naturalistic concept, it is knowable a priori that an entity to which a naturalistic concept is applied belongs to a relevant category. Given this a priori knowledge and a priori knowledge concerning the category, one can know a priori that the naturalistic

²⁸ See Thompson (2010) for a detailed discussion.

entity has some property of the category. For example, if one has the concept of being water, one can know a priori that an entity to which the concept of being water is applied is a substance. Given this a priori knowledge and a priori knowledge about the nature of substances, one can know a priori that the entity to which the concept of being water is applied has properties of substances such as the property of having extension (if it is knowable a priori that substances have extension). Since the properties of substances such as the properties of having extension and mass are macroscopic properties, there are macroscopic properties which it is knowable a priori that a substance has.

Now let an a priori property be a property which it is knowable a priori that a substance has. Also, let an a posteriori property be a property which it is knowable a posteriori that a substance has. Given these notions, we can explain the thesis of a posteriori macroscopic necessity by considering the following three claims:

- (1) It is knowable a priori that a substance necessarily has only a priori macroscopic properties and not a posteriori macroscopic properties.
- (2) It is knowable a priori that a substance necessarily has a posteriori macroscopic properties above and beyond a priori macroscopic properties.
- (3) It is knowable a posteriori whether a substance necessarily has a posteriori macroscopic properties above and beyond a priori macroscopic properties.²⁹

First of all, let us consider the claim (2). If (2) is the case, it follows that in order to know what macroscopic properties a substance

²⁹ This claim is a combination of the following two claims: (3.1) It is knowable a posteriori that a substance necessarily has only a priori macroscopic properties and not a posteriori macroscopic properties, and (3.2) it is knowable a posteriori that a substance necessarily has a posteriori macroscopic properties above and beyond a priori macroscopic properties.

necessarily has, we need empirical information. This is because some of those properties are such that it is knowable a posteriori that a substance has them. Thus, (2) entails the thesis of a posteriori macroscopic necessity.

The claim (3) also entails the thesis of a posteriori macroscopic necessity. To see this, suppose that all macroscopic properties a substance necessarily has are a priori macroscopic properties. But according to (3), in order to know this, we need empirical information. Without empirical information, we cannot rule out a priori that the substance turns out to necessarily have some a posteriori macroscopic properties. Thus, even if the substance necessarily has only a priori macroscopic properties, we need empirical information to know that it has only such properties. This entails the thesis of a posteriori macroscopic necessity that it is knowable a posteriori what macroscopic properties a substance necessarily has.

Now suppose that a substance necessarily has a posteriori macroscopic properties above and beyond a priori macroscopic properties. According to (3), in order to know this, we need empirical information. Also, the former properties are the very properties which it is knowable a posteriori that the substance has. These entail the thesis of a posteriori macroscopic necessity.

Before turning to the claim (1), I need to explain an implication of the thesis of a posteriori macroscopic necessity. Given the thesis, it follows that for an arbitrary macroscopic property P_r which it is not knowable a priori whether a substance lacks, one cannot a priori rule out the case that the substance turns out to necessarily have P_r . For example, if it is not knowable a priori whether water does not have the property of being radioactive, one cannot a priori rule out the case that water turns out to be necessarily radioactive. This is because for an arbitrary macroscopic property P_r which one cannot know a priori

whether a substance lacks or not, one cannot a priori rule out that the substance turns out to have Pr. Then, given the thesis of a posteriori macroscopic necessity, one cannot a priori rule out that Pr turns out to be a necessary macroscopic property of the substance. Note that given this result, one cannot a priori rule out that it turns out to be impossible for the substance to lack Pr. Also, since one cannot a priori rule out such an impossibility, one cannot know a priori whether there is a possible world where the substance lacks Pr. From this, it follows that if there is a genuinely possible world where the substance exists, one cannot know a priori what macroscopic properties the substance has in that world.

Now let us turn to the claim (1). According to it, a substance necessarily has only a priori macroscopic properties and we can know this fact a priori. Since this means that we can know a priori what macroscopic properties a substance necessarily has, the claim (1) is inconsistent with the thesis of a posteriori macroscopic necessity.

In the next chapter, I will argue for the thesis of a posteriori macroscopic necessity by considering two main theories about the nature of properties, i.e., categoricism and dispositionalism. In particular, it will be argued that according to categoricism, either (2) or (3) is true while according to dispositionalism, (2) is true. Then, it will be shown that in either case, (1) is false and the thesis of a posteriori macroscopic necessity is true. In this chapter, I will simply assume that the thesis is true for the sake of argument.

But a consideration against the claim (1), although inconclusive, can be given as of now. The claim (1) allows a substance to possibly have radically different properties from the actual ones. This is because according to (1) all a posteriori macroscopic properties are contingent properties. Thus, if the property of being non-radioactive

is an a posteriori macroscopic property of water, it is possible that water lacks this property and has the property of being radioactive. In this way, it is possible that water has many radically different properties such as the properties of being radioactive, metallic, poisonous, etc. In a similar way, it is possible that gold is a transparent odorless tasteless liquid in room temperature. For some philosophers such as McGinn (1975), this is an intuitively implausible modal claim.³⁰

I will now argue that if one assumes the above two theses explained so far, then one must reject the condition (b.i) of full understanding. For the sake of easy reference, let me list the theses I formulated in the previous subsection as follows:

[Metaphysical possibility of p_{3c}] p_3 has a true counterpart p_{3c} if and only if there is a counterpart world where x_c applies the concept of being water_c to H₂O.

[Necessary condition for the metaphysical possibility of p_{3c}] If there is a counterpart world where x_c applies the concept of being water_c to H₂O, the concept of being water_c plays the same epistemic role in x_c 's cognitive life as the concept of being water does in x 's cognitive life.

[The same epistemic role] If the concept of being water_c plays the same epistemic role in x_c 's cognitive life as the concept of being water does in x 's cognitive life and if x has a perceptual belief that water is colourless, odorless, etc., x_c has a true belief that water_c is colourless_c, odorless_c, etc.

³⁰ Consider the following claim by McGinn (1975: 182) where secondary properties roughly correspond to macroscopic properties: "Consider a possible world containing a substance with all the secondary properties of gold yet lacking its atomic constitution, and suppose also that this world contains a substance having that constitution yet lacking all of gold's secondary properties, suppose indeed that it instantiates all of the secondary properties of rubber: then [according to the opponent's view] it is the second substance not the first that is gold. On the view I defend, however, *such implausibilities* are avoided, since on that view the world just described is impossible." (my emphasis)

[(b.i) applied to p₃] p₃ is true *only if* it is possible for x to settle with a priori stability that there is a counterpart world where x_c applies the concept of being water_c to H₂O.

Now let us examine conditions for the metaphysical possibility of p_{3c}. If the counterpart proposition p_{3c} is metaphysically possible, by the thesis of metaphysical possibility of p_{3c}, there is a counterpart world where x_c applies the concept of being water_c to a substance having H₂O as its microscopic structure (a H₂O substance, for short). Then, by the thesis of necessary condition for the metaphysical possibility of p_{3c}, the concept of being water_c plays the same epistemic role in x_c's cognitive life as the concept of being water does in x's cognitive life. Given the thesis of the same epistemic role and the hypothesis that x has a perceptual belief that water is colourless, odorless, etc., it follows that x_c has a true belief that water_c is colourless_c, odorless_c, etc. Now *given the thesis of identical macroscopic perceptual condition*, x_c's perceptual condition concerning every macroscopic property is the same as x's. Therefore, if x_c has a true belief that water_c is colourless_c, odorless_c, etc., water_c has the same properties of being colourless, odorless, etc. as water in fact has. Finally, since the concept of being water_c is applied to the H₂O substance, it follows that the H₂O substance has the same properties of being colourless, odorless as water in fact has.

The conditions for the metaphysical possibility of p_{3c} are combined as follows:

[Combined conditions for the metaphysical possibility of p_{3c}] If the thesis of identical macroscopic perceptual condition is true, (1) the counterpart proposition p_{3c} is metaphysically possible only if (2) there is a counterpart world where x_c applies the concept of being water_c to the H₂O substance only if (3) the concept of being water_c plays the same epistemic role in x_c's

cognitive life as the concept of being water does in x 's cognitive life only if (4) x_c has a true belief that water_c is colourless_c , odorless_c , etc. only if (5) the H_2O substance has the properties of being colourless, odorless, etc. in the counterpart world.

It is not difficult to see that the metaphysical possibility of p_{3c} holds. Although not knowable a priori, the counterpart world conceived is indeed the actual world. Since actuality entails possibility, the counterpart world is possible. Also, if the counterpart world is possible, the counterpart proposition p_{3c} is possible by the thesis of metaphysical possibility of p_{3c} . Therefore, p_{3c} is possible.

The problem is that the metaphysical possibility of p_{3c} is not knowable a priori.³¹ This is because x cannot know a priori that the condition (5) holds since it is not knowable a priori that the H_2O substance has the properties of being colourless, odorless, etc. in the counterpart world. *Given the thesis of a posteriori macroscopic necessity*, it follows that for an arbitrary macroscopic property Pr which it is not knowable a priori whether the H_2O substance lacks, x cannot a priori rule out the case that the substance turns out to necessarily have Pr . Thus, given that it is not knowable a priori whether the H_2O substance lacks the property of being coloured,³² x

³¹ This should not be confused with the non-problematic fact that it is not knowable a priori that x_c 's world and p_{3c} are in fact x 's world and p_3 .

³² In Footnote 20, I claimed that H_2O in p_3 can be replaced by an entity satisfying N (i.e., an entity satisfying a semantically neutral microphysical description of H_2O). Then, one might claim that given this replacement, x can know a priori that the H_2O substance lacks the property of being coloured because this fact can be derived from N . But this claim does not hold. It may be the case that x can derive some microphysical property from N and such a property is in fact the property of being colourless. The problem is that x cannot know a priori that the microphysical property is the property of being colourless. To see this point, suppose that x derives a certain value of spectral reflectance P from N and P is in fact the property responsible for x 's experience of colourlessness. But without empirical information such as one about x 's vision, x cannot know how P appears to her. This entails that without relevant empirical information, x cannot know that P is the property of being colourless. Thus, x cannot know a priori that the H_2O substance has the property

cannot a priori rule out the case that the H₂O substance turns out to be necessarily coloured. Thus, x cannot a priori rule out the case that the H₂O substance turns out to be coloured also in the counterpart world. Since this means that x cannot know a priori that the condition (5) is satisfied, it follows that x cannot know a priori that the condition (1) is satisfied. Therefore, x cannot know a priori that the counterpart proposition p_{3c} is metaphysically possible.³³

Now it is easy to see why the condition (b.i) fails. Given that the condition (5) is not knowable a priori, it follows that the condition (2) is not knowable a priori. This leads to the falsehood of the consequent of the condition (b.i) applied to p₃. Therefore, given that p₃ is true (that is, given that the antecedent of the condition (b.i) applied to p₃ is true), it follows that the condition (b.i) does not hold.

In a sense, my argument embodies theoretical systematisation of intuitions by rejecting the prima facie twin-earth intuition about the metaphysical possibility of p_{3c} presented at the beginning of the previous subsection. But as I claimed there, this does not lead to rejecting our intuition about the possibility of Putnam's Twin-Earth. This is because it is knowable a priori that the substance having XYZ as its microscopic structure has the properties of being colourless, odorless, etc. in Twin-Earth since it is initially stipulated that that

of being colourless by reasoning from N. Also, x cannot know a priori whether the H₂O substance lacks the property of being coloured, even given the above replacement.

³³ On Mackie's (1974a) liberal modal view about macroscopic properties, a substance is identified with its microscopic internal structure and there is nearly no limit to macroscopic properties such a structure could have. For example, it is possible that a substance having H₂O as its internal structure is a shining yellow metal and it is possible that a substance having 79 as its atomic number is a transparent odorless potable liquid. Given this view, it can be claimed that although what macroscopic properties the H₂O substance has in the actual world is knowable a posteriori, it is knowable a priori that it is possible for the H₂O substance to have any different macroscopic properties. Thus, it is knowable a priori that there is a possible world where the H₂O substance has the property of being colourless as opposed to my argument. I will explain and criticise this view in Subsections 3.2.2 and 3.2.3 of the next chapter.

substance has such properties in Twin-Earth.

2.3. Identical Macroscopic Perceptual Condition

To block my argument, Bealer could reject the thesis of identical macroscopic perceptual condition. In this section, I will provide such a possible reply to my argument on Bealer's behalf and offer my response. First of all, in Subsection 2.3.1, I will present the possible reply based on the Fregean theory of phenomenal content. Then, I will argue in Subsection 2.3.2 that given Bealer's notion of semantically stable concepts, there is a weaker version of the thesis that Bealer has to endorse and that the weaker version is enough to get my argument off the ground.

2.3.1. Reply based on the Fregean theory of phenomenal content

In this subsection, I will provide a possible reply to my argument on the basis of the Fregean theory of phenomenal content, in particular, focusing on colour and spatial experiences.

To begin with, let us consider again the combined conditions for the metaphysical possibility of p_{3c} as follows:

[Combined conditions for the metaphysical possibility of p_{3c}] If the thesis of identical macroscopic perceptual condition is true, (1) the counterpart proposition p_{3c} is metaphysically possible only if (2) there is a counterpart world where x_c applies the concept of being water_c to the H_2O substance only if (3) the concept of being water_c plays the same epistemic role in x_c 's cognitive life as the concept of being water does in x 's cognitive life only if (4) x_c has a true belief that water_c is colourless $_c$, odorless $_c$, etc. only if (5) the H_2O substance has the properties of being colourless, odorless, etc. in the counterpart world.

As argued in the previous section, the condition (4) requires the

condition (5) as a necessary condition if the thesis of identical macroscopic perceptual condition is assumed. In order to respond to my argument and save the condition (b.i) of full understanding, one could reject the thesis of identical macroscopic perceptual condition and attempt to show that the condition (4) is satisfiable regardless of satisfying the condition (5). If this attempt is successful, the crucial claim of my argument that x cannot know a priori that the condition (5) holds will become pointless because the condition (5) is not required as a necessary condition for the condition (4). Thus, my argument claiming a priori unknowability of (1) on the basis of a priori unknowability of (5) will also become pointless.

The main task of the reply, therefore, is to show how the condition (b.i) holds without assuming the thesis of identical macroscopic perceptual condition, and in particular, to show how the condition (4) is satisfiable regardless of satisfying the condition (5).

Let me explain how the reply goes. Given the thesis of a posteriori macroscopic necessity, x cannot know a priori what macroscopic properties the H₂O substance necessarily has. But the respondent claims that for each particular a posteriori macroscopic property which x cannot know a priori whether the H₂O substance lacks, x can make a hypothesis that the H₂O substance necessarily has it. In this way, x can make infinitely many hypotheses exhausting every possible combination of every particular necessary property.³⁴ For example, consider the following table showing such hypotheses:

hypothesis	general macroscopic property	particular necessary macroscopic property
1	none	none
2.1	property responsible for	property responsible for x's experience

³⁴ Here I am assuming that x's rational reflection and conceptual repertory are ideal.

	x's colour experience	of yellowness
2.2		property responsible for x's experience of redness
2.3		property responsible for x's experience of blueness
...		...
3.1	property responsible for x's olfactory experience	property responsible for x's experience of odorlessness
3.2		property responsible for x's experience of a rotten egg smell
...		...
4.1.1	property responsible for	necessary properties in 2.1 and 3.1
4.1.2	x's colour experience,	necessary properties in 2.1 and 3.2
...	property responsible for	...
4.2.1	x's olfactory experience	necessary properties in 2.2 and 3.1
4.2.2		necessary properties in 2.2 and 3.2
...		...
...

Table 2.1

In this table, Hypothesis 1 says that the H₂O substance has no necessary macroscopic property (which x cannot know a priori whether the H₂O substance lacks). Hypothesis 2.1 says that the H₂O substance necessarily has the property responsible for x's experience of yellowness.³⁵ Hypothesis 4.2.2 says that the H₂O substance necessarily has the properties responsible for x's

³⁵ This hypothesis does not mean that the H₂O substance is necessarily experienced as yellow. There may be another species in x's world that experience the H₂O substance as green. What is meant by the hypothesis is that even if the H₂O substance is experienced differently in colour across species, there is a physical property that is responsible for such different colour experiences and the H₂O substance necessarily has this property. Meanwhile, if we take account of metamerism, we should say that the H₂O substance necessarily has some property (rather than the property) responsible for x's experience of yellowness. Since metamerism does not affect our discussion, I will ignore it for the sake of simplicity.

experiences of redness and a rotten egg smell. In this way, the whole set of hypotheses exhausts every possible combination of every particular necessary property. Note that among all combinations, there is a combination which exactly corresponds to particular necessary macroscopic properties that the H₂O substance in fact has. In this respect, among the whole set of hypotheses, there is a true hypothesis. Although *x* cannot know a priori what such a combination or hypothesis is, *x* can know a priori at least that there is a true hypothesis among the whole set.

Given the whole set of hypotheses, *x* can conceive for each hypothesis a possible world which satisfies the condition (4). For example, given Hypothesis 2.1, first of all, *x* can conceive a possible world where the H₂O substance has the (necessary) property responsible for *x*'s experience of yellowness and other (contingent) properties responsible for *x*'s experiences of odorlessness, tastelessness, etc. And then, *x* can conceive that in this world *x_c* correctly applies the concept of being colourless_c to the property responsible for *x*'s experience of yellowness and the concepts of being odorless_c and tasteless_c to the properties responsible for *x*'s experiences of odorlessness and tastelessness.

If the thesis of identical macroscopic perceptual condition were correct, *x_c* could never correctly apply the concept of being colourless_c to the property responsible for *x*'s experience of yellowness. This is because given the condition for the counterpart concept offered in Subsection 2.2.2, *x_c* can correctly apply the concept of being colourless_c to a property only if it looks colourless to *x_c* (or it looks to *x_c* in the same way as the colour of water looks to *x*). But given the thesis of identical macroscopic perceptual condition, the property responsible for *x*'s experience of yellowness looks yellow to *x_c* (or it looks to *x_c* in the same way as the colour of gold looks to

x). Thus, x_c cannot correctly apply the concept of being colourless_c to this property.

But the respondent rejects the thesis of identical macroscopic perceptual condition. Thus, x can conceive a counterpart world where x_c 's perceptual condition is different from x 's. In particular, x can conceive a counterpart world where x_c experiences the property responsible for x 's experience of yellowness in phenomenally the same way as x experiences the property responsible for x 's experience of colourlessness. And as I will explain below, the respondent has reason to think that x_c 's experience is veridical. Given x_c 's veridical experience, x_c can correctly apply the concept of being colourless_c to the property responsible for x 's experience of yellowness.

With regard to contingent properties of the H₂O substance, it is conceived that the H₂O substance has the original properties responsible for x 's experience of odorlessness, tastelessness, etc. Thus, if the concepts of being odorless_c, tasteless_c, etc. are applied to those properties, they are the same as the original concepts of being odorless, tasteless, etc. Since the latter concepts are correctly applied to the original properties, the former concepts are also correctly applied to them.

Now given the above discussion, x_c can correctly apply the concepts of being colourless_c, odorless_c, tasteless_c, etc. to the properties responsible for x 's experiences of yellowness, odorlessness, tastelessness, etc. Therefore, given that the H₂O substance to which x_c applies the concept of being water_c has those properties, x_c has a true belief that water_c is colourless_c, odorless_c, tasteless_c, etc. Thus, the counterpart world conceived by x satisfies the condition (4) of the combined conditions for the metaphysical possibility of p_{3c} . Also, since the H₂O substance has the property

responsible for x 's experience of yellowness rather than colourlessness, the condition (5) is not satisfied. Thus, this case shows that the condition (4) is satisfiable without satisfying the condition (5).

Given the above treatment of Hypothesis 2.1, now the respondent claims that x can do the same thing to every hypothesis in the table.³⁶ And by doing this, x conceives a counterpart world for each hypothesis that satisfies the condition (4) regardless of satisfying the condition (5).

As discussed before, x can know a priori that there is a true hypothesis among the whole set although x cannot know a priori which hypothesis is true. Given that x can conceive a proper counterpart world for each hypothesis, x can know a priori that there is a counterpart world for the true hypothesis. Thus, whichever hypothesis turns out to be true, x can know a priori that there is a counterpart world that is in fact possible although x cannot know a priori which counterpart world is in fact possible. This satisfies the consequent of (b.i) applied to p_{3c} that it is possible for x to settle with a priori stability that there is a counterpart world where x_c applies the concept of being water_c to the H_2O substance. Therefore, the condition (b.i) applied to p_{3c} is true.

As mentioned above, success of the reply depends on showing the veridicality of x_c 's experience. Let me discuss this by considering Hypothesis 2.1. According to the hypothesis, the H_2O substance necessarily has the property responsible for x 's experience of yellowness. Therefore, the H_2O substance in the counterpart world also has this property. Let p_{yellow} be the property responsible for x 's experience of yellowness. But x_c 's experience of the H_2O substance

³⁶ I will discuss below whether x can do the same thing to hypotheses involving spatial properties.

has the same phenomenal character as an experience x has when x sees something colourless. Let $C_{\text{colourless}}$ be such a phenomenal character. Then, showing the veridicality of x_c 's experience amounts to showing how x_c 's experience with $C_{\text{colourless}}$ is caused by and represents p_{yellow} .

The question about the veridicality of x_c 's experience raises an issue about the relationship between phenomenal characters of experiences and physical properties. Thompson (2010) distinguishes two main views concerning the relationship. One is the Russellian theory of phenomenal content, according to which two phenomenally indiscernible experiences necessarily represent the same physical property.³⁷ The other is the Fregean theory of phenomenal content, according to which two phenomenally indiscernible experiences are regarded as having the same mode of presentation. Since the same mode of presentation can pick out different referents in different contexts, the physical properties represented by the two phenomenally indiscernible experiences can be different if the contexts of the experiences are different.

It is easy to see that the reply to my argument is not compatible with the Russellian theory of phenomenal content. According to the reply, x has an experience with a phenomenal character $C_{\text{colourless}}$ and this experience represents the physical property of being colourless, i.e., $p_{\text{colourless}}$. On the other hand, it is supposed that the H_2O substance in x_c 's world has the physical property p_{yellow} . But the respondent claims that it is possible for x_c to be in the qualitatively identical epistemic situation with x when x_c experiences the H_2O substance. Also, the respondent accepts that x_c 's experience can be

³⁷ See Thompson (2010: 150-151). Thompson (2010: 153) formulates the Russellian theory of phenomenal content applied to physical properties as follows: "For any experience with phenomenal character r , there is some physical property p_r such that necessarily experiences with phenomenal character r attribute p_r ."

veridical. This leads to the claim that it is possible that x_c has an experience with the phenomenal character $C_{\text{colourless}}$ and this experience veridically represents the physical property p_{yellow} . After all, according to the reply, two experiences with the same phenomenal character $C_{\text{colourless}}$ can represent two different physical properties, $p_{\text{colourless}}$ and p_{yellow} . This is incompatible with the Russellian theory of phenomenal content because according to the theory, two experiences with the same phenomenal character necessarily represent the same physical property.

The Fregean theory of phenomenal content argued by Thompson (2010) provides a theoretical framework for the reply. x 's and x_c 's experiences have the same phenomenal character $C_{\text{colourless}}$ but represent different physical properties, $p_{\text{colourless}}$ and p_{yellow} . Since a phenomenal character of experience is regarded as a mode of presentation in the Fregean theory, the two experiences having the same phenomenal character are regarded as having the same mode of presentation. Given that a mode of presentation is a way of determining reference, the two experiences have the same way of determining reference. But it is possible that the same way determines different references in different contexts. Therefore, it is possible that the two experiences with the same phenomenal character $C_{\text{colourless}}$ represent different physical properties of $p_{\text{colourless}}$ and p_{yellow} in each context.

Now let me explain the veridicality of x_c 's experience. Given that x_c 's perceptual condition is different from x 's, it is possible that in a normal condition, a physical property p_{yellow} causes an experience with a phenomenal character $C_{\text{colourless}}$ in x_c and $C_{\text{colourless}}$ determines the referent of x_c 's experience as p_{yellow} in x_c 's context. In this scenario, if x_c has an experience with $C_{\text{colourless}}$ and other things are equal, x_c 's experience is veridical if and only if it represents p_{yellow} . Therefore, if

it is supposed that the counterpart world is a world where the scenario holds, x_c 's experience with $C_{\text{colourless}}$ representing p_{yellow} is veridical.

The above explanation about the veridicality of x_c 's experience is specific to Hypothesis 2.1. But it seems intuitively plausible that a similar explanation can be given to each hypothesis at least given that each hypothesis only includes properties responsible for x 's experience of secondary qualities such as colour and smell as necessary properties of the H_2O substance.

The Fregean theory of phenomenal content is based on the intuition that there need not be a resemblance between a phenomenal character of our experience and a physical property our experience represents. In particular, in the case of colour, this intuition has some plausibility and is reflected in the thought experiment of non-illusory inverted spectrum. On the other hand, with regard to spatial properties of objects, the intuition is much weaker. We usually believe that the external world is spatially arranged just like it appears to us. As Thompson (2010: 155) notes, the Fregean theory of spatial phenomenal content is not a popular position.

Given our weaker intuition about the Fregean theory of spatial phenomenal content, the reply based on the Fregean theory of phenomenal content seems not to hold in the case of spatial properties. To see whether this impression is correct, I need to briefly provide my argument applied to spatial properties and discuss how the reply goes.

First of all, suppose that x believes that water is spherical in a certain condition A such as zero gravity. Then, we have the following combined conditions for the metaphysical possibility of p_{3c} :

If the thesis of identical macroscopic perceptual condition is true, (1) the counterpart proposition p_{3c} is metaphysically possible only if (2) there is a counterpart world where x_c applies the

concept of being water_c to the H_2O substance only if (3) the concept of being water_c plays the same epistemic role in x_c 's cognitive life as the concept of being water does in x 's cognitive life only if (4') x_c has a true belief that *water_c is spherical_c in A-condition* only if (5') the H_2O substance has *the property of being spherical in A-condition* in the counterpart world. ((4') and (5') are like (4) and (5) except that they focus only on a particular spatial property.)

My argument is that x cannot know a priori that the condition (5') holds since it is not knowable a priori that the H_2O substance has the property of being spherical in A-condition in the counterpart world. *Given the thesis of a posteriori macroscopic necessity*, it follows that for an arbitrary macroscopic property Pr which it is not knowable a priori whether the H_2O substance lacks, x cannot a priori rule out the case that the substance turns out to necessarily have Pr . Thus, given that it is not knowable a priori whether the H_2O substance lacks the property of being ellipsoidal in A-condition, x cannot a priori rule out the case that the H_2O substance turns out to be necessarily ellipsoidal in A-condition. Thus, x cannot a priori rule out the case that the H_2O substance turns out to be ellipsoidal in A-condition in the counterpart world. Since this means that x cannot know a priori that the condition (5') is satisfied, x cannot know a priori that the condition (4') is satisfied. Then, x cannot know a priori that the condition (1) is satisfied. Therefore, x cannot know a priori that the counterpart proposition p_{3c} is metaphysically possible.

As explained above, the reply rejects the thesis of identical macroscopic perceptual condition and attempts to show that the condition (4') is satisfiable regardless of satisfying the condition (5'). For this purpose, the respondent claims that although x cannot know a priori what spatial property the H_2O substance necessarily has, x can make the whole set of hypotheses shown in the table 2.1. And

then, for each hypothesis, x can conceive a counterpart world that satisfies the condition (4') regardless of satisfying the condition (5') by conceiving x_c 's different perceptual condition.

For example, consider the following hypothesis belonging to the whole set: the H_2O substance necessarily has the property of being ellipsoidal in A-condition. Since x and x_c are in qualitatively the same epistemic situation, if x has an experience with a phenomenal character $C_{\text{spherical}}$ by seeing a spherical form of water in A-condition, x_c has an experience with the same phenomenal character $C_{\text{spherical}}$ by seeing water_c in A-condition. Since it is hypothetically supposed that the H_2O substance (to which the concept of being water_c is applied) is ellipsoidal in A-condition, it follows that x_c has an experience with $C_{\text{spherical}}$ by seeing something ellipsoidal. If we assume that the Fregean theory of spatial phenomenal content is correct, we can explain the veridicality of x_c 's experience with $C_{\text{spherical}}$ representing the property of being ellipsoidal in the same way as the veridicality of x_c 's experience with $C_{\text{colourless}}$ representing p_{yellow} . Then, the condition (4') is satisfied without satisfying the condition (5'). Now the respondent claims that x can do the same thing to every hypothesis. By doing this, x conceives a counterpart world for each hypothesis that satisfies the condition (4') regardless of satisfying the condition (5').

As claimed above, whichever hypothesis turns out to be true, x can know a priori that there is a counterpart world that is in fact possible although x cannot know a priori which counterpart world is in fact possible. Given this, the condition (b.i) applied to p_{3c} is satisfied as explained above.

However, in the above explanation, it seems intuitively not possible that x_c 's experience with $C_{\text{spherical}}$ representing the property of being ellipsoidal is veridical. Our Fregean style intuition about this spatial

property case is much weaker than the colour property case because we usually believe that the external world is spatially arranged just like it appears to us.

Against our *prima facie* impression about the resemblance between phenomenal characters and spatial physical properties, Thompson (2010) argues for the Fregean theory of spatial phenomenal content. In supporting this view, he provides several persuasive thought experiments showing that an experience can represent a spatial physical property that does not resemble its phenomenal character and that experiences having the same phenomenal character can represent different spatial properties in different contexts. The thought experiments such as his Doubled Earth case and qualitative spatial Twin Earth scenario deal with different types of spatial properties such as spatial quantities and the qualitative nature of physical space. With regard to the hypothesis we are discussing, a particularly important thought experiment is his El Greco World case where he deals with an isomorphism between phenomenal characters and spatial physical properties.

Thompson (2010: 176-177) explains his El Greco World case as follows:

On El Greco World, everything is stretched so that objects are twice as tall as objects on Earth. Objects are stretched vertically relative to the center of El Greco World. [...] The “stretching” on El Greco World that I will consider is plastic rather than rigid. That is, El Greco World is not a once-off vertically stretched duplicate of Earth. Rather, objects are dynamically stretched in the vertical direction. [...] A circular ball, rolled on the ground on Earth, retains its shape. The same ball, on El Greco world [sic], continuously changes its dimensions as it rolls, at each moment remaining taller than it is wide. It will remain egg-shaped, but the two most distant points on its surface will constantly change as it rolls.

Stretched Oscar is Oscar's counterpart on El Greco World. He too is stretched vertically relative to the center of El Greco World. But [...] Stretched Oscar is a phenomenal duplicate of Oscar. He has visual experiences that are phenomenally just like Oscar's.

As presented above, El Greco World is a possible world where phenomenally the same experience is caused by a different spatial property. While Oscar's experience with a phenomenal character $C_{\text{spherical}}$ is caused by a spherical object, Stretched Oscar's experience with the same phenomenal character is caused by an ellipsoidal object.

Initially, it seems that the experience had by Stretched Oscar is not veridical. In the case of Oscar's experience, the phenomenal character is such that all points on the surface of a ball appear to be equidistant from the centre. And all points on the surface of a ball are indeed equidistant from the centre. On the other hand, in the case of Stretched Oscar's experience, there is a mismatch between the phenomenal character and the ellipsoid because unlike the phenomenal character, points on the surface of the ellipsoid are not equidistant from the centre.

Thompson (2010: 179-180) responds to the problem of mismatch by claiming that the length property represented by Stretched Oscar's experience is different from that by Oscar's experience. Unlike the static length property represented by Oscar's experience, the length property represented by Stretched Oscar's experience is dynamical. If two dynamical length properties are identical if and only if they have the same maximum vertical value and the same minimum horizontal value, every distance from every point on the surface of the ellipsoid to its centre has an identical dynamical length property on El Greco World. That is, the ellipsoid on El Greco World is a dynamic sphere. Since Stretched Oscar's experience with a phenomenal character

$C_{\text{spherical}}$ represents this dynamic sphere, there is no mismatch between the phenomenal character and the object. In this way, Stretched Oscar's experience can be veridical.

Thompson's El Greco World case provides an answer to the problem arising from the hypothesis. The problem was that it seems not possible that x_c 's experience with $C_{\text{spherical}}$ representing the property of being ellipsoidal is veridical. But Thompson's argument implies that it is possible that x_c 's experience is veridical by representing a dynamic sphere. Therefore, given Thompson's argument, the problem arising from the hypothesis can be resolved.

The hypothesis discussed so far is just one of the infinitely many hypotheses. Thus, for success of the reply, it should be argued that the above treatment of the hypothesis or something similar can be given to all other hypotheses. But it is not clear whether this can be argued. In particular, if a hypothesis includes a topologically different shape property such as the property of being ring-shaped rather than topologically the same shape property of being ellipsoidal, it is not easy to conceive a world where there is no mismatch between the phenomenal character $C_{\text{spherical}}$ of x_c 's experience and such a property. This difficulty might be sufficient for claiming that the reply is not successful. But I will not depend on this point. Rather, in responding to the reply, I will suppose that there is no such difficulty and the treatment depending on Thompson's argument or something similar is generally applicable to all hypotheses.

2.3.2. Response to the reply: Semantically stable concepts

In this subsection, I will respond to the reply to my argument by arguing that given Bealer's notion of semantically stable concepts,

there are cases requiring an identical macroscopic perceptual condition between x and x_c . And it will be shown that in these cases, the reply does not hold since the Fregean theory of phenomenal content is not applicable to them. Finally, I will argue that these cases are enough for rejecting the condition (b.i) of full understanding.

To begin with, let me explain Bealer's notion of semantically stable concepts I introduced in Subsection 2.1.2. According to Bealer (2002: Footnote 1, 1999: 44), semantic stability is a property of concepts and propositions that are invariant across counterpart worlds. Given that x 's counterpart x_c is in a qualitatively identical epistemic situation with x and x_c 's concept c_c plays the same epistemic role in x_c 's cognitive life as x 's concept c does in x 's cognitive life, c is a semantically stable concept if and only if necessarily, c_c is identical to c . A semantically stable proposition can be explained in an analogous way.³⁸

As mentioned in Subsection 2.1.2, naturalistic concepts are semantically unstable. This is because it is possible that naturalistic concepts and their counterparts are not identical. For example, while the concept of being gold is applied to an element with atomic number 79, it is possible that the concept of being gold_c is applied to a different substance in a counterpart world.

On the other hand, Bealer claims that logical concepts, mathematical concepts, and central philosophical concepts mostly are semantically stable. For example, with regard to the mathematical concept of being a prime number, it is not possible to conceive a variant of Putnam's Twin-Earth case where due to the difference in the external environment, the concept of being a prime number and

³⁸ Bealer (2002: 72) provides the following condition for the semantic stability of propositions: "More precisely, (for thinkable p) p is semantically stable iff, necessarily, if p plays some cognitive role in the mental life of a community c , then it is necessary that for any other community c' in qualitatively the same epistemic situation as c , no proposition can play that role other than p itself."

its counterpart concept are different. This is because any change in the external environment such as one from H₂O to XYZ does not affect the concept of being a prime number. Since the concept of being a prime number is invariant across counterpart worlds, it is semantically stable.

For the sake of argument, let us consider a variant of the thesis of the same epistemic role as follows:

[Identical epistemic role] If the concept of being water_c plays the same epistemic role in x_c's cognitive life as the concept of being water does in x's cognitive life and if x has a perceptual belief that water is colourless, spherical in A-condition, etc., x_c has a true belief that water_c is colourless_c, spherical_c in A-condition, etc.

Given the discussion in the previous subsection, it is easy to see that x's concepts of being colourless and being spherical are semantically unstable. The concept of being colourless is applied to the physical property p_{colourless}, but given the Fregean theory of phenomenal content, it is possible that the concept of being colourless_c is applied to a different physical property such as p_{yellow}. Also, the concept of being spherical is applied to the physical property of being statically spherical, but given the Fregean theory of spatial phenomenal content, it is possible that the concept of being spherical_c is applied to a different physical property such as the property of being dynamically spherical. Since the concepts of being colourless and spherical are not identical to their counterpart concepts, they are not semantically stable.

It is an interesting result that the geometrical concept of being spherical is semantically unstable. Since this concept is mathematically definable in terms of the concepts of point, distance, and three-dimensional space, it seems at first glance to be

semantically stable. However, as the El Greco World case shows, the concept of distance is not semantically stable because while the concept of distance is applied to a static distance, it is possible that the counterpart concept is applied to a dynamical distance. Also, in a similar way, it can be shown that the concept of space is not semantically stable by conceiving a counterpart world where the counterpart of the concept of space is applied to space in Riemannian geometry while the original concept is applied to space in Euclidean geometry. Given such semantic instability of the concepts of distance and space, it follows that the geometrical concept of being spherical is also semantically unstable since this concept is definable in terms of them.

Bealer accepts that there are semantically unstable non-naturalistic concepts and proposes a method of applying them in a semantically stable way. Consider Bealer's (1996: 135) claim as follows:

It might be held that there are uses of 'time', 'space', 'probable', 'cause', and 'matter' which are semantically unstable. Even if there are, however, there exist other uses — seen in expressions like 'a kind of time', 'a kind of space', etc. — which are semantically stable. These *generic* uses occur in sentences such as 'Euclidean space is a possible kind of space', 'Newtonian time is a possible kind of time', etc. which are semantically stable sentences. In any language group in an epistemic situation qualitatively identical to ours, these sentence would mean the same as they mean for us and presumably would be true, just as they are for us.

This passage concerns expressions rather than concepts, but the same point can be applied to concepts. Although it is possible that the concept of time is applied to Newtonian time in a world and the counterpart of the concept is applied to the relativistic time in a

counterpart world, the generic concept of time involved in the complex concept of being a kind of time is semantically stable. It is important to notice that the qualified generic concepts such as the concept of Euclidean space and the concept of Newtonian time are also semantically stable.

Given the method proposed by Bealer, x 's concept of being spherical can be made semantically stable. Since the concept of being spherical is applied to a static sphere located in a certain type of space in x 's world, if we suppose that such a type of space is Euclidean space (or E-space for short), we get the following semantically stable concept: the concept of being E-spatially statically spherical.

Given the thesis of identical epistemic role, it is supposed that x has a perceptual belief that water is colourless, spherical in A-condition, etc. If x has the concept of Euclidean space and knows that the space of x 's world is Euclidean, x will have a perceptual belief that water is colourless and E-spatially statically spherical in A-condition, etc.

Now let me respond to the reply to my argument. If the concept of being (E-spatially statically spherical)_c is the counterpart of the concept of being E-spatially statically spherical, the following thesis holds:

[Identical epistemic role stabilised] If the concept of being water_c plays the same epistemic role in x_c 's cognitive life as the concept of being water does in x 's cognitive life and if x has a perceptual belief that water is colourless, E-spatially statically spherical in A-condition, etc., x_c has a true belief that water_c is colourless_c, (E-spatially statically spherical)_c in A-condition, etc.

Since the concept of being E-spatially statically spherical is semantically stable, the concept of being (E-spatially statically

spherical)_c is identical to it. Therefore, x_c 's experience with the phenomenal character $C_{\text{spherical}}$ represents the property of being E-spatially statically spherical (or a property to which the concept of being E-spatially statically spherical is applied). Given that x 's experience with the same phenomenal character $C_{\text{spherical}}$ represents the same property of being E-spatially statically spherical, it follows that x and x_c are in the same perceptual condition concerning the property of being E-spatially statically spherical. This result is generalised for all macroscopic properties to which semantically stable concepts are applied.

Now it can be shown that the reply to my argument does not hold given the properties to which semantically stable concepts are applied. Let semantically stable properties be such properties. The reply depends on the possibility that x_c 's experience having the same phenomenal character as x 's experience veridically represents a different property from what is represented by x 's experience. And this possibility depends on the possibility that x_c 's perceptual condition is different from x 's. Also, the reply depends on the claim that such a Fregean strategy is applied to properties involved in each hypothesis of the whole set. But concerning semantically stable properties, x_c 's perceptual condition cannot be different from x 's. Therefore, given semantically stable properties, the reply does not hold.

Now let me reformulate my argument so that it is immune from the reply. Given the result of the identical perceptual condition concerning semantically stable properties, the thesis of identical macroscopic perceptual condition can be revised as follows:

[Identical macroscopic perceptual condition stabilised] x_c 's perceptual condition concerning every semantically stable macroscopic property is the same as x 's.

Given this revised thesis, the combined conditions for the metaphysical possibility of p_{3c} presented in Subsection 2.2.3 can also be revised as follows:

[Stabilised conditions for the metaphysical possibility of p_{3c}] If the thesis of identical macroscopic perceptual condition stabilised is true, and for some semantically stable property Pr , if x has a perceptual belief that water has Pr , (1) the counterpart proposition p_{3c} is metaphysically possible only if (2) there is a counterpart world where x_c applies the concept of being $water_c$ to the H_2O substance only if (3) the concept of being $water_c$ plays the same epistemic role in x_c 's cognitive life as the concept of being water does in x 's cognitive life only if (4) x_c has a true belief that $water_c$ has Pr only if (5) the H_2O substance has Pr in the counterpart world.

Note that in the condition (4), it is no longer required to suppose a counterpart property Pr_c because the semantically stable property Pr and its counterpart Pr_c are identical. Given the thesis of identical macroscopic perceptual condition stabilised and the condition (4), the condition (5) follows just as in the original argument.

However, x cannot know a priori that the condition (5) holds. Given the thesis of a posteriori macroscopic necessity, it follows that for an arbitrary macroscopic property which it is not knowable a priori whether the H_2O substance lacks, x cannot a priori rule out the case that the substance turns out to necessarily have such a property. Thus, given that it is not knowable a priori whether the H_2O substance lacks a property Q (for example, the property of being E-spatially statically cubic) which is incompatible with the semantically stable property Pr (for example, the property of being E-spatially statically spherical), x cannot a priori rule out the case that the H_2O substance turns out to necessarily have Q . Thus, x cannot a priori rule out the

case that the H₂O substance turns out to have Q in the counterpart world. This implies that x cannot know a priori that the condition (5) is true. If the truth of the condition (5) is not knowable a priori, the truth of the condition (1) is also not knowable a priori. Therefore, x cannot know a priori that the counterpart proposition p_{3c} is metaphysically possible. Finally, just as in the original argument, this result falsifies the condition (b.i) of full understanding.

Appendix: Truth of the Counterpart Belief

In Subsection 2.2.2, I argued that if the counterpart proposition p_{3c} is metaphysically possible, x_c has a true belief that water_c is colourless_c , odorless_c , etc. In this appendix, I will discuss the truth of the counterpart belief in detail and provide some formal characterisation. In particular, I will argue that for a proposition p that a substance S has a property Q , if a counterpart proposition p_c is metaphysically possible and if x believes that S has the properties $\text{Pr}_1, \text{Pr}_2, \text{Pr}_3$ and not Pr_4, Pr_5 , the counterpart substance S_c has the counterpart properties $\text{Pr}_{1c}, \text{Pr}_{2c}, \text{Pr}_{3c}$ and not $\text{Pr}_{4c}, \text{Pr}_{5c}$ in the counterpart world. Then, from this, it will follow that if a counterpart proposition p_c is metaphysically possible, x_c has a true belief that S_c has $\text{Pr}_{1c}, \text{Pr}_{2c}, \text{Pr}_{3c}$ and not $\text{Pr}_{4c}, \text{Pr}_{5c}$ in the counterpart world.

To begin with, let me explain Bealer's idea of the counterpart world. Bealer (2002: 79-81) derives the notion of epistemic possibility and the analysis of it in terms of the counterpart world from the use of 'could' as 'could'-of-qualitative-evidential-neutrality. This 'could' is used when we utter an epistemic possibility sentence, e.g., 'it could have turned out that water was XYZ'. And we can analyse this epistemic possibility in terms of a counterpart world where water_c is XYZ. The important point is that as the counterpart world originates from the use of 'could'-of-qualitative-evidential-neutrality, x 's qualitative evidence is neutral between x 's world and the counterpart world. That is, x 's qualitative evidence cannot determine by itself which world x 's world is.

Having the notion of qualitative evidential neutrality in mind, suppose that x conceives a counterpart world indicated by an epistemic possibility that a substance S has a property Q . In conceiving this world, first of all, x must identify a counterpart

substance, i.e., S_c . Since the counterpart world is the world where the qualitative evidential neutrality holds, identification of S_c must be done in the way that satisfies x 's qualitative evidence about S .

In order to explain my point more easily, let me consider a familiar epistemic possibility given by Kripke (1980) and discussed by many philosophers including Bealer (2002: 81-83) as follows: It is epistemically possible that Hesperus is different from Phosphorus. To conceive a counterpart world indicated by this epistemic possibility, first of all, x must identify the counterpart Hesperus, i.e., $Hesperus_c$. Since the qualitative evidential neutrality holds in this counterpart world, $Hesperus_c$ must be a qualitative duplicate of Hesperus. That is, $Hesperus_c$ must satisfy x 's qualitative evidence about Hesperus. Such qualitative evidence is given by x 's belief about Hesperus that Hesperus is white, visible in the evening sky, and sometimes appears very close to Jupiter. Then, $Hesperus_c$ must be a heavenly body which is white, visible in the evening sky, and sometimes appears very close to Jupiter.

But note that the qualitative evidence of sometimes appearing very close to Jupiter does not need to involve Jupiter because the evidence is not about Jupiter itself but about the qualitative look of Jupiter. Thus, if $Jupiter_c$ is a qualitative duplicate of Jupiter just as $Hesperus_c$ is that of Hesperus, the evidence of sometimes appearing very close to Jupiter is qualitatively identical to the evidence of sometimes appearing very close to $Jupiter_c$.

Another point about the qualitative evidence concerns the evidence of being white. Suppose that in x 's world, a physical property responsible for an experience of whiteness is P while in the counterpart world, a physical property responsible for an experience of whiteness is P_c due to different perceptual conditions in this world. Then, having P_c will satisfy the qualitative evidence of being white in

this world. If the concept of being white is applied to P and the concept of being white_c is applied to P_c, the evidence of being white in x's world will be qualitatively identical to the evidence of being white_c in the counterpart world.³⁹

Given the above discussion, it follows that the evidence of being white, visible in the evening sky and sometimes appearing very close to Jupiter is qualitatively identical to the evidence of being white_c, visible in the evening sky and sometimes appearing very close to Jupiter_c.

In the above, I claimed that Hesperus_c must satisfy x's qualitative evidence about Hesperus. Thus, it was claim that Hesperus_c is a heavenly body which is white, visible in the evening sky, and sometimes appears very close to Jupiter in a counterpart world. Given the discussion about the qualitatively identical evidence, Hesperus_c can also be identified with a heavenly body which is white_c, visible in the evening sky, and sometimes appears very close to Jupiter_c in a different counterpart world.

Our discussion so far shows that Hesperus_c must satisfy the qualitative evidence about Hesperus but there are different ways of satisfying it as shown by the qualitatively identical evidence. Such different ways correspond to different counterpart worlds. Then, we can say that Hesperus_c has properties which satisfy the qualitative evidence about Hesperus and such properties can vary across counterpart worlds.

My argument is based on the requirement of the qualitative evidential neutrality for the counterpart world. Then, one might object

³⁹ It may be that the property of being white is a qualitative property of an experience and not applied to a physical property. If we accept this view, we can say that the evidence of having a physical property of x's world responsible for an experience of whiteness is qualitatively identical to the evidence of having a physical property of the counterpart world responsible for an experience of whiteness. For the sake of simplicity, I will stick to the account in the main text.

my argument by claiming that if the reason for accepting that Hesperus_c has properties satisfying the qualitative evidence is to satisfy the requirement of the qualitative evidential neutrality, one need not accept that. This is because the qualitative evidential neutrality holds even when Hesperus_c does not have such properties. Suppose that in a world, Hesperus_c is identified with a heavenly body which is *red*, visible in the evening sky and sometimes appears very close to Jupiter. Also, suppose that due to a visual illusion in this world, the heavenly body looks white. Then, Hesperus_c in this world will look qualitatively identical to Hesperus in x's world. In this way, the world satisfies the requirement of the qualitative evidential neutrality.

I accept that x's qualitative evidence cannot determine by itself that x's world is not the world involving a visual illusion. In this sense, I accept that the qualitative evidential neutrality holds between x's world and the world involving a visual illusion. But my point is that the world involving a visual illusion is not the world where Hesperus_c exists. This is because there is no heavenly body in this world which by itself satisfies x's qualitative evidence about Hesperus. (Note that since the red heavenly body experienced as white is conceived to be the qualitative duplicate of Hesperus, there is no other heavenly body that satisfies x's qualitative evidence about Hesperus in this world.) In conceiving Hesperus_c, there is no way to identify Hesperus_c other than depending on x's qualitative evidence and belief about Hesperus and identifying a heavenly body which has the properties satisfying the qualitative evidence with Hesperus_c. If a conceived heavenly body does not satisfy by itself the qualitative evidence by lacking a relevant property satisfying that evidence, it will not be identified with Hesperus_c although it is experienced qualitatively in the same way as Hesperus due to a visual illusion. In fact, it is not difficult to conceive a world where the qualitative evidential neutrality holds but there is

no Hesperus_c. For example, suppose a world where there is no heavenly body at all in the evening sky but due to visual illusions, the qualitative evidential neutrality holds. I think it is obvious that there is no Hesperus_c in this world.

The objection is correct in saying that Hesperus_c does not need to have the properties which satisfy the qualitative evidence in order to satisfy the requirement of the qualitative evidential neutrality. But it must be pressed that Hesperus_c must have such properties in order for it to exist in the counterpart world.

Then, why does Hesperus_c need to exist in the counterpart world in addition to satisfying the requirement of the qualitative evidential neutrality? The reason is that the counterpart world is the world where a counterpart proposition is supposed to be true. Thus, given that the counterpart proposition of our present case is that Hesperus_c is different from Phosphorus (or Phosphorus_c), there must be Hesperus_c in the counterpart world in order for the counterpart proposition to be true.

Now let me apply the above discussion to the following claim made at the beginning of this appendix: For a proposition *p* that a substance *S* has a property *Q*, if a counterpart proposition *p_c* is metaphysically possible and if *x* believes that *S* has the properties *Pr*₁, *Pr*₂, *Pr*₃ and not *Pr*₄, *Pr*₅, the counterpart substance *S_c* has the counterpart properties *Pr*_{1c}, *Pr*_{2c}, *Pr*_{3c} and not *Pr*_{4c}, *Pr*_{5c} in the counterpart world. As I noted above, *x*'s qualitative evidence is offered by *x*'s belief. Let us say that *Q*₁, *Q*₂, *Q*₃, not-*Q*₄ and not-*Q*₅ are *x*'s qualitative evidence of being experienced in a certain way which is offered by *x*'s belief that *S* has the properties *Pr*₁, *Pr*₂, *Pr*₃ and not *Pr*₄, *Pr*₅. For example, if *Pr*₁ is the property of being a cubic crystal, *Q*₁ corresponds to a qualitative property of *x*'s experience of cubicity. 'not-*Q*₄' (and 'not-*Q*₅') means the absence of *Q*₄ (and the absence of *Q*₅).

Given x 's qualitative evidence, x can conceive the following worlds each of which satisfies the requirement of qualitative evidential neutrality:

W_1 : A world where there is no substance at all but a visual illusion satisfies x 's qualitative evidence of Q_1 , Q_2 , Q_3 , not- Q_4 and not- Q_5 .

W_2 : A world where there is only a kind of substance and this substance has the properties L_1 satisfying Q_1 , L_2 satisfying Q_2 , L_3 satisfying Q_3 , L_4 satisfying Q_4 and lacks any property satisfying Q_5 (thereby satisfying not- Q_5). But due to a visual illusion, it appears that the substance satisfies not- Q_4 .

W_3 : A world where there is a substance having the properties Pr_1 satisfying Q_1 , Pr_2 satisfying Q_2 , Pr_3 satisfying Q_3 and lacking any property satisfying Q_4 and any property satisfying Q_5 (thereby satisfying not- Q_4 and not- Q_5).

W_4 : A world where there is a substance having the properties M_1 satisfying Q_1 , M_2 satisfying Q_2 , M_3 satisfying Q_3 and lacking any property satisfying Q_4 and any property satisfying Q_5 (thereby satisfying not- Q_4 and not- Q_5).

Before examining each world, note that if the counterpart proposition p_c is metaphysically possible, p_c is true in a counterpart world. Thus, in order for the above worlds to be a counterpart world for the metaphysical possibility of p_c , they must be a world where p_c is true and hence S_c exists.

Now let us examine the above worlds. First, we can see that W_1 is not a counterpart world for the metaphysical possibility of p_c . This is because given the fact that there is no S_c in W_1 , p_c is not true in W_1 . Meanwhile, we can see from W_1 that merely satisfying the requirement of qualitative evidential neutrality is not sufficient for a world to count as a counterpart world for the metaphysical possibility of p_c .

In order to examine the other worlds, I need to explain how a

counterpart substance is identified in a world. Although Bealer does not provide an explanation about this, such an explanation can be drawn from our above discussion concerning Hesperus_c.

First of all, note that the resource x can rely on in identifying S_c is x 's belief about S . Such a belief provides x the qualitative evidence of $Q_1, Q_2, Q_3, \text{not-}Q_4$ and $\text{not-}Q_5$. But as W_1 shows, identifying S_c relying only on this evidence is too weak to rule out the world where there is no S_c .

However, x 's belief provides another sort of evidence, i.e., having Pr_1, Pr_2, Pr_3 and lacking Pr_4, Pr_5 . Given this evidence about properties in addition to the qualitative evidence, S_c is identified with a substance having Pr_1 satisfying Q_1, Pr_2 satisfying Q_2, Pr_3 satisfying Q_3 and lacking any property (including Pr_4) satisfying Q_4 and any property (including Pr_5) satisfying Q_5 . This way of identification rules out the problematic world W_1 . But this identification is too strong because it rules out the intuitively correct counterpart world W_4 . In the above discussion about Hesperus_c, I claimed that Hesperus_c can be identified with a heavenly body which is white_c, visible in the evening sky, and sometimes appears very close to Jupiter_c. But if the same way of identification as S_c is applied, the world containing this heavenly body will be ruled out. Thus, we need to weaken the way of identification.

I think the correct way of identification is given by quantification over the properties involved in the evidence about properties. Let us replace $Pr_1, Pr_2, Pr_3, Pr_4,$ and Pr_5 with $\Phi_1, \Phi_2, \Phi_3, \Phi_4,$ and Φ_5 . Then, the quantified evidence plus the qualitative evidence yields the following identification: For some $\Phi_1, \Phi_2, \Phi_3,$ and for all Φ_4, Φ_5, S_c is a substance having Φ_1 satisfying Q_1, Φ_2 satisfying Q_2, Φ_3 satisfying Q_3 and lacking Φ_4 satisfying Q_4, Φ_5 satisfying Q_5 . This way of identifying S_c yields the correct result of accepting W_3 and W_4 as a

counterpart world for the metaphysical possibility of p_c and ruling out W_1 .⁴⁰

Also, the above way of identification allows us to judge whether W_2 is a counterpart world or not. In W_2 , the substance appears to satisfy not- Q_4 due to a visual illusion, but it in fact has some Φ_4 (i.e., L_4) satisfying Q_4 . Thus, the substance is not identified with S_c and W_2 is not a counterpart world for the metaphysical possibility of p_c .

Meanwhile, given that a counterpart property is a qualitative duplicate of the original property, Φ_1 satisfying Q_1 , ..., Φ_5 satisfying Q_5 in a counterpart world are just the counterpart properties Pr_{1c} , ..., Pr_{5c} . Thus, given the above identification of S_c , it follows that S_c has the properties Pr_{1c} , Pr_{2c} , Pr_{3c} and not Pr_{4c} , Pr_{5c} . This entails that x_c 's belief that S_c has Pr_{1c} , Pr_{2c} , Pr_{3c} and not Pr_{4c} , Pr_{5c} is true.

⁴⁰ For the sake of simplicity, I am assuming that other things such as the same epistemic role of the counterpart concepts, the property Q (or Q_c) involved in p_c , and the counterpart subject are properly conceived.

3. Nature of Properties and Modal Knowledge

It is commonly accepted that identity between a substance and its chemical nature, if it holds, necessarily holds and is only knowable a posteriori. The identity claim that water is H₂O is a popular example of this. This sort of necessary a posteriori truth is regarded as a counterexample against the putative link between a priori intuition and modal facts. Also, given the argument in the previous chapter, a fallback position trying to restore the link by appealing to epistemic possibility is not successful. But as I noted there, my argument depends on an undischarged assumption: the thesis of a posteriori macroscopic necessity. One of the aims of this chapter is to discharge it from my argument in the previous chapter.

However, the main aim and topic of this chapter are distinct from those of the previous chapter. In this chapter, my focus is on modal knowledge concerning property-possession of a substance rather than that concerning identity between a substance and its chemical nature. Unlike the latter sort of modal knowledge, philosophers (in particular, categoricists about the nature of properties) seem to think that the former sort of modal knowledge is obtainable a priori. For example, they seem to accept that we can know a priori that water could have been acidic and gold could have been radioactive.

However, I will argue in this chapter that we cannot know a priori whether it is metaphysically possible for a given substance to have a new non-fundamental property. Also, it will be argued that we are not in the position to know a priori whether it is metaphysically possible for a given substance to lack its actual non-fundamental property.

Then, I will argue that given Bealer's notion of epistemic possibility, our a priori knowledge about epistemic possibility concerning those issues does not give us a priori knowledge about metaphysical possibility except in some cases which I will argue are exceptions. In these exceptional cases to which my argument is not applicable, our a priori knowledge about epistemic possibility might give us a priori knowledge about metaphysical possibility. But as will be claimed, establishing such cases requires substantial arguments and Bealer does not provide them. Thus, the fact that the cases are thinkable does not by itself make the cases hold.

In this chapter, I will explain the direct reference theory offered by Putnam in detail and extract four theses that I think capture the core idea of the theory. This preliminary work is important because it helps understand the main theories of this chapter: Categoricalism offered by Armstrong and dispositionalism offered by Bird, both of which accept Putnam's theory or at least the four theses. Also, for the self-containedness of the whole thesis, my exposition of Putnam's theory is important because moderate rationalism in the previous chapter and Chalmers's modal rationalism in the next chapter presuppose the truth of Putnam's theory and try to provide an alternative account of modal knowledge. In any case, a detailed explanation of the direct reference theory is necessary.

Since the main topic of this chapter is property-possession of a substance, it is essential to examine the nature of properties. With regard to this, there are broadly two main views, categoricalism and dispositionalism. Categoricalism is roughly a view that properties are self-contained and do not indicate any further effects in themselves. I will consider Armstrong's view to this effect. On the other hand, dispositionalism claims that the nature of properties is given not by what they are but by what they do for an entity that has them. In this

sense, properties indicate further effects by their nature. I will examine this position by considering Bird's view.

After presenting categoricism and dispositionalism, I will try to derive a modal epistemological result of each view. In particular, I will argue that each view implies that we cannot know a priori whether it is metaphysically possible for a given substance to have a new non-fundamental property and whether it is metaphysically possible for it to lack its actual non-fundamental property. Also, it will be argued that given Bealer's notion of epistemic possibility, each view in most cases implies that our a priori knowledge about epistemic possibility concerning property-possession of a substance does not give us a priori knowledge about metaphysical possibility. As the phrase "in most cases" indicates, there is some case to which my argument is not applicable. But it will be claimed that the fact that such a case is thinkable does not by itself make the case hold.

(This chapter proceeds as follows: In Section 3.1, I will explain Putnam's direct reference theory and extract the following four theses from it: Rigid designation of substance terms, the same-substance relation, rigid designation of property terms, and the same-property relation. In Section 3.2, I will explain categoricism about properties, in particular, focusing on Armstrong's theory. After presenting Armstrong's ontology and his view about natural kinds as a preliminary discussion, I will explain his categoricism about the nature of properties and laws of nature. Then, I will argue that we cannot know a priori whether it is metaphysically possible for a given substance to have a new non-fundamental property and whether it is metaphysically possible for it to lack its actual non-fundamental property. It will be also argued that given Bealer's notion of epistemic possibility, in most cases, our a priori knowledge about epistemic possibility concerning property-possession of a substance does not

give us a priori knowledge about metaphysical possibility. There is an exceptional case in which our a priori knowledge about epistemic possibility might give us a priori knowledge about metaphysical possibility. But I will claim that the fact that such a case is thinkable does not by itself make the case hold. In Section 3.3, I will explain dispositionalism about the nature of properties offered by Bird. First of all, I will present Hawley and Bird's ontological account of properties and natural kinds as a preliminary discussion and then explain Bird's dispositionalism about the nature of properties and laws of nature. Just as in the case of categoricalism, it will be argued that our a priori intuition about metaphysical possibility and epistemic possibility does not give us a priori knowledge about metaphysical possibility concerning property-possession of a substance. Finally, in Section 3.4, I will justify the thesis of a posteriori macroscopic necessity offered in Chapter 2 by considering categoricalism and dispositionalism.)

3.1. Direct Reference Theory

In this section, I will explain Putnam's direct reference theory and extract four theses that capture his core idea.

Putnam (1975: 229-235) offers a semantic analysis of natural-kind terms in terms of rigid designation and the sameness relation. Consider Putnam's (1975: 231) following claim about an ostensive definition of the natural-kind term 'water' in the form of 'this is water': (In the following quote, 'the same_L relation' means the same-liquid relation.)

When I say '*this* (liquid) is water', the 'this' is, so to speak, a *de re* 'this' — i.e. the force of my explanation is that 'water' is whatever bears a certain equivalence relation (the relation we called 'same_L' above) to the piece of liquid referred to as 'this' *in the actual world*.

He (1975: 231) formulates his claim as follows:

(For every world W) (For every x in W) (x is water \equiv x bears same_L to the entity referred to as 'this' *in the actual world* W_1).

His claim and formulation say that water is whatever bears the same-liquid relation to the entity referred to as 'this' in the actual world. In this analysis, the crucial elements are the entity referred to as 'this' and the same_L relation. Let me explain them one by one.

First of all, with regard to the entity referred to as 'this', contrast the above formulation with the following one that Putnam (1975: 231) explicitly rejects:

(For every world W) (For every x in W) (x is water \equiv x bears same_L to the entity referred to as 'this' in W).

In the latter formulation, what is referred to as ‘this’ can vary across possible worlds W because different tokens of ‘this’ in different possible worlds W can refer to different entities. On the other hand, in the former formulation, the entity referred to as ‘this’ is fixed as something in the actual world because the value of “the entity referred to as ‘this’ in the actual world W_1 ” is constant across possible worlds W . Thus, according to Putnam, the natural-kind term ‘water’ designates in every possible world entities that have the same_L relation to the fixed entity referred to as ‘this’ in the actual world. (Note that the entity referred to as ‘this’ is also designated by the term ‘water’ in the ostensive definition (‘this is water’).⁴¹ Therefore, the entity referred to as ‘this’ in the actual world is just the entity designated by the term ‘water’ in the actual world.)

Since Putnam’s semantic analysis is not specific only to the term ‘water’ but, as Putnam shows, applicable to other natural-kind substance terms such as ‘aluminum’, ‘molybdenum’, etc., we can formulate the following thesis:

[Rigid Designation of Substance Terms] For every natural-kind substance term T ⁴² and every possible world W , if T

⁴¹ Putnam (1975: 225) claims that an ostensive definition of ‘water’ is defeasible because it presupposes the following to be true: “that the body of liquid I am pointing to bears a certain sameness relation (say, *x is the same liquid as y*, or *x is the same_L as y*) to most of the stuff I and other speakers in my linguistic community have on other occasions called ‘water’.”

⁴² It must be noted that in order for the thesis to hold, the scope over which T ranges must be confined to every *natural-kind* substance term rather than allowing T to range over every substance term. Let me explain this point by considering the following claim by Putnam (1975: 241):

It could have turned out that the bits of liquid we call ‘water’ had *no* important common physical characteristics *except* the superficial ones. In that case the necessary and sufficient condition for being ‘water’ would have been possession of sufficiently many of the superficial characteristics.

designates some entity E in the actual world, T designates in W an entity that has the same-substance relation to E, if such an entity exists in W.

In this thesis, I confine T to natural-kind *substance* terms although Putnam's semantic analysis is applicable to other sorts of natural-kind terms such as 'elm' and 'beech'. The reason is that natural-kind substances are less problematic than other sorts such as biological species in the ontology of natural kinds.

The second crucial element of Putnam's formulation is the *same_L* relation, i.e., the same-liquid relation. According to Putnam (1975: 232), this is a cross-world relation as follows:

Similarly, we can understand the relation *same_L* (same liquid as)

In this case, the term 'water' would not be a natural-kind term. To see this, suppose that our linguistic community has a term 'gro' which designates green round objects existent in nature. Also, suppose that we have regarded it as a natural-kind term. But after investigating a lot of gros, our scientists have revealed that there was no common physical characteristics among gros other than the properties of being green and being round. (For example, there are moss-covered iron gros, mold-covered wooden gros, gros made of jade, etc.) Given this empirical result, we would not think that the gros form a natural kind because they do not reflect a natural division. Also, we would not regard the term 'gro' as a natural-kind term. The same point is applied to the water case.

In the above thesis, the consequent concerns the same-substance relation. As will be explained, Putnam thinks that the same-substance relation holds between two substances if and only if they have the same microstructure. Now it is easy to see that 'gro' or 'water' in the previous paragraph does not satisfy the consequent because such terms designate an entity that has the same superficial properties as the actual gro or the actual water rather than an entity that has the same microstructure. Thus, in order to avoid these cases that make the thesis false, we need to confine the scope over which T ranges to every natural-kind substance term.

Meanwhile, the discussion about the non-natural kind case allows us to see that it is an empirical matter to decide whether a certain substance term is a natural-kind term or not. As discussed above, if what is designated by a substance term is a mixture of many microstructures so that there is no common microstructure, the substance term in question is not a natural-kind term. But to know whether what is designated by a substance term has a common microstructure or not requires empirical investigation. Thus, it is not knowable a priori whether a given substance term is a natural-kind term or not. For a discussion about this, see Bird (2005b: 454-455).

as a cross-world relation by understanding it so that a liquid in world W_1 which has the same important physical properties (in W_1) that a liquid in W_2 possesses (in W_2) bears *same_L* to the latter liquid.

As this passage explains, for a set of important physical properties Pr , a liquid having Pr in W_1 has the same-liquid relation to a liquid having Pr in W_2 . This implies that if a liquid in the actual world has a set of important properties Pr_1 , every sample of liquid having Pr_1 in any possible worlds is the same liquid as the liquid in the actual world. From Putnam's discussion about other cases such as one about aluminum and molybdenum, it is obvious that the sameness relation is not confined to the same-liquid relation but generalisable to other sorts, e.g., the same-substance relation and the same-biological-species relation, etc. As I did above, I will focus on the case of substances.

In his various arguments about natural kinds and about twin-earth cases, Putnam claims that a set of important physical properties of a substance is the microstructure or chemical composition of the substance. For example, Putnam (1975: 232) says as follows:

Suppose, now, that I have not yet discovered what the important physical properties of water are (in the actual world) — i.e. I don't yet know that water is H_2O .

Also, consider his (1975: 239) following claim:

Normally the 'important' properties of a liquid or solid, etc., are the ones that are *structurally* important: the ones that specify what the liquid or solid, etc., is ultimately made out of — elementary particles, or hydrogen and oxygen, or earth, air, fire, water, or whatever — and how they are arranged or combined to produce the superficial characteristics.

Given Putnam's claim about the important physical properties of a substance, if a substance in a possible world has the same microstructure as that of the actual substance, the former substance is regarded as bearing the same-substance relation to the latter one. I formulate his claim by the following thesis: For every substance A and B and for every world W_1 and W_2 , if A exists in W_1 and B exists in W_2 , then, for some microstructure S, A has S in W_1 and B has S in W_2 only if B is the same substance as A.

So far, I have explained Putnam's claim about important physical properties and the sameness relation. In this explanation, it was shown that Putnam regards the fact that important physical properties are shared by substances in different possible worlds as a sufficient condition for the sameness relation to hold between such substances. But given Putnam's twin-earth case to the effect that a substance having XYZ (or not having H_2O) as its microstructure is not water, we can also regard the fact as a necessary condition. Given this point, the thesis I formulated at the end of the last paragraph is revised as follows:

[The Same-Substance Relation] For every substance A and B and for every possible world W_1 and W_2 , if A exists in W_1 and B exists in W_2 , then, for some microstructure S, B is the same substance as A if and only if A has S in W_1 and B has S in W_2 .⁴³

⁴³ Salmon (1979, 1982) argues that this thesis is a metaphysical claim and it does not derive from Putnam's semantic thesis such as the thesis of rigid designation of substance terms. Given Salmon's argument, it is problematic to include such a metaphysical thesis in the direct reference theory as a semantic theory. But I will ignore this issue. Any theories discussed throughout this thesis that accept the direct reference theory also accept Putnam's metaphysical claim. Thus, a strict distinction between Putnam's semantic and metaphysical claims is not required in our discussion. In this respect, I will not have a separate name for Putnam's metaphysical claim in addition to 'the direct reference theory' for his semantic claim. Although it may not be strictly correct, I will use the name 'the direct reference theory' to refer to both semantic and metaphysical claims offered by Putnam for the sake of simplicity. For a discussion about the thesis of the same-substance relation

So far, I have formulated the following two theses: Rigid designation of substance terms and the same-substance relation. But it is obvious that similar theses can be formulated for natural properties and their terms, given Putnam's intent about the following words. For example, according to him, "*grow* is a natural-kind *verb*" (Putnam (1975:240)) and "[v]erbs like 'grow', adjectives like 'red', etc., all have indexical features" (Putnam (1975: 244)). In the context to which the latter sentence belongs, Putnam regards 'grow' and 'red' as natural kind words since the indexical feature is regarded in that context as the prominent feature of natural kind words.⁴⁴ Given Putnam's treatment of those words, there is no reason not to regard natural property terms as natural kind words. Also, it is obvious that Putnam's twin-earth thought experiment can be easily constructed for natural properties, implying that natural property terms are natural kind words. Since according to Putnam natural kind words are susceptible to his semantic analysis, we can construct two similar theses about natural properties and their terms.⁴⁵ First of all, I formulate the thesis of rigid designation of property terms as follows:

[Rigid Designation of Property Terms] For every natural property term T and every possible world W, if T designates

and its import of essentialism, see Salmon (1979, 1982). Also, see Bird (2018) and Bird and Tobin (2017) for a discussion about interpreting Putnam's theory as essentialism in the face of Fine's (1994) argument about the distinction between necessity and essence. For arguments against microphysical essentialism, see Needham (2000), van Brakel (2000), and VandeWall (2007).

⁴⁴ It is controversial to regard 'red' as a natural kind word. But I will ignore this issue in this chapter because I will not deal with colour terms and colour properties.

⁴⁵ A similar point is noted by Kripke (1980: 134): "First, my argument implicitly concludes that certain general terms, those for natural kinds, have a greater kinship with proper names than is generally realized. This conclusion holds for certain for various species names, whether they are count nouns, such as 'cat', 'tiger', 'chunk of gold', or mass terms such as 'gold', 'water', 'iron pyrites'. It also applies to certain terms for natural phenomena, such as 'heat', 'light', 'sound', 'lightning', and, presumably, suitably elaborated, to corresponding adjectives—'hot', 'loud', 'red'."

some entity E in the actual world, T designates in W an entity that has the same-property relation to E, if such an entity exists in W.

Now we need to examine what the same-property relation consists of. In the above discussion about substances, it was claimed that two different samples of substances in different possible worlds have the same-substance relation if and only if they share a set of important physical properties. And the set of important physical properties of a substance was identified with its microstructure. However, it is not straightforward how to apply this idea to natural properties because it is not clear whether a natural property has a set of important physical properties. Also, even if a natural property in fact has important physical properties, it should be examined what they are.

Although it is difficult to provide a general answer to the questions raised above, I think there are natural properties which allow a similar treatment to the substance case. Among natural properties, there are non-fundamental physical properties that have more fundamental physical properties as their microscopic bases. Then, the latter properties can be regarded as important physical properties of the former, given Putnam's general sympathy towards microscopic criteria for the sameness relation. For example, consider the property of being radioactive. This property has as more fundamental physical properties a certain sort of atomic properties such as unstable nuclei. Also, consider the property of being acidic. This property has as more fundamental physical properties a certain sort of chemical compositions such as containing hydrogen. In this way, a non-fundamental physical property has a set of more fundamental physical properties, and we can identify the important physical properties of the non-fundamental physical property with the set of

more fundamental physical properties. Given this identification, we can formulate the following thesis:

[The Same-Property Relation] For every non-fundamental physical property Pr_1 and Pr_2 and for every possible world W_1 and W_2 , if Pr_1 exists in W_1 and Pr_2 exists in W_2 , then, for some set of more fundamental physical properties S , Pr_2 is the same property as Pr_1 if and only if Pr_1 has S in W_1 and Pr_2 has S in W_2 .

3.2. Categoricalism and Modal Knowledge

Let me raise the main questions of this chapter as follows:

- (1) Is it knowable a priori whether it is metaphysically possible for a given substance to have a new non-fundamental physical property and whether it is metaphysically possible for it to lack its actual non-fundamental physical property?
- (2) Does our a priori knowledge about epistemic possibility concerning property-possession of a substance give us a priori knowledge about metaphysical possibility?

In this section and the next, I will try to answer these questions by examining the main two views about the nature of properties, i.e., categoricalism and dispositionalism. The reason for my examination of those views is related to Putnam's thesis formulated in the previous section. Given the thesis of the same-substance relation, it holds that for an actual substance A in the actual world W_1 and a substance B in a possible world W_2 , and for a set of important physical properties S , B is the same substance as A if and only if A has S in W_1 and B has S in W_2 . Thus, A and B are the same substance if and only if they have the same set of important physical properties S . Now given the different views about the nature of properties, we might get different results about the relation between S and a non-fundamental physical property Pr . That is, it might be the case that according to categoricalism, having S is not contradictory to having Pr while according to dispositionalism, it is. This leads to the result that according to categoricalism, it is possible for a substance having S to have Pr while according to dispositionalism it is not. If an actual substance having S is designated by a natural-kind substance term T in the actual world, a substance having S in a possible world is also

designated by T. Then, it follows that the sentence ‘it is possible for T to have Pr’⁴⁶ is true in categoricism while it is false in dispositionalism.

Consider the following example. In every possible world where water exists, water has the microstructure H₂O as its important physical property. Then, suppose that according to categoricism, having H₂O is not contradictory to having the property of being metallic while according to dispositionalism it is. It follows from this that according to categoricism, it is possible for water to be metallic while according to dispositionalism it is not.

Since the different views about the nature of properties might yield different metaphysical facts about properties a substance possibly has, they might affect the answers to our main questions about a priori knowability of such metaphysical facts. Therefore, it is important to examine those views before trying to provide the answers. In this section, I will focus on categoricism. In particular, I will explain Armstrong’s categoricism about the nature of properties. Then, I will try to answer our main questions on behalf of categoricism. A similar work in relation to dispositionalism will be done in Section 3.3.

3.2.1. Categoricism about the nature of properties

Categoricism is argued by many philosophers (for example, Armstrong (1968, 1973, 1983, 1986, 1997, 2012), Mackie (1973, 1974a, 1977), Pargetter and Prior (1982), Prior, Pargetter and Jackson (1982), Prior (1982)) as a theory about the nature of properties. In this subsection, I will explain categoricism by

⁴⁶ I will use ordinary quotation marks where, strictly, corner quotes are required as far as there is no danger of confusion.

presenting Armstrong's theory. Since Armstrong's categoricism is based on his ontology, I need to explain his theory of states of affairs as his ontological account of the world.

First of all, let us consider Armstrong's (1997: 1) following assertion about his basic ontological doctrine, factualism, in his theory of states of affairs:

The hypothesis of this work is that the world, all that there is, is a world of states of affairs. [...] The general structure of states of affairs will be argued to be this. A state of affairs exists if and only if a particular [...] has a property or, instead, a relation holds between two or more particulars. Each state of affairs, and each constituent of each state of affairs, meaning by their constituents the particulars, properties, relations and, in the case of higher-order states of affairs, lower-order states of affairs, is a contingent existent. The properties and the relations are universals, not particulars. The relations are all external relations.

As this passage shows, Armstrong regards a world as a totality of states of affairs. Also, according to him, each existent state of affairs is constituted by properties or relations that Armstrong regards as universals and particulars in the way that a particular instantiates a property universal or a relation universal is instantiated by particulars.

Given Armstrong's basic ontological framework, we can explain his idea about complex universals. These universals are important in relation to our main topic of this chapter because they are employed in analysing natural-kind substances and natural properties. First of all, let us consider Armstrong's (1997: 31) claim about conjunctive universals as follows:

If there are complex universals at all, then conjunctions of universals should qualify. [...] Given that F and G are distinct universals, then F&G can be a universal, provided always that

a particular exists at some time which is both F and G.

As Armstrong claims, if distinct universals are co-instantiated by the same particular, the conjunction of them, which Armstrong calls a 'conjunctive universal', is a complex universal.

There is another sort of complex universals which Armstrong calls 'structural universals'. Consider the following claim by Armstrong (1997: 32):

Instantiation of the universal F may come to this. To be an F a particular must be made up of just two non-overlapping parts, one of which instantiates universal G while the other instantiates universal H, with the G part and the H part linked by the (external) relation R. To be an F is thus to be a certain sort of structure, so F may be called a structural property.

According to Armstrong, a structural universal is instantiated by a particular. But in order for this particular to instantiate such a universal, it must have parts instantiating other universals and there must be relations holding between those parts. In this way, instantiating a structural universal is instantiating a certain structure.

Armstrong provides an example of a structural universal. According to him (1997: 34-37), the property of being methane is analysed as a structural universal. Given that the chemical composition of methane (CH₄) is such that one carbon atom is bonded with each four hydrogen atom with no other bonding, we can analyse a single methane molecule by using universals and particulars. First of all, following Armstrong, let universal H be the property of being a hydrogen atom and universal C be the property of being a carbon atom. Also, let universal B be a bonding relation. If a,b,c and d are the hydrogen parts of a particular instantiating the structural universal of being methane and e is the carbon part of it, we get the following

states of affairs: Ha, Hb, Hc, Hd, Ce. As noted above, a carbon atom makes a bonding with each four hydrogen atom. Thus, the following states of affairs hold: aBe, bBe, cBe, dBe. Now by conjoining those states of affairs, we get the following state of affairs representing a single methane molecule: Ha&Hb&Hc&Hd&Ce&aBe&bBe&cBe&dBe.

Given the state of affairs of a single methane molecule, we can get a structural universal corresponding to the property of being methane. Armstrong's (1997: 28-29) following assertion allows us to do this:

If particular *a* has the property-universal *F*, then the state of affairs is *a's being F*. For convenience we may continue often to refer to the universal by the mere letter 'F'. But it is best thought of as *'s being F*. Similarly, we have *'s having R to '*. The universal is a gutted state of affairs; it is everything that is left in the state of affairs after the particular particulars involved in the state of affairs have been abstracted away in thought. So it is a state-of-affairs type, the constituent that is common to all states of affairs which contain that universal.

According to Armstrong's claim in this passage, universals are state-of-affairs types obtainable after getting rid of particulars from states of affairs. As shown by the above examples, i.e., "*'s being F*" and "*'s having R to '*", they are unsaturated, having "one or more blanks as part of its nature." (Armstrong (1997: 29))

Given the notion of state-of-affairs types, we can get the structural universal of being methane by getting rid of particulars, a, b, c, d and e from the state of affairs of the single methane molecule (Ha&Hb&Hc&Hd&Ce&aBe&bBe&cBe&dBe).⁴⁷ In this way, a structural universal is a conjunction of universals, i.e., "a conjunction

⁴⁷ For the sake of simplicity, I ignore mereology of particulars and the totality state of affairs.

of state-of-affairs types” (Armstrong (1997: 37)).⁴⁸

Armstrong’s methane example shows not only how to understand a structural universal but also how to understand natural-kind substances. In the example, Armstrong identifies the property of being methane with a structural universal representing its chemical composition. But obviously, his point is not confined to methane but applicable to other substances. Thus, we can get Armstrong’s general point about natural-kind substances to the effect that the property of being a substance is a structural universal representing the substance’s chemical composition.⁴⁹

⁴⁸ Note that the notion of a conjunction of universals is different from the notion of a conjunctive universal introduced before.

⁴⁹ One might think that this general point is problematic, given Armstrong’s (1997: 67) following claim: “It would *appear*, however, that a reductive account is available of electronhood. Unlike an ordinary macroscopic object, or even a molecule or atom, the electron is not credited with very many properties. And for properties to make it an electron there are required only mass, charge, and the absolute value of the spin, properties that are identical in all electrons. Why, then, should not electronhood be identified with the property that is the conjunction of these three properties?” It seems that Armstrong in this passage claims that a molecule or atom is not susceptible of a reductive account because it has very many properties. But even if a molecule has very many subatomic properties, this should not prevent us from giving a reductive account of a molecule. Armstrong (1997: 19) distinguishes between “atomic states of affairs *strictly so-called*, and atomic states of affairs in a *loose sense*”. According to him (1997: 20), the latter “may be susceptible of ontological analysis, turning out to be ontologically equivalent to conjunctions of simpler, if not simple, states of affairs” while the former is not. This point is equally applicable to universals, allowing that atomic universals in a loose sense are constituted by further simpler universals. Armstrong even allows the possibility that such simpler universals are still analysable into further simpler universals ad infinitum. Given this possibility, it might turn out that what we regard as very simple properties such as mass, charge, and the absolute value of the spin are constituted by very complicated structures having many further simpler properties. However, this possibility does not prevent us from giving a reductive account to electronhood because we can regard such complicated structural universals as atomic universals in a loose sense and make a conjunction of them to identify it with the property of electronhood. In the same way, many subatomic properties that a molecule has are not a barrier to giving a reductive account. For example, we can regard the property of being a certain atom (such as the property of being a hydrogen atom) as our atomic universal in a loose sense and construct a structural universal using such atomic universals in a loose sense together with atomic relation-universals in a loose sense just as in the methane example. In this way, a substance molecule is susceptible of a reductive account, and the property of being a substance molecule

Let me explain Armstrong's view about the ontological status of complex universals and their identity condition. With regard to the former matter, Armstrong argues that complex universals are ontologically no addition to their constituent universals because the former universals supervene upon the latter. Armstrong (1997: 11) provides the following definition of supervenience: "entity Q supervenes upon entity P if and only if it is impossible that P should exist and Q not exist, where P is possible." Thus, according to the definition, the existence of P necessitates the existence of Q if and only if Q supervenes upon P. In the above, it was claimed that the complex universal (the conjunctive universal and the structural universal) is a conjunction of constituent universals. Since the existence of the totality of conjuncts entails (or necessitates) the existence of a conjunction of those conjuncts, the complex universal supervenes upon its constituent universals.⁵⁰ Now given Armstrong's (1997: 12-13) doctrine of the ontological free lunch to the effect that "[w]hat supervenes is no addition of being" or "the supervenient is not something additional to what it supervenes upon", the complex universal is ontologically not an additional being.

With regard to the identity condition, Armstrong (1997: 33) claims that the identity condition for the complex universal consists of its structure, i.e., its constituent universals. Thus, necessarily, a complex universal has the structure that it in fact has.⁵¹

is identified with a structural universal. For a discussion about Armstrong's atomic universals in a loose sense, see Sider (2005). Also, see Tobin (2013) for a discussion about Armstrong's reductive account. In both papers, substances are susceptible of a reductive account.

⁵⁰ This is based on the following claim by Armstrong (1997: 35): "This suggests, what seems obviously true, that a conjunction of states of affairs supervenes upon the totality of its conjuncts and that the conjuncts supervene upon the conjunction."

⁵¹ In the above, it was claimed that there are two sorts of complex universals, i.e., conjunctive universals and structural universals. One might think that unlike structural universals, conjunctive universals do not have structures because they

Now we can apply Armstrong's idea concerning the complex universal to Putnam's theses formulated in the previous section. Consider the original theses about the sameness relation as follows:

[The Same-Substance Relation] For every substance A and B and for every possible world W_1 and W_2 , if A exists in W_1 and B exists in W_2 , then, for some microstructure S, B is the same substance as A if and only if A has S in W_1 and B has S in W_2 .

[The Same-Property Relation] For every non-fundamental physical property Pr_1 and Pr_2 and for every possible world W_1 and W_2 , if Pr_1 exists in W_1 and Pr_2 exists in W_2 , then, for some set of more fundamental physical properties S, Pr_2 is the same property as Pr_1 if and only if Pr_1 has S in W_1 and Pr_2 has S in W_2 .

In the previous section, it was claimed by Putnam that to be the same substance is to have the same important physical property. For Armstrong, such an important physical property is a structural universal because according to him, to be the same substance is to instantiate the same structural universal. Also, as his example about methane shows, such a structural universal is just the microstructure of a substance. Thus, we can revise the original thesis of the same-substance relation as follows:

[The Same-Substance Relation Revised] For every substance A and B and for every possible world W_1 and W_2 , if A exists in W_1 and B exists in W_2 , then, for some structural universal S, B is the same substance as A if and only if A has S

do not include relations. This worry can be remedied by transforming each conjunctive universal into a structural universal involving an identity relation. For example, according to Armstrong (1997: 31), F&G is a conjunctive universal when Fa&Ga holds. We can transform Fa&Ga into Fa&Gb&alb where universal I is the identity-relation universal. Given this state of affairs, we can get a structural universal by getting rid of particulars a and b. In this way, each conjunctive universal can be transformed into a structural universal including an identity relation. For this idea, see Hawley and Bird (2011: 211).

in W_1 and B has S in W_2 .

With regard to the same-property relation, a non-fundamental physical property is in Armstrong's ontology a complex universal. And a set of more fundamental physical properties is a conjunction of constituent universals. Since a complex universal is identified with a conjunction of constituent universals, we can get the following revised thesis:

[The Same-Property Relation Revised] For every complex universal C_1 and C_2 and for every possible world W_1 and W_2 , if C_1 exists in W_1 and C_2 exists in W_2 , then, for some conjunction of universals S, C_2 is the same property as C_1 if and only if C_1 is identified with S in W_1 and C_2 is identified with S in W_2 .

Given Armstrong's ontological account of substances and properties, now we can explain his categoricism about the nature of properties. First of all, consider the following definition of categoricism by Armstrong (1997: 69):

Properties (and relations) are thought of by some philosophers as having a nature that is self-contained, distinct from the powers that they bestow. We shall call this position *Categoricism*.⁵²

Also, consider the following claim by Armstrong (1997: 80):

Properties are self-contained things, keeping themselves to themselves, not pointing beyond themselves to further effects brought about in virtue of such properties.

⁵² Also, consider the following comment by Prior (1982: 93): "The commonly accepted view is that dispositions differ from categorical properties because the former possess a special relationship to subjunctive conditionals not possessed by the latter."

According to the above passages, properties have a self-contained nature⁵³ without referring to any powers or effects they are somehow related to. Although it is obscure what such a nature is, I will not pursue this issue because Armstrong's simple characterisation is enough for my purpose.

Armstrong (1997: 82-83) seems to think that categoricism implies the contingency of laws of nature.⁵⁴ At least, it is obvious that he strongly supports the contingency of laws of nature. Also, unlike dispositionalists, he does not need to accept the necessity of laws of nature which many find unintuitive.

According to Armstrong's theory about the laws of nature usually called 'the nomic necessitation view'⁵⁵, the laws of nature are contingent external relations between universals, "symbolized as 'N(F,G)'" (Armstrong (1983: 85)) which means that a nomic relation holds between universals F and G. Since the nomic relation is a contingent external relation, its related terms could have been different from the actual ones, allowing different possible laws of nature.

The categoricist conception of properties as having a self-contained nature and its accompanying view about the laws of nature seem to have an important implication for a priori modal knowledge. In the next subsection, I will discuss this issue.

But before turning to the next subsection, I need to make some dialectical points. In this section about categoricism and the next about dispositionalism, I assume the ontological account of properties in terms of universals and natural-kind substances and natural

⁵³ Armstrong (1989: 44) calls such a nature 'quiddity'.

⁵⁴ See Choi and Fara (2018: Section 3) for their following claim: "Quidditism therefore implies that laws of nature are *metaphysically contingent*".

⁵⁵ This view is also called 'DTA theory' because it is proposed independently by Dretske (1977), Tooley (1977), and Armstrong (1983).

properties in terms of complex (i.e., structural and conjunctive) universals. And then I discuss the two main views about the nature of properties and their implication for a priori modal knowledge. But the notion of structural universals is controversial.⁵⁶ Also, there are philosophers who deny the existence of universals. Therefore, one might think that my argument assuming such an ontological account appeals only to those who also accept the account.

But it should be noted that my argument does not depend on the assumed ontological account of properties and natural-kind substances and natural properties. Rather, my assumption of the account is just a convenient way of arguing. In order to reach the main point of my argument, I need to assume an ontological account because it provides a way to get there. But such an account does not need to be a particular one. As far as an ontological account is consistent with Putnam's original four theses that are the ground of my argument, it can be assumed in order to reach the main point of my argument. This is because assuming such an ontological account, I can use the two semantic theses of rigid designation and derive two similar revised theses about the sameness relation in its ontological terms. And this is sufficient for getting my argument off the ground. (Note that ontological accounts of properties and natural-kind substances and natural properties at issue are generally orthogonal to the topic about whether properties are categorical or dispositional.)

As an example, consider a trope nominalist account of properties and natural kinds offered by Keinänen (2015). According to him (2015: 167), "[t]he application conditions of [kind term] K in the actual world [...] fix the application conditions of K in every possible world. Thus, kind term K has exactly the same application conditions in every

⁵⁶ For a criticism against the notion of structural universals, see Lewis (1986a).

possible world". This corresponds to our two theses of rigid designation. Meanwhile, with regard to the application condition, Keinänen (2015: 167) claims as follows: "Kind term K applies to complex object i if and only if i has objects x_1, \dots, x_m belonging to certain natural kinds K_1, \dots, K_m as its proper parts." In the context to which this claim belongs, the complex object i is a natural-kind substance and objects x_1, \dots, x_m are subatomic particles. Thus, according to the claim, the application condition reflects the microstructure of a natural-kind substance. Given this and Keinänen's (2015: 161-165) claim that subatomic particles are bundles of tropes, we can construct similar revised theses of the sameness relation in terms of tropes rather than universals. In this way, we can extract the four theses from a trope nominalist account of properties and natural kinds, and they are sufficient for getting my argument off the ground.

3.2.2. Categoricalism about property-possession

In this subsection, I will explain categoricalism about property-possession of a substance which is implied by categoricalism about the nature of properties and its accompanying view about the laws of nature.

For the sake of discussion, let us consider the following theses again:

[Rigid Designation of Substance Terms] For every natural-kind substance term T and every possible world W , if T designates some entity E in the actual world, T designates in W an entity that has the same-substance relation to E , if such an entity exists in W .

[The Same-Substance Relation Revised] For every

substance A and B and for every possible world W_1 and W_2 , if A exists in W_1 and B exists in W_2 , then, for some structural universal S, B is the same substance as A if and only if A has S in W_1 and B has S in W_2 .

Given these theses, if a natural-kind substance term T designates a substance A having a structural universal S in the actual world, any substances having S in any possible worlds are designated by T. For example, suppose that T is 'salt' which designates an actual substance having NaCl as its microstructure. Following Armstrong, we can construct a state of affairs for a single molecule of salt as follows: (If universal N is the property of being a sodium atom, universal C is the property of being a chloride atom, and universal B is a bonding relation,) Na&Cb&aBb. By getting rid of particulars a and b, we get a structural universal S of being salt. Then, by the above theses, 'salt' designates any substances having S in any possible worlds.

As explained in the previous subsection, categoricism holds that laws of nature are contingent. This leads to the result that the same structural universal S designated by 'salt' can be governed by different laws of nature in nomologically different possible worlds. Then, suppose a possible world where laws of nature governing the universals N, C and B are different from the actual ones. (Or if N and C are also structural universals consisting of simpler universals instantiated by subatomic particles, we can suppose a possible world where laws of nature governing those simpler universals are different.⁵⁷) Then, salt having the structural universal S in the possible world will have different non-fundamental physical properties due to different causal interactions between constituent universals. For

⁵⁷ For a related point, see Footnote 49 which discusses the notion of atomic universals in a loose sense.

example, given different laws of nature, it might be the case that salt is a yellow substance. Also, it might be the case that salt smells like rotten eggs. In this way, many non-fundamental physical properties of salt such as the boiling point, electrical conductivity, etc. will be different in nomologically different possible worlds.

We can see the same point from Mackie, one of the main supporters of categoricism. Consider the following claim by Mackie (1974a: 178-179, 179-180):

It is a consequence of our using the word 'gold' with this intention [intention of referring to the internal constitution] that if we contemplate the counterfactual possibility that something with this same internal constitution was not (through some change in other things or in the laws of nature) shining yellow in colour, malleable, fusible, soluble in *aqua regia*, and so on, we would express this by saying that gold might not be yellow, might not be malleable, etc, whereas if we contemplate the counterfactual possibility that something with a different internal constitution had all these features, we would say not that gold might have a different internal constitution, but only that something else might look and behave like gold.

Sorts of substance do have internal constitutions, the causal relationships between these and the more immediately detectable features are complex, so that those we have been relying upon can be upset [...].

In the latter passage, "those we have been relying upon" can be roughly regarded as non-fundamental physical properties in our discussion. According to Mackie, the necessary and sufficient condition for the sameness between substances in different possible worlds is to have the same internal constitution. This corresponds to having the same structural universal in our discussion. As the gold example shows, if laws of nature were different, the same internal constitution could have different non-fundamental physical properties

due to different causal interactions. This also corresponds to our original point about the contingent relation between a substance and its non-fundamental physical properties.

From the above discussion, we can extract the following view that I will call ‘categoricalism about property-possession’: It is possible that a substance has different non-fundamental physical properties from the actual ones.⁵⁸

3.2.3. Categoricalism about property-possession and modal knowledge

Given categoricalism about property-possession, one might think that it is possible for a substance to have any non-fundamental physical properties. According to categoricalism about property-possession, it is possible that a substance has different non-fundamental physical properties because it is possible that a structural universal (or an internal constitution in Mackie’s term) of a substance is governed by different laws of nature. If one has reason to think that there are infinitely many possible laws of nature so that a structural universal can be governed by infinitely many laws of nature across nomologically different possible worlds, one also seems to have reason to think that it is possible that a substance having a structural universal has any non-fundamental physical properties.⁵⁹ (In this

⁵⁸ For an opposite view, see McGinn (1975). According to him (1975: 181), the chemical composition of a substance and its superficial properties are necessarily coextensive.

⁵⁹ Someone might find this claim unintuitive because it allows a substance to possibly have radically different properties. For example, according to the claim, it is possible that salt is a shining yellow radioactive metal and gold is a tasteless odorless colourless liquid at room temperature. (For a discussion about unintuitiveness of the claim, see McGinn (1975).) Also, someone might object to

respect, one might think that Mackie's first counterfactual possibility quoted in the previous subsection that gold is not yellow, malleable, etc. is not merely a speculation but a real metaphysical fact.)

Such a liberal metaphysical idea that there is no limit to the non-fundamental physical properties a substance possibly possesses has an implication for the epistemology of modality. Suppose that one conceives transparent gold. Given the liberal metaphysical idea, one can know a priori that it is possible that gold is transparent because among infinitely many nomologically different possible worlds there is a possible world where gold is transparent. This does not mean that one can know a priori which world is such a world. But at least one can know a priori that there is such a world among them. In general, given the liberal metaphysical idea, for any substance S and for any non-fundamental physical property Pr, it is knowable a priori that it is possible for S to have Pr. (Thus, it is knowable a priori that Mackie's first counterfactual possibility holds.)

However, I think that the liberal metaphysical idea is problematic because it misses an important point of categoricism about property-possession. According to the latter view, it is possible that a substance has different non-fundamental physical properties from the actual ones. But this possibility holds *only if the substance has its actual structural universal*. Thus, if possessing a certain non-fundamental physical property makes a substance give up its actual structural universal, it is impossible for the substance to possess this property. The problem of the above liberal metaphysical idea is that it ignores this important point and presupposes the identity of the actual structural universal of a substance whatever property the substance

the claim by arguing that there may be a non-fundamental physical property which cannot come from any law of nature governing a structural universal. But rather than discussing these issues, I will focus on the implication that the claim has for modal epistemology.

possesses.

I will argue below that it is not knowable a priori whether the liberal metaphysical idea is true. (Although I believe that the liberal metaphysical idea is false, a priori unknowability of the idea is enough for my purpose.) For the sake of argument, I will examine the case where possessing a certain non-fundamental physical property makes a substance give up its actual structural universal.

To begin with, let us consider the salt case offered in the previous subsection where the structural universal of being salt is S and it is constituted by universals N, C, and B. According to categoricism about property-possession, there are possible worlds where S is governed by different laws of nature and salt has different non-fundamental physical properties. Then, suppose that we conceive a world where due to different laws of nature, salt has the property of being acidic. According to the liberal metaphysical idea, such a world is possible because there is no limit to possible laws of nature and non-fundamental physical properties salt possibly possesses. But as I will argue below, it is not knowable a priori whether such a world is possible and hence it is not knowable a priori whether the liberal metaphysical idea is true.

Suppose that the property of being acidic is a natural property. Since the property of being acidic is a non-fundamental physical property, according to Armstrong it is a complex universal identified with a conjunction of more fundamental constituent universals. Let me call such a conjunction 'A'. Then, consider the following theses we formulated before:

[Rigid Designation of Property Terms] For every natural property term T and every possible world W, if T designates some entity E in the actual world, T designates in W an entity that has the same-property relation to E, if such an entity exists

in W .

[The Same-Property Relation Revised] For every complex universal C_1 and C_2 and for every possible world W_1 and W_2 , if C_1 exists in W_1 and C_2 exists in W_2 , then, for some conjunction of universals S , C_2 is the same property as C_1 if and only if C_1 is identified with S in W_1 and C_2 is identified with S in W_2 .

Given these two theses, and also given that the property of being acidic is identified with the conjunction of universals A , it follows that 'being acidic' designates A in every possible world where A exists. Also, by the identity condition for complex universals, if A has among its conjuncts a certain constituent universal U , necessarily, A has U . Equivalently, if the property of being acidic has among its more fundamental properties the property corresponding to universal U , necessarily, the former has the latter. According to chemistry, the non-fundamental physical property of being acidic has among its more fundamental properties the property of being a hydrogen atom. Thus, the conjunction of universals A has universal H of being a hydrogen atom among its conjuncts. Then, it holds that necessarily, A has H .

Now let us examine the world where salt has the property of being acidic. According to the above discussion, salt has the structural universal S which has N , C , and B as its constituent universals. If S were governed by different laws of nature, it would behave quite differently from how it behaves in the actual world. However, it is not possible for salt to be acidic whatever laws of nature are operating. The reason is that in order for salt to be acidic, S must have H among its constituent universals because H is necessarily contained in A as a conjunct. But if S has H as its constituent universal, it is no longer S because necessarily, S has its actual structure consisting of its constituent universals N , C , B and no other. Thus, it is impossible for S to have H as its constituent universal and this means that it is

impossible for salt to be acidic whatever laws of nature are operating.

The acidic salt case concerns the possibility for a substance to have a new non-fundamental physical property. But there is a possibility for a substance to lack its actual non-fundamental physical property. Suppose that we conceive a world where salt lacks a certain actual non-fundamental physical property. Also, suppose that this property is a natural property. Then, since the property is natural and non-fundamental, it is identified with a conjunction of universals. Let us call this conjunction 'P'. Now suppose that the set of conjuncts constituting P is a proper subset of the set of conjuncts constituting the structural universal S (the property of being salt). Then, it is not possible for salt to lack the non-fundamental physical property whatever laws of nature are operating. The reason is that in order for salt to lack the non-fundamental physical property, S must lack at least one of the conjuncts constituting P. This means that S must lack at least one of S's own conjuncts. But if S lacks one of its conjuncts, it is no longer S because necessarily, S has its conjuncts. Thus, to lack the non-fundamental physical property is to fail to be salt. This means that it is impossible for salt to lack the non-fundamental physical property.⁶⁰

⁶⁰ It should be noted that this does not entail that it is necessary for salt to display an actual disposition supported by the non-fundamental physical property. According to categoricism, the same property can behave differently across nomologically different possible worlds. Therefore, even if it is necessary that salt has the non-fundamental physical property, it is possible that salt does not display the actual disposition supported by this property. Also, it should be noted that in categoricism, not to display an actual disposition supported by a property does not entail to lose the property.

I intentionally said that salt does not display the actual disposition supported by the property rather than saying that salt lacks the actual disposition supported by the property in order to reflect Armstrong's position about disposition. Consider the following suggestion offered by Armstrong (1997: 73):

But it may still be defensible to identify the brittleness with the bonding. Consider that the first-order state plus the laws will, in the given conditions,

The above two cases do not provide the counterexamples against the liberal metaphysical idea. This is because the idea is a view about metaphysical facts holding in reality rather than a view about a priori knowability of such facts. Thus, if it turns out empirically that there is no such case as the first and the second ones, these cases will not be the counterexamples against the liberal metaphysical idea. In particular, if it turns out empirically that the property of being acidic in the first case is not a natural property, the property term 'being acidic' will not rigidly designate the conjunction of universals A. Then, there will be no such metaphysical fact as the impossibility for salt to have the property of being acidic. With regard to the second case, it might turn out that there is no non-fundamental natural property whose set of more fundamental physical properties is a proper subset of the set of more fundamental physical properties constituting a substance. Then, we cannot use the second case in order to reject the liberal metaphysical idea because the impossibility for salt to lack its actual

be sufficient to entail [...] that a suitable striking will shatter the object. [...] Given this, cannot one say that, *relative to the laws*, the first-order state is the disposition, and then leave this relativity in the semantic background?

According to this claim, the disposition of brittleness is identified with a conjunction of universals corresponding to the bonding. But it is possible that given different laws of nature, an object having the conjunction of universals is not easily breakable. To avoid this problem, Armstrong suggests us to regard laws of nature as a semantic background of the disposition term 'brittleness'. Given that Armstrong does not explain his suggestion in detail, it is not clear exactly what he means. But one plausible understanding seems as follows: relative to laws of nature, there are different dispositions referred to by different disposition terms such as 'brittleness@' of the actual world, 'brittleness_{W₁}' of a possible world W₁ where laws of nature are different from the actual world, 'brittleness_{W₂}' of a possible world W₂ where laws of nature are different from the actual world and W₁, etc. Given this idea, the above object lacks the disposition of brittleness_{W₁} but it still has the disposition of brittleness@ in W₁ although it is not displayed in this world. In the same way, a substance does not lack its actual disposition (referred to by the term 'disposition@') supported by its necessary property in a nomologically different possible world (or supported by an actual property the substance has also in this possible world). Rather, it merely does not display its actual disposition in this possible world. See Footnote 65 for a discussion about disposition by categorialists who have a different position from Armstrong.

non-fundamental physical property in the second case is not a metaphysical fact.

Nevertheless, the two cases are important because they provide the counterexamples against a priori knowability of the liberal metaphysical idea. Note that we cannot a priori rule out that the above two cases turn out to hold in reality. In the first case, we cannot a priori rule out that the property of being acidic turns out to be a natural property. Also, we cannot a priori rule out that if it turns out to be a natural property, necessarily, it has the property of being a hydrogen atom among its more fundamental physical properties. In this way, we cannot a priori rule out that the first case turns out to hold. But if the first case holds, it is metaphysically impossible that salt has the property of being acidic. Thus, we cannot a priori rule out such a metaphysical impossibility. This entails that we cannot a priori rule out the case that the liberal metaphysical idea turns out to be false. And this entails that we cannot know a priori that the liberal metaphysical idea is true. (An argument based on the second case is structurally the same as this argument based on the first case.)⁶¹

From the above discussion against a priori knowability of the liberal metaphysical idea, we can extract a general modal epistemological point. In the first case, we have a prima facie intuition to the effect that it is possible that salt has the property of being acidic by conceiving a world where salt has such a property. But we also have an a priori reason to reject the prima facie intuition because we can devise a counterexample such as the first case. The structure of the counterexample is that a non-fundamental physical property which we conceive a substance to possess in a world is a natural property and has among its more fundamental properties the property of being

⁶¹ I believe that scientists can easily provide similar but empirically established cases. If so, the liberal metaphysical idea will be false.

a certain atom. Thus, if the substance has the property, it is no longer the same substance. From this, it follows that it is impossible for the substance to have this non-fundamental physical property. Given this general counterexample case, for every non-fundamental physical property Pr^{62} , we are not in the position to know a priori whether Pr is not the property in the counterexample. That is, we cannot a priori rule out the counterexample. This provides an a priori reason not to trust the prima facie intuition about the possibility for a substance to have a new non-fundamental physical property.

In the second case, I argued a priori unknowability of the possibility that salt lacks a certain actual non-fundamental physical property. Just as the first case, the second one provides us a general a priori reason not to trust our prima facie intuition about the possibility for a substance to lack a certain actual non-fundamental physical property. The structure of the second case is that a non-fundamental physical property which we conceive a substance to lack in a world is a natural property and has as its more fundamental physical properties only a subset of those properties that the substance has as its more fundamental physical properties. And if the substance lacks such a non-fundamental physical property, it is no longer the same substance. Given this general counterexample case, for every non-fundamental physical property Pr^{63} , we are not in the position to know a priori whether Pr is not the property in the counterexample. That is, we cannot a priori rule out the counterexample. This provides us a general a priori reason not to trust our prima facie intuition about the possibility for a substance to lack a certain actual non-fundamental physical property.

⁶² This needs a qualification because there seem to be some non-fundamental physical properties such that we can know a priori that they are not the property in the counterexample. I will discuss this point shortly.

⁶³ As in the first case, this needs a qualification, which I will discuss shortly.

In discussing the general counterexample cases, I claimed that for every non-fundamental physical property Pr, we are not in the position to know a priori whether Pr is not the property in the counterexample. This is just a claim that for every non-fundamental physical property Pr, we cannot know a priori whether it is not the case that (1) Pr is a natural property and (2) is identified with a conjunction of universals offered in each counterexample case. However, for some Pr, if we can know a priori that Pr is not a natural property, we will be in the position to know a priori that it is not the case that (1) and (2) because it is knowable a priori that (1) is not the case. Therefore, if there are some non-fundamental physical properties whose non-naturalness is knowable a priori, it will not be the case that for every non-fundamental physical property Pr, we are not in the position to know a priori whether Pr is not the property in the counterexample. That is, my claim will be false.

There seem to be some non-fundamental physical properties such that we can know a priori that they are not natural. For example, consider the property of being 2,000 kilometres away from the highest point of Mt. Everest. If there are non-fundamental physical properties whose non-naturalness is knowable a priori, this spatial property seems to qualify.⁶⁴ Also, many other spatial and temporal properties seem to qualify as such properties.

In order to avoid the problem, we need to exclude from the scope over which Pr ranges every non-fundamental physical property

⁶⁴ But it is not completely clear that it is knowable a priori that this property is not natural as its non-naturalness seems not readable from the concepts about the property. Also, there might be some natural spatial properties whose naturalness is only knowable a posteriori. If I am right about this, we need an answer to the question why it is knowable a priori that the former property is not natural while it is knowable a posteriori whether the latter property is natural or not. I will not pursue this issue any further. But note that it could turn out that non-fundamental physical properties whose non-naturalness is knowable a priori are fewer than expected.

whose non-naturalness is knowable a priori.⁶⁵ Note that this qualification does not exclude every non-natural non-fundamental physical property from the scope of Pr. If a property is not natural but we cannot know its non-naturalness a priori, such a property will not be excluded.

I argued in this subsection that it is not knowable a priori whether it is metaphysically possible for a given substance to have a new non-fundamental physical property and whether it is metaphysically possible for it to lack a certain actual non-fundamental physical

⁶⁵ This qualification will exclude some dispositions from the scope of Pr given the following understanding of disposition in categoricism. Prior, Pargetter, and Jackson (1982) claim that dispositions are second-order properties. Consider their (1982: 255) following claim:

The property of being fragile will be identical with the property of having a property or property-complex (causal basis) responsible for breaking (in the right way) on dropping. And [...] this second-order property remains the same property even though the first-order basis may vary from case to case or world to world.

In this claim, disposition (the property of being fragile) is identified with a property of having a property, i.e., a second-order property. Also, the same disposition may have different causal bases (i.e., different first-order properties) across possible worlds.

According to the notion of disposition offered by Prior, Pargetter, and Jackson, dispositions are not natural properties. First of all, dispositions are causally impotent because the causally responsible properties are not dispositions but their first-order properties. Also, given that natural property terms are rigid designators of causally responsible actual properties, disposition terms are not natural property terms. This is because they designate dispositions having different first-order properties across possible worlds.

That dispositions are not natural properties does not by itself make dispositions fall out of the scope of Pr. But if we accept that the argument given by Prior, Pargetter, and Jackson is an a priori knowable philosophical analysis and if we can know a priori whether a given property is a disposition or not, we will be able to know a priori that a given property is a disposition and it is a non-natural property.

Without the second antecedent, we will not be able to depend on their argument. This is because if we cannot know a priori whether a given property is a disposition or not, we will not know a priori whether their argument is applied to the property. It is not clear whether for every disposition D, we can know a priori that D is a disposition. But at least for some dispositions, it seems that we can have such a priori knowledge. If so, for some disposition D, we will be able to know a priori that D is a disposition and a non-natural property. Then, such dispositions will be excluded from the scope of Pr.

property. But in response to my argument, one might claim that our a priori knowledge about epistemic possibility indirectly gives us a priori knowledge about metaphysical possibility. In the next subsection, I will explain and assess this claim.

3.2.4. Epistemic possibility about property-possession of a substance

Before discussing epistemic possibility about property-possession of a substance, I need to explain the notion of epistemic possibility. There are several ways of explicating this notion,⁶⁶ but as I did in Chapter 2, I will depend on Bealer's account of it in this chapter.

As I provided a detailed account of Bealer's notion of epistemic possibility in Subsections 2.1.2, 2.2.2 and the appendix of Chapter 2, here I will briefly explain the main points of his notion. According to him, the following holds:

That a proposition p is epistemically possible entails that it is metaphysically possible that a counterpart proposition p_c of the original proposition p is true.

For example, if twin-earthlings' concept of being water_c is a counterpart of earthlings' concept of being water, the epistemic possibility that water is XYZ entails the metaphysical possibility that water_c is XYZ.

The important notion in the above claim is the counterpart relation between p and p_c . According to Bealer (2004: Footnote 15), p_c is a counterpart of p if and only if given that p plays a certain epistemic role in x 's cognitive life and given that a possible subject x_c is in

⁶⁶ See Yablo (2002) for a discussion about them.

qualitatively the same epistemic situation as x , a proposition p_c in x_c 's world plays the same epistemic role in x_c 's cognitive life as p does in x 's cognitive life. The same point is also applied to the counterpart relation between a concept and its counterpart because the epistemic role of propositions can be defined in terms of that of concepts and vice versa. Thus, the following condition for the counterpart relation between concepts holds:

x_c 's concept c_c is a counterpart of x 's concept c if and only if x_c 's epistemic situation is qualitatively identical to that of x and c_c plays the same epistemic role in x_c 's cognitive life as c does in x 's cognitive life.

In Subsection 2.2.2, I provided the following condition for the same epistemic role when x and x_c have the same concepts except that x_c 's concept of being water _{c} is the counterpart of x 's concept of being water: (In the following condition, ' p [water/water _{c}]' means a proposition obtained by substituting every occurrence of the original concept 'water' in p by the concept 'water _{c} '.) If x_c 's concept of being water _{c} plays the same epistemic role with x 's concept of being water, then, for every proposition p , x believes p if and only if x_c believes p [water/water _{c}]. In this subsection, I will consider the following condition for the same epistemic role which holds when x and x_c have the same concepts except that x_c 's concept of being salt _{c} is the counterpart of x 's concept of being salt:

If x_c 's concept of being salt _{c} plays the same epistemic role with x 's concept of being salt, then, for every proposition p , x believes p if and only if x_c believes p [salt/salt _{c}].

(When I discussed the condition for the same epistemic role, I also considered the case where every concept possessed by x_c is the counterpart of x 's concepts. But I will ignore this case in this

subsection as I will discuss it in detail in the next subsection.)

To sum, according to Bealer's notion of epistemic possibility, (1) an epistemic possibility of p entails a metaphysical possibility of a true counterpart proposition p_c . (2) x_c 's concept c_c is a counterpart of x 's concept c if and only if x_c 's epistemic situation is qualitatively identical to that of x and c_c plays the same epistemic role in x_c 's cognitive life as c does in x 's cognitive life. (3) (Given that x and x_c have the same concepts except that x_c 's concept of being salt _{c} is the counterpart of x 's concept of being salt,) if x_c 's concept of being salt _{c} plays the same epistemic role with x 's concept of being salt, then for every proposition p , x believes p if and only if x_c believes p [salt/salt _{c}].

Given the account of the notion of epistemic possibility, we can explain an attempt to respond to my argument in the previous subsection by appealing to epistemic possibility. According to such an attempt, although given my argument, we cannot know a priori that it is metaphysically possible for a given substance to have a new non-fundamental physical property and that it is metaphysically possible for it to lack a certain actual non-fundamental physical property, my argument does not imply that we cannot know a priori that they are epistemically possible. Then, consider the following argument:

- (a) It is knowable a priori that it is epistemically possible for a given substance to have a new non-fundamental physical property and for it to lack its actual non-fundamental physical property.
- (b) It is knowable a priori that an epistemic possibility of p entails a metaphysical possibility of a true counterpart proposition p_c . (That is, the above claim (1) is knowable a priori).
- (c) Therefore, it is knowable a priori that it is metaphysically possible that relevant counterpart propositions are true.

In responding to this attempt, I will not raise any objection to the premise (a), assuming that it is true. The premise (b) has some initial

plausibility. This is because if the claim (1) is knowable at all, it seems to be knowable a priori given that it is intended as a result of a priori philosophical analyses.

However, I will argue that at least in our present case, (c) is false. (Given that (a) is assumed to be true, this entails that (b) is false.) In particular, I will suppose a priori knowledge about an epistemic possibility and provide a counterpart world following the above claims (2) and (3). Then, I will argue that it is not knowable a priori whether the counterpart world is metaphysically possible. It will be concluded that our a priori knowledge about epistemic possibility does not give us a priori knowledge about metaphysical possibility.

In order to prevent confusion, I need to clarify my position about Bealer's notion of epistemic possibility. I do not object his analysis of epistemic possibility in terms of a counterpart world. Thus, I will not raise any objection to (2) and (3) which capture his idea about an epistemic possibility and a counterpart world. What I do not accept is that we can know a priori that such a counterpart world is metaphysically possible. Of course, it might turn out empirically that a counterpart world is in fact metaphysically possible. But we cannot know this a priori by having a priori knowledge about epistemic possibility. This leads to rejecting a priori knowability of the claim (1), i.e., rejecting (b).

For the sake of argument, suppose that x has a priori knowledge about the following epistemic possibility: It is epistemically possible that salt has the property of being acidic. As I mentioned above, I accept Bealer's analysis of epistemic possibility in terms of the counterpart relation. Thus, the epistemic possibility can be analysed as follows: The epistemic possibility indicates a counterpart world where a substance to which the concept of being salt_c is applied has the property of being acidic. Since the concept of being salt_c is the

counterpart of x 's concept of being salt, it follows by (2) that x_c who possesses the former concept is in qualitatively the same epistemic situation as x . Also, it follows by (2) that the concept of being salt_c plays the same epistemic role as the concept of being salt. Then, it follows by (3) (and the assumption of this subsection about x_c 's counterpart concept) that for every proposition p , x believes p if and only if x_c believes p [salt/salt_c].

Suppose that x believes that salt has the properties Pr_1 , Pr_2 , Pr_3 and not Pr_4 , Pr_5 . Then, it follows by the discussion in the previous paragraph that x_c believes that salt_c has the properties Pr_1 , Pr_2 , Pr_3 and not Pr_4 , Pr_5 . We may think that Pr_1 , Pr_2 , and Pr_3 are such properties as having a certain crystal structure, being an electrolyte, etc. and Pr_4 and Pr_5 are such properties as being radioactive, being a heavy metal, etc. For my purpose, such a rough characterisation is enough, but it should be noted that Pr_1 , Pr_2 , Pr_3 , Pr_4 , and Pr_5 are non-fundamental physical properties.

In Subsection 2.2.2 and the appendix of Chapter 2, I argued in detail that in order for a counterpart world (where a counterpart proposition is true) to be metaphysically possible, x_c 's belief as above must be true. Given this point, it follows that salt_c has the properties Pr_1 , Pr_2 , Pr_3 and not Pr_4 , Pr_5 in the counterpart world.

Now let us examine the counterpart world indicated by the epistemic possibility that salt has the property of being acidic. As I explained above, the counterpart world is the world where the counterpart substance (i.e., salt_c) has the property of being acidic. Given the above discussion, it follows that the counterpart substance in the counterpart world must have the property of being acidic together with the properties Pr_1 , Pr_2 , Pr_3 and must not have Pr_4 , Pr_5 . This is because if the counterpart substance does not have the property of being acidic, the counterpart world cannot be the world

indicated by the epistemic possibility. Also, if it is not the case that the counterpart substance has Pr_1 , Pr_2 , Pr_3 and not Pr_4 , Pr_5 , the counterpart world is not metaphysically possible.

Given the discussion about the properties of the counterpart substance, we can raise the following question: Is it knowable a priori that the counterpart world is metaphysically possible? Since the counterpart world is the world where the counterpart substance has the property of being acidic, the question is equivalent to a question whether it is knowable a priori that it is metaphysically possible that the counterpart substance has the property of being acidic together with the properties Pr_1 , Pr_2 , Pr_3 and not Pr_4 , Pr_5 .

Then, suppose that Pr_1 and the property of being acidic are natural properties. As explained before, a natural non-fundamental physical property is identified with a conjunction of universals. Suppose that Pr_1 is identified with a conjunction of universals A and the property of being acidic with a conjunction of universals B. It might be the case that A has among its conjuncts five repetitions of the universal of being a proton (distinguished by different particulars instantiating the universal just as in the case of methane⁶⁷) and B has among its conjuncts ten repetitions of the universal of being a proton. In this case, the counterpart substance cannot have both Pr_1 and the property of being acidic because no substance can have different numbers of protons at the same time. Therefore, given this case, it is metaphysically impossible for the counterpart substance to have the property of being acidic. This means that the counterpart world is metaphysically impossible.

As another case, it might be that different non-fundamental physical properties in fact have the same set of more fundamental

⁶⁷ For an argument against this idea and against the notion of structural universals in general, see Lewis (1986a).

physical properties. For example, according to Armstrong (1997: 26), the property of being gravitational rest mass and the property of being inertial rest mass have the same set of more fundamental physical properties. In the same way, it might be the case that Pr_4 and the property of being acidic are natural properties and have the same set of more fundamental physical properties so that they are identified with the same conjunction of universals. Then, the counterpart world where the counterpart substance has the property of being acidic is metaphysically impossible. This is because the counterpart substance must lack Pr_4 in order for the counterpart world to be metaphysically possible as discussed above. Since Pr_4 and the property of being acidic are identified with the same conjunction of universals, it must also lack the property of being acidic. This entails that the counterpart world where the counterpart substance has the property of being acidic is metaphysically impossible.

A similar case can be constructed for an epistemic possibility that salt lacks a certain actual non-fundamental physical property. Let P be such a property. Then, the epistemic possibility indicates a counterpart world where the counterpart substance lacks P . Suppose that P and Pr_1 are natural properties and have the same set of more fundamental physical properties so that they are identified with the same conjunction of universals. In this case, the counterpart world where the counterpart substance lacks P is impossible. This is because the counterpart substance must have Pr_1 in order for the counterpart world to be metaphysically possible. Since Pr_1 and P are identified with the same conjunction of universals, it must also have P . This entails that the counterpart world where the counterpart substance lacks P is metaphysically impossible.⁶⁸

⁶⁸ Or, simply, it can be argued that in order for the counterpart world to be

The above cases are not based on empirical information, so it might turn out empirically that there are no such cases in reality. But my point is that we cannot know a priori that there are no such cases. In other words, we cannot a priori rule out the above cases. Given that we cannot a priori rule out the former two cases, it follows that we cannot know a priori that it is metaphysically possible that salt_c has the property of being acidic. Also, given that we cannot a priori rule out the latter case, it follows that we cannot know a priori that it is metaphysically possible that salt_c lacks a certain actual non-fundamental physical property.

The above cases show that even if we can know the epistemic possibility of *p* a priori, we cannot know a priori whether it is metaphysically possible that the counterpart proposition *p_c* is true (entailing a priori unknowability of the claim (1) introduced at the beginning of this subsection). This means that our a priori knowledge about epistemic possibility does not give us a priori knowledge about metaphysical possibility.

Before turning to the next subsection, I need to respond to a worry about my supposition of natural properties. In the above discussion, I supposed that the properties *Pr*₁, *Pr*₄, *P* and the property of being acidic are natural properties. But one might think that this is problematic because it is knowable only a posteriori whether a property is a natural property or not so that my supposition could turn out to be false. And according to the worry, if the supposition turns out to be false, it will also turn out that my argument is unsound because it is based on a false premise.

But the worry misses the point of my argument. If my argument

metaphysically possible, the counterpart substance must have properties that *x* believes that salt has. Then, it follows that the counterpart world where the counterpart substance lacks such properties is metaphysically impossible.

aimed at revealing a concrete metaphysical fact about the world such as the necessity of water being H₂O, my argument would have to be based on empirically true suppositions. But the point of my argument concerns a priori knowability of metaphysical facts rather than the facts themselves. Thus, it was important in my argument to examine whether one can a priori rule out conceivable counterexamples against a priori knowability of metaphysical possibility. Whether such counterexamples are empirically correct had nothing to do with my argument because the fact that the counterexamples are conceivable was enough for undermining the a priori knowability of metaphysical facts. For the same reason, it is not problematic to suppose that the properties Pr₁, Pr₄, P and the property of being acidic are natural properties. Whether they are natural properties or not has nothing to do with my argument. Rather, the important point is that it is conceivable that they are natural properties and we cannot a priori rule this out. Given this point, one must understand my supposition as expressing a truth that it is conceivable that the properties Pr₁, Pr₄, P and the property of being acidic are natural properties, rather than as making an empirical claim that might turn out to be false.

3.2.5. A thinkable case for a priori knowledge about metaphysical possibility

In this subsection, I will discuss a thinkable case where our a priori knowledge about epistemic possibility might give us a priori knowledge about metaphysical possibility.

To begin with, consider the following account of Bealer's notion of epistemic possibility: (1) an epistemic possibility of p entails a metaphysical possibility of a true counterpart proposition p_c. (2) x_c's

concept c_c is a counterpart of x 's concept c if and only if x_c 's epistemic situation is qualitatively identical to that of x and c_c plays the same epistemic role in x_c 's cognitive life as c does in x 's cognitive life. (3) (Given that x and x_c have the same concepts except that x_c 's concept of being salt _{c} is the counterpart of x 's concept of being salt,) if x_c 's concept of being salt _{c} plays the same epistemic role with x 's concept of being salt, then for every proposition p , x believes p if and only if x_c believes p [salt/salt _{c}].

In the previous subsection, I argued against a priori knowability of metaphysical possibility based on a priori knowability of epistemic possibility, considering the case where x and x_c have the same concepts except that x_c 's concept of being salt _{c} is the counterpart of x 's concept of being salt. This case was reflected in (3). In this subsection, I will consider a case in which every concept possessed by x_c is a counterpart of x 's concepts and examine whether a priori knowledge about metaphysical possibility is obtainable based on a priori knowledge about epistemic possibility.⁶⁹ Then, I will claim that this case can be regarded as a thinkable case where our a priori knowledge about epistemic possibility might give us a priori knowledge about metaphysical possibility.

In this subsection, I will proceed as follows: First of all, I will revise (3) in order for it to reflect the case of this subsection. I will introduce the notion of a neutral counterpart concept and provide a revised version of (3). Then, as an analysis of epistemic possibility, I will offer

⁶⁹ There are intermediate cases between the case in the previous subsection and one in this subsection. Those cases are such that more than one of x_c 's semantically non-stable concepts but not all are the counterpart of x 's concepts. I think that the argument in the previous subsection is applicable to most cases. This is because in most cases propositions concerning a certain substance believed by x_c include x 's original semantically non-stable concepts or we can get such propositions by logical operations on propositions believed by x_c . But there might be some cases to which these points are not applicable. Then, such cases can be treated in principle in the same way as the case in this subsection.

a counterpart world which satisfies (2) and the revised version of (3). After providing the counterpart world, I will argue that no counterexample is conceivable against a priori knowability of the metaphysical possibility of the counterpart world. Thus, it will be argued that given the case of this subsection, our a priori knowledge about epistemic possibility might give us a priori knowledge about metaphysical possibility.

In order to discuss the case in which every concept possessed by x_c is a counterpart of x 's concepts, I need to revise (3) so that it reflects this case rather than the case of the previous subsection. First of all, note that if every x_c 's concept is the counterpart of x 's concepts, every proposition believed by x_c consists only of counterpart concepts.⁷⁰ If we apply this point to the example in the previous subsection, we have the following example of the condition for the same epistemic role: if x_c 's concept of being salt_c plays the same epistemic role with x 's concept of being salt, then, x believes that salt has the properties $\text{Pr}_1, \text{Pr}_2, \text{Pr}_3$ and not Pr_4, Pr_5 if and only if x_c believes that salt_c has the properties $\text{Pr}_{1c}, \text{Pr}_{2c}, \text{Pr}_{3c}$ and not $\text{Pr}_{4c}, \text{Pr}_{5c}$. Although it is possible to formulate a general condition for the same epistemic role holding in the case of this subsection as shown by Footnote 71, I will use this example in my argument. This is because using the general condition makes our discussion unnecessarily complicated and using the above example rather than the general condition does not affect my argument. In fact, the example is sufficiently arbitrary so that it reveals the essential point of the general condition in a simpler way. Given the example, I can

⁷⁰ As explained in Subsection 2.1.2, for every concept c possessed x and for every concept c_c possessed by x_c , if c is semantically stable and if c_c is the counterpart of c , c_c is identical to c . For example, given that the concept of being a prime number is semantically stable, x_c 's concept of being (a prime number)_c is identical to its original concept of being a prime number.

revise (3) as follows: (3') (Given that every concept possessed by x_c is a counterpart of x 's concepts,) if x_c 's concept of being salt_c plays the same epistemic role with x 's concept of being salt, then x believes that salt has the properties Pr₁, Pr₂, Pr₃ and not Pr₄, Pr₅ if and only if x_c believes that salt_c has the properties Pr_{1c}, Pr_{2c}, Pr_{3c} and not Pr_{4c}, Pr_{5c}.⁷¹

In order to clarify my below argument, I need to introduce the notion of a neutral counterpart concept. Let a neutral counterpart concept be a concept possessed by x_c in the case where every concept

⁷¹ Since (3') is formulated based on a certain example, it cannot be a general formulation about the case of this subsection. But by defining the following function, we can generalise it: Let $p[\forall(c/c_c)]$ be a function yielding a proposition that is obtained by substituting every occurrence in p of every concept c by c_c . Also, let $p[\forall(c\neq a/c_c)]$ be a function yielding a proposition that is obtained by substituting every occurrence in p of every concept c other than concept a by c_c . Given these functions, we can formulate the following general condition for the same epistemic role applicable not only to the case of this subsection but also to the case of the previous subsection and intermediate cases between those: For every semantically non-stable concept c possessed by x and for every semantically non-stable concept c_c possessed by x_c , if c_c is the counterpart of c , and for some semantically non-stable concept a possessed by x and for some semantically non-stable concept a_c possessed by x_c , if a_c is the counterpart of a , then a_c plays the same epistemic role with a , only if for every proposition p , x believes p if and only if x_c believes $p[\forall(c\neq a/c_c)][a/a_c]$. Given this general condition for the same epistemic role, it is easy to see that (3) is a special case of the general condition applied to the case of the previous subsection where x and x_c have the same concepts except that x_c 's concept of being salt_c is the counterpart of x 's concept of being salt. In a similar way, we can have a different special case of the general condition applied to the case of this subsection. But this special case is more general than (3') because it does not include any particular proposition. Let me offer the special case as follows: if every concept possessed by x_c is a counterpart of x 's concepts, a_c plays the same epistemic role with a only if for every proposition p , x believes p if and only if x_c believes $p[\forall(c\neq a/c_c)][a/a_c]$ (for every semantically non-stable concept c possessed by x and for every semantically non-stable concept c_c possessed by x_c , if c_c is the counterpart of c , and for some semantically non-stable concept a possessed by x and for some semantically non-stable concept a_c possessed by x_c , if a_c is the counterpart of a). If we do not focus on the same epistemic role of a particular counterpart concept a_c , the following condition is also acceptable: if every concept possessed by x_c is a counterpart of x 's concepts, then, for every proposition p , x believes p if and only if x_c believes $p[\forall(c/c_c)]$ (for every semantically non-stable concept c possessed by x and for every semantically non-stable concept c_c possessed by x_c , if c_c is the counterpart of c). As this discussion shows, using the general form can make my argument unnecessarily complicated. Thus, regarding (3') as an arbitrary example of the general form, I will provide my argument using (3'). This choice does not affect my argument.

possessed by x_c is the counterpart of x 's concepts. I will indicate this concept by adding a superscript 'n', e.g., ' ${}^n c_c$ ' or ' ${}^n \text{salt}_c$ '. Note that neutral counterpart concepts are just a special case of counterpart concepts and not a different sort. The notion is designed to merely indicate the counterpart concept in our present case. Given the notion of a neutral counterpart concept, it follows that each counterpart concept possessed by x_c in our present case is a neutral counterpart concept.

As I mentioned above, in the case where every concept possessed by x_c is the counterpart of x 's concepts, every proposition believed by x_c consists only of counterpart concepts. Given that the concept of being ' ${}^n \text{salt}_c$ ' is a neutral counterpart concept holding in this case, every proposition concerning ' ${}^n \text{salt}_c$ ' believed by x_c consists only of counterpart concepts. Thus, given that each concept possessed by x_c in the case is a neutral counterpart concept, we have the following condition:

(3'') (Given that every concept possessed by x_c is a counterpart of x 's concepts,) if x_c 's concept of being ' ${}^n \text{salt}_c$ ' plays the same epistemic role with x 's concept of being salt, then x believes that salt has the properties $\text{Pr}_1, \text{Pr}_2, \text{Pr}_3$ and not Pr_4, Pr_5 if and only if x_c believes that ' ${}^n \text{salt}_c$ ' has the properties ' ${}^n \text{Pr}_{1c}, {}^n \text{Pr}_{2c}, {}^n \text{Pr}_{3c}$ ' and not ' ${}^n \text{Pr}_{4c}, {}^n \text{Pr}_{5c}$ '.

Given (3''), I can explain the thinkable case where our a priori knowledge about epistemic possibility might give us a priori knowledge about metaphysical possibility. Suppose that x has a priori knowledge about the following epistemic possibility: It is epistemically possible that salt has the property of being acidic. As I mentioned in the previous subsection, I accept Bealer's analysis of epistemic possibility in terms of the counterpart relation to the effect that an epistemic possibility indicates a counterpart world. Thus, first of all, I

need to examine a counterpart world which satisfies (2) and (3”).

According to the analysis of epistemic possibility in terms of the counterpart relation, the epistemic possibility that salt has the property of being acidic indicates a counterpart world where ${}^n\text{salt}_c$ has the property of being ${}^n\text{acidic}_c$. Given the claim (2) that x_c 's concept c_c is a counterpart of x 's concept c if and only if x_c 's epistemic situation is qualitatively identical to that of x and c_c plays the same epistemic role in x_c 's cognitive life as c does in x 's cognitive life, it follows that the concept of being ${}^n\text{salt}_c$ plays the same epistemic role as the concept of being salt. Then, it follows by (3”) (and the assumption about x_c 's counterpart concepts) that x believes that salt has the properties Pr_1 , Pr_2 , Pr_3 and not Pr_4 , Pr_5 if and only if x_c believes that ${}^n\text{salt}_c$ has the properties ${}^n\text{Pr}_{1c}$, ${}^n\text{Pr}_{2c}$, ${}^n\text{Pr}_{3c}$ and not ${}^n\text{Pr}_{4c}$, ${}^n\text{Pr}_{5c}$. If we suppose that x has such a belief just as in the previous subsection, it follows that x_c believes that ${}^n\text{salt}_c$ has the properties ${}^n\text{Pr}_{1c}$, ${}^n\text{Pr}_{2c}$, ${}^n\text{Pr}_{3c}$ and not ${}^n\text{Pr}_{4c}$, ${}^n\text{Pr}_{5c}$.

In Subsection 2.2.2 and the appendix of Chapter 2, I argued in detail that in order for a counterpart world (where a counterpart proposition is true) to be metaphysically possible, x_c 's belief as above must be true. Given this point, it follows that ${}^n\text{salt}_c$ has the properties ${}^n\text{Pr}_{1c}$, ${}^n\text{Pr}_{2c}$, ${}^n\text{Pr}_{3c}$ and not ${}^n\text{Pr}_{4c}$, ${}^n\text{Pr}_{5c}$ in the counterpart world.

Now let us examine the counterpart world indicated by the epistemic possibility that salt has the property of being acidic. The counterpart world is the world where ${}^n\text{salt}_c$ has the property of being ${}^n\text{acidic}_c$. Given the above discussion, it follows that ${}^n\text{salt}_c$ must have the property of being ${}^n\text{acidic}_c$ together with the properties ${}^n\text{Pr}_{1c}$, ${}^n\text{Pr}_{2c}$, ${}^n\text{Pr}_{3c}$ and must lack ${}^n\text{Pr}_{4c}$, ${}^n\text{Pr}_{5c}$. This is because if ${}^n\text{salt}_c$ does not have the property of being ${}^n\text{acidic}_c$, the counterpart world cannot be the world indicated by the epistemic possibility. Also, if it is not the case that ${}^n\text{salt}_c$ has the properties ${}^n\text{Pr}_{1c}$, ${}^n\text{Pr}_{2c}$, ${}^n\text{Pr}_{3c}$ and not ${}^n\text{Pr}_{4c}$, ${}^n\text{Pr}_{5c}$, the

counterpart world will not be metaphysically possible.

So far I have examined the counterpart world. Now let us try to answer the question whether it is knowable a priori that the counterpart world is metaphysically possible. Since the counterpart world is the world where ${}^n\text{salt}_c$ has the property of being ${}^n\text{acidic}_c$ together with the properties ${}^n\text{Pr}_{1c}$, ${}^n\text{Pr}_{2c}$, ${}^n\text{Pr}_{3c}$ and not ${}^n\text{Pr}_{4c}$, ${}^n\text{Pr}_{5c}$, the question is equivalent to a question whether it is knowable a priori that it is metaphysically possible that ${}^n\text{salt}_c$ has the property of being ${}^n\text{acidic}_c$ together with the properties ${}^n\text{Pr}_{1c}$, ${}^n\text{Pr}_{2c}$, ${}^n\text{Pr}_{3c}$ and not ${}^n\text{Pr}_{4c}$, ${}^n\text{Pr}_{5c}$.

In order to answer the question, let me contrast the above counterpart world with the counterpart world discussed in the previous subsection where salt_c has the property of being acidic. In the previous subsection, it was argued that salt_c must have the property of being acidic together with the properties Pr_1 , Pr_2 , Pr_3 and must not have Pr_4 , Pr_5 . Based on this, I provided the following two counterexamples against a priori knowability of the possibility of the counterpart world: one involving different numbers of protons and the other involving two non-fundamental physical properties that have the same set of more fundamental physical properties. In these counterexamples, the crucial element was that there are at least two actual non-fundamental physical properties that salt_c must have or lack (i.e., Pr_1 and the property of being acidic in the first case and Pr_4 and the property of being acidic in the second). In constructing the counterexamples, the two actual properties were supposed to be natural properties and also supposed to be identified with the conjunctions of universals offered in each case. Then, it was argued that since we cannot a priori rule out the counterexamples, it is not knowable a priori whether the counterpart world is metaphysically possible.

However, unlike the counterpart world in the previous subsection, our present counterpart world does not allow any conceivable counterexample of the above sort. As discussed above, the latter world is the world where salt_c has the property of being acidic_c together with the properties Pr_{1c} , Pr_{2c} , Pr_{3c} and not Pr_{4c} , Pr_{5c} . While the former world involves the properties to which actual property concepts are applied, the latter world involves only the properties to which neutral counterpart concepts are applied. This feature prevents us from conceiving a counterexample of the above sort because it provides a different picture with regard to a priori knowability of entities to which x_c 's concepts are applied.

In the case of the counterpart world of the previous subsection, we are not in the position to know (or determine) a priori whether properties to which the actual concepts are applied are natural. Also, if some of them are natural, we are not in the position to know (or determine) a priori what conjunctions of universals they are identified with. Such a priori unknowability allowed us to conceive the counterexamples of the previous subsection. On the other hand, in the case of our present counterpart world, what entities the neutral counterpart concepts are applied to is determined by a priori conceiving. Thus, by properly assigning an entity to each neutral counterpart concept,⁷² we might be able to conceive a counterpart world allowing an entity assigned to the concept of being salt_c to

⁷² Assigning entities to neutral counterpart concepts must be done in the way that satisfies the counterpart relation. That is, it must satisfy the following two conditions required by (2): (2.1) x_c 's epistemic situation is qualitatively identical to that of x and (2.2) x_c 's concept c_c plays the same epistemic role in x_c 's cognitive life as x 's concept c does in x 's cognitive life. In order to satisfy (2.2), assigning entities to neutral counterpart concepts must satisfy the general condition for the same epistemic role offered in Footnote 71. And in order to satisfy the condition (2.1), x_c 's experience must be phenomenally the same as x 's experience. Satisfying these conditions will require one to conceive a world with a highly detailed blueprint. For the same reason, assigning entities to neutral counterpart concepts will be a highly complicated matter.

have entities assigned to the concepts of being ${}^n\text{acidic}_c$, ${}^n\text{Pr}_{1c}$, ${}^n\text{Pr}_{2c}$ and ${}^n\text{Pr}_{3c}$ and to lack entities assigned to the concepts of being ${}^n\text{Pr}_{4c}$ and ${}^n\text{Pr}_{5c}$ without any contradiction of the sort in the counterexamples of the previous subsection.⁷³

Then, it could be argued that epistemic possibility understood in terms of neutral counterpart concepts as above entails metaphysical possibility and this entailment relation is knowable a priori. If this claim is correct, metaphysical possibility will be knowable a priori because epistemic possibility is knowable a priori. Then, given our case, it will be knowable a priori that the above counterpart world is metaphysically possible. That is, it will be knowable a priori that it is metaphysically possible that ${}^n\text{salt}_c$ has the property of being ${}^n\text{acidic}_c$.

However, I think that establishing the above case requires substantial arguments. For example, it needs to be shown how one can construct a world a priori and how one can assign entities to neutral counterpart concepts in an a priori constructed world. Also, we need an explanation about idealisation of rationality required for constructing a world a priori and an explanation about vocabularies to be employed in constructing a world a priori. In a fundamental level, an answer to the following question must be given: Why is there a tie between rationality and modality? Although Bealer provides some resources concerning these issues, they are not sufficient to establish the case. Thus, his notion of epistemic possibility does not by itself make the case hold.

⁷³ We can treat in a similar way the epistemic possibility that salt lacks a certain actual non-fundamental physical property.

3.3. Dispositionalism and Modal Knowledge

In this section, I will answer the following questions by considering dispositionalism:

- (1) Is it knowable a priori whether it is metaphysically possible for a given substance to have a new non-fundamental physical property and whether it is metaphysically possible for it to lack a certain actual non-fundamental physical property?
- (2) Does our a priori knowledge about epistemic possibility concerning property-possession of a substance give us a priori knowledge about metaphysical possibility?

Dispositionalism argued by philosophers such as Bird (2005a, 2007, 2012), Ellis (2001, 2012), and Shoemaker (1980) is a view about the nature of properties which makes a sharp contrast with categoricalism. Unlike categoricalism holding that properties have a self-contained nature without referring to any effects, dispositionalism claims that (at least, some) properties are dispositional by their nature, thereby being necessarily related to further effects. Also, concerning the modal status of laws of nature, dispositionalism is in a sharp contrast to categoricalism. Unlike categoricalism holding that the laws of nature are contingent, dispositionalism claims that they are metaphysically necessary.⁷⁴

In this section, I will explain dispositionalism by presenting Bird's view and try to answer the above questions based on his view. But as a preliminary discussion, I need to present the ontological account of natural kinds offered by Hawley and Bird (2011).

⁷⁴ For metaphysical necessity of the laws of nature, see also Bird (2001), Swyer (1982), and Fales (1993). See Korman (2005: Footnote 1) for papers supporting law necessitarianism.

3.3.1. The ontological account of natural kinds offered by Hawley and Bird

In their paper, “What are Natural Kinds?”, Hawley and Bird provide an ontological account of natural kinds. First of all, consider the following claims made by them (2011: 210, 211, 214):

Methane molecules form a natural kind, and so, given the assumptions we have already made about kinds and universals, we identify that kind with the structural universal *being a methane molecule*.

We can thus identify the kind [electron] with a conjunctive universal, i.e. a complex universal with electron-mass, electron-spin, electron-charge and identity amongst its proper parts [...]. Each electron instantiates this conjunctive complex universal.

Our suggestion, then, is that kinds are complex universals: some conjunctive, some structural.

In these claims, Hawley and Bird identify natural kinds with complex universals some of which are conjunctive and the other of which are structural.⁷⁵ This is a familiar idea that we have already explained in detail when spelling out Armstrong’s ontological view about natural kinds. Thus, I think we can extract the same theses from Hawley and Bird’s view as those from Armstrong’s view.

First of all, since Hawley and Bird accept the rigid designation of natural-kind terms, I introduce Putnam’s theses as follows:

[Rigid Designation of Substance Terms] For every natural-

⁷⁵ Consider the following assertion by Hawley and Bird (2011: 210): “We will refer to conjunctive and structural universals collectively as ‘complex universals’ [...].”

kind substance term T and every possible world W, if T designates some entity E in the actual world, T designates in W an entity that has the same-substance relation to E, if such an entity exists in W.

[Rigid Designation of Property Terms] For every natural property term T and every possible world W, if T designates some entity E in the actual world, T designates in W an entity that has the same-property relation to E, if such an entity exists in W.

Given these theses, we need to elucidate the same-substance relation and the same-property relation. According to our discussion about Putnam's theory in Section 3.1, to be the same substance or to be the same non-fundamental physical property is to have the same important physical property. For Hawley and Bird, such an important physical property is a complex universal representing the microstructure of a substance or more fundamental physical properties of a non-fundamental physical property. This is because according to them the property of being a natural-kind substance or a natural non-fundamental physical property is identified with a complex universal.⁷⁶ Thus, to be the same natural-kind substance is to instantiate the same complex universal and to be the same natural

⁷⁶ Hawley and Bird's claims quoted above do not explicitly show that a natural non-fundamental physical property is identified with a complex universal. But I believe that this can be easily drawn from their (2011: 206) basic assumption that "at least some natural properties are universals" together with their other claims about universals and natural kinds. Also, the following claim by Bird (2007: 13) gives us reason for accepting such an identification: "More generally these fundamental properties participate in (or generate) the laws of nature which in turn ensure that certain properties combine in clusters or that certain kinds of object combine in complex objects or that certain kinds of process occur; and these may be combined in yet more complex properties, objects, and processes. The corresponding complex properties [...] may be regarded as more or less natural, being the outcome of processes and principles of combination that are themselves natural." Given this claim, we can regard natural non-fundamental (or complex) physical properties as combinations of more fundamental physical properties. This allows us to identify a natural non-fundamental physical property with a complex universal representing its more fundamental physical properties.

non-fundamental physical property is to be identified with the same complex universal. Given this elucidation, we can extract the same theses from Hawley and Bird's view as those from Armstrong's view as follows:

[The Same-Substance Relation Revised] For every substance A and B and for every possible world W_1 and W_2 , if A exists in W_1 and B exists in W_2 , then, for some structural universal S, B is the same substance as A if and only if A has S in W_1 and B has S in W_2 .

[The Same-Property Relation Revised] For every complex universal C_1 and C_2 and for every possible world W_1 and W_2 , if C_1 exists in W_1 and C_2 exists in W_2 , then, for some conjunction of universals S, C_2 is the same property as C_1 if and only if C_1 is identified with S in W_1 and C_2 is identified with S in W_2 .⁷⁷

3.3.2. Dispositionalism about the nature of properties and laws of nature

Dispositionalism, or dispositional essentialism, claims that properties are dispositional by their nature. Consider the following assertion by Bird (2007: 43):

⁷⁷ In introducing the two theses, we need to be cautious about the structural universal S in the former thesis and the conjunction of universals S in the latter thesis. According to Hawley and Bird (2011: 218-220), it is a genuine option to regard a natural-kind substance or a natural non-fundamental physical property as a complex universal consisting of both essential parts and non-essential ones. For example, according to them (2011: 220), "we can take the kind universal [being an electron] to include *having spin* $\frac{1}{2}$ as a part in every possible world (along with other essential parts), but other parts which differ from world to world, depending upon the local laws." Given this idea, the structural universal S in the former thesis must be regarded as the essential part of a complex universal of being a substance, and the conjunction of universals S in the latter thesis must be regarded as the essential part of a complex universal of a non-fundamental physical property. Also, the theses must be revised properly in order to accommodate this idea. Since this issue does not affect my argument, I will ignore it in my discussion for the sake of simplicity.

This [dispositional essentialism] is a view about the nature of properties—or, as far as I am concerned, principally about *fundamental* natural properties and possibly others besides. This view [...] says that the relevant properties have essences that are dispositional in character.

As this explains, according to dispositionalism, fundamental natural properties have dispositional essences. Equivalently, this means that a fundamental natural property has a disposition as (a part of) its essence.

Given the basic idea of dispositionalism, it is important to explain the notion of disposition. Bird (2007: 24) provides what he calls “the conditional analysis of dispositions” as follows:

x is disposed to manifest M in response to stimulus S iff were x to undergo S x would yield manifestation M.

According to this analysis, having a disposition D to manifest M in response to S is equivalent to being subjunctively related to S and M. Bird (2007: 43) claims that if the conditional analysis of dispositions holds, it necessarily holds.⁷⁸ But as he (2005a: 357-359) argues, the conditional analysis of dispositions does not generally hold because there are counterexamples against it such as finks and antidotes to dispositions. However, I do not need to deal with these counterexamples and Bird’s response to them in terms of *ceteris paribus* laws in this short presentation of dispositionalism as they are irrelevant to our current topic. Also, although the conditional analysis of dispositions does not generally hold, it captures the most important

⁷⁸ Consider the following comment by Bird (2007: 43): “As its name suggests (CA) [the conditional analysis of dispositions] is intended to be an analysis of the relevant dispositional locutions. I do not make this claim myself, although if (CA) is true, it is plausible that it is analytically true. Instead I shall take (CA) as a necessary equivalence [...]”

idea of dispositionalism. Thus, ignoring complications arising from the counterexamples for the sake of simplicity, I will stick to the above formulation.

From the dispositional nature of properties and the conditional analysis of dispositions, Bird (2007: 46-47) derives the following law of nature.⁷⁹ If it is supposed that a property P essentially has a disposition D, the law governing P is such that for all x, if x has P and x undergoes S, x manifests M. (If it is supposed that P, S, and M are universals, the law governing P (having D essentially) is such that a nomological relation holds among P, S, and M.) Given that P has D essentially and given that the conditional analysis of dispositions holds necessarily, it follows that the law of nature (in either form) is metaphysically necessary.

Bird (2007: 48-49) extends his claim about metaphysical necessity of a fundamental law as above to all fundamental laws of nature on the basis of his criticism against alternative views about the laws of nature and his consideration of unified metaphysics. Thus, according to Bird, all fundamental laws of nature are metaphysically necessary at least in the sense that a law governing a fundamental property P holds in every possible world where P exists. Based on this, Bird (2007: 172) also claims that some non-fundamental laws of nature which supervene upon fundamental ones are metaphysically necessary although it is an empirical matter how the former laws supervene upon the latter.

⁷⁹ Bird's (2007: 46) derivation is as follows: Given that P is a property having D essentially, from the conditional analysis of dispositions holding necessarily, it follows "(I) $\Box(Px \rightarrow (Sx \Box \rightarrow Mx))$ ". Now consider any world w and any case where some x in w possesses the potency [property with a dispositional essence D] P. Let x acquire the stimulus S, i.e. (II) Px & Sx. By (I) and (II) we have: (III) Mx. Discharging (II) we have: (IV) $(Px \& Sx) \rightarrow Mx$. Since x is arbitrary we may generalize: (V) $\forall x((Px \& Sx) \rightarrow Mx)$." He (2007: 48) adds the following: "Since (V) holds in an arbitrary world w it is necessary: $(V_{\Box}) \Box \forall x((Px \& Sx) \rightarrow Mx)$."

3.3.3. Dispositionalism and modal knowledge about property-possession

Given dispositionalism about the nature of properties and laws of nature, it is not difficult to see that a given substance necessarily has some non-fundamental physical properties. For the sake of argument, let us consider salt as our example. Given Hawley and Bird's ontological view about natural-kind substances, the property of being salt is identified with a structural universal representing the microstructure of salt. If universal N is the property of being a sodium atom, universal C is the property of being a chloride atom, and universal B is a bonding relation, a structural universal S identified with the property of being salt has N, C, and B as its constituent universals. Given the theses of rigid designation of substance terms and the same-substance relation revised, the term 'salt' rigidly designates a substance having S.

According to dispositionalism, fundamental physical properties have dispositional essences. Also, the laws of nature governing those properties hold in every possible world where such properties exist. Suppose that N, C, and B are fundamental universals. In this case, they have their own dispositional essences and some laws of nature hold in every possible world in which they exist. Or suppose that N, C, and B are complex universals. In this case, each universal consists of fundamental universals having dispositional essences. Then, some laws governing those fundamental universals hold in every possible world where N, C, and B exist. Also, there hold some higher-level laws governing N, C, and B which supervene on the fundamental laws. For example, if N exists in a possible world, there hold some

laws of nature flowing from the dispositional essences of the fundamental universals constituting N. Given these fundamental laws, there are also higher-level laws governing N which supervene upon them. For example, the law of nature that a lump of sodium explodes in water is such a higher-level law governing N. As revealed by scientists, this law supervenes on fundamental laws such as Coulomb's law about a force between charged particles.⁸⁰ (Given this higher-level law, we can say that N has a non-fundamental physical property of being explosive in water.) From this discussion, it follows that whether N, C, and B are fundamental universals or not, some laws governing them hold in every possible world where they exist.

Now given that the structural universal S consists of N, C, and B, there are some non-fundamental laws governing S which supervene on the laws governing N, C, and B. Let L be such a non-fundamental law. Then, it follows that S has a non-fundamental physical property of following L. For example, if L is a law that salt melts ice, salt has a non-fundamental physical property of melting ice. Given the above discussion, L holds in every possible world where S exists because the subvenient laws governing N, C, and B hold in every possible world where S exists. Therefore, S necessarily has a non-fundamental physical property of following L. Applying this point to the example, it follows that salt necessarily has the property of melting ice.

As discussed so far, given dispositionalism about the nature of properties and laws of nature, a given substance necessarily has some non-fundamental physical properties. But it is not knowable a priori what properties a given substance necessarily has. This is

⁸⁰ For a relevant discussion, see Mason et al. (2015).

because in order to know what such necessary properties are, one must know what structural universal the substance has and what dispositions the constituent universals of that essentially have. Also, one needs to know what non-fundamental laws governing the substance supervene on fundamental laws governing the constituent universals and how they do. All these questions are answerable by empirical investigation.

Given the above discussion, we can see that it is not knowable a priori whether it is metaphysically possible for a given substance to lack a certain actual non-fundamental physical property Pr. If it is possible that the substance lacks Pr, Pr is not a necessary property of the substance. But it is not knowable a priori whether Pr is a necessary property or not because it is not knowable a priori what properties the substance necessarily has. Thus, it is not knowable a priori whether it is possible that the substance lacks Pr.

We can depend on the same argument to see that it is not knowable a priori whether it is metaphysically possible that a given substance has a new non-fundamental physical property P. If it is possible that the substance has P (e.g., the property of being metallic), a contradictory property Pr (e.g., the property of being non-metallic) is not a necessary property of the substance. But it is not knowable a priori whether Pr is a necessary property or not because it is not knowable a priori what properties the substance necessarily has. Thus, it is not knowable a priori whether it is possible that the substance has P.

3.3.4. Dispositionalism and epistemic possibility

One might try to respond to the argument in the previous subsection

by claiming that our a priori knowledge about epistemic possibility concerning property-possession of a substance gives us knowledge about metaphysical possibility concerning that matter. In this subsection, I will criticise this claim in the context of dispositionalism by considering the case where x and x_c have the same concepts except that x_c 's concept of being salt_c is the counterpart of x 's concept of being salt just as in Subsection 3.2.4. In the next subsection, the case where every concept possessed by x_c is the counterpart of x 's concepts will be discussed.

First of all, let us consider again the following claims offered in Subsection 3.2.4 that capture the main point of Bealer's notion of epistemic possibility: (1) an epistemic possibility of p entails a metaphysical possibility of a true counterpart proposition p_c . (2) x_c 's concept c_c is a counterpart of x 's concept c if and only if x_c 's epistemic situation is qualitatively identical to that of x and c_c plays the same epistemic role in x_c 's cognitive life as c does in x 's cognitive life. (3) (Given that x and x_c have the same concepts except that x_c 's concept of being salt_c is the counterpart of x 's concept of being salt,) if x_c 's concept of being salt_c plays the same epistemic role with x 's concept of being salt, then for every proposition p , x believes p if and only if x_c believes p [salt/salt_c].

Given the account of the notion of epistemic possibility, we can explain the response to my argument of the previous subsection. According to the response, my argument does not imply that we cannot have a priori knowledge about epistemic possibility. Indeed, it is plausible that we can have such a priori knowledge based on our a priori intuition about epistemic possibility. In addition, if the claim (1) is knowable at all, it seems to be knowable a priori because it is intended as an a priori philosophical analysis. Then, given that we can have a priori knowledge about an epistemic possibility of p and a

priori knowledge about the claim (1), we can have a priori knowledge about a metaphysical possibility of a true counterpart proposition p_c .

However, as argued in Subsection 3.2.4, I think that even if we have a priori knowledge about an epistemic possibility of p , we are not in the position to know a priori whether it is metaphysically possible that the counterpart proposition p_c is true. In this subsection, I will argue this point based on dispositionalism.

Following Bealer's analysis of epistemic possibility in terms of the counterpart relation, I will provide a counterpart world indicated by an epistemic possibility. Then, I will argue that given dispositionalism, we are not in the position to know a priori whether the counterpart world is metaphysically possible.

Before providing an argument, I need to note that the same argument offered in the context of categoricism in Subsection 3.2.4 is also applicable to the present context of dispositionalism. This is because the argument is based on the four theses about natural-kind substances and natural properties and dispositionalism discussed so far accepts them. However, in this subsection, I will provide an argument specifically reflecting dispositionalism.

To begin with, let us suppose that x has a priori knowledge about the following epistemic possibility: It is epistemically possible that salt has the property of being acidic. Given Bealer's analysis of epistemic possibility in terms of the counterpart relation, this epistemic possibility indicates a counterpart world where a substance to which the concept of being salt_c is applied has the property of being acidic. Since x_c 's concept of being salt_c is the counterpart of x 's concept of being salt, it follows from (2) and (3) (and the assumption about x_c 's counterpart concept) that for every proposition p , x believes p if and only if x_c believes p [salt/salt_c].

Suppose that x believes that salt has the properties Pr_1 , Pr_2 , Pr_3

and not Pr_4 , Pr_5 . Then, it follows that x_c believes that $salt_c$ has the properties Pr_1 , Pr_2 , Pr_3 and not Pr_4 , Pr_5 . As argued in Subsection 2.2.2 and the appendix of Chapter 2, in order for the counterpart world to be metaphysically possible, $salt_c$ must have the properties Pr_1 , Pr_2 , Pr_3 and must lack Pr_4 , Pr_5 . Also, in order for the counterpart world to be a world indicated by the epistemic possibility, $salt_c$ must have the property of being acidic. Thus, in the counterpart world indicated by the epistemic possibility, $salt_c$ has the property of being acidic together with the properties Pr_1 , Pr_2 , Pr_3 and lacks Pr_4 , Pr_5 .

Now let us suppose that the property of being acidic and Pr_4 are natural properties, each identified with a conjunction of universals. Also, let the property of being acidic be identified with a conjunction of universals A and Pr_4 with a conjunction of universals B. Given that A has fundamental universals as its constituent universals, a set of laws of nature flowing from the dispositional essences of those fundamental universals governs A in every possible world where A exists. Let L_A be such a set of laws. In the same way, a set of laws of nature governs B in every possible world where B exists. Let L_B be this set of laws. As discussed in the previous subsection, given fundamental laws, there are some higher-level laws supervening on them. Let S_B be such a higher-level law supervening on L_B . Also, as discussed there, given S_B , there is a property of following S_B . Let Pr_4 be such a property.

Suppose that L_A includes L_B .⁸¹ Then, it is necessarily the case that if L_A holds, L_B holds. Since S_B supervenes on L_B , it is necessarily the case that if L_B holds, S_B holds. Thus, it is necessarily the case that if L_A holds, S_B holds.

Since L_A is a set of fundamental laws necessarily governing A, i.e.,

⁸¹ In constructing this case, I depended much on Bird's (2001, 2007: 176-179) case which shows that necessarily, salt dissolves in water.

the property of being acidic, a substance having this property is also necessarily governed by L_A . Then, the substance is necessarily governed by L_B and hence by S_B and necessarily has the property of following S_B . Since Pr_4 is such a property, the substance necessarily has Pr_4 . From this, it follows that it is necessarily the case that if a substance has the property of being acidic, it has Pr_4 .

Now we can see the impossibility of the counterpart world where $salt_c$ has the property of being acidic. First of all, in order for the counterpart world to be metaphysically possible, $salt_c$ must lack Pr_4 . But it is necessarily the case that if $salt_c$ has the property of being acidic, it has Pr_4 . Therefore, if $salt_c$ has the property of being acidic, the counterpart world is not metaphysically possible. In other words, the counterpart world where $salt_c$ has the property of being acidic is impossible.

Since the above case is not based on empirical information, it might turn out empirically that there is no such case in reality. But my point is that even if there is no such case, this fact is not knowable a priori. That is, such a case is not ruled out a priori. This entails that it is not knowable a priori whether it is metaphysically possible that $salt_c$ has the property of being acidic because the case provides a counterexample against a priori knowability of the metaphysical possibility.

Our discussion shows that even if we have a priori knowledge that it is epistemically possible that salt has the property of being acidic, such knowledge does not give us a priori knowledge about metaphysical possibility. In this respect, the response trying to support a priori knowability of metaphysical possibility based on a priori knowability of epistemic possibility is not successful.⁸²

⁸² The same argument holds in the case of an epistemic possibility that salt lacks

3.3.5. A thinkable case employing neutral counterpart concepts

In Subsection 3.2.5, I provided the case where every concept possessed by x_c is the counterpart of x 's concepts and introduced the notion of a neutral counterpart concept in order to indicate x_c 's concepts in this case. Then, I argued that this case might be the case where our a priori knowledge about epistemic possibility gives us a priori knowledge about metaphysical possibility. The same argument holds in the present context of dispositionalism given some additional detail. Thus, rather than giving a full argument, I will supplement such a detail in this subsection.

In Subsection 3.2.5, I supposed a priori knowledge about the following epistemic possibility: It is epistemically possible that salt has the property of being acidic. I analysed this epistemic possibility in terms of the counterpart world where ${}^n\text{salt}_c$ has the property of being ${}^n\text{acidic}_c$ together with the properties ${}^n\text{Pr}_{1c}$, ${}^n\text{Pr}_{2c}$, ${}^n\text{Pr}_{3c}$ and not ${}^n\text{Pr}_{4c}$, ${}^n\text{Pr}_{5c}$. Then, I argued that by properly assigning an entity to each neutral counterpart concept, one might be able to conceive a counterpart world allowing an entity assigned to the concept of being ${}^n\text{salt}_c$ to have entities assigned to the concepts of being ${}^n\text{acidic}_c$, ${}^n\text{Pr}_{1c}$, ${}^n\text{Pr}_{2c}$, and ${}^n\text{Pr}_{3c}$ and to lack entities assigned to the concepts of being ${}^n\text{Pr}_{4c}$, ${}^n\text{Pr}_{5c}$ without any contradiction of the sort in the counterexamples of Subsection 3.2.4.

In the present context of dispositionalism, in order to avoid the counterexample of the previous subsection as well as those in Subsection 3.2.4, properly assigning an entity to each neutral

a certain actual non-fundamental physical property if we replace the property of being acidic by Pr_1 and Pr_4 by this actual non-fundamental physical property.

counterpart concept must take account not only of universals constituting each entity but also of their dispositional essences. Thus, in order to properly assign an entity, there must be no contradiction among dispositional essences of universals constituting each entity as well as no contradiction among the universals.⁸³ Given these requirements, other points about the case of Subsection 3.2.5 are equally applicable to the case of this subsection.

⁸³ Also, assigning entities to neutral counterpart concepts must satisfy the conditions offered in Footnote 72.

3.4. Justification of A Posteriori Macroscopic Necessity

As indicated in the previous chapter, our discussion of this chapter allows us to justify the thesis of a posteriori macroscopic necessity introduced in Subsection 2.2.3. First of all, let us consider the thesis as follows:

[A posteriori macroscopic necessity] It is knowable a posteriori what macroscopic properties a substance necessarily has.

I explained this thesis by considering the following three claims: (In the following claims, an a priori property is a property which it is knowable a priori that a substance has. And an a posteriori property is a property which it is knowable a posteriori that a substance has.)

- (1) It is knowable a priori that a substance necessarily has only a priori macroscopic properties and no a posteriori macroscopic property.
- (2) It is knowable a priori that a substance necessarily has some a posteriori macroscopic property above and beyond a priori macroscopic properties.
- (3) It is knowable a posteriori whether a substance necessarily has some a posteriori macroscopic property above and beyond a priori macroscopic properties.

According to our discussion in Subsection 2.2.3, each of the claims (2) and (3) entails the thesis of a posteriori macroscopic necessity. And the negation of the claim (1) entails (2) or (3). Thus, by showing that either (2) or (3) holds or by showing that (1) does not hold, we can show that the thesis holds. I will argue below that given

categoricalism, (1) does not hold and given dispositionalism, (2) holds.

Before providing my argument, I need to make clear the notions of macroscopic properties and non-fundamental physical properties because while the thesis concerns macroscopic properties, arguments in this chapter were given in terms of non-fundamental physical properties. According to the discussion about macroscopic properties in Chapter 2, a macroscopic property is a physical property (possessed by a substance) responsible for x's experience with a certain phenomenal character. For example, if x has a veridical experience with a phenomenal character C_{yellow} (which is normally had by x's experience when x sees a yellow substance) while seeing gold, gold has as a macroscopic property a physical property responsible for x's experience of yellowness. In this way, macroscopic properties discussed in the previous chapter are closely related to experience. But it should be noted that macroscopic properties are not the properties of experience but the physical properties of substances. For example, if a substance necessarily has the above macroscopic property, this does not mean that the substance is necessarily experienced as yellow. Rather, it means that the substance necessarily has a physical property responsible for x's experience of yellowness in the actual world. Thus, the claim that a substance necessarily has the macroscopic property is compatible with a claim that the substance is experienced as red in a possible world where perceptual conditions are different from the actual world (as far as the substance in this possible world has the macroscopic property, i.e., the physical property responsible for the experience of yellowness in the actual world).

On the other hand, non-fundamental physical properties are understood in this chapter as properties that have more fundamental physical properties as their microscopic bases. In this chapter, I

provided the properties of being acidic and being radioactive as examples of non-fundamental physical properties as they have as their microscopic bases more fundamental physical properties, i.e., a certain sort of chemical compositions such as containing hydrogen and a certain sort of atomic properties such as unstable nuclei.

Having the above distinction in mind, let us consider the claim (1) as follows: It is knowable a priori that a substance necessarily has only a priori macroscopic properties and no a posteriori macroscopic property. We can argue against the claim (1) by providing a conceivable case where a substance necessarily has an a posteriori macroscopic property and showing that it is not knowable a priori whether this case holds or not.

In order to provide a counterexample against the claim (1) in the context of categoricism, I need to briefly consider Armstrong's ontological framework. According to this framework, a substance designated by a natural-kind substance term T_S has a structural universal S and given the theses of rigid designation of substance terms and the same-substance relation revised, substances having S in any possible worlds are designated by T_S . Also, a non-fundamental physical property designated by a natural property term T_P is identified with a conjunction of universals C and given the theses of rigid designation of property terms and the same-property relation revised, T_P designates C in every possible world where C exists.

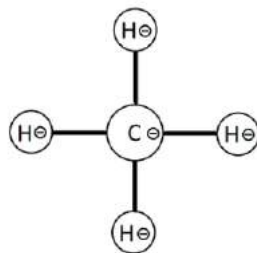
Given the basic idea, we can see that the case I offered in Subsection 3.2.3 is a case against the claim (1) in the context of categoricism. In arguing that it is not knowable a priori whether it is metaphysically possible for a substance to lack a certain actual non-fundamental physical property Pr , I presented a case where it is supposed that Pr is a natural property and identified with a conjunction of universals C . Also, it was supposed that the set of

conjuncts constituting C is a proper subset of the set of conjuncts constituting the structural universal of being the substance in question. Then, it was argued that given this case, it is metaphysically impossible for the substance to lack Pr. This is equivalent to a claim that given the case, the substance necessarily has Pr.

Now suppose that the non-fundamental physical property Pr is a macroscopic property responsible for an experience of a certain colour, e.g., yellowness, in the actual world. Then, the substance necessarily has that macroscopic property (although it is possible for the macroscopic property to look red in a possible world where different perceptual conditions hold). Meanwhile, note that the macroscopic property is an a posteriori property as unlike the property of having mass or extension, it is only knowable a posteriori what colour a substance has.

The above case is a conceivable case where a substance necessarily has an a posteriori macroscopic property. Also, we cannot know a priori whether the case holds or not in reality because in order to know this, we need empirical information about what universals the substance and Pr consist of and what experience Pr is responsible for. In this respect, we can regard the case as a counterexample against the claim (1).

In order to provide another counterexample, I need to note that categorialists accept that a substance has its own molecular geometry, e.g., linear, tetrahedral, and octahedral molecular geometries. For example, in explaining the structural universal of being methane, Armstrong (1997: 36) provides the following diagram.



(In the diagram, 'H' and 'C' mean universal H of being a hydrogen atom and universal C of being a carbon atom. '⊖' means a blank to be filled in by a particular. A line between two circles represents a bonding relation, i.e., the relational universal of bonding.)

Armstrong regards the molecular geometry of methane shown by the above diagram as a categorical property and reflects it to the structural universal of being methane by using bonding relations. In this way, the structural universal of being methane involves the molecular geometry of methane. This means that methane necessarily has its molecular geometry. This point is generalisable to other substances.⁸⁴

Given the above point, suppose that the crystal structure of a substance supervenes only upon the molecular geometry. For example, suppose that the cubic crystal structure of each grain of salt supervenes only upon the linear molecular geometry of salt. Then, salt will necessarily have the cubic crystal structure. If the cubic crystal structure is the macroscopic property responsible for an experience of cubicity of each grain of salt in the actual world, salt will necessarily have this macroscopic property. (I do not mean that the

⁸⁴ Since methane in fact has the tetrahedral molecular geometry, the above molecular geometry is not quite right although it is widely used as a structural formula of methane. But we should regard it as a simplification as in the context where Armstrong discusses this example, the exact representation of methane's molecular geometry is not crucial.

Meanwhile, note that the molecular geometry is one of the important elements of the microstructure of a substance and regarded as a paradigmatic categorical property. (For example, consider the following by Mellor (1974: 171): "Take the paradigm, molecular structure—a geometrical (for example, triangular) array of inertial masses.") Therefore, if the structural universal of being a substance reflects the microstructure of a substance, it is very plausible that the structural universal involves the molecular geometry. I regard Armstrong's methane example as expressing a general point that the molecular geometry of a substance is involved as a categorical property in the structural universal of being a substance.

cubic crystal structure is necessarily experienced as cubical. As discussed in Subsection 2.3.1 where the Fregean theory of spatial phenomenal content is dealt with, it is possible that even a shape property is experienced differently in a possible world where different perceptual conditions hold.)

Or suppose that the refractive index of a substance supervenes only upon the molecular geometry. For example, suppose that the refractive index of water supervenes only upon the molecular geometry of water. Then, by a similar argument to the above, it follows that water has a certain refractive index in every possible world where water exists. Meanwhile, the refractive index of water is a macroscopic property responsible for our visual experience of depth of water. For example, the refractive index of water makes the bottom of a pond look closer than it in fact is. Thus, water necessarily has the macroscopic property responsible for our visual experience of depth of water. (Just as above, this does not mean that the bottom of a pond necessarily looks closer than it in fact is.)

Each of the above two cases is a conceivable case where a substance necessarily has an a posteriori macroscopic property. But it is not knowable a priori whether each case holds or not in reality. This is because in order to know that, one must answer the following questions: what structural universal a substance has and whether each macroscopic property in each case in fact supervenes only upon the molecular geometry of a substance. These questions are answerable a posteriori. In this respect, we can regard the above cases as counterexamples against the claim (1).

At the beginning of this subsection, I claimed that the falsehood of the claim (1) entails the thesis of a posteriori macroscopic necessity. Thus, the thesis holds in categoricism.

Now let us discuss the thesis of a posteriori macroscopic necessity

in the context of dispositionalism. Before providing an argument, I need to note that even if one does not accept the below argument, the thesis holds because the above argument is equally applicable to dispositionalism. But I think that dispositionalism allows a stronger claim than the above argument (which entails that (2) or (3) is true) because as I will argue below, (2) is true in dispositionalism.

According to our discussion of dispositionalism in Subsection 3.3.3, some high-level law governing a substance holds in every possible world where the substance exists. This is because given that the substance necessarily has fundamental physical properties having dispositional essences, fundamental laws flowing from those essences hold in every possible world where the substance exists and some high-level law governing the substance supervenes upon the fundamental laws.

Given that there is a necessary high-level law governing a substance, a substance necessarily has a non-fundamental physical property of following this law. In Subsection 3.3.3, I provided the property of being explosive in water possessed by a lump of sodium as an example of the necessary non-fundamental physical property.

Dispositionalism accepts that given different microstructures of substances, different high-level laws supervene upon them. This entails that different substances have different non-fundamental physical properties of following a high-level law. Since each of the different non-fundamental physical properties is specific to each substance, they are a posteriori properties rather than general a priori properties.⁸⁵

Given the above discussion, it follows that a substance necessarily

⁸⁵ For example, while the general property of having mass is an a priori property, the specific property of having a certain value of mass (1000g) in a certain condition (1 litre and 4 °C) is an a posteriori property.

has an a posteriori non-fundamental physical property of following a high-level law. Then, it can be shown that a substance necessarily has an a posteriori macroscopic property. First, I need to note that the following claim holds in dispositionalism: for every a posteriori non-fundamental physical property Pr of following a high-level law, Pr causes an experience with a certain phenomenal character. Since Pr is a property of following a law, if a proper stimulus S is given, a substance having Pr will yield a certain manifestation M. Then, since this causal process is just following a high-level law, it is usually experienced by our perceptual faculties. But even if it is not experienced as such, it is in principle experienceable because given that each of S and M has its own dispositional essence, they will affect properly designed scientific devices.

Given that Pr is in principle experienceable, Pr will cause an experience with a certain phenomenal character, e.g., an experience of a substance turning from green to red in a certain condition or an experience of a light on a certain scientific device turning from green to red. Then, we can say that Pr is a macroscopic property responsible for such an experience. Given the above claim that a substance necessarily has Pr, it follows that it necessarily has that macroscopic property.

I argued above that each Pr is a specific property so that it is an a posteriori property rather than a general a priori property. This point is equally applied to the macroscopic property. If Pr is a specific property, it will cause a specific experience. Then, a macroscopic property responsible for this experience will be a specific a posteriori property rather than a general a priori property.

Given our discussion so far, it follows that a substance necessarily has an a posteriori macroscopic property. In drawing this conclusion, I depended on a priori philosophical analyses offered by

dispositionalism. Thus, given dispositionalism, it is knowable a priori that a substance necessarily has some a posteriori macroscopic property above and beyond a priori macroscopic properties. This means that (2) is true in dispositionalism. Since (2) entails the thesis of a posteriori macroscopic necessity, the thesis is also true in dispositionalism.

4. Modal Rationalism and A Priori Conceivability

In this chapter, I will discuss Chalmers's modal rationalism.⁸⁶ According to Chalmers, a priori conceivability entails metaphysical possibility and we can know this entailment a priori. Then, we can know metaphysical possibility by our a priori conceivability. For example, if one can conceive a priori that salt has the property of being acidic, one will be able to know that there is a metaphysically possible world where a substance playing a role of salt has a property playing a role of acidity.

I think that Chalmers's argument for a priori knowability of metaphysical possibility based on a priori conceivability is plausible. At least, I will not raise any objection to it in this chapter. Rather, I will argue that a priori conceivability entails more than our metaphysical possibility (i.e., metaphysical possibility from the perspective of our world). Based on this argument, I will claim that we must be cautious not to commit a modal error of regarding what is not metaphysically possible from the perspective of our world as possible when we depend on a priori conceivability to know metaphysical possibility.

In order to argue my point, I will provide intuitively conceivable statements which Chalmers's notion of a priori conceivability (i.e.,

⁸⁶ Chalmers's modal rationalism is closely related to the thinkable case of the previous chapter. In the previous chapter, I provided a case in which given Bealer's notion of epistemic possibility, our a priori knowledge about epistemic possibility might give us a priori knowledge about metaphysical possibility. I explained it in terms of neutral counterpart concepts. A structurally similar case is discussed by Chalmers in terms of his notion of a primary intension which behaves in a very similar way to the notion of a neutral counterpart concept at least with regard to our main concern. In this respect, discussions of this chapter can be seen as considering the thinkable case of the previous chapter seriously.

primary conceivability) cannot accommodate because given the notion, the intuitively conceivable statements become inconceivable. Nevertheless, I will argue that the intuitively conceivable statements are still conceivable a priori and this constitutes the intuitiveness or a robust sense of intuitive conceivability. Then, it will be argued that intuitive conceivability is best identified with ideal two-dimensional conceivability. I will show that although ideal two-dimensional conceivability is a priori conceivability, it does not entail metaphysical possibility from the perspective of our world. Based on my argument, I will claim that we must be cautious not to commit a modal error when we depend on a priori conceivability to know metaphysical possibility.

(In this chapter, I will proceed as follows: In Section 4.1, I will explain Chalmers's modal rationalism, in particular, focusing on his different notions of conceivability and possibility and the entailment relation between a certain sort of conceivability and possibility. Also, his notion of a canonical description of a world and speaker-relativity of a primary intension will be explained. In Section 4.2, I will present intuitively conceivable statements and argue that Chalmers's notion of ideal primary conceivability does not accommodate them as the notion makes them inconceivable. Then, I will try to understand intuitive conceivability in terms of *prima facie* secondary conceivability involving ideal rational reflection. Also, in this section, aposteriority of a posteriori impossible statements will be discussed as the intuitively conceivable statements are a posteriori impossible. Finally, I will derive a notion of two-dimensional conceivability from Chalmers's epistemic two-dimensional semantics and show that it is a priori conceivability. Then, it will be argued that intuitive conceivability is best identified with ideal two-dimensional conceivability. Also, it will be shown that ideal two-dimensional conceivability entails metaphysical possibility from perspectives of

other worlds. In Section 4.3, I will claim that we must be cautious not to commit a modal error of regarding what is not metaphysically possible from the perspective of our world as possible when we depend on a priori conceivability to know metaphysical possibility.)

4.1. Chalmers's Modal Rationalism

Chalmers's modal rationalism is one of the crucial parts of his large project. In this project, Chalmers tries to recover constitutive ties between meaning, modality and reason which he (2006: 55) calls a "golden triangle". He diagnoses that after Kripke and Putnam argued for a posteriori necessary truths, it has been thought that the constitutive tie between reason (e.g., apriority and aposteriority) and modality (i.e., metaphysical necessity and possibility) is severed. Also, Chalmers argues that such a severance has a consequence of severing another constitutive tie, i.e., the tie between meaning (e.g., Fregean sense) and reason (e.g., cognitive significance). Given this diagnosis, reconnecting the tie between reason and modality constitutes the crux of the project of reconstructing the golden triangle. Chalmers attempts to do this crucial work by arguing modal rationalism.

In this section, I will provide an exposition of Chalmers's modal rationalism, in particular, focusing on his modal epistemological thesis that conceivability entails possibility. For the purpose of this, I will explain Chalmers's notions of conceivability and possibility and other relevant notions for our discussion such as canonical descriptions of worlds and speaker-relativity of a primary intension.

As the notion of a primary intension derives from Chalmers's epistemic interpretation of the two-dimensional semantic framework, his epistemic two-dimensionalism is relevant to our discussion. But in this section, I will only deal with the notion of a primary intension as the framework itself is indirectly related to our main topic. This will be introduced in the later section where I deal with two-dimensional conceivability.

Modal rationalism has some implication for other issues, for

example, construction of epistemic space of scenarios, vindication of Fregean sense, an anti-reductive account of the phenomenal, etc.⁸⁷ These issues will be set aside since dealing with them makes our discussion unnecessarily complicated and they are largely independent from our main concern.

4.1.1. Conceivability and possibility

The most crucial claim of Chalmers's modal rationalism is that conceivability entails possibility. But it is well known that a posteriori necessary truths offered by Kripke and Putnam provide counterexamples against this claim. For example, it is conceivable that water is not H₂O, but this is not metaphysically possible because it is necessarily the case that water is H₂O. Recognising the problem raised by a posteriori necessities, Chalmers argues for a way of supporting the entailment relation between conceivability and possibility while avoiding the apparent counterexamples.

To begin with, let us consider the following claim about the entailment relation argued by Chalmers (2002a: 171):

[Entailment⁸⁸] *Ideal primary positive conceivability entails primary possibility.*⁸⁹

⁸⁷ For the construction of epistemic space of scenarios, see Chalmers (2011, 2012: tenth excursus); for the vindication of Fregean sense, see Chalmers (2002b, 2012: eleventh excursus); for an anti-reductive account of the phenomenal, see Chalmers (1996) and Chalmers and Jackson (2001). Also, for some important criticism against modal rationalism, see Byrne (1999), Byrne and Pryor (2006), Block and Stalnaker (1999), Yablo (2000, 2002), and Soames (2005).

⁸⁸ 'Entailment' is my naming.

⁸⁹ Italics in the original. Chalmers (2002a: 171) offers other varieties of the entailment relation as follows: "*Ideal primary negative conceivability entails primary possibility*"; "*Ideal secondary (positive/negative) conceivability entails secondary possibility*." The latter claim concerns a posteriori conceivability to the effect that

Chalmers's idea is that among different varieties of conceivability and possibility, the sort of conceivability and possibility in the thesis of entailment have an entailment relation. Thus, in order to explain his idea, I need to present his notions of conceivability and possibility.

Chalmers (2002a: 146) distinguishes notions of conceivability in three dimensions as follows: "prima facie versus ideal conceivability, positive versus negative conceivability, and primary versus secondary conceivability". Also, possibility is distinguished into two notions: primary versus secondary possibility. Let me briefly explain these notions.

(1) Prima facie vs. ideal conceivability

According to Chalmers (2002a: 147), for a statement S, "S is prima facie conceivable for a subject when S is conceivable for that subject on first appearances." For example, suppose that conceiving that water is XYZ involves imagining a situation in which a colourless tasteless odourless drinkable substance has XYZ as its microstructure. If this situation is imaginable for a subject on first appearances, it is prima facie conceivable that water is XYZ.

On the other hand, according to Chalmers (2002a: 147) "S is ideally conceivable when [and only when]⁹⁰ S is conceivable on ideal

roughly, given every non-modal empirical information about the actual world and ideal rational reflection, one can know what might have been the case. As for the former claim, given the assumption of Chalmers's pure modal rationalism that I will make in this chapter, it is equivalent to the thesis of entailment in the main text. Also, positive conceivability is a more familiar notion than negative one in philosophical practices. For these reasons, I will focus only on the thesis of entailment involving positive conceivability.

⁹⁰ We can regard this condition as a bi-conditional, given the following claim by Chalmers (2002a: 147): "It sometimes happens that S is prima facie conceivable to a subject, but that this prima facie conceivability is undermined by further reflection

rational reflection”.⁹¹ For example, consider a case in which a subject finds a situation where Fermat’s last theorem is false prima facie conceivable by imagining a situation where a Fields medalist mathematician announces that Fermat’s last theorem is false at a prestigious mathematical conference. But given ideal rational reflection, the subject will find it contradictory that Fermat’s last theorem is false. In this case, the falsehood of Fermat’s last theorem is prima facie conceivable but not ideally conceivable. As this example indicates, that S is ideally conceivable means that on ideal rational reflection, conceiving S can satisfy relevant requirements for conceivability such as involving no contradiction or (truly) verifying S, which will be introduced by other notions of conceivability.

(2) Negative vs. positive conceivability

According to Chalmers (2002a: 149), “S is negatively conceivable when [and only when]⁹² S is not ruled out a priori, or when there is no (apparent) contradiction in S”. For example, the falsehood of Fermat’s last theorem is prima facie negatively conceivable because one cannot find a contradiction in the negation of the theorem on first appearances. But it is not ideally negatively conceivable as one can find a contradiction in it given ideal rational reflection.

The condition for negative conceivability needs to be revised in

showing that the tests that are criterial for conceivability are not in fact passed. In this case, S is not ideally conceivable.” Also, see the next footnote.

⁹¹ More precisely, Chalmers (2002a: 148) says that “S is ideally conceivable when there is a possible subject for whom S is prima facie conceivable, with justification that is undefeatable by better reasoning.” For more on Chalmers’s notion of idealisation (e.g., modal, normative, and warrant idealisations), see Chalmers (2012: 62-64, 188-189).

⁹² Just as in the condition for ideal conceivability, we can regard this as a bi-conditional, given the following claim by Chalmers (2002a: 147): “But it [(~M)] is not ideally [negatively] conceivable, as ideal reflection will rule out ~M a priori.”

order to accommodate the case where S has no determinate truth-value. Given that S is not ruled out a priori if and only if it is not a priori that $\sim S$, we have the following condition: “S is ideally negatively conceivable when it is not a priori that $\sim S$ ” (Chalmers (2002a: 149)). Then, suppose that it is a priori that S’s truth-value is indeterminate. In this case, it is not a priori that $\sim S$, so according to the condition for negative conceivability S is negatively conceivable. But intuitively it is wrong to say that S is negatively conceivable as the indeterminacy of S does not suggest the possibility of S. In order to avoid this problem, Chalmers (2002a: 150) offers the following condition for negative conceivability: “S is ideally negatively conceivable when [and only when]⁹³ it is not a priori that $\sim \text{det}(S)$. Here [...] ‘ $\sim \text{det}(S)$ ’ expresses the claim that S is false or indeterminate.”

Let us turn to positive conceivability. According to Chalmers (2002a: 153), S is positively conceivable when and only when one can coherently imagine a situation that verifies S.⁹⁴ Here coherent imagination is to imagine a situation or a world in a way that it is possible to flesh out every detail of the situation or the world without any contradiction.

Given the purpose of this chapter, the notion of verification is important. Consider the following claim by Chalmers (2002a: 152):

⁹³ The following claim by Chalmers (2002a: 150) allows us to regard this condition as a bi-conditional: “In the case of a priori indeterminacy above, it will be a priori that $\sim \text{det}(S)$, so S will not be ideally negatively conceivable.”

⁹⁴ This condition for positive conceivability is revised from Chalmers’s (2002a: 153) following condition: “S is positively conceivable when one can coherently modally imagine a situation that verifies S”. Here modal imagination is a mode of imagination introduced to cover cases where perceptual imagination is impossible (e.g., an unperceptible being) or irrelevant. Given my purpose of this chapter, issues concerning different modes of imagination are irrelevant. Concerning ‘only when’ in the revised condition for positive conceivability in the main text, the following claim by Chalmers (2002a: 154) allows us to insert it: “In these cases, however, even a moment’s reflection is enough to undermine the positive conceivability. In the first case, one can easily detect a contradiction (or the inability to fill in crucial detail). In the second case, reflection reveals the situation as one in which one has evidence that M, but not clearly as a situation in which M”.

“an imagined situation verifies S when [and only when]⁹⁵ reflection on the situation reveals it as a situation in which S”. For example, in the above case about Fermat’s last theorem, the situation where a Fields medalist mathematician announces that Fermat’s last theorem is false at a prestigious mathematical conference does not verify that the theorem is false. This is merely a situation in which one has evidence for the falsehood of the theorem and not a situation in which the theorem is false. On the other hand, a situation involving Gettier’s cases verifies that ‘every justified true belief is knowledge’ is false.

Before turning to other notions of conceivability, let me introduce Chalmers’s (2002a: 152) following claim about the feature of verification as this will be relevant to later discussions: “verification of a statement by an imagined situation is broadly analogous to an entailment of one statement by another (a priori entailment, in the central cases): if it is coherent to suppose that the situation obtains without S being the case, then the situation does not verify S.”

(3) Primary vs. secondary conceivability

Although it is metaphysically necessary that water is H₂O, it is conceivable that water is XYZ or it is epistemically possible that water is XYZ. The notion of primary conceivability is introduced to explain this phenomenon. Chalmers (2002a: 157) provides the following condition for primary conceivability: “S is *primarily conceivable* (or *epistemically conceivable*) when it is conceivable that S is *actually* the case.” Given this notion, the condition for primary positive conceivability can be formulated as follows: “S is primarily positively

⁹⁵ The following claim by Chalmers (2002a: 152) allows us to regard this condition as a bi-conditional: “In such cases, consideration of the imagined situation alone does not reveal it as a situation in which S [...], so the imagined situations do not verify S.”

conceivable when [and only when]⁹⁶ one can coherently imagine a situation that verifies S when considered as actual” (Chalmers (2002a: 157)). For example, suppose that one coherently imagines Putnam’s twin-earth world. If this world turns out to be the actual world (i.e., if this world is considered as actual), one will conclude that water is XYZ on rational reflection. In this way, primary conceivability explains the phenomenon mentioned above.⁹⁷

While primary conceivability is related to epistemic possibility, secondary conceivability is related to subjunctive possibility. According to Chalmers (2002a: 157), “S is *secondarily conceivable* (or *subjunctively conceivable*) when S conceivably *might have been* the case.” Secondary conceivability is a posteriori conceivability in that it depends on non-modal empirical information about the actual world as well as rational reflection.

(4) Primary vs. secondary possibility

Secondary possibility (or 2-possibility) is counterfactual possibility we usually identify with metaphysical possibility. Chalmers (2002a: 164) provides the following condition for this notion: “S is *secondarily possible* (or 2-possible) if its secondary intension is true in some possible world (i.e., if S is true in some world considered as counterfactual).” Here a secondary intension is the familiar sort of

⁹⁶ The following claim by Chalmers (2002a: 158) allows us to regard this condition as a bi-conditional: “Positive primary conceivability, by contrast, requires coherently imagining a situation (considered as actual) that verifies S.”

⁹⁷ Primary negative conceivability is formulated by Chalmers (2002a: 158) as follows: “S is primarily negatively conceivable when it is not ruled out a priori that S is actually the case, or, more briefly, if S is not ruled out a priori.” We can regard this condition as a bi-conditional. From the condition for positive conceivability and the condition for primary positive conceivability, it follows that the condition for primary conceivability is a bi-conditional. And from this condition for primary conceivability and the condition for negative conceivability, it follows that the condition for primary negative conceivability is a bi-conditional.

counterfactual modal intension, i.e., a function from (counterfactually considered) possible worlds to truth-values.

On the other hand, primary possibility (or 1-possibility) is defined in terms of a primary intension. According to Chalmers (2002a: 164), “S is *primarily possible* (or 1-possible) if [and only if]⁹⁸ its primary intension is true in some possible world (i.e., if [and only if] S is true in some world considered as actual).” In order to understand this condition, we need to focus on the notion of a primary intension.

As the condition for primary possibility alludes to, the primary intension of a statement S is defined as a function from (centered)⁹⁹ possible worlds considered as actual to truth-values. For example, suppose that S is ‘water is XYZ’. Then, the primary intension of S is true in Putnam’s twin-earth world (considered as actual) while it is false in the world in which water is H₂O (when considered as actual). More precisely, Chalmers (2002a: 163) provides the following condition for the primary intension: “the primary intension of S is true in W if the material conditional ‘if W is actual, then S’ is a priori [...]. S’s primary intension is false in W if the conditional ‘if W is actual, then ~S’ is a priori; and S’s primary intension is indeterminate in W if neither of these conditionals is a priori.” I will explain these conditions in the later subsection where a canonical description of a world is

⁹⁸ Primary necessity allows us to regard this condition as a bi-conditional. Given Chalmers’s (2002a: 164) claim that “It is clear that when S is a priori, it will have a necessary primary intension, so it will be 1-necessary”, we have the following condition: S is primarily necessary (or 1-necessary) if its primary intension is true in all possible worlds. Then, ~S is primarily necessary (i.e., S is primarily impossible) if the primary intension of ~S is true in all possible worlds (i.e., S’s primary intension is false in all possible worlds). By contraposition, it follows that if S is primarily possible, S’s primary intension is true in some possible world.

⁹⁹ A center marking a specific individual and a certain time is needed to deal with indexical claims and other issues related to them (e.g., a world containing the earth and a twin-earth). For a discussion about a centered world, see Chalmers (2002a: 166, 2006: 82, 2011: 68-70) and Chalmers and Jackson (2001: 318). Unless otherwise indicated, I will ignore this complication in my discussion as it is largely irrelevant to my topic.

dealt with.

An important point is that primary possibility is just metaphysical possibility. Although the world in which the primary intension of the statement 'water is XYZ' is true is not the world such that when it is considered as counterfactual, water is XYZ (because there is no such world), it is still a metaphysically possible world in which a colourless tasteless odourless drinkable substance is XYZ. Also, note that the primary intension of a statement is defined over a space of (centered) metaphysically possible worlds (considered as actual). Therefore, S's primary intension is true in a world W if and only if W is a metaphysically possible world and S is true when W is considered as actual. This leads to a result that S is primarily possible if and only if there is a metaphysically possible world such that when it is considered as actual, S is true. (Compare this with the usual sort of metaphysical possibility: S is secondarily possible if and only if there is a metaphysically possible world such that when it is considered as counterfactual, S is true.)

4.1.2. The thesis of entailment

Now we can explain the import of Chalmers's thesis of entailment. To begin with, let us consider the thesis again as follows:

[Entailment] Ideal primary positive conceivability entails primary possibility.

Given the notions of conceivability and possibility explained in the previous subsection, we can reformulate this thesis as follows:

[Entailment*] If on ideal rational reflection one can coherently

imagine a world W^{100} that verifies S when considered as actual, then S 's primary intension is true in W^{101} .

In order to reformulate the above thesis further, let us consider again the following condition for verification offered by Chalmers (2002a: 152): "an imagined situation verifies S when [and only when] reflection on the situation reveals it as a situation in which S ." Here reflection is a priori rational reflection. Given this condition, saying that an imagined world W verifies S when W is considered as actual is equivalent to saying that 'if W is actual, then S ' is a priori. Then, the above thesis can be reformulated as follows:

[Entailment**] If on ideal rational reflection one can coherently imagine a world W such that 'if W is actual, then S ' is a priori, then S 's primary intension is true in W .

Meanwhile, in the previous subsection, it was claimed that the primary intension of a statement is defined over a space of (centered) metaphysically possible worlds. Then, we can obtain the following thesis:

[Entailment Reformulated] If on ideal rational reflection one can coherently imagine a world W such that 'if W is actual, then

¹⁰⁰ Chalmers's (2002a: 157) condition for primary positive conceivability we discussed above was as follows: " S is primarily positively conceivable when [and only when] one can coherently imagine a situation that verifies S when considered as actual." In the thesis of entailment*, I replaced 'a situation' with 'a world W '. This is not problematic because on ideal rational reflection, the following holds: one can coherently imagine a situation that verifies S when considered as actual if and only if one can coherently imagine a world that verifies S when considered as actual.

¹⁰¹ Chalmers's (2002a: 164) condition for primary possibility we discussed above was as follows: " S is *primarily possible* (or 1-possible) if [and only if] its primary intension is true in some possible world." In the thesis of entailment*, I replaced 'some possible world' with ' W ', making the consequent say that S 's primary intension is true in an ideally coherently imagined world W verifying S when considered as actual. I think that this replacement is correct. Otherwise, there would be no relation between a world W in the antecedent and some possible world in the consequent. Then, there would be no substantial relation between the antecedent and the consequent. This would make the thesis insubstantial.

S' is a priori, then W is a metaphysically possible world in which S's primary intension is true.

This thesis says that if a world W is properly conceivable, it is metaphysically possible. Thus, we can say that the import of the thesis of entailment is that a certain way of conceiving entails a certain sort of metaphysical possibility. This means that modality is accessible by rationality or that there is a tie between modality and reason which modal rationalism tries to establish.

Chalmers considers a number of counterexamples which he calls 'strong necessities' against the thesis of entailment but rejects them as highly controversial and tendentious. Also, he provides some positive reason for accepting the thesis although he concedes that it is not conclusive. I think that Chalmers's negative argument against the counterexamples is plausible, but supporting the thesis still raises difficult issues requiring a large amount of discussion. In this chapter, I will assume that the thesis is true rather than committing myself to those issues.

In explaining Chalmers's modal rationalism, I have depended on the thesis of entailment formulated in terms of positive conceivability. But Chalmers (2002a: 171) provides a similar thesis formulated in terms of negative conceivability as follows: "Ideal primary negative conceivability entails primary possibility." Although there are some interesting issues concerning this entailment relation, I will not deal with them. Rather, in this chapter, I will assume that this thesis is true. Also, I will assume the truth of Chalmers's pure modal rationalism, according to which ideal primary negative conceivability, ideal primary positive conceivability, and primary possibility are extensionally

equivalent.¹⁰² This assumption will significantly simplify our discussion in later sections.

4.1.3. Canonical description of a world

Before closing the exposition of Chalmers's modal rationalism, I need to explain two important ideas, i.e., a canonical description of a world and speaker-relativity of a primary intension, which are relevant to my argument. In this subsection, I will focus on the former.

In order to understand the thesis of entailment reformulated, we need an explanation about what it means to say that 'if *W* is actual, then *S*' is a priori. Such an explanation is offered by Chalmers when he discusses the primary intension of a statement.

Consider the following condition for a primary intension offered by Chalmers (2002a: 163): "the primary intension of *S* is true in *W* if the material conditional 'if *W* is actual, then *S*' is a priori". According to him, in order to evaluate the material conditional, we need a canonical description of *W*. He (2002a: 166) says that "the primary intension of *S* is true at *W* if the material conditional 'if *D*, then *S*' is a priori, where *D* is a canonical description of *W*."

There are two important requirements that a canonical description must satisfy. The first requirement is that a canonical description *D* must describe a world using semantically neutral vocabularies. According to Chalmers (2002a: 166), we can regard a semantically neutral expression as "one that behaves the same way in epistemic and subjunctive evaluation, so that it is not susceptible to Twin Earth thought experiments". For example, expressions like 'red' and 'two'

¹⁰² Accepting pure modal rationalism is equivalent to accepting a claim that there are no inscrutabilities, open inconceivabilities, and strong necessities. For a relevant discussion, see Chalmers (2002a: 173-195).

are semantically neutral because whether a world is considered as actual or counterfactual, they have the same extensions. On the other hand, 'water' is semantically non-neutral because when a twin-earth world is considered as actual, it refers to XYZ while when a twin-earth world is considered as counterfactual, it refers to H₂O.

To see the point of the requirement, suppose that a canonical description D involves a semantically non-neutral vocabulary, e.g., 'water'. If D is a canonical description of a twin-earth world, D will involve a sentence such as 'there is no water' because in the twin-earth world, there is no H₂O. If S is a statement 'there is no water', then 'if D, then S' will be a priori. But this is problematic because if the twin-earth world is considered as actual, then S is false.

The second requirement is that a canonical description D must completely describe a world, i.e., that it must be a complete description of a world. If D is not a complete description of a world W, there will be a statement S such that if W is considered as actual, S is true but 'if D, then S' is not a priori. Chalmers provides three notions of completeness such as ontological, epistemic, and qualitative completeness.¹⁰³ This distinction need not bother us because given our assumption of Chalmers's pure modal rationalism, they are extensionally equivalent.

Chalmers provides an example of a canonical description D of our world. According to him (2002a: 178), D is a conjunction of all microphysical truths, all phenomenal truths, indexical information, and a totality claim (i.e., PQTI in Chalmers's term). But for my purpose, it is not important how to construct a canonical description D of our

¹⁰³ Consider the following claim by Chalmers (2002a: 176-177): "an epistemically complete statement is one that, roughly speaking, epistemically settles everything that could be settled"; "an ontologically complete description of the world [is,] roughly speaking, one that metaphysically necessitates all truths about the world"; "A qualitatively complete description of the world, then, should be understood as a description to the limits of positive conceivability."

world. Rather, the important point is that since D does not contain semantically non-neutral expressions such as 'water' and 'salt', it must include information based on which one can identify something (e.g., H₂O and NaCl) as the referent of such expressions.¹⁰⁴ The same point applies to any hypothetical canonical descriptions. For example, if we suppose that D is a canonical description of a twin-earth world, then D must include information based on which one can identify XYZ as the referent of 'water'.

Given the notion of a canonical description of a world, we can revise the thesis of entailment reformulated as follows:

[D-Entailment] If on ideal rational reflection one can a priori construct a canonical description D of a world W¹⁰⁵ such that 'if D, then S' is a priori, then W is a metaphysically possible world in which S's primary intension is true.

Given the thesis of D-entailment, if S is ideally primarily positively conceivable, there is an a priori constructible canonical description D such that 'if D, then S' is a priori,¹⁰⁶ and this entails that a world W of which D is a canonical description (or a D-world for short) is

¹⁰⁴ To see the reason for this requirement, suppose that W is the actual world and D is a canonical description of W. Then, the primary intension of 'water is H₂O' is true in W because it is a priori that 'if W is actual, then water is H₂O' is true. However, if D does not include information based on which one can identify the referent of 'water', then it will be a priori that 'if D, then water is H₂O' is false or indeterminate. Thus, in order for D not to wrongly define the primary intension of 'water is H₂O', it must satisfy the requirement.

¹⁰⁵ Constructing a canonical description will require one to possess any concepts needed to construct an arbitrary canonical description (e.g., concepts of alien properties which are not instantiated in the actual world). Also, such a construction will raise other issues concerning idealisation. I will not discuss these complexities here, assuming that there is a plausible notion of idealisation allowing one to construct an arbitrary canonical description. For a relevant discussion, see Chalmers (2011).

¹⁰⁶ Note that S is ideally primarily positively conceivable (the antecedent of the thesis of entailment) if and only if on ideal rational reflection one can coherently imagine a world W such that 'if W is actual, then S' is a priori (the antecedent of the thesis of entailment reformulated). And the latter is equivalent to the antecedent of the thesis of D-entailment.

metaphysically possible. After all, if S is ideally primarily positively conceivable, a relevant D-world is metaphysically possible.

Now let me explain how one can obtain knowledge about metaphysical possibility based on ideal primary positive conceivability. Suppose that S is ideally primarily positively conceivable. Then, since “[p]rimary conceivability is always an a priori matter” (Chalmers (2002a: 158)), it is knowable a priori that S is ideally primarily positively conceivable. Also, since the thesis of D-entailment is an a priori philosophical analysis, it is knowable a priori. Then, one can know a priori that a relevant D-world is metaphysically possible based on one’s a priori knowledge that S is ideally primarily positively conceivable and one’s a priori knowledge of the thesis of D-entailment.

4.1.4. Speaker-relativity of a primary intension

Chalmers’s another important idea relevant to my argument is speaker-relativity of a primary intension. According to Chalmers (2002a: 167), the primary intension of some expressions such as names and natural kind terms can be different from speaker to speaker. Let me explain this by the following example.

Suppose that a person A uses ‘Albert Camus’ to refer to a person who wrote *The Stranger* and a person B uses the same name to refer to a person who wrote *The Myth of Sisyphus*. Then, consider a statement ‘Albert Camus wrote *The Plague*’ and a world containing a person who wrote only two novels, *The Stranger* and *The Plague* and another person who wrote only *The Myth of Sisyphus*. That is,

For A, ‘Albert Camus’ refers to a person who wrote *The Stranger*.
For B, ‘Albert Camus’ refers to a person who wrote *The Myth of Sisyphus*.

S is a statement 'Albert Camus wrote *The Plague*'.
W contains a person who wrote only *The Stranger* and *The Plague* and a person who wrote only *The Myth of Sisyphus*.

If W is considered as actual, S will be true when made by A but false when made by B. In this way, the primary intension of the statement involving 'Albert Camus' varies between A and B. We can apply the same point to a statement involving natural kind terms. For example, suppose that for a person, 'molybdenum' is used to refer to a silvery metal having a very high melting point while for another person, it is used to refer to a corrosion-resistant silvery metal. In this case, the primary intension of a statement involving 'molybdenum' will vary between those two speakers.¹⁰⁷

Because of the speaker-relativity, the primary intension must be understood as a semantic value associated with an expression token rather than an expression type. Reflecting this point, Chalmers (2002a: 167) offers the following condition for a primary intension: "the primary intension of a statement token S (used by a speaker) is true in W if the material conditional 'if W [is actual]¹⁰⁸, then S' is a priori for the speaker."

¹⁰⁷ Chalmers (2002b: 168-173) claims that descriptions associated by a speaker with an expression do not need to be explicitly believed or linguistically expressible. I will deal with this claim in the next section.

¹⁰⁸ It is clear that 'is actual' is mistakenly missing.

4.2. Ideal Primary Inconceivability and Intuitively Conceivable Statements

In this section, I will provide intuitively conceivable statements and argue that although the intuitive conceivability of them is a priori conceivability, it does not entail metaphysical possibility from the perspective of our world. In Subsections 4.2.1 and 4.2.2, I will present intuitively conceivable statements and argue that the notion of ideal primary conceivability does not explain intuitive conceivability as the notion makes them inconceivable. In Subsection 4.2.3, I will try to understand intuitive conceivability in terms of prima facie secondary conceivability (involving ideal rational reflection) as the intuitively conceivable statements are a posteriori impossible. In Subsections 4.2.4 and 4.2.5, I will explain and criticise an idea that aposteriority of a posteriori impossible statements entails ideal primary conceivability and primary possibility of them. Finally, in Subsection 4.2.6, a notion of a priori two-dimensional conceivability will be derived from Chalmers's epistemic two-dimensional semantics. Then, I will argue that intuitive conceivability is identified with ideal two-dimensional conceivability. Also, it will be argued that given this identification, intuitive conceivability does not entail metaphysical possibility from the perspective of our world.

To begin with, let us consider the thesis of D-entailment again as follows:

[D-Entailment] If on ideal rational reflection one can a priori construct a canonical description D of a world W such that 'if D, then S' is a priori, then W is a metaphysically possible world in which S's primary intension is true.

Given that the antecedent of this thesis is equivalent to the claim that

S is ideally primarily positively conceivable, we can formulate ideal primary (positive) inconceivability as follows:

[Inconceivability] S is ideally primarily inconceivable if and only if for all canonical descriptions D (of a world W) which one can a priori construct on ideal rational reflection, either (1) 'if D, then \sim S' is a priori or (2) neither 'if D, then S' nor 'if D, then \sim S' is a priori.¹⁰⁹

Although the thesis of inconceivability is formulated from ideal primary positive conceivability, it also covers ideal primary negative inconceivability. Consider the following condition for ideal primary negative conceivability: S is ideally primarily negatively conceivable if and only if it is not a priori that \sim det(S) (i.e., that S is false or indeterminate).¹¹⁰ From this condition, it follows that S is ideally primarily negatively inconceivable if and only if it is a priori that \sim det(S).

Then, we can see that the right-side of the thesis of inconceivability is equivalent to ideal primary negative inconceivability. Given ideal rational reflection, the claim that for all a priori constructible D, either (1) 'if D, then \sim S' is a priori or (2) neither 'if D, then S' nor 'if D, then \sim S' is a priori is equivalent to a claim that it is a priori that for all D, either (1) 'if D, then \sim S' is true or (2) neither 'if D, then S' nor 'if D, then \sim S' is true.¹¹¹ And the latter claim is equivalent to a claim that it

¹⁰⁹ Or simply, for all D, 'if D, then S' is not a priori. I intentionally formulated the thesis as above in order to highlight the indeterminacy expressed in (2).

¹¹⁰ This condition is derivable from Chalmers's (2002a: 150) condition for ideal negative conceivability discussed in Subsection 4.1.1 as follows: "S is ideally negatively conceivable when [and only when] it is not a priori that \sim det(S)." According to Chalmers (2002a: 158), saying that it is not a priori that \sim det(S) is equivalent to saying that S is not ruled out a priori and this is equivalent to saying that it is not ruled out a priori that S is actually the case. Since the latter is just a claim that S is ideally primarily negatively conceivable, it follows that ideal negative conceivability is equivalent to ideal primary negative conceivability.

¹¹¹ According to Chalmers (2002a: 164), given the assumption of pure modal

is a priori that S is false or indeterminate, i.e., that $\sim\text{det}(S)$. Therefore, S satisfies the right-side of the thesis of inconceivability if and only if S is ideally primarily negatively inconceivable.

Given the formal structure of inconceivability, we can present some cases satisfying it. But before providing such cases, I need to deal with the opposite case involving conceivability rather than inconceivability. Consider the following claim by Chalmers (2002a: 179):

[T]he basic idea is that straightforward a priori reasoning from PQTI puts one in a position to know all about the physical composition, the phenomenal appearance, the spatial structure, and the dynamic behavior of macroscopic systems, along with facts about their relation to oneself and their distribution in space and time; and this information, in turn, puts one in a position to know all ordinary macroscopic truths S about such systems, as long as one possesses the concepts involved in S. The information will include all the information on which ordinary perceptual or theoretical knowledge that S might be based, along with sufficient information to conclusively rule out skeptical counter possibilities. If so, it is very plausible that PQTI implies S.

According to this passage, a canonical description D (i.e., PQTI in the passage) includes every piece of information from which one can reason that S is true. For example, suppose that D is a canonical description of our world and S is a statement, 'Jupiter is the largest planet in the solar system'. Given D, one can know the physical composition, phenomenal appearance, spatial structure and dynamic behavior of the solar system, and from these pieces of information one can identify which planet Jupiter is. Also, from such information,

rationalism, it holds that S's primary intension is true in all worlds if and only if S is a priori. From this, it follows that for all D, 'if D, then S' is a priori if and only if it is a priori that for all D, 'if D, then S' is true.

one can know that Jupiter is the largest planet in the solar system. In this way, one can reason from D that S is true.

4.2.1. An example of inconceivability involving an unfamiliar substance

With the above picture of how one can reason from D to S's truth in mind, let us examine inconceivable statements. First, consider the following case:

[Iridium] An epistemic subject X is an ordinary adult having average scientific knowledge. X knows that there are many chemical elements of which she does not know even their names. Of some other elements, X knows their names but has no idea about their properties. Iridium and rubidium are among such elements. Of still other elements such as lithium and gold, X has familiarity in varying degrees.

Given the above case, it is straightforward that the following statement is inconceivable:

(S₁) 'Iridium is not a substance.'

The inconceivability of S₁ is not news. Also, such an inconceivability is not my main concern because S₁ is intuitively inconceivable.¹¹²

¹¹² One might imagine a situation in which after scientific investigation, what we refer to by 'iridium' turns out not to be a substance and say that this is the situation in which iridium is not a substance. But I think it intuitively correct that this is the situation in which there is no iridium. Also, one might counterfactually imagine a situation in which iridium is not a substance and say that this is the situation in which iridium is not a substance. But one cannot imagine such a situation counterfactually because as far as one understands the term 'iridium' even

Now let me turn to the following statement which is not as straightforward as S₁:

(S₂) 'Iridium is a metallic substance.'

In order to evaluate S₂, I need to distinguish canonical descriptions D into two sorts: (1) D such that it is a priori that 'if D, then iridium does not exist' is true and (2) D such that it is not a priori. First of all, let me examine the former case. If D is such that it is a priori that 'if D, then iridium does not exist' is true, S₂ is not true. Then, since the truth of S₂ is a priori ruled out given each of such D, S₂ is ideally primarily negatively inconceivable for all such D. Also, since 'if D, then S₂' is not a priori given each of such D, S₂ is ideally primarily positively inconceivable for all such D. Thus, if D is such that it is a priori that 'if D, then iridium does not exist' is true, S₂ is ideally primarily inconceivable.

In what follows, I will regard the former sort of D as undefined and

minimally, one can a priori reason that iridium is necessarily a substance. Either way, it is inconceivable that iridium is not a substance.

Meanwhile, I provided as an example of inconceivability the statement 'iridium is not a substance' rather than 'iridium is not a chemical element'. This is because I think that the latter statement is conceivable. For example, suppose that after scientific investigation, the substance chemists have called 'iridium' so far turns out to be a chemical compound rather than a chemical element. As a matter of course, this situation cannot hold in X's world because as known by X, iridium is a chemical element in X's world. But the situation can be hypothetically considered as actual and if so, iridium will not be a chemical element.

But against my judgment, one might claim that the situation cannot be considered as actual because X knows that iridium is a chemical element. This claim will be correct if X's knowledge as such is a priori knowledge. This is because if it is a priori for X that 'iridium is a chemical element' is true, then 'iridium is not a chemical element' will be ruled out a priori and hence a situation verifying the latter statement will be ruled out a priori. However, it seems obvious that 'iridium is a chemical element' is not a priori. (Compare this with a statement 'water is a chemical compound'. Even if one knows that the statement is true (maybe by knowing that water is H₂O), one's such knowledge will clearly not be a priori.) Then, given the notion of negative conceivability, 'iridium is not a chemical element' is conceivable. Also, given the assumption of pure modal rationalism, it is positively conceivable. Then, we can regard the case in the previous paragraph as one of the positively conceivable cases verifying the statement 'iridium is not a chemical element'.

set them aside in evaluating a statement for the sake of simplicity. This does not affect my discussion. My purpose of this section is to show that given Chalmers's notion, some statements become inconceivable despite their intuitive conceivability. Thus, if undefined canonical descriptions contributed to conceivability of the statements, ignoring them would be problematic. But as argued in the previous paragraph, they yield inconceivability and this point is applied to the statements I will deal with below. Thus, ignoring undefined canonical descriptions does not raise any problem for my discussion.

As we have set aside the undefined canonical descriptions, all canonical descriptions D are the latter sort in the above distinction. That is, all D are such that it is not a priori that 'if D , then iridium does not exist' is true. Then, in order to evaluate S_2 , X must identify the referent of 'iridium' in each D by picking out a certain chemical substance. But can X identify the referent given her understanding of 'iridium'? At first glance, the answer seems negative. Given that X has nearly no idea about the properties of iridium, it seems that there are not sufficient associated properties allowing X to pick out a certain chemical substance as the referent of 'iridium'. Contrast this with the term 'water'. Since X is an ordinary adult as described above, we can say that X has a significant amount of knowledge and associates many properties with 'water' (e.g., properties of being clear, odourless, tasteless, drinkable, etc.). And we can say that such associated properties are sufficient to allow X to pick out a certain substance as the referent of 'water'. However, in the case of 'iridium', such reference-fixing associated properties seem absent.

If the above impression is correct, how should X judge the truth-value of S_2 ? First of all, note that for each D , there is at least one

candidate¹¹³ for the referent of 'iridium'. But for each candidate for the referent of 'iridium' from each D, X cannot know that it is the referent of 'iridium' because X lacks sufficient reference-fixing properties associated with 'iridium'. And for each candidate from each D, X cannot know that it is not the referent of 'iridium' because it is a candidate for the referent of 'iridium'. Thus, for each candidate for the referent of 'iridium' from each D, X must judge that it is indeterminate whether it is the referent of 'iridium'. This leads to the result that for all D, it is a priori that 'if D, then S₂' is indeterminate. Given the thesis of inconceivability, this entails that S₂ is ideally primarily inconceivable.¹¹⁴

At first glance, the inconceivability of S₂ seems plausible. But the above discussion misses an important associated property of the term 'iridium'. X knows that iridium is called 'iridium' by chemists in X's community. Then, based on this metalinguistic knowledge, X can associate the property of being called 'iridium' by chemists in X's community with 'iridium'. In fact, there is reason to think that this associated property plays a crucial role in fixing the reference of

¹¹³ We can understand a candidate for the referent of a term by the following condition: for all entities c and some term t, c is a candidate for the referent of t if and only if it is not a priori that c is not the referent of t.

¹¹⁴ As will be explained below, a meta-linguistic property associated with 'iridium' allows X to identify the referent of the term. But one might argue that even if X sets aside the meta-linguistic property, X can identify the referent of 'iridium' given a proper canonical description. Consider a canonical description D that involves only one candidate for the referent of 'iridium'. Then, it seems that X can pick out the candidate as the referent of 'iridium' given D. However, even such a D will not allow X to identify the referent because the candidate for the referent of 'iridium' will also be a candidate for the referent of 'rubidium'. In presenting the iridium case, I said that for some chemical elements, X knows their names but has no idea about their properties and iridium and rubidium are among such elements. This means that there is no property associated with 'iridium' or 'rubidium' (other than meta-linguistic properties) which distinguishes the referent of one from that of the other. Thus, if X sets aside meta-linguistic properties, X cannot determinately judge whether the candidate is the referent of 'iridium' or 'rubidium'. This leads to the result that X cannot identify the referent of 'iridium' even given such a D.

'iridium'. The reason is that X's use of 'iridium' is almost¹¹⁵ totally deferential to chemists' uses of the term. Then, how can X identify the referent of 'iridium' given the metalinguistic property? Consider the following claim by Chalmers (2002b: 170):

For example, if someone knows only that Feynman is a famous physicist and that Gell-Mann is a famous physicist, how will external information allow her to identify the distinct referents of 'Feynman' and 'Gell-Mann'? The answer seems clear: she will look to *others'* use of the name. Further information will allow her to determine that members of their community use 'Feynman' to refer to a certain individual, and that they use 'Gell-Mann' to refer to a different individual. Once she has this information, she will have no problem determining that her own use of 'Feynman' refers to the first, and that her own use of 'Gell-Mann' refers to the second.

This passage says that one's ignorance about the referent of a term does not prevent one from identifying the referent of the term as far as some metalinguistic property is associated with the term. Once one has sufficient information about the external world, one will have information about others' uses of the term and such information will allow one to identify the referent of the term.

The same picture is applied to our discussion about 'iridium'. Suppose that a canonical description D is a complete description of the actual world. Then, D will contain sufficient information about chemists' uses of 'iridium' and this information will allow X to identify the referent of 'iridium'. Here I do not mean that D must be a description about the actual world. The above picture is applied equally to a canonical description about the original twin-earth world in which watery stuff is XYZ or a world identical to the actual world

¹¹⁵ Note that X associates the property of being a substance with 'iridium'. In a small number of cases, this property will allow X to use 'iridium' non-deferentially.

except that it contains one more chair. My point is that Chalmers's picture allows X to identify the referent of 'iridium' in many canonical descriptions.

Now we can see that the above claim about inconceivability of S_2 does not hold. This claim followed from the claim that for all D, it is a priori for X that 'if D, then S_2 ' is indeterminate. But given the discussion in the previous paragraph, there is some D such that it is a priori that 'if D, then S_2 ' is true. Such a D is the canonical description about the actual world, the original twin-earth world or the world containing one more chair.¹¹⁶ Then, S_2 is ideally primarily positively conceivable. Also, since the truth of S_2 is not a priori ruled out given that canonical description, S_2 is ideally primarily negatively conceivable.

At this point, one might think that the following statement is inconceivable:

(S_3) 'Iridium is not called 'iridium' by chemists in our community.'

At first glance, inconceivability of S_3 seems plausible. If X identifies the referent of 'iridium' depending on the property of being called 'iridium' by chemists in X's community, for all D in which X can identify the referent of 'iridium' depending on such a property, it will be a priori that 'if D, then S_3 ' is false. For example, given the canonical description D about the original twin-earth world, X can identify the referent of 'iridium' from the information about chemists' uses of 'iridium'. But since in this case iridium is called 'iridium' by chemists, S_3 is false. This means that it is a priori for X that 'if D, then S_3 ' is false. Meanwhile, for all D in which X cannot identify the referent of 'iridium' depending on the metalinguistic property, it is a priori that 'if D, then

¹¹⁶ Note that what S_2 expresses is really a chemical fact.

S₃' is indeterminate.

However, the initial judgment about S₃ is false because there are canonical descriptions D given which S₃ is true. For example, suppose that from D, X can know that X misread the term 'idirium' in the periodic table as 'iridium' and chemists in X's community use 'idirium' to refer to a certain chemical element. Given this information, X will know that such an element is what she takes to be the referent of 'iridium' and is not called 'iridium' by chemists in her community. Then, it will be a priori for X that 'if D, then S₃' is true. From this, it follows that S₃ is ideally primarily (positively and negatively) conceivable.¹¹⁷

What the discussion about S₃ shows is that unlike negating the epistemic core property associated with a term (e.g., the property of being a substance for 'iridium'), negating a property playing a role of reference-fixing does not automatically lead to inconceivability. I think this is intuitively correct because unlike S₁ (i.e., 'iridium is not a substance') which is intuitively inconceivable, S₃ is intuitively conceivable.

In our discussion of the statements S₁, S₂, and S₃, Chalmers's notions of conceivability and inconceivability have corresponded to intuitive notions of conceivability and inconceivability. But I think that the following statement breaks this relation:

(S₄) 'iridium has 70 protons and there is no sentient being.'

This statement seems intuitively conceivable. Intuitively, a world in

¹¹⁷ This example is related to Chalmers's idea that the primary intension of a term is not given by linguistic expressions or explicit beliefs. He provides this idea in responding to Kripke's (1980) epistemological argument against descriptivism. See Chalmers (2002b: 168-173). For a different sort of response on behalf of descriptivists, see Jeshion (2002). Also, see Nelson (2002) for descriptivists' responses to Kripke's modal and semantic arguments against descriptivism.

which iridium has 70 protons is conceivable even though it is not metaphysically possible.¹¹⁸ And a world in which there exists no sentient being is conceivable. Also, there is no reason to think that the truth of one conjunct makes the other conjunct false. Thus, a world in which iridium has 70 protons and there is no sentient being is intuitively conceivable.¹¹⁹

However, given Chalmers's notions of conceivability and inconceivability, S_4 becomes inconceivable because for all canonical descriptions D , it is a priori that 'if D , then S_4 ' is false or indeterminate. First, consider canonical descriptions D such that it is a priori that 'if D , then iridium has 70 protons' is true. For all such D , each D allows X to identify the referent of 'iridium'. Since X identifies the referent depending on metalinguistic properties associated with 'iridium', each D entails that there are language users. But the existence of language users makes the latter conjunct of S_4 false. Therefore, for each D , it is a priori that 'if D , then iridium has 70 protons' is true and 'if D , then there is no sentient being' is false. Thus, for all D such that it is a priori that 'if D , then iridium has 70 protons' is true, it is a priori that 'if D , then S_4 ' is false.

Now let me consider canonical descriptions D such that it is a priori that 'if D , then there is no sentient being' is true. Since for all such D , the latter conjunct of S_4 is true, each D entails that there is no language user. But if so, X cannot identify the referent of 'iridium' because each D does not entail any metalinguistic information based on which X can identify such a referent. Then, given each D , it is a priori for X that the reference of 'iridium' is indeterminate. This leads to the result that for each D , it is a priori that 'if D , then iridium has 70

¹¹⁸ The number of protons of iridium is 77.

¹¹⁹ One might claim that this intuitive conceivability is just secondary conceivability. I will discuss this claim in Subsection 4.2.3. But in any case, we can say that intuitive conceivability is not ideal primary conceivability as will be argued below.

protons' is indeterminate. Then, for all D we are considering, it is a priori that 'if D, then S₄' is indeterminate.

After all, there is no canonical description D that makes both conjuncts of S₄ true. Rather, for all D, it is a priori that 'if D, then S₄' is false or indeterminate. This means that S₄ is ideally primarily inconceivable.¹²⁰

4.2.2. An example of inconceivability involving a familiar substance

So far, I have argued that there is an intuitively conceivable statement which, given Chalmers's notions of conceivability and inconceivability, becomes inconceivable. I have provided S₄ as such a statement. As a response to this argument, one might claim that S₄ is problematic because X lacks competence to use the term 'iridium' and understands it only superficially. If terms to which Chalmers's notions apply are limited to terms sufficiently understood by X, there will arise no similar phenomenon.

I do not think that 'iridium' in S₄ is particularly problematic given

¹²⁰ While discussing the above case, an objection was raised to me. The objection claims that X can identify the referent of 'iridium' in the world where there is no sentient being based on the meta-linguistic property associated with 'iridium'. According to the objection, first, given a canonical description D about X's world, X can identify the referent of 'iridium' in X's world depending on the meta-linguistic property associated with 'iridium'. Also, given D, X can obtain enough information about the properties of iridium. Then, X will associate many properties with 'iridium' and they will allow X to identify the referent of 'iridium' in some canonical description which entails that there is no sentient being.

However, the objection is problematic. First, it idealises X's understanding of a term by supplying every piece of information about X's world. But such an idealised understanding is clearly irrelevant to primary conceivability which is based on X's current understanding. Also, if the idealised understanding of a term is allowed, the speaker-relativity of a primary intension will be diminished significantly. But this is at odds with Chalmers's notion of a primary intension. Thus, the objection to the above argument does not hold.

Chalmers's discussion about 'Feynman' and 'Gell-Mann'. Also, it is not clear what it means to say that X sufficiently understands natural-kind terms or names. In any case, I do not think that the above response poses a threat to my main claim because the phenomenon arising for S_4 similarly arises for statements involving familiar ordinary substances.

Before discussing a case involving an ordinary substance, consider the following claim by Chalmers (2012: 230):

More deeply, however, Waismann also suggests that there are cases in which the application of a concept is not dictated by our previous grasp of the concept at all. ('Suppose I come across a being that looks like a man, speaks like a man, behaves like a man, and is only one span tall—shall I say it is a man?') In the current framework any such cases are best seen as cases of indeterminacy. It is worth stressing that the scrutability framework is consistent with a good deal of indeterminacy when concepts are applied to previously unanticipated scenarios.

We can understand this passage by supposing that one is evaluating a statement involving the term 'man' across different canonical descriptions D . According to the passage, some D entails the existence of a being that looks like a man, speaks like a man, behaves like a man, and is only one span tall. (Let me call this being 'one-span-tall being'.) And it is indeterminate whether the concept of being a man is applied to the one-span-tall being. Chalmers says that this sort of indeterminacy that Waismann's cases¹²¹ provide poses

¹²¹ Consider the following cases offered by Waismann (1945: 121-122): "[S]uppose I [...] actually see a cat. [...] What, for instance, should I say when that creature later on grew to a gigantic size? Or if it showed some queer behaviour usually not to be found with cats, say, if, under certain conditions, it could be revived from death whereas normal cats could not? [...] Or what about the case of a person who is so old as to remember King Darius?"

no threat to his framework.¹²²

Note that insofar as the indeterminate case is linguistically describable by one's terms as above, there will be a corresponding statement S such that it is a priori that S is indeterminate. For example, according to the above passage, it is indeterminate whether the concept of being a man is applied to a one-span-tall being. Then, whatever world turns out to be actual (i.e., whatever canonical description is given), it is indeterminate that a one-span-tall being is a man. Thus, it is a priori that 'a one-span-tall being is a man' is indeterminate.¹²³ (Given the thesis of inconceivability, this statement is ideally primarily inconceivable.)

Having the above point in mind, let us consider a case involving a familiar ordinary substance as follows:

[Salt] An epistemic subject X is an ordinary adult having average scientific knowledge. X is familiar with many chemical substances and salt is one of them. X knows many properties of salt. For example, X knows that salt is salty, edible, white, solid at room temperature, forms cubic crystals, etc.

Now suppose that X evaluates a statement 'salt exists' across various canonical descriptions D of worlds. While evaluating the statement, X will come across many different substances. For some, X will determinately judge that they are salt or not. For the others, it will be indeterminate for X that they are salt.

Let me examine X's judgments by considering an example. Suppose that while evaluating the statement 'salt exists' against a certain canonical description, X judges that there is a substance m_1

¹²² Note that when one evaluates a statement across different canonical descriptions, one will come across many indeterminate cases because a lot of eccentric cases will be entailed from various canonical descriptions.

¹²³ The same result is derivable by examining each not-undefined canonical description just as I did in the previous subsection.

which is similar to salt in that it forms white cubic crystals, is solid at room temperature, is dissolved in seawater, is used for melting ice, covers a large area of land forming a desert, etc. But X judges that unlike salt, m_1 is strongly acidic.

Then, what is the correct judgment about whether m_1 is salt or not? I think X should judge that it is false or indeterminate that m_1 is salt. At least, it seems clear that X is reasonable not to judge that m_1 is salt. Since m_1 is strongly acidic, it tastes sour, dissolves metals, destroys organic tissues, is not edible, etc. These properties of m_1 will provide very good reason not to judge that m_1 is salt. (I think that those properties are at least as good reason as the fact that a being is one span tall is for not judging that such a being is a man.)

Then, is X reasonable to judge that m_1 is not salt? The answer is not clear because it is not clear what properties are associated with the term 'salt' and how important each property is in playing a reference-fixing role. For example, suppose that the property of being dissolved in seawater is associated with 'salt' and this property plays a reference-fixing role as important as the property of tasting salty. Then, the fact that m_1 has the former property will provide a good reason to judge that m_1 is salt. In this way, X may have good reasons supporting that m_1 is salt. I do not think that these reasons are weightier than the reasons supporting that m_1 is not salt given our assumption that X is an ordinary adult. But such reasons may make X suspend judgement about whether m_1 is salt. I think it plausible that this in fact reflects X's cognitive situation. But it seems not unreasonable to think that the reasons supporting that m_1 is salt is weaker than the reason supporting the opposite. If so, X will have to judge that m_1 is not salt.

Now let us evaluate the following statement:

(S₅) 'Salt is strongly acidic.'

Given the above discussion, whatever world turns out to be actual (i.e., whatever canonical description is given), X must judge that it is false or indeterminate that salt is strongly acidic. Thus, it is a priori for X that S₅ is false or indeterminate.¹²⁴ Given the thesis of inconceivability, S₅ is ideally primarily inconceivable.

But for a moment, let us set aside Chalmers's notions of conceivability and inconceivability and think of S₅. Is S₅ really inconceivable? It seems to me that our pre-theoretical intuition supports that S₅ is conceivable. One might claim that the intuitive conceivability of S₅ is just secondary conceivability. I will discuss this claim in the next subsection. But in any case, we can say that intuitive conceivability is not explained by ideal primary conceivability.

4.2.3. Intuitive conceivability as prima facie secondary conceivability

For the sake of discussion, consider again the following statements:

(S₄) 'iridium has 70 protons and there is no sentient being.'

(S₅) 'Salt is strongly acidic.'

In the previous subsections, it was argued that these statements are ideally primarily inconceivable but intuitively conceivable. Thus, the intuitive conceivability of S₄ and S₅ cannot be understood in terms of ideal primary conceivability. Then, what does it mean to say that they are intuitively conceivable? In particular, what states of affairs do they

¹²⁴ The same result is derivable by examining each not-undefined canonical description just as I did in the previous subsection.

represent when they are intuitively conceivable?¹²⁵

In order to answer the question, it is helpful to consider two different understandings of Putnam's twin-earth world case: understanding in terms of primary conceivability and understanding in terms of counterfactual (i.e., secondary) conceivability. When X finds it conceivable that water is XYZ in the former sense, X imagines a world in which XYZ satisfies the properties associated with X's term 'water'.

On the other hand, when X finds it conceivable that water is XYZ in the latter sense, X supposes that the actual referent of 'water' is some substance m. Then, X imagines a world in which the supposed referent m is XYZ. We can say that when X finds it conceivable that water is XYZ in the latter sense, for some substance m which is supposed by X to be the actual referent of 'water', X finds it conceivable that m is XYZ.

We can understand the intuitive conceivability of S₄ and S₅ in terms of secondary conceivability as above. When X finds it conceivable that iridium has 70 protons and there is no sentient being, X supposes that the actual referent of 'iridium' is some substance m. Then, X imagines a world in which the supposed substance m has 70 protons and there is no sentient being. In other words, when X finds S₄ intuitively conceivable, for some substance m which is supposed by X to be the actual referent of 'iridium', X finds it conceivable that m has 70 protons and there is no sentient being.

We can understand the intuitive conceivability of S₅ in the same

¹²⁵ One might try to understand the intuitive conceivability of S₄ and S₅ in terms of prima facie primary conceivability. As explained in Subsection 4.1.1, prima facie (but not ideal) primary conceivability lacks ideal rational reflection. Thus, even if a statement is not primarily conceivable under ideal rational reflection, it is prima facie primarily conceivable. But as I will explain below, intuitive conceivability has a robust sense which cannot be explained by lack of ideal rational reflection. In what follows, I will set aside the notion of prima facie primary conceivability as irrelevant to understanding intuitive conceivability.

way. When X finds it conceivable that salt is strongly acidic, X supposes that the actual referent of 'salt' is some substance m and the actual referent of 'being strongly acidic' is some property P. Then, X imagines a world in which m has P. In other words, when X finds S₅ intuitively conceivable, for some substance m and some property P which are supposed by X to be the actual referents of 'salt' and 'being strongly acidic', X finds it conceivable that m has P.

Then, is the secondary conceivability of S₄ and S₅ prima facie or ideal? First, note that S₄ and S₅ are metaphysically impossible (i.e., secondarily impossible) because iridium necessarily has 77 protons and all acidic substances necessarily contain hydrogen while salt does not. Thus, given Chalmers's (2002a: 171) claim that "*Ideal secondary (positive/negative) conceivability entails secondary possibility*" (emphasis in original), it follows that S₄ and S₅ are not ideally but only prima facie secondarily conceivable.

Then, what sort of deficiency makes the secondary conceivability of S₄ and S₅ only prima facie? As explained in Subsection 4.1.1, secondary conceivability depends on the following two factors: rational reflection and non-modal empirical information about the actual world. I think that the deficiency is not the former sort. First, the above description about the secondary conceivability of S₄ and S₅ involves no obvious failure of rational reflection. Also, I will argue below that rational reflection involved in the prima facie secondary conceivability of S₄ and S₅ can be idealised. Rather, the deficiency involved in the prima facie secondary conceivability must be the latter sort. The reason why S₄ and S₅ are secondary conceivable despite their metaphysical impossibility is that X lacks relevant non-modal empirical information. That is, since X does not have empirical information that iridium has 77 protons and every substance having the natural property of being acidic contains hydrogen while salt does

not, X can secondarily conceive S_4 and S_5 . (Consider, as a simple case, prima facie secondary conceivability of 'water is not H_2O '. When X finds it secondarily conceivable that water is not H_2O , for some substance m which is supposed by X to be the actual referent of 'water', X finds it conceivable that m is not H_2O . The reason why X finds it conceivable that m is not H_2O is that X does not have empirical information that water is H_2O . Otherwise, X would find it contradictory that m is not H_2O .)

So far, I have argued that the intuitive conceivability of S_4 and S_5 can be understood in terms of prima facie secondary conceivability and the latter conceivability is prima facie not due to lack of rational reflection but due to lack of relevant non-modal empirical information. Given this point, it is plausible to take the intuitiveness or a robust sense of intuitive conceivability to originate from the ideal rational reflection involved in the prima facie secondary conceivability of S_4 and S_5 .

Understanding intuitive conceivability as above seems to satisfy my purpose of showing that our a priori conceivability does not give us knowledge about metaphysical possibility. This is because although prima facie secondary conceivability of S_4 and S_5 involves ideal rational reflection, it does not entail secondary possibility of them. However, just as ideal primary conceivability entails primary possibility, ideal rational reflection involved in the prima facie secondary conceivability might entail some sort of possibility although it does not entail secondary possibility of S_4 and S_5 . And such a sort of possibility might be genuine metaphysical possibility just as primary possibility is. In order to examine this thought, let me first discuss an idea which can be easily confused with the thought. This discussion will allow us to explain the thought more clearly.

4.2.4. A posteriori impossible statements

A posteriori impossible statements are the prominent type of statement which is only prima facie secondarily conceivable not due to lack of ideal rational reflection but due to lack of non-modal empirical information. 'Water is not H₂O' (or 'water is XYZ'), 'Hesperus is not Phosphorus', and 'Iridium has 70 protons' are examples of such statements. Then, one might claim that the aposteriority of a posteriori impossible statements entails ideal primary conceivability of the statements and their primary possibility given the notion of aposteriority derivable from Chalmers's claim.

In order to examine the above idea, let us consider the following thesis argued by Chalmers (2006: 64):

Core Thesis: For any sentence S, S is a priori iff S has a necessary 1-intension.

In this thesis, the notion of a 1-intension can be regarded as the notion of a primary intension.¹²⁶ Then, the core thesis says that for any sentence S, S is a priori if and only if for all canonical descriptions D, it is a priori that 'if D, then S' is true. From the core thesis, we can derive the following thesis:

[Aposteriority] For any sentence S, S is a posteriori if and only if S's primary intension is contingently true (i.e., for some canonical description D, it is a priori that 'if D, then S' is false or indeterminate and for some D, it is a priori that 'if D, then S' is true).

¹²⁶ Claiming that the core thesis holds for primary intensions requires substantial arguments. (See Chalmers (2002a) for those arguments.) But I do not need to deal with this issue because given our assumption of Chalmers's pure modal rationalism, the core thesis holds for primary intensions.

For our discussion, it is convenient to have the following theses derivable from the core thesis:

[Core Thesis*] For any sentence S, it is a priori that S is false or indeterminate if and only if S's primary intension is necessarily false or indeterminate (i.e., for all canonical descriptions D, it is a priori that 'if D, then S' is false or indeterminate).

[Aposteriority*] For any sentence S, it is a posteriori that S is false or indeterminate if and only if S's primary intension is contingently false or indeterminate (i.e., for some canonical description D, it is a priori that 'if D, then S' is true and for some D, it is a priori that 'if D, then S' is false or indeterminate).

Given the above theses, it can be argued that the aposteriority of a posteriori impossible statements entails ideal primary conceivability and primary possibility of them. To explain this claim, let us say that S_0 is an a posteriori impossible statement. Since S_0 is an impossible statement, S_0 is false in the actual world. Also, since S_0 is an a posteriori statement, it is knowable a posteriori that S_0 is false in the actual world. Given the thesis of aposteriority*, then, there is some canonical description D such that it is a priori that 'if D, then S_0 ' is true.¹²⁷ This means that there is some metaphysically possible world W (corresponding to D) in which S_0 's primary intension is true (or that S_0 is primarily possible).

¹²⁷ In order to apply the thesis of aposteriority* to S_0 , it should be a posteriori that S_0 is false or indeterminate. Thus, in my discussion below, I will focus only on a posteriori impossible statements S such that it is knowable a posteriori that S is false and it is knowable a posteriori that S is false or indeterminate. Note that given this stipulation, the fact that it is knowable a posteriori that S is false entails that it is knowable a posteriori that S is false or indeterminate. (The stipulation excludes a posteriori impossible statements S for which the following claim holds: Although it is knowable a priori that S is not true (i.e., false or indeterminate), it is knowable a posteriori whether S is false or indeterminate. That is, it is knowable a posteriori that S is false while it is knowable a priori that S is false or indeterminate.)

To see the relation of primary possibility of S_0 to ideal primary conceivability, consider the thesis of D-entailment as follows:

[D-Entailment] If on ideal rational reflection one can a priori construct a canonical description D of a world W such that ‘if D , then S ’ is a priori, then W is a metaphysically possible world in which S ’s primary intension is true.

Although this thesis is a conditional, we can regard it as a bi-conditional given our assumption of Chalmers’s pure modal rationalism. According to pure modal rationalism, ideal primary negative conceivability, ideal primary positive conceivability, and primary possibility are extensionally equivalent. Since the antecedent of the thesis of D-entailment says ideal primary positive conceivability and the consequent says primary possibility, we can regard the thesis as a bi-conditional.

As discussed above, S_0 is primarily possible, so S_0 is ideally primarily positively conceivable. When S_0 is so conceivable, S_0 is also ideally primarily negatively conceivable since a canonical description D verifying S_0 is not ruled out a priori. Thus, S_0 is ideally primarily conceivable.

Given the above discussion, the following thesis holds:

[Entailment from aposteriority to primary possibility] For all a posteriori impossible statements S ,¹²⁸ the aposteriority of S entails ideal primary conceivability and primary possibility of S .

For example, consider an a posteriori impossible statement ‘water is XYZ’. Given that the statement is impossible, it is false in the actual world. And given that the statement is a posteriori, it is knowable a

¹²⁸ More precisely, for all a posteriori impossible statements S such that it is knowable a posteriori that S is false and it is knowable a posteriori that S is false or indeterminate. See Footnote 127 for a relevant discussion.

posteriori that the statement is false. Then, by the thesis of aposteriority*, there is some canonical description D such that it is a priori that 'if D, then water is XYZ' is true. This is equivalent to saying that 'water is XYZ' is primarily possible. Then, by the biconditionalised thesis of D-entailment, 'water is XYZ' is ideally primarily conceivable. And one can ideally primarily conceive 'water is XYZ' by conceiving Putnam's twin-earth world (if this world is ideally primarily conceivable).

Having the above discussion in mind, now let us examine S₄ and S₅. Note that they are metaphysically impossible statements. S₄ (i.e., 'iridium has 70 protons and there is no sentient being') is metaphysically impossible because necessarily, iridium has 77 protons. S₅ (i.e., 'salt is strongly acidic') is metaphysically impossible because necessarily, all acidic substances contain hydrogen while salt does not.

Also, S₄ and S₅ are a posteriori statements. First, let us examine S₄. It is knowable a posteriori whether S₄ is true or not if it is knowable a posteriori whether each conjunct is true or not. It is knowable a posteriori whether the first conjunct is true or not because it is knowable a posteriori how many protons iridium has. With regard to the second conjunct, the matter is not as clear as the first one. In particular, one might think that it is knowable a priori that I exist. If this idea is correct, it will be a priori knowable that the second conjunct of S₄ is false and this will entail that it is knowable a priori that S₄ is false. I will not discuss this issue in detail. Rather, the fact that Chalmers rejects the idea provides a dialectical reason to set aside the worry.¹²⁹ More importantly, I can avoid the worry by replacing the second

¹²⁹ Consider the following claim by Chalmers (2006: 108): "If 'I exist' is a posteriori (as I think is the case), then there will be various epistemically possible hypotheses for me under which I do not exist: for example, a hypothesis under which nothing exists (which is arguably itself not ruled out a priori)."

conjunct of S₄ with 'there is only one sentient being'. First, this move does not affect my argument in Subsection 4.2.1 because whether there is no sentient being or only one, the metalinguistic property associated with 'iridium' will not allow X to identify the referent of 'iridium'. Also, the move makes the second conjunct of S₄ clearly a posteriori. It is obvious that it is a posteriori knowable whether there is only one sentient being or more. In this way, the worry can be properly dealt with. (In what follows, I will stick to the original version of S₄. If you are sympathetic to the worry, just replace the second conjunct with the new one.)

It is also knowable a posteriori whether S₅ is true or not although it is less clear due to our discussion in Subsection 4.2.2. But what is relevant to the discussion about the aposteriority of a posteriori impossible statements is a term's referent itself rather than properties associated with a term. (I will justify this claim in the next subsection. For the sake of argument, let us assume that it is correct for a moment.) Thus, when we judge whether S₅ is an a posteriori statement, the associated properties of 'salt' such as tasting salty, forming white cubic crystals, etc. and those of 'being strongly acidic' such as tasting sour, dissolving metals, etc. are irrelevant. Rather, our focus must be on the claim that a substance referred to by 'salt' (i.e., sodium chloride) has a certain natural property referred to by 'being strongly acidic'. Obviously, it is knowable a posteriori whether the claim is true or not because knowing that requires substantial chemical investigation. (Note that it is knowable a posteriori that the referent of 'salt' is sodium chloride and the referent of 'being strongly acidic' is a certain natural property.) Thus, it is knowable a posteriori whether S₅ is true or not.¹³⁰

¹³⁰ For a detailed discussion about this, see the appendix of this chapter.

So far, I have argued that S_4 and S_5 are a posteriori impossible statements. Then, given the thesis of entailment from aposteriority to primary possibility, it follows that S_4 and S_5 are ideally primarily conceivable. But in Subsections 4.2.1 and 4.2.2, I argued that S_4 and S_5 are ideally primarily inconceivable. Thus, at least one of the premises of this reasoning is wrong. I think that the problematic premise is the thesis of entailment from aposteriority to primary possibility. In the next subsection, I will provide an argument showing that the thesis does not hold.

4.2.5. Aposteriority of a posteriori impossible statements

One might try to respond to the reductio argument at the end of the previous subsection by arguing that S_4 and S_5 are in fact ideally primarily conceivable. But I do not think that this move will solve the problem because the issue is deeper than merely having some counterexamples. To see the problem, consider again the following thesis:

[Entailment from aposteriority to primary possibility] For all a posteriori impossible statements S , the aposteriority of S entails ideal primary conceivability and primary possibility of S .

I think that the reason why this thesis does not hold is as follows: The aposteriority of a posteriori impossible statements is different from the aposteriority based on which the ideal primary conceivability and primary possibility hold.

To explain my point, let me consider the following statement and distinguish readings of it according to its primary intension and according to its secondary intension:

(S₆) 'Water is XYZ.'

First, consider the reading of S₆ according to its primary intension (or the primary reading of S₆ for short). If P is the primary intension of 'water' and Q is the primary intension of 'XYZ', the primary reading of S₆ is as follows:

(P-S₆) For any entity x, Px if and only if Qx.

On the other hand, the reading of S₆ according to its secondary intension (or the secondary reading of S₆ for short) is given by the secondary intensions of 'water' and 'XYZ'. The secondary intensions of 'water' and 'XYZ' are just familiar counterfactual modal intensions. Thus, if the referent of 'water' is p and the referent of 'XYZ' is q, the secondary reading of S₆ is as follows:

(S-S₆) p = q.

Now let me explain the problem of the thesis of entailment from aposteriority to primary possibility. First, the aposteriority of the a posteriori impossible statement 'water is XYZ' must be the a posteriori knowability of the falsity of S-S₆.¹³¹ The reason why 'water is XYZ' is an a posteriori impossible statement is that the impossibility is knowable a posteriori. Here, the impossibility is the usual sort of counterfactual impossibility, i.e, secondary impossibility. Obviously, such an impossibility is not P-S₆, but S-S₆.¹³²

On the other hand, the aposteriority based on which ideal primary

¹³¹ Note that it is knowable a posteriori that p is H₂O (and q is XYZ if it is not knowable a priori that 'XYZ' refers to XYZ). If this empirical information is given, then one will be able to know the falsity of S-S₆ without further empirical information. But this does not mean that the falsity of S-S₆ is knowable a priori.

¹³² This thought justifies my claim in the previous subsection that the aposteriority of S₅ concerns not the associated properties of a term but the referent of it.

conceivability and primary possibility hold concerns P-S₆. Given the thesis of aposteriority*, it is a posteriori that 'water is XYZ' is false or indeterminate if and only if the primary intension of 'water is XYZ' is contingently false or indeterminate. The right-side of this biconditional entails the ideal primary conceivability and primary possibility of 'water is XYZ'. Thus, the aposteriority allowing the ideal primary conceivability and primary possibility of 'water is XYZ' must be understood as the contingent falsity or indeterminacy of P-S₆.

Given the above distinction, we can see the reason why the thesis of entailment from aposteriority to primary possibility does not hold. Let us say that S₀ is an a posteriori impossible statement. The thesis claims that ideal primary conceivability and primary possibility are derived from the aposteriority of a posteriori impossible statements. Thus, according to the thesis, ideal primary conceivability and primary possibility of S₀ are derived from the a posteriori knowability of the falsity of S-S₀ (i.e., the secondary reading of S₀). But as argued in the previous paragraph, in order for the ideal primary conceivability and primary possibility of S₀ to hold, they must be derived from the other aposteriority, i.e., the contingent falsity or indeterminacy of P-S₀ (i.e., the primary reading of S₀).

Thus, in order for the thesis to hold, the following claim must be true: the a posteriori knowability of the falsity of S-S₀ entails the contingent falsity or indeterminacy of P-S₀. But I think that this claim is false. Let me examine the claim by considering the following statement:

(S₇) 'Water is metallic.'

If the primary intension of 'water' is P and that of 'being metallic' is Q, the primary reading of S₇ is as follows:

(P-S₇) For any entity x, if Px, then Qx.

If a substance referred to by 'water' is p and a natural property referred to by 'being metallic' is M, the secondary reading of S₇ is as follows:

(S-S₇) Mp.

Whether S₇ (or more exactly S-S₇) is metaphysically possible or not is irrelevant because our discussion concerns aposteriority of S-S₇ and (primary) contingency of P-S₇.

Since water is not metallic, S-S₇ is false. Also, the falsity of S-S₇ is knowable a posteriori because in order to know that 'water' refers to p, 'being metallic' refers to M, and p does not have the property M, substantial chemical investigation is required.¹³³ On the other hand, P-S₇ is (primarily) necessarily false or indeterminate rather than contingently false or indeterminate. This is because insofar as one is an ordinary adult understanding the terms 'water' and 'being metallic', it is a priori for one that 'water is metallic' is false or indeterminate (i.e., that P-S₇ is false or indeterminate). Thus, the a posteriori knowability of the falsity of S-S₇ does not entail the contingent falsity or indeterminacy of P-S₇. In this respect, 'water is metallic' is a counterexample against the above claim.

The counterexample involves natural-kind and natural-property terms whose primary intensions are (sufficiently) incompatible with each other. In a similar way, we can provide many counterexamples such as 'gold is non-metallic', 'salt is silver', and 'salt is strongly acidic'. ('Iridium has 70 protons and there is no sentient being' is a little bit more complicated, but it also counts as a counterexample.) Given these counterexamples, the claim that the a posteriori knowability of

¹³³ For a relevant discussion, see the appendix of this chapter.

the falsity of S - S_0 entails the contingent falsity or indeterminacy of P - S_0 does not hold.

Also, among counterexamples, there are some metaphysically impossible statements such as ‘salt is silver’, ‘salt is strongly acidic’, and ‘iridium has 70 protons and there is no sentient being’. These statements will count as counterexamples against the thesis of entailment from aposteriority to primary possibility.

4.2.6. Intuitive conceivability as ideal two-dimensional conceivability

In this subsection, I will derive a notion of two-dimensional conceivability from Chalmers’s epistemic two-dimensional semantics. Then, I will explain the intuitive conceivability of S_4 and S_5 and ideal rational reflection involved in *prima facie* secondary conceivability of them in terms of ideal two-dimensional conceivability. Also, I will try to answer the question whether ideal two-dimensional conceivability entails metaphysical possibility.

First of all, let me introduce the notion of two-dimensional conceivability. As Chalmers does not offer this notion, we need to derive it from his theory. The relevant theory is his epistemic interpretation of the two-dimensional semantic framework.

The two-dimensional semantic framework is a formal tool devised to reveal the two dimensions of the meaning of expressions. There are various interpretations of the framework leading to various two-dimensional semantic theories ¹³⁴ and Chalmers’s epistemic

¹³⁴ For various interpretations of the two-dimensional framework and relevant discussions, see Chalmers (2004, 2006), Jackson (1998), Stalnaker (1978, 2001, 2006), Davies and Humberstone (1980), Kaplan (1989), and Schroeter (2017).

interpretation is one of them. In order to introduce the two-dimensional conceivability, I do not need to explain his interpretation in detail. I will only briefly present the epistemic interpretation ignoring many complications.

To begin with, consider the following claim by Chalmers (2006: 102): (In the following passage, we can regard a scenario as a (centered) world considered as actual. Also, it holds that W satisfies S if and only if S is true at W considered as counterfactual.)

In many cases, a term's subjunctive intension will depend on its actual extension, or on other aspects of the actual world. This is particularly clear in the case of rigid designators such as names and indexicals. If Kripke is correct, these pick out the same individual in all possible worlds, and so pick out the term's actual extension in all possible worlds [...]. [...] Here, in effect, a term's subjunctive intension depends on which epistemic possibility turns out to be actual.

One can naturally encapsulate this behavior in a *two-dimensional intension*. This can be seen as a mapping from scenarios to subjunctive intensions, or equivalently as a mapping from (scenario, world) pairs to extensions. We can say: the two-dimensional intension of a statement S is true at (V, W) if V verifies the claim that W satisfies S .

Let me explain this passage by considering an example. Suppose that W_1 is a twin-earth world in which XYZ plays the role of water. Also, suppose that W_2 is a world in which XYZ is a red explosive substance. Then, the two-dimensional intension of 'water is a red explosive substance' is true at (W_1, W_2) . First, it is a priori that 'if W_1 is actual, then water is XYZ' is true (i.e., W_1 verifies 'water is XYZ'). Then, 'water is XYZ' is true in every subjunctively (i.e., counterfactually) considered world, and so 'water is XYZ' is true in W_2 considered as counterfactual. Meanwhile, W_2 is a world in which XYZ is a red explosive substance. Thus, 'water is a red explosive

substance' is true in W_2 considered as counterfactual if W_1 is considered as actual. This means that the two-dimensional intension of 'water is a red explosive substance' is true at (W_1, W_2) .

Given the above account, we can introduce the notion of two-dimensional conceivability. First, let us say that some world W_a is ideally primarily conceivable. Then, some world W_c is ideally secondarily conceivable because non-modal empirical information about the actual world is given by the ideal primary conceivability of W_a . In this way, (W_a, W_c) is ideally two-dimensionally conceivable. Note that ideal two-dimensionally conceivability is a priori conceivability.

For example, consider the statement 'water is a red explosive substance'. Given our discussion in this chapter, it is a priori that 'water is a red explosive substance' is false or indeterminate so that it is not ideally primarily conceivable. But it is ideally two-dimensionally conceivable. First, 'water is XYZ' is ideally primarily conceivable. W_1 in the above example is a world verifying this statement. Also, 'water is a red explosive substance' is ideally secondarily conceivable because every non-modal empirical information including water being XYZ is given by the ideal primary conceivability of W_1 . W_2 is a world satisfying 'water is a red explosive substance'. Thus, by ideally primarily conceiving W_1 and ideally secondarily conceiving W_2 , one can ideally two-dimensionally conceive 'water is a red explosive substance'.

Now we can see that X can ideally two-dimensionally conceive S_4 and S_5 although X cannot ideally primarily or secondarily conceive them. With regard to S_4 (i.e., 'iridium has 70 protons and there is no sentient being'), X can ideally primarily conceive a variant of the twin-earth world W_3 in which a substance m called 'iridium' has 70 protons. Also, X can ideally secondarily conceive a world W_4 in which iridium

(i.e., m) exists but there is no sentient being. Thus, by ideally primarily conceiving W_3 and ideally secondarily conceiving W_4 , X can ideally two-dimensionally conceive 'iridium has 70 protons and there is no sentient being'. With regard to S_5 (i.e., 'salt is strongly acidic'), X can ideally primarily conceive a variant of the twin-earth world W_5 in which a substance m is called 'salt' and a natural property P is called 'being strongly acidic'. Also, X can ideally secondarily conceive a world W_6 in which salt (i.e., m) has the property of being strongly acidic (i.e., P). Thus, by ideally primarily conceiving W_5 and ideally secondarily conceiving W_6 , X can ideally two-dimensionally conceive 'salt is strongly acidic'.

The ideal two-dimensional conceivability of S_4 and S_5 allows us to explain the ideal rational reflection involved in the prima facie secondary conceivability of them. In Subsection 4.2.3, I described the prima facie secondary conceivability of S_4 and S_5 as follows: in the case of S_4 , for some substance m which is supposed by X to be the actual referent of 'iridium', X finds it conceivable that m has 70 protons and there is no sentient being; in the case of S_5 , for some substance m and some property P which are supposed by X to be the actual referents of 'salt' and 'being strongly acidic', X finds it conceivable that m has P. Given that the supposition of the referents of the terms 'iridium', 'salt', and 'being strongly acidic' can be regarded as primary conceiving, we can say that the above descriptions are just the descriptions of the two-dimensional conceivability of S_4 and S_5 . In this respect, we can identify the prima facie secondary conceivability of S_4 and S_5 with the two-dimensional conceivability of them.

As the above descriptions show, the prima facie secondary conceivability of S_4 and S_5 consists only of rational reflection as it lacks empirical information. (If not, we can make it so by removing empirical information. But I think that there is no remaining empirical

information to be removed in the above descriptions.) Then, we can identify the prima facie secondary conceivability of S_4 and S_5 with the relevant rational reflection. Also, since the prima facie secondary conceivability of S_4 and S_5 is identified with the two-dimensional conceivability of them, the relevant rational reflection is also identified with the latter. Meanwhile, since the two-dimensional conceivability can be idealised, the rational reflection can also be idealised.

In Subsection 4.2.3, I regarded the intuitive conceivability of S_4 and S_5 as prima facie secondary conceivability involving ideal rational reflection and lacking empirical information. Also, I claimed that the intuitiveness or a robust sense of intuitive conceivability can be taken to originate from the ideal rational reflection. Given the above identification, then we can identify the intuitive conceivability of S_4 and S_5 with ideal two-dimensional conceivability of them.

Now let me examine the relation between ideal two-dimensional conceivability and possibility. If ideal two-dimensional conceivability of a statement A is based on (1) ideal primary conceivability of B and (2) ideal secondary conceivability of C , then ideal two-dimensional conceivability of A entails secondary possibility of C . This is because given that (1) ideal primary conceivability of B entails a metaphysically possible world in which the primary intension of B is true and (2) ideal secondary conceivability of C entails a metaphysically possible world in which the secondary intension of C is true, ideal two-dimensional conceivability of A entails a metaphysically possible world in which the secondary intension of C is true. In this way, the ideal two-dimensional conceivability of S_4 and S_5 entails some metaphysical possibilities.

Then, exactly what possibility is entailed by ideal two-dimensional conceivability? In order to answer this question, consider the above case involving the statement 'water is a red explosive substance'. If

the primary intension of 'water' is P_w , then 'water' in the statement has P_w as its primary intension and H_2O as its secondary intension. Let me express this by ' $water_{(P_w, H_2O)}$ '. Then, ideal two-dimensional conceivability of ' $water_{(P_w, H_2O)}$ is a red explosive substance' entails a possible world such that when it is considered as counterfactual, ' $water_{(P_w, XYZ)}$ is a red explosive substance' is true. Thus, ideal two-dimensional conceivability of a statement involving one's term ' $water_{(P_w, H_2O)}$ ' ends up with a counterfactual possibility of a statement involving a different term ' $water_{(P_w, XYZ)}$ '. We can understand this by thinking that ideal two-dimensional conceivability of 'water is a red explosive substance' entails that twin-earth water could have been a red explosive substance. Ideal two-dimensional conceivability of S_4 and S_5 can be understood in a similar way. For example, if X ideally primarily conceives variant twin-earth worlds in ideally two-dimensionally conceiving S_4 and S_5 , ideal two-dimensional conceivability of S_4 and S_5 will entail counterfactual possibilities of twin-earth iridium and twin-earth salt. Thus, we can say that ideal two-dimensional conceivability entails metaphysical possibility from perspectives of other worlds such as variant twin-earth worlds rather than from the perspective of our world.

4.3. Concluding Remarks: Modal Error

In this chapter, I presented intuitively conceivable statements and argued that the intuitive conceivability of them is not explained by the notion of ideal primary conceivability as it makes them inconceivable. Then, I derived the notion of two-dimensional conceivability from Chalmers's epistemic two-dimensional semantics and argued that it is a priori conceivability. Also, it was argued that intuitive conceivability is best identified with ideal two-dimensional conceivability. At the end of the previous subsection, it was shown that ideal two-dimensional conceivability entails metaphysical possibility from perspectives of other worlds.

Given my argument, we can say that primary conceivability is not the only a priori conceivability as two-dimensional conceivability is a priori conceivability. Thus, when one depends on a priori conceivability to know metaphysical possibility, one should not carelessly regard one's a priori conceivability as primary conceivability. This is particularly important given the fact that many statements involving rigid designators (e.g., natural-kind terms, natural-property terms, names, and indexicals) are ideally two-dimensionally conceivable while they are ideally primarily conceivable. Although in my argument, I employed statements such as S_4 and S_5 which are not ideally primarily conceivable but ideally two-dimensionally conceivable in order to reveal my point more clearly, the two notions of conceivability do not need to exclude each other. In this respect, when one depends on a priori conceivability, one must make sure whether one's a priori conceivability is primary conceivability or two-dimensional one. Otherwise, one might commit a modal error of regarding what is not metaphysically possible from the perspective of one's world as primarily possible and hence

metaphysically possible.

Appendix: Aposteriority of A Posteriori Impossible Statements

In this appendix, I will explain aposteriority of a posteriori impossible statements (or, more precisely, aposteriority of the secondary intensions of those statements), in particular, focusing on S_5 .

One might think that ideal two-dimensional conceivability of S_4 and S_5 allows us to explain aposteriority of them. Consider the following argument which seems initially plausible but is in fact problematic:

In ideally two-dimensionally conceiving S_4 and S_5 , X can ideally primarily conceive different worlds, and these worlds will yield different secondary intensions of the terms 'iridium', 'salt', and 'being strongly acidic'. But without empirical information, X will not be able to know which world X's world in fact is and which secondary intensions the secondary intensions of 'iridium', 'salt', and 'being strongly acidic' in X's world in fact are. Thus, in order for X to know the secondary intensions of S_4 and S_5 involving those terms, X needs empirical information. This means that the secondary intensions of S_4 and S_5 are knowable a posteriori. And this leads to the result that the truth-value of the secondary intensions of S_4 and S_5 is knowable a posteriori. (Note that the aposteriority of a posteriori impossible statements concerns the reading of them according to their secondary intensions as argued before.) In this way, ideal two-dimensional conceivability can explain the aposteriority of S_4 and S_5 in virtue of its element, i.e., ideal primary conceivability.

This argument is problematic because given that it is a priori that S_5 is not true (i.e., false or indeterminate), it is a priori that the (assigned) secondary intension of S_5 is not true in the world considered as actual. As explained before, the secondary intensions of 'salt' and 'being strongly acidic' are assigned to these terms by ideally primarily conceiving a world. But whatever world W is ideally primarily

conceived, 'salt is strongly acidic' is not true in W considered as actual because it is a priori that S_5 is not true. This entails that whatever secondary intensions are assigned to 'salt' and 'being strongly acidic' by ideally primarily conceiving W , the assigned secondary intension of 'salt is strongly acidic' is not true in W considered as actual. And this entails that it is a priori that the assigned secondary intension of S_5 is not true in the world considered as actual (i.e., in the world in which it is assigned to S_5). (Note that in the two-dimensional semantic framework, the truth-value of a secondary intension of a statement S in W considered as actual is the same as the truth-value of the primary intension of S in W . This is because both intensions are equivalent to the two-dimensional intension of S at (W, W) .)

Then, the above argument is problematic in claiming that the truth-value of the secondary intension of S_5 is knowable a posteriori. In the argument, such a truth-value is the truth-value of an assigned secondary intension of S_5 in the actual world. But according to the discussion in the previous paragraph, it is a priori that the assigned secondary intension of S_5 is not true in the world considered as actual. Thus, unlike the claim in the argument, it is knowable a priori that the assigned secondary intension of S_5 is not true in the actual world.

However, the objection against the above argument does not entail that it is knowable a priori whether the real (rather than assigned) secondary intension of S_5 is true or not in the actual world. First, note that primary intensions of 'salt' and 'being strongly acidic' are speaker-relative while the secondary intensions of those terms are invariant across speakers. Given this fact, it is plausible that not every speaker will pick out the same entities (i.e., sodium chloride and a certain natural property) as the referents of 'salt' and 'being strongly acidic' when their world is considered as actual. Also, this claim is supported by the fact that a primary intension of a term can involve

some false belief as such a belief can play some cognitive role in using the term. (But if every speaker's uses of those terms are totally deferential to chemists, every speaker will pick out the same referents. Then, one might try to regard primary intensions of 'salt' and 'being strongly acidic' as something like what is called 'salt' by chemists and what is called 'being strongly acidic' by chemists. But this move will deprive primary intensions of their important merit of reflecting the cognitive significance of a term and make them nearly speaker-invariant. For a relevant discussion of this point, see Byrne and Pryor (2006).)

If not every speaker picks out the same entities as the referents of 'salt' and 'being strongly acidic' when their world is considered as actual, there will be no guarantee that X will pick out the real secondary intensions as the referents of 'salt' and 'being strongly acidic'. Rather, it may be the case that the real secondary intensions are never assigned to those terms if X's understanding of the terms involves many false beliefs. And X will not be able to rule this out a priori because it is only knowable a posteriori whether X's current understanding of the terms is correct in X's world. Then, X will not be able to rule out the following case a priori:

It is a priori for X that S_5 is not true so that it is a priori for X that the assigned secondary intension of S_5 is not true in the world considered as actual. But X's understanding of the terms 'salt' and 'being strongly acidic' is based on some false beliefs. In X's world, salt is in fact strongly acidic so that the real secondary intension of S_5 is true.

If this case holds, whatever secondary intension is assigned to S_5 by ideally primarily conceiving a world, the real secondary intension will never be assigned to S_5 . This is because while every assigned secondary intension is false or indeterminate (i.e., not true) in its

world considered as actual (i.e., the world in which it is assigned to S_5), the real secondary intension is true in the actual world. Since this case is not ruled out a priori, it is not a priori for X whether every assigned secondary intension includes the real secondary intension. Thus, although it is a priori for X that every assigned secondary intension is false or indeterminate in the world in which it is assigned to S_5 , it is not a priori for X whether the real secondary intension is true or not. Therefore, it is knowable a posteriori whether the secondary intension of S_5 is true or not in the actual world.

5. Conclusion

In this thesis, I argued in Chapter 2 that given Bealer's moderate rationalism, our a priori intuition about epistemic possibility concerning property-identities does not give us a priori knowledge about metaphysical possibility. In arguing this, I assumed the following two theses: Identical macroscopic perceptual condition and a posteriori macroscopic necessity. With regard to the former thesis, I provided a weakened thesis which Bealer must accept and showed that my argument holds given the weakened thesis. With regard to the latter thesis, I independently justified it by considering categoricalism and dispositionalism.

In Chapter 3, I discussed two main views about the nature of properties, i.e., categoricalism and dispositionalism. Then, I argued that given each view, it is not knowable a priori whether it is metaphysically possible for a given substance to have (or lack) a new property (or its actual property). Also, it is argued that given each view and Bealer's notion of epistemic possibility, our a priori intuition about epistemic possibility concerning property-possession does not give us a priori knowledge about metaphysical possibility. I provided an exceptional case to which my argument is not applicable in terms of neutral counterpart concepts. But I claimed that this case does not by itself amount to a case in which we can know metaphysical possibility a priori. This was because establishing such a case requires substantial arguments such as constructing a world a priori and Bealer does not provide them.

I argued in Chapter 4 that given Chalmers's modal rationalism, our a priori conceivability entails more than our metaphysical possibility. I

provided intuitively conceivable statements and claimed that their intuitive conceivability is best identified with ideal two-dimensional conceivability. Then, I showed that ideal two-dimensional conceivability as a priori conceivability entails metaphysical possibility from perspectives of other worlds. From this, it was claimed that we must be cautious not to commit a modal error of regarding what is not metaphysically possible from the perspective of our world as possible when we depend on a priori conceivability to know metaphysical possibility.

In this thesis, I did not raise a question about the plausibility of Bealer's moderate rationalism when it is applied to a priori domains such as mathematics. In fact, I think that one may depend on moderate rationalism in order to know metaphysical possibility in such domains. But given my argument, moderate rationalism is not successful in responding to Putnam's and Kripke's counterexamples against rationalism. This entails that we should not rely on moderate rationalism in order to know metaphysical possibility concerning natural-kind substances and natural properties.

With regard to Chalmers's modal rationalism, I did not provide an objection to his claim about the entailment between ideal primary conceivability and primary possibility. In fact, I think that one may rely on primary conceivability to know metaphysical possibility if one's rational reflection is sufficiently good. But given my argument, primary conceivability is not the only a priori conceivability. Thus, when one depends on a priori conceivability, one should not carelessly regard one's a priori conceivability as primary conceivability. In particular, when something is intuitively conceivable a priori, one must make sure whether the intuitive conceivability of it is primary conceivability or two-dimensional conceivability. Otherwise, one might commit a modal error of regarding what is not metaphysically possible from the

perspective of one's world as primarily possible and hence as metaphysically possible.

Bibliography

Adams, Robert Merrihew (1974). "Theories of Actuality", *Noûs*, 8(3): 211-231.

Almog, J., Perry, J. and Wettstein, H. (eds.) (1989). *Themes from Kaplan*. Oxford: Oxford University Press.

Armstrong, D. M. (1968). *A Materialist Theory of the Mind*. London: Routledge & Kegan Paul.

_____ (1973). *Belief, Truth and Knowledge*. Cambridge: Cambridge University Press.

_____ (1978). *A Theory of Universals*. Cambridge: Cambridge University Press.

_____ (1983). *What is a Law of Nature?*. Cambridge: Cambridge University Press.

_____ (1986). "The Nature of Possibility", *Canadian Journal of Philosophy*, 16(4): 575-594.

_____ (1989). *A Combinatorial Theory of Possibility*. Cambridge: Cambridge University Press.

_____ (1993). "Reply to Fales", in J. Bacon, K. Campbell and L. Reinhardt (eds.) (1993), 144-151.

_____ (1997). *A World of States of Affairs*. Cambridge: Cambridge University Press.

- _____ (2012). "Defending Categoricalism", in Alexander Bird, Brian Ellis and Howard Sankey (eds.) (2012), 27-33.
- Bacon, J., Campbell, K. and Reinhardt, L. (eds.) (1993). *Ontology, Causality and Mind: Essays in Honour of D. M. Armstrong*. Cambridge: Cambridge University Press.
- Bealer, George (1987). "The Philosophical Limits of Scientific Essentialism", *Philosophical Perspectives*, 1: 289-365.
- _____ (1996). "A Priori Knowledge and the Scope of Philosophy", *Philosophical Studies*, 81: 121-142.
- _____ (1999). "A Theory of the A Priori", *Philosophical Perspectives*, 13: 29-55.
- _____ (2002). "Modal Epistemology and the Rationalist Renaissance", in Tamar Szabó Gendler and John Hawthorne (eds.) (2002), 71-125.
- _____ (2004). "The Origins of Modal Error", *Dialectica*, 58(1): 11-42.
- Beebe, Helen (2013). "How to Carve Across the Joints in Nature Without Abandoning Kripke-Putnam Semantics", in Stephen Mumford and Matthew Tugby (eds.) (2013), 141-163.
- Berger, Alan (ed.) (2011). *Saul Kripke*. New York: Cambridge University Press.
- Bird, Alexander (2001). "Necessarily, Salt Dissolves in Water", *Analysis*, 61(4): 267-274.
- _____ (2004a). "Antidotes All the Way Down?", *Theoria*, 51: 259-

269.

- _____ (2004b). "Strong Necessitarianism: The Nomological Identity of Possible Worlds", *Ratio*, 17(3): 256-276.
- _____ (2005a). "The Dispositionalist Conception of Laws", *Foundations of Science*, 10: 353-370.
- _____ (2005b). "Laws and Essences", *Ratio*, 18(4): 437-461.
- _____ (2007). *Nature's Metaphysics: Laws and Properties*. Oxford: Oxford University Press.
- _____ (2012). "Monistic Dispositional Essentialism", in Alexander Bird, Brian Ellis and Howard Sankey (eds.) (2012), 35-41.
- _____ (2016). "Overpowering: How the Powers Ontology Has Overreached Itself", *Mind*, 125(498): 341-383.
- _____ (2018). "The Metaphysics of Natural Kinds", *Synthese*, 195: 1397-1426.
- Bird, Alexander, Ellis, Brian and Sankey, Howard (eds.) (2012). *Properties, Powers and Structures: Issues in the Metaphysics of Realism*. Oxford: Routledge.
- Bird, Alexander and Tobin, Emma (2017). "Natural Kinds", *The Stanford Encyclopedia of Philosophy* (Spring 2018 Edition), Edward N. Zalta (ed.), URL = <<https://plato.stanford.edu/archives/spr2018/entries/natural-kinds/>>.
- Block, Ned and Stalnaker, Robert (1999). "Conceptual Analysis, Dualism, and the Explanatory Gap", *The Philosophical Review*, 108(1): 1-46.

- Byrne, Alex (1999). "Cosmic Hermeneutics", *Philosophical Perspectives*, 13: 347-383.
- Byrne, Alex and Pryor, James (2006). "Bad Intensions", in Manuel García-Carpintero and Josep Macià (eds.) (2006), 38-54.
- Carnap, Rudolf (1950). "Empiricism, Semantics, and Ontology", *Revue Internationale de Philosophie*, 4(11): 20-40.
- Carroll, John W. (2020). "Laws of Nature", *The Stanford Encyclopedia of Philosophy* (Winter 2020 Edition), Edward N. Zalta (ed.), URL = <<https://plato.stanford.edu/archives/win2020/entries/laws-of-nature/>>.
- Chalmers, David J. (1996). *The Conscious Mind: In Search of a Fundamental Theory*. Oxford: Oxford University Press.
- _____ (2002a). "Does Conceivability Entail Possibility?", in Tamar Szabó Gendler and John Hawthorne (eds.) (2002), 145-200.
- _____ (2002b). "On Sense and Intension", *Philosophical Perspectives*, 16: 135-182.
- _____ (2004). "Epistemic Two-Dimensional Semantics", *Philosophical Studies*, 118: 153-226.
- _____ (2006). "The Foundations of Two-Dimensional Semantics", in Manuel García-Carpintero and Josep Macià (eds.) (2006), 55-140.
- _____ (2011). "The Nature of Epistemic Space", in Andy Egan and Brian Weatherson (eds.) (2011), 60-107.
- _____ (2012). *Constructing the World*. Oxford: Oxford University

Press.

Chalmers, David J. and Jackson, Frank (2001). "Conceptual Analysis and Reductive Explanation", *The Philosophical Review*, 110(3): 315-360.

Choi, Sungho and Fara, Michael (2018). "Dispositions", *The Stanford Encyclopedia of Philosophy* (Spring 2021 Edition), Edward N. Zalta (ed.), URL = <<https://plato.stanford.edu/archives/spr2021/entries/dispositions/>>.

Davies, Martin and Humberstone, Lloyd (1980). "Two Notions of Necessity", *Philosophical Studies*, 38: 1-30.

Dretske, Fred I. (1977). "Laws of Nature", *Philosophy of Science*, 44(2): 248-268.

Dummett, Michael (1993). *The Seas of Language*. Oxford: Oxford University Press.

Egan, Andy and Weatherson, Brian (eds.) (2011). *Epistemic Modality*. Oxford: Oxford University Press.

Ellis, Brian (2001). *Scientific Essentialism*. Cambridge: Cambridge University Press.

_____ (2012). "The Categorical Dimensions of the Causal Powers", in Alexander Bird, Brian Ellis and Howard Sankey (eds.) (2012), 11-26.

Evnine, Simon (2008). "Modal Epistemology: Our Knowledge of Necessity and Possibility", *Philosophy Compass*, 3(4): 664-684.

Fales, Evan (1993). "Are Causal Laws Contingent?", in J. Bacon, K.

- Campbell and L. Reinhardt (eds.) (1993), 121-144.
- Fine, Kit (1994). "Essence and Modality", *Philosophical Perspectives*, 8: 1-16.
- _____ (2002). "The Varieties of Necessity", in Tamar Szabó Gendler and John Hawthorne (eds.) (2002), 253-281.
- Fischer, Bob and Leon, Felipe (eds.) (2017). *Modal Epistemology After Rationalism*. Dordrecht: Springer.
- Fisher, A. R. J. (2018). "Structural Universals", *Philosophy Compass*, 13: e12518, <https://doi.org/10.1111/phc3.12518>.
- Foley, Richard (1993). *Working Without a Net: A Study of Egocentric Epistemology*. New York: Oxford University Press.
- Frege, Gottlob (1918). "The Thought: A Logical Inquiry", in A. P. Martinich (ed.) (2008), 36-49.
- García-Carpintero, Manuel and Macià, Josep (eds.) (2006). *Two-Dimensional Semantics*. Oxford: Oxford University Press.
- Gendler, Tamar Szabó and Hawthorne, John (2002). "Introduction: Conceivability and Possibility", in Tamar Szabó Gendler and John Hawthorne (eds.) (2002), 1-70.
- Gendler, Tamar Szabó and Hawthorne, John (eds.) (2002). *Conceivability and Possibility*. Oxford: Oxford University Press.
- Guigon, Ghislain and Rodriguez-Pereyra, Gonzalo (eds.) (2015). *Nominalism about Properties: New Essays*. New York: Routledge.
- Hale, Bob (2003). "Knowledge of Possibility and of Necessity",

Proceedings of the Aristotelian Society, 103: 1-20.

Hawley, Katherine and Bird, Alexander (2011). "What are Natural Kinds?", *Philosophical Perspectives*, 25: 205-221.

Hill, Christopher S. (2006). "Modality, Modal Epistemology, and the Metaphysics of Consciousness", in Shaun Nichols (ed.) (2006), 205-236.

Hughes, G. E. and Cresswell, M. J. (1996). *A New Introduction to Modal Logic*. Oxford: Routledge.

Ichikawa, Jonathan and Jarvis, Benjamin (2012). "Rational Imagination and Modal Knowledge", *Noûs*, 46(1): 127-158.

Jackson, Frank (1998). *From Metaphysics to Ethics: A Defence of Conceptual Analysis*. Oxford: Oxford University Press.

Jenkins, C. S. (2005). "Knowledge of Arithmetic", *The British Journal for the Philosophy of Science*, 56: 727-747.

_____ (2008). "Modal Knowledge, Counterfactual Knowledge and the Role of Experience", *The Philosophical Quarterly*, 58(233): 693-701.

_____ (2010). "Concepts, Experience and Modal Knowledge", *Philosophical Perspectives*, 24: 255-279.

Jeshion, Robin (2002). "The Epistemological Argument Against Descriptivism", *Philosophy and Phenomenological Research*, 64(2): 325-345.

Kaplan, David (1970). "Dthat", in A. P. Martinich (ed.) (2008), 343-356.

_____ (1989). "Demonstratives", in J. Almog, J. Perry and H.

- Wettstein (eds.) (1989), 481-563.
- Keinänen, Markku (2015). "A Trope Nominalist Theory of Natural Kinds", in Ghislain Guigon and Gonzalo Rodriguez-Pereyra (eds.) (2015), 156-174.
- Kenny, Anthony (2010). "Concepts, Brains, and Behaviour", *Grazer Philosophische Studien*, 81: 105-113.
- Kment, Boris (2014). *Modality and Explanatory Reasoning*. Oxford: Oxford University Press.
- _____ (2021). "Varieties of Modality", *The Stanford Encyclopedia of Philosophy* (Spring 2021 Edition), Edward N. Zalta (ed.), URL = [<https://plato.stanford.edu/archives/spr2021/entries/modality-varieties/>](https://plato.stanford.edu/archives/spr2021/entries/modality-varieties/).
- Korman, Daniel Z. (2005). "Law Necessitarianism and the Importance of Being Intuitive", *The Philosophical Quarterly*, 55(221): 649-657.
- _____ (2006). "What Externalists Should Say about Dry Earth", *The Journal of Philosophy*, 103(10): 503-520.
- Kripke, Saul A. (1971). "Identity and Necessity", in Milton Karl Munitz (ed.) (1971), 135-164.
- _____ (1980). *Naming and Necessity*. Cambridge, MA: Harvard University Press.
- Kroedel, Thomas (2012). "Counterfactuals and the Epistemology of Modality", *Philosophers' Imprint*, 12(12): 1-14.
- Lewis, David (1973). *Counterfactuals*. Oxford: Blackwell.

- _____ (1986a). "Against Structural Universals", *Australasian Journal of Philosophy*, 64(1): 25-46.
- _____ (1986b). *On the Plurality of Worlds*. Oxford: Basil Blackwell.
- Lowe, E. J. (2012). "What is the Source of Our Knowledge of Modal Truths?", *Mind*, 121(484): 919-950.
- Mackie, J. L. (1973). *Truth, Probability, and Paradox: Studies in Philosophical Logic*. Oxford: Oxford University Press.
- _____ (1974a). "Locke's Anticipation of Kripke", *Analysis*, 34(6): 177-180.
- _____ (1974b). "De What Re is De Re Modality?", *The Journal of Philosophy*, 71(16): 551-561.
- _____ (1977). "Dispositions, Grounds, and Causes", *Synthese*, 34(4): 361-369.
- _____ (1980). *The Cement of the Universe: A Study of Causation*. Oxford: Oxford University Press.
- Malmgren, Anna-Sara (2011). "Rationalism and the Content of Intuitive Judgements", *Mind*, 120(478): 263-327.
- Margolis, Eric and Laurence, Stephen (2019). "Concepts", *The Stanford Encyclopedia of Philosophy* (Spring 2021 Edition), Edward N. Zalta (ed.), URL = <<https://plato.stanford.edu/archives/spr2021/entries/concepts/>>.
- Martinich, A. P. (ed.) (2008). *The Philosophy of Language*. New York: Oxford University Press.
- Mason, Philip E. et al. (2015). "Coulomb Explosion during the Early

- Stages of the Reaction of Alkali Metals with Water”, *Nature Chemistry*, 7: 250-254.
- McGinn, Colin (1975). “A Note on the Essence of Natural Kinds”, *Analysis*, 35(6): 177-183.
- Mellor, D. H. (1974). “In Defense of Dispositions”, *The Philosophical Review*, 83(2): 157-181.
- Menzel, Christopher (2016). “Possible Worlds”, *The Stanford Encyclopedia of Philosophy* (Winter 2017 Edition), Edward N. Zalta (ed.), URL = <<https://plato.stanford.edu/archives/win2017/entries/possible-worlds/>>.
- Mumford, Stephen and Tugby, Matthew (eds.) (2013). *Metaphysics and Science*. Oxford: Oxford University Press.
- Munitz, Milton Karl (ed.) (1971). *Identity and Individuation*. New York: New York University Press.
- Needham, Paul (2000). “What Is Water?”, *Analysis*, 60(1): 13-21.
- _____ (2015). “One Substance or More?”, in Eric Scerri and Lee McIntyre (eds.) (2015), 91-105.
- Nelson, Michael (2002). “Descriptivism Defended”, *Noûs*, 36(3): 408-435.
- Nichols, Shaun (ed.) (2006). *The Architecture of the Imagination: New Essays on Pretence, Possibility, and Fiction*. Oxford: Oxford University Press.
- Nimtze, Christian (2012). “Conceptual Truths, Strong Possibilities and Our Knowledge of Metaphysical Necessities”, *Philosophia*

Scientiæ, 16(2): 39-58.

Nolan, Daniel (1997). "Impossible Worlds: A Modest Approach", *Notre Dame Journal of Formal Logic*, 38(4): 535-572.

Pargetter, Robert and Prior Elizabeth W. (1982). "The Dispositional and the Categorical", *Pacific Philosophical Quarterly*, 63: 366-370.

Peacocke, Christopher (1999). *Being Known*. Oxford: Oxford University Press.

Pollock, John L. (1967). "Criteria and Our Knowledge of the Material World", *The Philosophical Review*, 76(1): 28-60.

Prior, Elizabeth W. (1982). "The Dispositional/Categorical Distinction", *Analysis*, 42(2): 93-96.

Prior, Elizabeth W., Pargetter, Robert and Jackson, Frank (1982). "Three Theses about Dispositions", *American Philosophical Quarterly*, 19(3): 251-257.

Pust, Joel (2017). "Intuition", *The Stanford Encyclopedia of Philosophy* (Summer 2019 Edition), Edward N. Zalta (ed.), URL = [<https://plato.stanford.edu/archives/sum2019/entries/intuition/>](https://plato.stanford.edu/archives/sum2019/entries/intuition/).

Putnam, Hilary (1973). "Meaning and Reference", in A. P. Martinich (ed.) (2008), 306-313.

_____ (1975). "The Meaning of 'Meaning'", in Hilary Putnam, *Mind, Language and Reality: Philosophical Papers, Volume 2*. Cambridge: Cambridge University Press, 215-271.

- Rescher, Nicholas (ed.) (1968). *Studies in Logical Theory*. Oxford: Blackwell.
- Roca-Royes, Sonia (2010). "Modal Epistemology, Modal Concepts and the Integration Challenge", *Dialectica*, 64(3): 335-361.
- _____ (2011a). "Conceivability and *De Re* Modal Knowledge", *Noûs*, 45(1): 22-49.
- _____ (2011b). "Modal Knowledge and Counterfactual Knowledge", *Logique et Analyse*, 216: 537-552.
- _____ (2017). "Similarity and Possibility: An Epistemology of *de re* Possibility for Concrete Entities", in Bob Fischer and Felipe Leon (eds.) (2017), 221-245.
- Rosen, Gideon (1990). "Modal Fictionalism", *Mind*, 99(395): 327-354.
- Rupert, Robert D. (2008). "The Causal Theory of Properties and the Causal Theory of Reference, or How to Name Properties and Why It Matters", *Philosophy and Phenomenological Research*, 77(3): 579-612.
- Russell, Bruce (2020). "A *Priori* Justification and Knowledge", *The Stanford Encyclopedia of Philosophy* (Summer 2020 Edition), Edward N. Zalta (ed.), URL = <<https://plato.stanford.edu/archives/sum2020/entries/apriori/>>.
- Salmon, Nathan Ucuozglu (1979). "How Not to Derive Essentialism from the Theory of Reference", *The Journal of Philosophy*, 76(12): 703-725.
- _____ (1982). *Reference and Essence*. Oxford: Basil Blackwell.

- Scerri, Eric (2005). "Some Aspects of the Metaphysics of Chemistry and the Nature of the Elements", *HYLE – International Journal for Philosophy of Chemistry*, 11(2): 127-145.
- Scerri, Eric and McIntyre, Lee (eds.) (2015). *Philosophy of Chemistry: Growth of a New Discipline*. Dordrecht: Springer.
- Schroeter, Laura (2017). "Two-Dimensional Semantics", *The Stanford Encyclopedia of Philosophy* (Spring 2021 Edition), Edward N. Zalta (ed.), URL = <<https://plato.stanford.edu/archives/spr2021/entries/two-dimensional-semantics/>>.
- Shoemaker, Sydney (1980). "Causality and Properties", in Peter van Inwagen (ed.) (1980), 109-135.
- _____ (1998). "Causal and Metaphysical Necessity", *Pacific Philosophical Quarterly*, 79: 59-77.
- Sidelle, Alan (2002). "On the Metaphysical Contingency of Laws of Nature", in Tamar Szabó Gendler and John Hawthorne (eds.) (2002), 309-336.
- Sider, Theodore (2005). "Another Look at Armstrong's Combinatorialism", *Noûs*, 39(4): 679-695.
- Skyrms, Brian (1981). "Tractarian Nominalism", *Philosophical Studies*, 40: 199-206.
- Soames, Scott (2005). *Reference and Description: The Case against Two-Dimensionalism*. Princeton: Princeton University Press.
- _____ (2011). "Kripke on Epistemic and Metaphysical Possibility: Two Routes to the Necessary A Posteriori", in Alan Berger (ed.) (2011), 78-99.

- Stalnaker, Robert (1968). "A Theory of Conditionals", in Nicholas Rescher (ed.) (1968), 98-112.
- _____ (1978). "Assertion", in A. P. Martinich (ed.) (2008), 196-207.
- _____ (1987). *Inquiry*. Cambridge, MA: The MIT Press.
- _____ (2001). "On Considering a Possible World as Actual", in Robert Stalnaker (2003), 188-200.
- _____ (2003). *Ways a World Might Be: Metaphysical and Anti-Metaphysical Essays*. Oxford: Oxford University Press.
- _____ (2006). "Assertion Revisited: On the Interpretation of Two-Dimensional Modal Semantics", in Manuel García-Carpintero and Josep Macià (eds.) (2006), 293-309.
- Swoyer, Chris (1982). "The Nature of Natural Laws", *Australasian Journal of Philosophy*, 60(3): 203-223.
- Thompson, Brad (2010). "The Spatial Content of Experience", *Philosophy and Phenomenological Research*, 81(1): 146-184.
- Tobin, Emma (2013). "Are Natural Kinds and Natural Properties Distinct?", in Stephen Mumford and Matthew Tugby (eds.) (2013), 164-182.
- Tooley, Michael (1977). "The Nature of Laws", *Canadian Journal of Philosophy*, 7(4): 667-698.
- Vaidya, Anand (2015). "The Epistemology of Modality", *The Stanford Encyclopedia of Philosophy* (Winter 2017 Edition), Edward N. Zalta (ed.), URL = <<https://plato.stanford.edu/archives/win2017/entries/modality-epistemology/>>.

- Van Brakel, Jaap (2000). *Philosophy of Chemistry: Between the Manifest and the Scientific Image*. Leuven: Leuven University Press.
- Van Inwagen, Peter (ed.) (1980). *Time and Cause: Essays Presented to Richard Taylor*. Dordrecht: Springer.
- _____ (1998). "Modal Epistemology", *Philosophical Studies*, 92: 67-84.
- VandeWall, Holly (2007). "Why Water Is Not H₂O, and Other Critiques of Essentialist Ontology from the Philosophy of Chemistry", *Philosophy of Science*, 74(5): 906-919.
- Waismann, F. (1945). "Verifiability", *Proceedings of the Aristotelian Society*, 19: 119-150.
- Wiggins, David (1974). "Essentialism, Continuity, and Identity", *Synthese*, 23: 321-359.
- Williamson, Timothy (2005). "Armchair Philosophy, Metaphysical Modality and Counterfactual Thinking", *Proceedings of the Aristotelian Society*, 105: 1-23.
- _____ (2007a). "Philosophical Knowledge and Knowledge of Counterfactuals", *Grazer Philosophische Studien*, 74: 89-123.
- _____ (2007b). *The Philosophy of Philosophy*. Malden, MA: Blackwell.
- Worley, Sara (2003). "Conceivability, Possibility and Physicalism", *Analysis*, 63(1): 15-23.
- Yablo, Stephen (1993). "Is Conceivability a Guide to Possibility?",

Philosophy and Phenomenological Research, 53(1): 1-42.

_____ (2000). "Textbook Kripkeanism and the Open Texture of Concepts", *Pacific Philosophical Quarterly*, 81: 98-122.

_____ (2002). "Coulda, Woulda, Shoulda", in Tamar Szabó Gendler and John Hawthorne (eds.) (2002), 441-492.

_____ (2006). "No Fool's Cold: Notes on Illusions of Possibility", in Manuel García-Carpintero and Josep Macià (eds.) (2006), 327-345.