Quine versus Kripke on the Metaphysics of Modality:

An Examination and Defence of Quine's Position

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Abstract

The aim of this thesis is to examine the theoretical commitments informing W.V. Quine's rejection of alethic modality and to advance a Quinean response to Saul Kripke's arguments in support of modal metaphysics. The novelty of this thesis consists in it being the first detailed explanation of how Quine's arguments against modality are situated within his system and informed by his epistemological and ontological views and the first adequate study of the epistemological and metaphysical criticisms Quine would advance against Kripke's defence of modality.

The Quinean response to Kripke presented here is guided by four tenets that Quine takes to be central to the current scientific worldview and which he consequently adopts as the guiding methodological constraints of his own project: empiricism, regimentation, physicalism and simplicity. I explain how Quine's referential opacity and mathematician-cyclist arguments against modality hang together with the rest of his philosophical project; and I show that while these arguments may seem unpersuasive and easily refuted by Kripke when taken in isolation, they are quite powerful when understood within the context of Quine's entire system and seen in light of his guiding methodological constraints.

By the end of this thesis, it will be clear why Quine remains unconvinced by Kripke's arguments in support of modal metaphysics and how his response to Kripke is grounded in his deepest methodological constraints. He ultimately rejects Kripke's arguments because they conflict with the tenets he takes to be the deepest commitments of the scientific worldview. Quine's arguments against modality must be understood within the context of his philosophical system as a whole and are best seen not as arguments to be met by Kripke on Kripke's terms but as illustrations of why, from the standpoint of Quine's project and the standards it adheres to (the standards of science, as Quine understands it), modality is a flawed and unnecessary addition to reconstructed scientific theory. While there may well be reasons for rejecting Quine's views about modality – and even reasons that would compel Quine, on his own terms, to reject his views – I argue that Kripke does not provide them.

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Abbreviations

CCE: Confessions of a Confirmed Extensionalist

COM: Comment on Marcus

EN: Epistemology Naturalized

FOM: Facts of the Matter

FSS: From Stimulus to Science

GWW: Goodman's *Ways of Worldmaking*

IR: Intensions Revisited

LK: The Limits of Knowledge

ML: Methods of Logic

MSLT: Mr. Strawson on Logical Theory

NK: Natural Kinds

NLWM: Naturalism; Or, Living within One's Means

NN: Naming and Necessity

NNK: The Nature of Natural Knowledge

NT: Necessary Truth

OIA: On the Individuation of Attributes

OWTI: On What There Is

PE: Promoting Extensionality

PL: Philosophy of Logic

PT: Pursuit of Truth

RCP: Reply to Charles Parsons

RDF: Reply to Dagfinn Føllesdal

RM: Reference and Modality

RPM: Reply to Professor Marcus

RR: The Roots of Reference

SLS: The Scope and Language of Science

SN: Structure and Nature

TDE: Two Dogmas of Empiricism

TGM: Three Grades of Modal Involvement

TPT: Things and Their Place in Theories

VPR: The Variable and Its Place in Reference

WA: Worlds Away

WO: Word and Object

Introduction

The aim of this thesis is to examine the theoretical commitments informing W.V. Quine's rejection of alethic modality and to advance a Quinean response to Saul Kripke's arguments in support of modal metaphysics. This Quinean response to Kripke is guided by four tenets that Quine takes to be central to the current scientific worldview and which he consequently adopts as the guiding methodological constraints of his own project: empiricism, regimentation, physicalism and simplicity. I explain how Quine's referential opacity and mathematician-cyclist arguments against modality hang together with the rest of his philosophical project; and I show that while these arguments may seem unpersuasive (and indeed have been deemed so) when taken in isolation, they are quite powerful when understood within the context of his entire system and seen in light of his guiding methodological constraints. I also point out where Quine scholars go wrong in their speculations concerning how he would respond to Kripke, and I show where commentators sympathetic to Kripke go wrong in their estimation of his success in responding to Quine's arguments against modality.

Not even the most comprehensive and astute books on Quine's philosophy (e.g. Gibson 1982, 1988; Hookway 1988; Hylton 2007; Kemp 2006; Orenstein 2002) contain a detailed explanation of how his arguments against modality are situated within his system and informed by his epistemological and ontological views. Nor do these works adequately address how Quine would reply to Kripke's challenge to these arguments. In their discussions of the history of the debate surrounding Quine's arguments against modality, some scholars point out that Kripke evades Quine's attacks by offering a new,

"metaphysical" construal of modality (e.g. Burgess 1998; Neale 2000). However, these scholars neither mention nor discuss the epistemological and metaphysical criticisms Quine would advance against Kripke's defence of modality and until these are addressed it is far from clear that Kripke does in fact evade Quine's original arguments. Some scholars maintain that Kripke does not simply evade but refutes Quine's arguments against modality (e.g. Linsky 1977; Rocca 1996; Soames 2003). These scholars, though, do not examine why Quine was unmoved by the arguments Kripke advances against his views and until this is examined it is unclear whether or not Kripke does in fact refute Quine.

Clearly, there is a need to situate Quine's rejection of modality within his broader philosophical project and examine how he might respond to Kripke's arguments in support of modal metaphysics. This thesis meets this need.

In Chapter 1, I outline the basic aim of Quine's philosophy – reconstructing scientific theory so as to clarify the logic of evidential support and the ontological commitments of theory – as well as introduce the tenets that Quine takes to be central to the current scientific worldview (and consequently his own project as well) and which guide the Quinean response to Kripke in the chapters that follow: empiricism (in Quine's sense of the term), regimentation, physicalism and simplicity. Quine refuses to admit the modal operators of necessity and possibility into his reconstructed language of science because he believes they result in failures of extensionality that cannot be remedied without betraying these tenets – methodological constraints which the supposed advantages of modal logic provide him with insufficient reason to modify or abandon. In this chapter I also discuss Quine's explanation of necessity and contingency in light of

the aims of his project and examine his account of natural law, causation, dispositions and subjunctive conditionals. This chapter examines Quine's initial arguments for thinking there is no reason to admit the modalities into reconstructed scientific theory and paves the way for the chapters that follow, where I discuss Kripke's arguments in support of modal metaphysics and the Quinean response to these arguments.

In Chapter 2, I examine Quine's referential opacity argument as well as Arthur Smullyan's response to it and I explain why Quine finds Smullyan's response unacceptable: he sees no justification for the distinction between names and descriptions that Smullyan's account endorses and believes that *de re* modality involves untenable metaphysical commitments. I then discuss Kripke's reply to Quine's argument and examine the philosophical theory (principally rigid designation) he advances to justify the distinction between names and descriptions (Kripke's defence of essentialism is reserved for a later chapter). The phenomenon of rigidity not only seems to vindicate a modal distinction between names and descriptions but also suggests that Quine should adopt a modal logic as his language of science. By providing an overview of Quine's argument and the methods Kripke employs in responding to it this chapter paves the way for the following one in which a Quinean response to Kripke is advanced.

In Chapter 3, I examine Quine's account of reference in order to better understand how he might respond to Kripke's use of rigid designation in justifying a modal distinction between names and descriptions. I argue that, from Quine's point of view, Kripke's justification of the distinction between co-referential terms (usually names and descriptions) is unsuccessful because the phenomenon of rigidity is ontologically superfluous – Quine's language of science can express all the truths of theory without it.

I examine Quine's account of the psychogenesis of reference and discuss how the primacy of the pronoun in this account undermines drawing a philosophically important distinction between names and descriptions by showing these terms to be redundant to reference. I then discuss Quine's reasons for omitting rigid designators from his language of science. I explain Quine's dismissal of our intuitions about rigidity through a consideration of his rejection of ordinary language in favour of a regimented idiom and I explain that rigidity has no place in Quine's reconstructed language of science because he thinks transworld identification is too problematic for possible worlds to be of any theoretical use. This chapter shows that Kripke's notion of rigid designation neither offers Quine any reason to accept modal metaphysics nor provides compelling grounds on Quine's terms for abandoning his preferred regimented language of science.

In Chapter 4, I examine Quine's mathematician-cyclist argument against essentialism. In this argument, Quine challenges the essentialist to: 1) provide some non-arbitrary grounds for distinguishing between essential and accidental properties and 2) show that attributions of necessity reflect genuine ontological features of the object in question and not merely linguistic usage. I then discuss Marcus' response to Quine's argument and why it ultimately fails – contrary to what Marcus supposes, Quine's argument constitutes not a formal objection to modal logic but questions the ontological significance of its interpretation. Finally, I discuss Kripke's reply to Quine's mathematician-cyclist argument and examine the philosophical considerations he advances to demonstrate that it is unsound. In response to Quine's epistemological challenge to essentialism, he argues that the intuitiveness of certain judgments makes evident the intelligibility of essentialism and provides a basis for deciding which

properties of an object are essential and which are accidental. In response to Quine's ontological challenge to essentialism, Kripke maintains that the existence of natural kinds and essential properties is implied by certain statements of science – a point which not only seems to show that attributions of necessity concern genuine features of the world but also suggests that Quine should adopt a modal logic as his language of science. This chapter explores the methods Kripke employs in his response as well as the force of that response if these methods are accepted.

In Chapter 5 I examine the reasons behind Quine's rejection of Kripkean essentialism. I explain that Quine takes all evidence to be stimulation and prediction to be the sole test of truth in science, and I discuss how this informs a Quinean response to Kripke's use of intuition as well as Quine's rejection of Kripke's essentialism. Next, I examine the role of Quine's physicalism in his rejection of essentialism. Drawing again on the importance assigned to prediction in Quine's system, I present a Quinean response to Kripke's arguments in support of natural kinds and essential properties. I then explain how Quine can account for Kripke's thought experiments in terms of his maxim of minimum mutilation and, finally, I examine how the aforementioned considerations – the rejection of intuitiveness, natural kinds and properties – inform Quine's mathematician-cyclist argument. Once we clarify the standards by which Quine approaches the issue of essentialism it becomes evident that Kripke does not provide him with a compelling reason to accept the doctrine or to adopt a modal logic as his regimented language of science.

By the end of this thesis, it will be clear why Quine remains unconvinced by Kripke's arguments in support of modal metaphysics and how his response to Kripke is

grounded in his deepest methodological constraints. He ultimately rejects Kripke's arguments because they conflict with central tenets of the scientific worldview discovered by naturalized epistemology (epistemology conducted as a natural science within the framework of natural science itself) – tenets which the supposed advantages of modal logic provide Quine with insufficient reason to abandon: empiricism, physicalism, regimentation and simplicity. Given the analysis offered in this thesis, it is no surprise that Quine did not feel compelled to alter his views in light of Kripke's work. Quine's arguments against modality must be understood within the context of his philosophical system as a whole and are best seen not as arguments to be met by Kripke on Kripke's terms but as illustrations of why, from the standpoint of Quine's project and the standards it adheres to (the standards of science, rightly understood), modality is a flawed and unnecessary addition to reconstructed scientific theory. While there may well be reasons for rejecting Quine's views about modality – and even reasons that would compel Quine, on his own terms, to reject his views – I argue that, contrary to widespread belief, Kripke does not provide them.

Chapter 1: Quine's Naturalism and Alethic Modality

Many philosophers believe that the modal notions of necessity and contingency are indispensable to philosophical speculation. They seem presupposed and useful in the analysis of various metaphysical or scientific concepts, such as natural law, causation, dispositions and subjunctive conditionals. The intelligibility of these notions is supported by the fact that we seem to have an intuitive idea of the distinction between necessary and contingent truths – for example, it seems as if some truths simply must be the case (e.g., 2 + 2 = 4) whereas other truths could be false (e.g., Ottawa is the capital city of Canada). In the view of many philosophers, the use of necessity and contingency in explaining the abovementioned concepts – as well as their intuitive intelligibility – provides compelling reason to think there are such things as modalities and to employ them in philosophical theorizing.

W.V. Quine, however, argues against admitting the alethic modalities (modalities concerning truth) into a scientific account of the world. Despite their intuitive plausibility, he believes that these notions have no place in a properly reconstructed scientific theory of the world and that they are not needed in accounting for the concepts mentioned above (natural law, causation, disposition and subjunctive conditionals). He expresses his views with respect to these issues in the following passage:

> Philosophy is in large part concerned with the theoretical, non-genetic underpinnings of scientific theory; with what science could get along with, could be reconstructed by means of, as distinct from what science has historically made use of. If certain problems of ontology, say, or modality, or causality, or contrary-to-fact conditionals, which arise in ordinary language, turn out not to arise in science as reconstituted with the help of formal logic, then those philosophical problems have in an important sense been solved: they have been shown not to be implicated in

> any necessary foundation of science. Such solutions are good to just the extent that (*a*) philosophy of science is philosophy enough and (*b*) the refashioned logical underpinnings of science do not engender new philosophical problems of their own (MSLT: 151).

Quine believes that the alethic modalities are not needed in reconstructed scientific theory – first-order predicate logic (which is free of the modalities) is sufficient as the regimented language of science. Moreover, he maintains that natural laws, causal statements, dispositions and subjunctive conditionals can be accounted for without relying on modal notions. In this chapter I examine his treatment of these concepts as well as his explanation of necessity and contingency.

The chapter is divided into 2 sections. In the first section I outline the basic aim of Quine's philosophy – reconstructing scientific theory so as to clarify the logic of evidential support and the ontological commitments of theory – as well as introduce the tenets that Quine takes to be central to the current scientific worldview (and consequently his own project as well) and which guide the Quinean response to Kripke in the chapters that follow: empiricism (in Quine's sense of the term), regimentation, physicalism and simplicity. In the second section I discuss Quine's explanation of necessity and contingency in light of the aims of his project and examine his account of natural law, causation, dispositions and subjunctive conditionals. This chapter examines Quine's initial reasons for thinking there is no reason to admit the modalities into the regimented language of science and paves the way for the chapters that follow, where I discuss Kripke's arguments in support of modal metaphysics and the Quinean response to these arguments. As we shall see in later chapters, the central tenets of Quine's project (as derived from the scientific worldview he seeks to understand) undermine Kripke's arguments and preclude Quine from accepting modal logic as the language of science.

Section 1: An Outline of Quine's Project

In Quine's view, epistemology is a part of science – it does not, as it was formerly thought to, seek to prove (or deny) that the natural sciences provide us with knowledge of the world but accepts the findings of science in conducting its investigations. His naturalism "looks only to natural science, however fallible, for an account of what there is and what there is does" (SN: 9) and he believes that the proper goal of epistemology is to "clarify, organize, and simplify the broadest and most basic concepts [of science], and to analyze scientific method and evidence within the framework of science itself" (NLWM: 257). This naturalized epistemology – epistemology conducted as a natural science within the framework of natural science itself – aims to discern the basic and most general features of scientific method as well as to clarify the ontology of science, both of which contribute to discovering the basic tenets of the current scientific worldview and what the world is like. At its most general level, Quine's naturalized epistemology aims to understand how it is that we have constructed our theory of the world (an aim that includes understanding the ontological commitments of theory) and why our theory is true. That this is the goal of epistemology is itself a consequence of the worldview science gives us.

> Retaining our present beliefs about nature, we can still ask how we can have arrived at them. Science tells us that our only source of information about the external world is through the impact of light rays and molecules upon our sensory surfaces. Stimulated in these ways, we somehow evolve an elaborate and useful science. How do we do this, and why does the resulting science work so well? (NNK: 68).

Quine maintains that it is a feature of the current scientific worldview to regard humans as physical objects in a physical world (SLS: 228) and he takes it as given that science

has discovered that we are "swarms of particles, swarms of medium density, making our filtered way through thinner swarms and moving erratically between other swarms as dense as ourselves or denser still" (LK: 65). He takes it as evident that physics studies the most basic features of reality and that causal explanation ends at the physical level – physicalism is one of the central tenets of current science and thus of Quine's own project that works within science while seeking to understand it. He believes that physical theory has discovered that we come to know about the world solely through the stimulation of our sensory receptors – science teaches that "the ultimate data of science are limited to our neural intake" (NLWM: 260) and that without the ability to touch, smell, taste, hear or see we could know nothing about the world. Empiricism (in this specific sense of empiricism) is thus one of the central tenets of the current scientific worldview and of Quine's project. "Light rays strike my retinas," he says, and "molecules bombard my eardrums and fingertips" – a barrage against which he "strike[s] back, emanating concentric air waves" that "take the form of a torrent of discourse about tables, people, molecules, light rays, retinas, air waves, prime numbers, infinite classes, joy and sorrow, good and evil" (SLS: 228). This torrent of discourse makes up our theory of the world, which is "proving successful in predicting subsequent sensory input" (PT: 1).

There are various branches of science that are somehow concerned with understanding how we construct our theory of the world, but Quine believes that there is one aspect of this study that is not adequately treated in these disciplines and can therefore be pursued by him.

> Within this baffling tangle of relations between our sensory stimulation and our scientific theory of the word, there is a segment that we can

> gratefully separate out and clarify without pursuing neurology, psychology, psycho-linguistics, genetics or history. It is the part where theory is tested by prediction. It is the relation of evidential support, and its essentials can be schematized by means of little more than logical analysis (PT: 1-2).

The neurologist, the geneticist, the psychologist and the historian of science all, in one way or another, contribute to our understanding of how we as a species have been able to construct our theory of the world from the basis of sensory stimulation. The epistemologist does so as well, but his study does not offer a neurological or cultural account of how we do so (though he makes use of such accounts and hopes to offer a neurological account someday, the study of the neurological and cultural conditions that enable us to construct our theory are reserved for the neurologist and the historian, respectively). Instead, the epistemologist reconstructs the logic of evidential support by clarifying the relation between evidence and theory in the simplest terms possible – simplicity ("economy of structure and ontology") being a "maxim that natural scientists habitually follow in framing new hypotheses" (FSS: 56) and a central tenet of the current scientific enterprise. This epistemological project is more general than that of the abovementioned branches of science because it concerns and clarifies the notion of evidence that they presuppose in their investigations. By studying the connection between evidence and theory the epistemology of science can and does shed light on the methodology and findings of other branches of science (e.g., it shows the chemist that while she may speak of properties in constructing her theory, she is not committed to the existence of these abstract entities – see Chapter 5) all while being contained in and informed by the scientific worldview it studies (e.g., physiology informs the naturalized epistemologist about the stimulation of nerve endings).

The current scientific enterprise has many goals, such as understanding and technological advancement (PT: 20). But in order for our theory to increase our understanding of the world or lead to technological advancements it must be true. At its most general level, science (and the epistemology of science that studies the scientific worldview) is the pursuit of truth – and we discern whether a theory is true or false by the predictions it issues. While the prominence of prediction in evaluating theories is clear to anyone with even the faintest knowledge of modern science, Quine does not regard prediction as the test of truth merely because it seems to serve this role in scientific practice. Rather, it is a discovery on the part of scientific epistemology that prediction is the sole means of testing the truth of theory. That is, it follows from the scientific fact that human beings causally interact with the rest of the world by way of their nerve endings that prediction is the test of truth in science.

Quine believes that in order to reconstruct the logic of evidential support he must clarify the notion of evidence. While the evidence for science is often said to consist in observations (and it is often held that theory predicts observations), Quine thinks that the notion of observation is problematic. Objects and events are recorded in scientific observations, but in Quine's view this does not capture the notion of evidence because "a gulf yawns between them [the observed objects and events] and our immediate input from the external world, which is rather the triggering of our sensory receptors" (PT: 2). It is not the observed object but the sensory stimulation that is evidentially fundamental – if our nerve endings were not triggered then (according to current science) we would never know of the object. "[B]y the stimulation undergone by a subject on a given occasion [Quine] just mean[s] the temporally ordered set of all those of his exteroceptors

that are triggered on that occasion" (PT: 2). The stimulation caused by some dog, for example, is made up of the observer's triggered nerve endings, whether triggered by the dog or not. Though stimulation is evidentially fundamental, however, by itself it is not the evidential support of science. Stimulation is private (in the physicalistic sense that no two organisms share the same receptors) and non-linguistic but evidence must be intersubjective and formulated in language because theory is objective and an apparatus made up of sentences.

The verbal counterpart of stimulation is the observation sentence. These sentences provide the "initial links in [the] connecting chains" between stimulation and theory (PT: 2-3) and are the sentences of theory most "directly and firmly associated with our stimulations" (PT: 3). Observation sentences are *occasion sentences*, in that unlike sentences such as 'John A. MacDonald is the Prime Minister of Canada on July 2, 1867', they are true on some occasions and false on others.

> Each [observation sentence] should be associated affirmatively with some range of one's stimulations and negatively with some range. The sentence should command the subject's assent or dissent outright, on the occasion of a stimulation in the appropriate range, without further investigation and independently of what he may have been engaged in at the time (PT: 3).

Examples of observation sentences include 'It's raining' and 'That's a dog'. Each of these sentences is true on some occasions and false on others. They are each associated affirmatively with some range of stimulation and negatively with some other range of stimulation – the *affirmative* and the *negative stimulus* meaning of the sentences, respectively. For example, in the case of the sentence 'It's raining', the affirmative stimulus meaning comprises all the stimulations that would compel a competent English speaker to assent to it (e.g., the feeling of water drops on the skin and the sound of water

drops hitting the pavement, etc). The negative stimulus meaning of the sentence 'It's raining' comprises all the stimulations that would compel a competent English speaker to dissent from it (e.g., the sight of a clear sky, the feeling of the sun beating on one's dry skin, etc). Observation sentences are intersubjective, in that "unlike a report of a feeling, [they] must command the same verdict from all linguistically competent witnesses of the occasion" (PT: 3). The sentence 'It's raining', for example, will command assent from any competent English speaker standing in the rain, unlike reports of subjective states (such as 'I feel warm') which command assent only from the person immediately experiencing them. Observation sentences can be conjoined together to form complex observation sentences – e.g., 'It's raining and the sky is cloudy' – and can be compounded together in predications – e.g., 'This pebble is blue', which may be constructed from the sentences 'Lo, a pebble' and 'Lo, blue' (PT: 4). Observation sentences are of central importance to the epistemology of science because they serve as the fundamental link between theory (which is linguistic) and stimulation (which is non-linguistic). "The observation sentence is the means of verbalizing the prediction that checks a theory. The requirement that it command a verdict outright is what makes it a final checkpoint. The requirement of intersubjectivity is what makes science objective" (PT: 4-5). Observation sentences report stimulation (in the sense of being responses to stimulations – they are not descriptions of them) and can be verified or falsified by all competent speakers that are present – in this way they allow us to check the predictions of theory because they are the sentences closest to stimulation (the ultimate data of science) and can be assented to or dissented from by all competent speakers present. They are "thus the vehicle of scientific evidence, we might say – though without

venturing a definition of 'evidence' itself" (PT: 5). They are the sentences at the periphery of our theory and provide the evidential support for the sentences in the interior of theory. They are "the link between language, scientific or not, and the real world that language is all about" (PT: 5).

Though observation sentences are fundamental to understanding the relation of stimulation to theory due to their connection to stimulation, they do not by themselves account for the link between stimulation and theory because they are occasion sentences (sentences true on some occasions and false on others) but theory comprises standing sentences – sentences that are eternally true, such as

(1) Iron melts at 1510° C.

However, two or more observation sentences joined in a relation of implication can form a standing sentence and thereby link stimulation to theory. Quine calls such statements *observation categoricals*, which are compounds of two (or more) observation sentences connected in a 'Whenever this, that' construction. An observation categorical is "a generality to the effect that the circumstances described in the one observation sentence are invariably accompanied by those described in the other" (PT: 10). The following sentence is an observation categorical:

(2) When iron is heated to 1510° C, it melts.

This sentence is composed of two observation sentences, namely 'Iron is heated to 1510° C' and 'It (the iron) melts', and the truth of the categorical is ascertained by observing whether or not when the antecedent (iron heated to 1510°) is true the consequent (the iron melts) is also true.

The study of the relation between stimulation and theory reveals that the logic of evidence consists in testing observation categoricals, which a certain theory (taken together with other sentences of theory) implies. Quine illustrates the role of observation categoricals in determining the truth of theory through an example. He imagines a test conducted by a group of mineralogists, who have discovered some pink material (which they call 'litholite'). One of the scientists guesses at its chemical composition. She hypothesises, for example, that the litholite has chemical composition *x*. That is, she thinks sentence

(3) Litholite has chemical composition *x*

should be included in our theory of the world. In order to check whether her hypothesis is correct she checks whether the observation categoricals implied by (3) are true. By taking into account her background theory (e.g., the current state of chemical knowledge) she reasons that if the pink material has the composition in question it will emit hydrogen sulphide when it is heated to 180° C. That is, the body of accepted chemical theory and the hypothesis concerning the composition of the mineral imply the following observation categorical:

(4) When litholite is heated to 180° C, it emits hydrogen sulphide.

The group of scientists performs a test to discern the truth of the categorical and by extension test the hypothesis. They heat the litholite and observe what happens. If the material does not emit the gas when heated, the hypothesis is discarded. If, on the other hand, it does emit the gas, the hypothesis is accepted, however provisionally. The truth of (3) – and whether or not it belongs in our theory of the world, which aims to discern

what the world is like – is ascertained by determining whether or not categorical (4) is true.

Observation sentences are the sentences most closely linked to stimulation and (taken with stimulation) are the evidential support for science, and they are combined together to form categoricals which are standing sentences and can be incorporated firmly into the body of accepted scientific theory – indeed, they are themselves "miniature scientific theor[ies] that we can test experimentally by waiting for an occasion where the first component of the categorical is fulfilled, or even by bringing out its fulfillment, and then watching for fulfillment of the second component" (FSS: 26). Categorical (4) is a scientific theory, a generality to the effect that all litholite emits hydrogen sulphide when heated to 180° C. Because they can be firmly incorporated into scientific theory (and being scientific theories themselves), observation categoricals account for the link between theory and stimulation.

> Though compounded of two occasion sentences, the observation categorical is itself a *standing* sentence, and hence fair game for implication by scientific theory. It thus solves the problem of linking theory logically to observation, as well as epitomizing the experimental situation (PT: 10).

Although the sentences making up sentence (4) are occasion sentences (i.e., 'The litholite is heated to 180° C' and 'The litholite emits hydrogen sulphide'), the categorical is a standing sentence – a sentence true on all occasions, if it is in fact true. Though Quine thinks more work has to be done by way of understanding how exactly we learn observation sentences and use them in framing categoricals in constructing our theory of the world (e.g., understanding the neurological mechanisms that are involved), he takes his outline of the logic of evidence as a significant achievement on the part of naturalized

epistemology – for his account of the relation of stimulation to theory provides us with "a sketch of a causal chain from the impacts of rays and particles on our receptors to a rudimentary theory of the external world" (FSS: 26).

Quine's investigation into how our theory is constructed shows that prediction is the test of truth in science. Whether or not a theory is counted as true ultimately depends on the predictive success of its observation categoricals – when the categoricals a theory implies are true that theory is accepted (however provisionally) but when its categoricals are false the theory is discarded (although Quine does acknowledge that it may take repeated failures before we discard the theory and that we may accept the theory in the face of these failed predictions if it is central enough to our overall theory of the world). All of this follows from what science tells us about our connection to the world we live in – the epistemology of science (which accepts the findings of science when investigating the evidential support of science) discovers that prediction (as expressed in observation categoricals) is the test of truth in science and one of the central tenets of the scientific worldview (included under the broader tenet 'empiricism') and hence of scientific epistemology as well.

When accounting for the link between evidence and theory Quine accepts the findings of science (e.g., that we have nerve endings and that we know about the world ultimately because of the stimulation of these nerve endings), but his project is not beholden to every claim scientists might make – using the very resources of science itself, his epistemology can reveal places where practicing scientists go wrong in their theorizing. Quine's investigations both inform and are informed by current science –

there is "reciprocal containment" of epistemology within natural science and natural science within epistemology.

> The old epistemology aspired to contain, in a sense, natural science; it would construct it somehow from sense data. Epistemology in its new setting, conversely, is contained in natural science, as a chapter of psychology. But the old containment remains valid too, in its way. We are studying how the human subject of our study posits bodies and projects his physics from his data, and we appreciate that our position in the world is just like his. Our very epistemological enterprise, therefore, and the psychology wherein it is a component chapter, and the whole natural science wherein psychology is a component book – all this is our own construction or projection from stimulations like those we were meting out to our epistemological subject. There is thus reciprocal containment, though containment in different senses: epistemology in natural science and natural science in epistemology (EN: 83).

Quine rejects the traditional epistemological task of standing apart from natural science and justifying (or calling into question) our theory of the world. Instead, he regards epistemology as part of that theory – it is in this sense that epistemology is contained in natural science. Naturalized epistemology is science gone self-reflective: it is reflection on science from a scientific point of view (i.e., reflection on science that utilizes the resources – findings, methods – that science makes available). However, natural science is also contained in epistemology in the sense that epistemology studies the logic of evidential support – how our theory of the world is constructed. Natural science informs Quine's epistemological investigations, but epistemology informs natural science as well – Quine's epistemological investigations can (and indeed do) clarify scientific discourse and reveal that certain entities posited by practicing scientists can be removed from our theory of the world without sacrificing any of our theory's truth (as defined in terms of predictive success). Due to his conception of reciprocal containment, Quine often takes epistemological findings to have ontological import and allows ontological

considerations in turn to inform his epistemological investigations. The interaction between epistemology and ontology is evident in this chapter and throughout the thesis as a whole.

Exposing the unnecessary posits of our theory of the world and the superfluous turns of phrase employed in scientific discourse is no mere adjunct to Quine's epistemological project. Rather, the clarification of the ontological commitments of theory constitutes an important part of his account of the logic of evidential support (and epistemology more generally) because it increases our understanding of the theory that we have projected from our stimulations and the construction of which we are studying. Following the methods of the best science of the day – which couches its theories in a specialized idiom that departs from ordinary language – Quine clarifies the ontological commitments of theory by means of a regimented language. The language he chooses as this reconstructed language of science (his "canonical notation") is a pure first-order predicate calculus with identity, where all the predicates belong to physics. As physicalism is a basic tenet of the modern scientific worldview, Quine admits only physical predicates into his language – the predicates of the canonical notation are supplied by current physics (suitably reconstructed), though not all (and perhaps none) of them are reducible to the technical vocabulary of physics (see GWW: 98). (Quine's canonical notation is more fully discussed in Chapter 3, where I also explain its role in a Quinean response to Kripke's use of rigid designators. Physicalism is more fully discussed in Chapters 3 and especially 5, where I explain its role in a Quinean rejection of possible worlds and Kripke's essentialism, respectively.)

Quine chooses first-order predicate logic as his canonical notation. He takes this logic to be syntactically simpler than other languages with the required expressive power (in the sense of having fewer grammatical items) and he takes simplicity to be crucial in choosing a regimented language of science due to the distance of logic from observational evidence. First-order predicate logic is an extensional language – extensionalism being Quine's standard of clarity – because it meets the requirements of substitutivity of covalence, of coextensiveness, and of identity, *salva veritate* (FSS: 90). His notation respects substitutivity of covalence because sentences with the same truth value can be substituted for each other without altering the truth value of the larger sentences in which they are found. For example, we can substitute either of the conjuncts in the sentence

(5) Quine is a philosopher and snow is white

with the true sentence 'Ottawa is the capital city of Canada' and the resulting statement is true. It also respects substitutivity of coextensiveness because predicates true of the same objects can be substituted for each other without altering the truth value of the sentences in which they occur. For example, because the 44th President of the United States is identical to the husband of Michelle Obama, 'the 44th President of the United States' can be substituted for 'the husband of Michelle Obama' in the following sentence without altering its truth value:

(6) The world loves the 44th President of the United States.

Quine's language also respects substitutivity of identity because coreferential terms can be substituted for each other without altering the truth value of the sentences in which

they are found. For example, '9' can be replaced by 'the number of planets' in the sentence

(7) 9 is greater than 7,

and the resulting sentence is true. Extensionalism is one of Quine's deepest theoretical commitments and among the last that he is willing to revise (though as with all of his commitments it is not immune from revision). The reasons for his choice of language are all internal to his epistemology. Like Carnap, Quine maintains that the adoption of a language is largely a practical choice. Given naturalized epistemology there is no a priori justification for the choice of a language – prediction is the test of truth and given the distance of logic from stimulatory evidence there is no deeper justification to be given for choice of logic than overall fit with theory. Quine adopts first-order predicate logic and moves on with his theorizing, but he is justified in this choice because naturalized epistemology provides him with no reason to adopt any other logic – the ultimate standard of success in language choice is how well the overall theory predicts observation sentences, and Quine claims that his extensional logic serves perfectly well in facilitating those predictions. His arguments in favour of first-order logic over modal logic (or any other regimented language) largely consist in weighing the pros and cons of each logic from the point of view of the purposes and methods of his naturalized epistemology. As we shall see throughout this thesis, he refuses to admit the modal operators of necessity and possibility into his reconstructed language of science because he believes they result in failures of extensionality that cannot be remedied without betraying central tenets of the scientific worldview that scientific epistemology discovers (empiricism, physicalism,

and simplicity) – tenets which the supposed advantages of modal logic provide him with insufficient reason to abandon.

Through his regimented language Quine eliminates problematic and needless expressions from our theory – he shows that these expressions can be eliminated from theory without sacrificing the truth of science. He does this by paraphrasing the problematic locutions into less troublesome idioms. Quine explains the nature and purpose of these paraphrases:

> We have, to begin with, an expression or form of expression that is somehow troublesome. It behaves partly like a term but not enough so, or it is vague in ways that bother us, or it puts kinks in a theory or encourages one or another confusion. But it also serves certain purposes that are not to be abandoned. Then we find a way of accomplishing those same purposes through other channels, using other and less troublesome forms of expression. The old perplexities are resolved (WO: 260).

Quine believes that our theory contains various troublesome expressions that must be clarified because they put kinks in our theory or lead to confusions in any number of ways. For example (as discussed in Chapter 3), non-referring names might seem to lead to truth-value gaps – a complication to Quine's preferred language that he would rather avoid, as it seems to contribute nothing to the goals of naturalized epistemology. One solution to this difficulty is to posit subsistent entities as the designata of non-referring names – a move that would bloat our ontology and so should be avoided if we can address the problem by other means that do not present difficulties of their own. Quine believes that the best solution to the problem is to simply paraphrase names as predicates. Such paraphrases serve the scientific purposes of the original expressions (as identified by scientific epistemology, e.g. denoting objects in the case of names) and preserve the truth values of the original sentences in which the problematic expressions are found

(e.g., paraphrasing names as predicates falsifies none of the sentences in which the names are originally used) but do not complicate our ontology with subsistent entities. In his explications Quine tries to "expose no more logical structure than seems useful for the […] inquiry at hand" – he adheres to a "maxim of shallow analysis" (WO: 160). That is, he paraphrases some expression only when doing so is required by the tenets guiding science that naturalized epistemology discovers – for example, eliminating names is required because doing so simplifies our language and ontology (simplicity being one of the central tenets of current science). The paraphrases Quine proposes are not meant to be synonymous with the original expressions; neither do the explications make clear "what the users of the unclear expression had unconsciously in mind all along", nor do they "expose hidden meanings, as the word 'analysis' and 'explication suggest" (WO: 259). Rather, in the process of regimenting theory we simply "fix on the particular functions of the unclear expression that make it worth troubling about, and then devise a substitute, clear and couched in terms of our liking, that fills those functions" (WO: 259). A function is worth troubling about when it contributes to the truth of our theory (e.g., a name contributes to the truth of our theory because it denotes some object that a true sentence is about). The 'terms of our liking' that Quine speaks of and into which he paraphrases troubling expressions include terms of his own idiosyncratic liking (e.g., his preference for first-order logic that his paraphrases show he has no reason to abandon) but also terms that are required by the tenets of the scientific worldview that scientific epistemology studies – for example, the predicates of the regimented language must be physicalistic and Quine's paraphrases must simplify (or at least not complicate) the

language of science and scientific ontology without sacrificing any of the truth of theory (judged in terms of predictive success).

The purpose of the regimented language of science is not to replace or reform the language of the layman or scientist (though discoveries made by Quine in reconstructing theory could contribute to the scientist's formulation of his or her theories).

> Not that the idioms thus renounced are supposed to be unneeded in the market place or in the laboratory […] The doctrine is only that such a canonical notation can be abstracted and then adhered to in the statement of one's scientific theory. The doctrine is that all traits of reality worthy of the name can be set down in an idiom of this austere form if in any idiom (WO: 228).

For example, although Quine eliminates names in favour of predicates he does not intend practicing geographers to forego their use of the names 'Mount Logan' or 'Washington' (or any other name) in favour of the predicates 'mount-loganizes' or 'washingtonizes'. As we shall see in the next section, neither does he intend scientists to forego mention of laws or causes or to stop using dispositional terms or subjunctive conditionals. (Quine himself mentions laws and causes and uses dispositional terms and subjunctive conditionals when explaining how we construct our theory – all while maintaining that these idioms need not be admitted into the canonical notation.) What the paraphrases of the regimented language are meant to do is clarify the ontological commitments of our theory – they show, for example, that while scientists (including Quine) speak of laws or causes in their theorizing, they are not committed to the existence such entities. Quine's desire to clarify and simplify the ontology of theory is no different from the "motives that impel scientists to seek ever simpler theories adequate to their subject matter" (scientists are forever seeking simpler theories) but the regimented language differs from these theories in its breadth and scope – it aims for "simplification and clarification of the

broader framework shared by all the sciences" (WO: 161). Whereas a biologist or a chemist seeks the simplest and clearest account of reality at the biological or chemical level, Quine's canonical notation clarifies reality at the most general level. As a branch of physics it aims at "full coverage" of what the world is like (GWW: 98), but it is the most general and abstract branch of physics because it discerns the ontological commitments of all science. "The quest of a simplest, clearest overall pattern of canonical notation is not to be distinguished from a quest of ultimate categories, a limning of the most general traits of reality" (WO: 161). Using the methods and findings of science itself as his guide, Quine discovers the basic structure of reality as science itself teaches.

Quine maintains that modal operators are not needed in the regimented language of science. As with the paraphrase of any expression he finds unclear, he strives to preserve the useful purposes of the modalities (if there are any) while eliminating necessity and contingency from his canonical notation.

> We should be within our rights in holding that no formulation of any part of science is definitive so long as it remains couched in idioms of […] modality. But to claim this is more modest than to claim that our standard logical grammar is enough grammar for science. Such good uses as the modalities are ever put to can probably be served in ways that are clearer and already known (PL: 33-34).

As we shall see, Quine maintains that the modal operators are not required in clarifying the ontological commitments of theory. He believes that the good uses to which the modalities are normally put provide no compelling reason to admit the modal operators of necessity and possibility into the canonical notion. Yet he also acknowledges that one way in which his preferred notation is not "enough grammar for science" is in the sense that his paraphrases are too burdensome for use in actual scientific practice (experiment,

etc.).[1] This presents no problem to his choice of language, however, because the purpose of his paraphrases is to clarify the ontological commitments of current theory and not to be used in experiment or to reform actual scientific practice. Quine explains our intuitions of necessary and contingent truth in terms of the place of true sentences within the fabric of our theory and he accounts for natural law, causal statements, dispositional terms and subjunctive conditionals in non-modal terms. His explanation of the alethic modalities and his treatment of these concepts are the topic of the next section.

Section 2: Explaining Away the Alethic Modalities

Quine sees no reason to admit necessity or contingency into his reconstructed language of science – he believes first-order predicate logic is sufficient for the purposes of scientific epistemology. He maintains that his theory dispenses with necessity and contingency in terms that do not engender the difficulties he sees as associated with these modalities. What is more, he thinks that modal notions are not required in accounting for natural laws, casual statements, dispositional terms and subjunctive conditionals. In this section I first examine Quine's approach to logical and mathematical necessity. He believes that we take logical and mathematical truths to be necessary because they are the sentences of theory that we are most reluctant to discard in the face of failed predictions. I then discuss his treatment of natural law, counterfactual conditionals, dispositional terms and causal statements. This section surveys Quine's initial reasons for thinking there is no reason to adopt a modal logic as the language of science and paves the way for

[1] In the passage quoted, Quine is acknowledging the difficulties of paraphrasing the propositional attitudes into his notation when admitting that his logic might not be "enough grammar for science", but in later work (e.g., PE: 149 and FSS: 98) he notes the usefulness of subjunctive conditionals in experiment and so the point applies to scientific practice as well.

the chapters that follow in which I examine Kripke's arguments in support of modal metaphysics and the Quinean response.

Many philosophers regard it as obvious that the proposition

(8) $2 + 2 = 4$

must be true, whereas the proposition

(9) There are brick houses on Elm Street

could be false. It is easy to imagine situations where proposition (9) is false (for example, it turns out there are no brick houses on Elm Street), but it seems impossible to imagine a situation where (8) is false. Many philosophers explain the apparent difference between these propositions by saying that (8) is a necessary truth, whereas (9) is a contingent truth (it is true in the actual world but not in some possible world(s) – it is possible but not necessary). Quine, however, explains the differences between these sentences differently. He believes that we take (8) to be a necessary truth because it is located closer to the core of our theory than is (9), which is closer to the periphery of our web of belief. Sentence (8) is a truth that we are reluctant to discard due to the important role it plays in our theory – elimination of this truth would require extensive and deep adjustments elsewhere – whereas we are more ready to eliminate (9) in the face of recalcitrant data because removal of it requires less revision to our overall theory (e.g., it simply turns out that there are no brick houses on Elm Street and very few sentences of our theory need be altered or eliminated in light of this fact).

As discussed in the previous section, Quine sees our theory of the world as an "overwhelmingly ingenious apparatus for systematizing, predicting, and partially controlling our [neural] intake" (NLWM: 260). Our theory "helps us to foresee and

control the triggering of our sensory receptors in the light of previous triggering of our sensory receptors" (TPT: 1) – it is built upon stimulation and predicts subsequent stimulation. Theory is a linguistic apparatus that systematizes our neural intake because it represents this intake in sentences and logically joins these sentences into a coherent whole. The result is a web-like network of sentences which, "primarily as a whole, is multifariously linked to non-verbal stimulation" (WO: 12). The sentences of each branch of science have a place in this fabric.

> Boundaries between disciplines are useful for deans and librarians, but let us not overestimate them – the boundaries. When we abstract from them, we see all of science – physics, biology, economics, mathematics, logic, and the rest – as a single sprawling system, loosely connected in some portions but disconnected nowhere. Parts of it – logic, arithmetic, game theory, theoretical parts of physics – are farther from the observational or experimental edge than other parts. But the overall system, with all its parts, derives its aggregate empirical content from that edge; and the theoretical parts are good only as they contribute in their varying degrees of indirectness to the systematizing of content (NT: 76).

Some sentences are located more to the periphery of the web (hence more closely linked to stimulation), while others figure more at the centre (farther from stimulation). For example, sentences reporting the results of experiment, such as

(10) The liquid emits a blue gas in conditions *c*,

are closer the periphery than logical and mathematical truths, which are found at the core of the web and are linked to stimulation only through various connecting sentences that end at the periphery.

Failed predictions compel us to revise our theory, which we do by discarding sentences previously held to be true. In principle any sentence of theory, no matter how central to the web, can be eliminated or revised.

> A conflict with experience at the periphery occasions readjustments in the interior of the field. Truth values have to be redistributed over some of our statements. Reevaluation of some statements entails reevaluations of others, because of their logical interconnections – the logical laws being in turn simply certain further statements of the system, certain further elements of the field. Having reevaluated one statement we must reevaluate some others, which may be statements logically connected with the first or may be the statements of logical connections themselves (TDE: 42).

For example, we may have some chemical theory that implies the following categorical,

(11) When liquid *x* is in conditions *c*, it emits a blue gas.

If we conduct an experiment and the categorical turns out to be false (the liquid does not emit the blue gas in conditions *c*) we must revise the chemical theory. Although certain truths at the interior of our theory (e.g., truths of logic at the very centre, basic truths of chemistry at a close distance from the centre, etc.) are up for revision in such a case, we are reluctant to discard them because doing so would occasion deep revisions throughout the rest of our theory. The distance of any given sentence from the centre of the web reflects not only its distance from stimulation but also "the relative likelihood, in practice, of our choosing [it] rather than another [sentence] for revision in the event of recalcitrant experience" (TDE: 44). Sentences at the core of the web are our most deeply held convictions and play a role in nearly all of our theorizing, whereas sentences at the boundary are expendable.

In Quine's view, the fact that logical and mathematical truths figure at the very heart of our theory explains our tendency to call them 'necessary' while our tendency to call other truths 'contingent' is explained by their place more to the periphery of theory. His maxim of minimum mutilation accounts for our reluctance to abandon statements in the interior and our readiness to discard ones at the periphery – we desire the simplest

revisions possible while maintaining the overall predictive success of theory. To illustrate the maxim, Quine describes a situation in which some set *S* of sentences implies a false prediction and we must decide which sentences of the set to abandon.

> We exempt some members of *S* from this threat on determining that the fateful implication still holds without their help. Any purely logical truth is thus exempted, since it adds nothing to what *S* would logically imply anyway; and sundry irrelevant sentences in *S* will be exempted as well. Of the remaining members of *S*, we rescind one that seems most suspect, or least crucial to our overall theory (PT: 14).

For instance, returning to the example outlined above, some piece of chemical theory implies the categorical

(11) When liquid *x* is in conditions *c*, it emits a blue gas.

Upon discovering that categorical (11) is false, we set out to revise the set of sentences that implied it (i.e., the sentences of the chemical theory plus some others – e.g., truths of logic, etc.) – a process whereby we eliminate certain sentences of set *S* from our theory. If the set continues to imply a false prediction after we have eliminated some sentences, we deliberate further and rescind others while either bringing the original sentences back into theory or keeping them out. We carry on in this way until the set no longer implies the failed prediction. Rarely do we discard some truth of logic or mathematics from our theory, "for mathematics infiltrates all branches of our system of the world, and its disruption would reverberate intolerably" (PT: 15). For example, we could revise the truth conditions of the material conditional so that the failed categorical (11) would not call into question the theory from which it is implied – we could accept it as a logical principle that a conditional with a true antecedent and a false consequent is true. But this would require such an immense amount of revision throughout our theory that it is much easier to eliminate sentences closer to the periphery – such as the sentence

(12) Liquids with molecular composition *y* emit a blue gas in conditions *c*,

which is central to prediction (11) because (let us imagine) the liquid spoken of in that sentence has the molecular composition *y*. Quine maintains that our reluctance to eliminate logical and mathematical truths accounts for their so-called necessity.

> If asked why he spares mathematics, the scientist will perhaps say that its laws are necessarily true; but I think we have here an explanation, rather, of mathematical necessity itself. It resides in our unstated policy of shielding mathematics by exercising our freedom to reject other beliefs instead (PT: 15).

Quine's reconstructed theory accounts for this use of alethic modalities (e.g., taking mathematical statements to be the quintessential necessity truths) by regarding 'necessary' truths as those truths that we are least likely to discard from our theory and 'contingent' truths, on the other hand, as those sentences that we are more likely to eliminate in the face of recalcitrant stimulation. True to the aims of his naturalized epistemology, Quine clarifies the notions of necessity and contingency and shows them to be unneeded in reconstructed theory – instead of 'necessary' and 'contingent' truths we can simply speak of the place of truths in the fabric of our theory. What was thought to be an important distinction in kind of truth is merely a difference of degree in susceptibility to revision. This is a manner of speaking which, unlike assigning a modal distinction between sentences like (8) and (9), is based on what science tells us about the nature of evidence and does not result in failures of extensionality or bloat our ontology (e.g., with possible worlds) and which also makes all knowledge to be of one kind, accounted for in the same terms – facts which make for clearer and simpler theory, simplicity being one of the tenets at the very core of our theory and central to resolving issues at the highest reaches of theory, such as the present one concerning the

metaphysics of modality. (In Chapter 5 we examine how the maxim of minimum mutilation applies to Kripke's arguments in support of essentialism.)

Many philosophers believe that the modalities are presupposed and useful in the analysis of various concepts that are central to scientific thought and practice – namely counterfactual conditionals, dispositional terms, natural laws and causal statements. Given the prevalence of these concepts in science and that they seem to require a modal analysis, it seems that Quine (as a thoroughgoing naturalist) should adopt a modal logic as the language of science after all. In what follows I discuss the use of modal notions in analyzing counterfactual conditionals, and then I discuss the use of counterfactuals in accounting for dispositional terms, natural laws and causal statements.

Counterfactuals are found throughout scientific reasoning and practice and are crucial in framing experiments, where we conjecture what would happen in any number of possible situations. The importance of counterfactual reasoning to the experimental method has been noted since the very beginnings of modern science, as is evidenced in Robert Boyle's description of the characteristics of an excellent hypothesis:

> That it [the hypothesis] enable a skilful Naturalist to foretell future Phenomena, by their Congruity or Incongruity to it; and especially the Events of such Experiments as are aptly devised to Examine it; as Things that ought or ought not to be Consequent to it (Boyle in Westfall 1971: 115).

In framing experiments we employ counterfactual reasoning and test what holds and what does not if a given hypothesis is correct. An examination of William Harvey's refutation of Galen's account of the movement of blood in human beings illustrates the role of counterfactual reasoning in scientific practice. According to Galen, blood flow is not continuous. Ingested food is converted into blood in the liver, from which the newly

created blood flows throughout the body and is absorbed as food – a process that requires the constant creation of new blood in the liver (Magner 2002: 60-61). Harvey, however, believed that the Galenic account of the movement of blood was wrong. In his view, blood is not constantly generated and then absorbed into the body but flows continuously throughout the body – and he proved the falsity of the Galenic theory by means of a simple counterfactual. He reasoned that if the heart pumped out 2 ounces of blood with each beat (a figure he deliberated underestimated) and the heart beats 70 times per minute, the heart must pump out 600 pounds of blood per hour – a quantity three times the weight of even a large man (Magner 2002: 108). The truth of the counterfactual

(13) If the heart pumped 2 ounces of blood per beat, it would pump 600 pounds of blood per hour

refutes the Galenic hypothesis,

(14) Blood flow is not continuous: blood is created in the liver and sent throughout the body where it is absorbed,

because it shows that if the hypothesis were true the body would contain more pounds of blood than the body itself weighs – an obvious absurdity. Harvey then set out to prove his own hypothesis, namely

(15) Blood flow is continuous: blood is pumped by the heart through the arteries and travels back to the heart through the veins.

To prove this, he proposed an experiment. He would tie his upper right arm with a ligature, stopping the blood flow. According to his and Galen's hypothesis, he would see his upper arm fill with blood. He ties his arm and this does in fact happen. However, his hypothesis differs from Galen's in implying that slightly loosening the ligature would

allow blood to flow into the lower arm but not back to the heart (Harvey knows that the arteries are deeper into the arm than the veins), causing the lower arm to swell with blood. That is, his hypothesis implies

(16) If a ligature on Harvey's arm were slightly loosened, his lower arm would fill with blood.

Upon performing his experiment, Harvey finds that (16) is true. Blood is coming in through the arteries but is building up in the veins because they are blocked by the ligature – vindicating his hypothesis that blood is continuous. Blood is pumped by the heart through the arties and travels back to the heart through the veins.

Counterfactual reasoning is by no means limited to Harvey's refutation of Galen or his support of his own hypothesis – counterfactual conditionals are found throughout scientific thought and practice. Yet the truth conditions of such statements are unclear. For example, consider the counterfactual that refuted the Galenic account of the movement of blood:

(13) If the heart pumped 2 ounces of blood per beat, it would pump 600 pounds of blood per hour.

In fact, the blood does not pump 2 ounces of blood per minute or 600 pounds per hour – but the counterfactual is true nonetheless. Moreover, consider the counterfactual that proves Harvey's hypothesis of continuous blood circulation,

(16) If a ligature on Harvey's arm were slightly loosened, his lower arm would fill with blood.

When Harvey utters this statement he does not have a ligature on his arm, but the counterfactual is nevertheless true (and it would be true whether or not he ever actually

put the ligature on his arm). Modal notions seem presupposed in sentences (13) and (16). These counterfactuals (and counterfactuals in general) seem to commit us to possible situations – that is, one where the heart pumps 2 ounces per beat and another where a ligature is on Harvey's arm. In the absence of such possible situations it is unclear how sentences (13) and (16) could be true – seeing as the actual world does not make them true (e.g. the heart does not pump 2 ounces of blood in the actual world) they must be true of some possible situation. What is more, the material conditional cannot be used to analyze counterfactual conditionals because a material conditional is true whenever its antecedent is false but counterfactual conditionals by definition have false antecedents – yet not all counterfactuals are true. It is only natural, then, to analyze counterfactuals along modal lines. That is, sentence (13) is true because in the possible worlds closest to ours where the heart pumps 2 ounces per minute, it pumps 600 pounds per hour. Sentence (16) is true because in the possible world closest to ours where Harvey loosens the ligature on his arm, his lower arm swells with blood. We can also account for the falsity of counterfactuals along these modal lines. For example, the counterfactual

(17) If the ligature on Harvey's arm were taken off, his upper arm would stay filled with blood

is false because in the worlds closest to ours where the ligature on Harvey's arm is taken off, his upper arm does not stay filled with blood – rather, blood flows into his lower arm and then back through his veins to his heart. Clearly modal notions seem not only presupposed by counterfactual conditionals (e.g., talk of possible worlds) but also seem to be required in their analysis.

The modal account of counterfactuals brings us a long way towards making sense of dispositional terms which, like counterfactuals, are found throughout scientific thought and practice, as for example when we say that some object is soluble or fragile. Brian P. McLaughlin explains the importance of counterfactuals to our understanding of dispositions:

> Possession of a disposition is satisfaction of a (perhaps complex) counterfactual condition. The view is typically formulated as a thesis about dispositional terms: dispositional terms can be defined by counterfactual sentences. On this view, the property of water solubility is (roughly) expressed by the counterfactual 'were *x* immersed in water, *x*'s immersion would (at least begin to) dissolve *x*' (1995: 121-22).

For example, consider the following sentence:

(18) Sugar cube *s* is soluble.

How can we account for the truth of this statement? Since *s* has never been placed in water (it has never dissolved and is not presently dissolving) the sentence seems to commit us to the existence of some possible scenario – i.e., one in which the cube is placed in water and dissolves. The sentence implies a counterfactual conditional, namely

(19) If *s* were placed in water, it would dissolve,

which is in turn analyzed along modal lines. That is, the counterfactual (and thus the original sentence (18)) is true if the possible world in which the sugar is placed in water and dissolves is closer to the actual world than the possible world in which the sugar is placed in water and does not dissolve.

The modal analysis of counterfactuals also provides a promising account of laws of nature. Scientists have long spoken of laws instead of mere regularities in their theorizing – a point which suggests a difference between genuine laws of nature such as

(20) All iron melts at 1510° C

and accidental generalities such as

(21) All the food in Smith's fridge is bland.

Both statements are true generalizations, but (20) appears to be true by some necessity whereas (21) appears to be true only contingently. That is, sentence (20) says something about the behaviour of all iron in certain circumstances – take any piece of iron you choose, heat it to 1510° C and it will melt – but (21) cannot be generalized over all food that might be placed in Smith's fridge – food does not become bland by being placed in the fridge. Sentence (20) expresses an important truth about the nature of the world and is of scientific interest but sentence (21), while true, does not provide any real insight into what the world is like and is of no interest to science. Counterfactual conditionals enable us to account for why one is a law and the other a mere generalization. For example, sentence (20) implies the counterfactual

(22) If some piece of iron *i* were heated to 1510° C, it would melt

and (21) implies the counterfactual

(23) If some food *f* were placed in Smith's fridge, it would be bland.

The counterfactuals are in turn analyzed along modal lines. That is, sentence (22) is true because in the worlds closest to ours where some piece of iron is heated to 1510° C, it melts. The fact that (22) is true in the possible worlds closest to ours (though perhaps not across all possible worlds – laws of nature may or may not be necessary truths) accounts for the fact that the original sentence (20) is a law in the actual world. Counterfactual (23), however, is false because in the worlds closest to ours where some tasty piece of food is placed in Smith's fridge, the food remains tasty – it does not become bland, as counterfactual (23) states and generalization (21) would require if it were a law. The

falsity of (23) in the worlds closest to ours accounts for the fact that the original sentence (21) is a mere accidental generalization.

Cause is another concept that is found throughout scientific thought and practice. It seems presupposed in scientific explanation itself, where we say that some event *e* occurred because of some event *c*. Many people (both scientists and laypeople alike) would employ this notion in explaining the difference between genuine laws like (20) and accidental generalizations like (21). That is, though both (20) and (21) are true, only the former is a law of nature because being heated to 1510° C causes iron to melt, while being placed in Smith's fridge does not cause food to become bland. The material conditional cannot be employed in the analysis of causal statements because it cannot account for the connection between cause and effect – its truth does not depend on any causal connection between the antecedent and consequent, as is evidenced by the fact that any material conditional with a false antecedent and true consequent is true. It seems, then, that causal statements require a counterfactual analysis. David Lewis, for example, takes some event *e* as caused by some event *c* if and only if both events occur but *e* would not have occurred without *c* – an analysis that is underpinned by counterfactual conditionals (Lewis 1973: 143). That is, the sentence

(24) Being heated to 1510° C causes iron to melt

implies the true counterfactual

(25) If some piece of iron *i* were not heated to 1510° C, it would not have melted.

In all possible worlds closest to ours where iron is not heated to 1510° C, it does not melt – only in worlds (close to ours) where iron is heated to 1510° C does it melt. On the other hand, the causal statement

(26) Being placed in Smith's fridge causes food to be bland,

implies the false counterfactual

(27) If some food *f* were not placed in Smith's fridge, it would not be bland.

There are many worlds close to ours where some piece of food is not placed in Smith's fridge but is bland nonetheless – being placed in Smith's fridge has nothing to do with blandness and in no way causes food to be bland.

Despite the prevalence of counterfactuals, dispositions, natural laws and causal statements in scientific practice and explanation and the fact that modal notions seem not only presupposed in these concepts but also useful in their analysis, Quine maintains that there is no reason for him to adopt a modal logic as his regimented language of science. Although practicing scientists routinely speak of laws and cause, he believes that we have no ontological commitment to these entities; and he believes that the use of counterfactual conditionals and dispositional terms in scientific theory commits us not to possible objects across possible worlds but merely the existence of physical objects in the actual world. In what follows I explain Quine's treatment of natural law, his account of counterfactuals and dispositional terms and finally his treatment of causal statements.

Quine believes that the notion of natural necessity is best left out of reconstructed theory and sees no reason to admit modal operators into the language of science to distinguish between laws and accidental generalizations or to account for any (purported) fact that laws are necessary truths (RCP: 398). He recognizes that scientists routinely speak of laws (e.g., Boyle's law, the law of universal gravitation, etc.), and does not advocate linguistic reform when eliminating laws from reconstructed theory (Quine himself speaks of laws in his theorizing – e.g., he calls observation categoricals "our first

faltering scientific laws" (FSS: 25)). However, in his view scientists' talk of laws does not carry an ontological commitment to these entities and neither does it require the adoption of a modal logic as the language of science – our theory does not commit us to the existence of laws of nature because regimenting such sentences simply as true generalizations results in simpler theory (we have a syntactically simpler regimented language and a more parsimonious ontology) and sacrifices none of the predictive success of science (and hence such a theory conforms to all and the only evidence there is). By eliminating laws of nature from ontology Quine does not deny that sentences normally considered to be laws are true (e.g., "water boils at 100° C" or "F = ma"). Rather, he maintains that the truth of these sentences does not imply the modalities.

Quine thinks that what are commonly considered to be laws of nature need be taken to imply nothing more than true generalizations, which we form after repeated occurrences of some phenomenon (NT: 76). Regularities are reported in observation sentences, and we sometimes connect regularities in observation categoricals and subsume these categoricals under some generalization. For example, from repeated occurrences of iron being heated to 1510° C, reported in the observation sentence

(28) The iron is heated to 1510° C

and occurrences of iron melting, reported in the observation sentence

(29) The iron melts

we construct the categorical

(30) When the iron is heated to 1510° C, it melts.

After repeated tests categorical (30) is shown to hold true, and so we are compelled to admit the following generalization into theory:

(20) All iron melts at 1510° C.

Take any piece of iron you like, heat it to 1510° C and it will melt. (Sometimes sentences of theory imply generalizations which we then test by discerning the truth of their observation categoricals, as is described in the litholite example.)

Given that sentence (20) is true on all occasions, for every piece of iron, it is natural to suppose that it is a natural law and occasions the adoption of a modal logic as the language of science. Quine, however, thinks that out of considerations of simplicity the notion of natural necessity is best left out of scientific ontology. Regarding (20) (or any other law of nature) simply as a true generalization (or, more generally, as a true sentence of theory) takes nothing away from its predictive power (and that of science as a whole) and results in a simpler ontology and language of science (we need not adopt a modal logic or an ontology of possible worlds to distinguish between laws and accidental generalizations). Whether or not we regard (20) as a law, it follows that for any piece of iron, it melts when heated to 1510° C – refusing to call it a law takes nothing away from the prediction and (since prediction is the test of truth in science) neither does it sacrifice any of the truth of theory. Quine takes such epistemological considerations to be crucial in resolving ontological disputes, whether at the highest reaches of theory (as in the present issue over admitting laws into scientific ontology) or in any of the various branches of science.

Quine believes that modal notions are not required to account for the (apparent) difference between laws of nature and accidental generalizations. To be sure, there is a distinction between the generalizations

(20) All iron melts at 1510° C

and

(21) All the food in Smith's fridge is bland

in the sense that (20) says something about all iron but (21) does not say something about all food that might happen to be placed in Smith's fridge. We take (20) to imply predictions about all iron, but we do not take (21) to imply predictions about any random piece of food that might be placed in Smith's fridge (though it does imply predictions about the current contents of Smith's fridge). This is not because (20) is a law of nature and (21) is an accidental generalization (at least not in the sense that the advocate of the modalities understands these claims). Rather, it is due to the place of each sentence in the fabric of theory. Taken with other sentences of theory, generalization (20) implies the categorical

(30) When iron is heated to 1510° C, it melts

But when taken with other sentences of theory, generalization (21) does not imply any categorical such as

(31) When food is in Smith's fridge, it is bland.

This is because there is some sentence of theory expressing the truth that food does not become bland simply by being stored in some fridge. As Peter Hylton explains (2007: 360), Quine's theory accounts for the apparent difference between (20) and (21) through his maxim of minimum mutilation. If some piece of iron is heated to 1510° C but does not melt, extensive revision would be required in our theory, whereas if some piece of food in Smith's fridge turns out to be tasty, very few revisions of our theory would be called for. What was thought to be a distinction between law and accidental generalization calling for a modal analysis is found to be a distinction in susceptibility to

revision and does not require the abandonment of first-order predicate logic as the language of science.

Contrary to the views of many recent philosophers, Quine thinks that the widespread use of subjunctive conditionals in scientific theorizing does not require the adoption of a modal logic as the language of science. While he acknowledges that "there is no denying that [the subjunctive conditional] pervades scientific thinking" since it "is implicit in the design of every experiment: 'If this and this were set up, such and such would occur'" (PE: 149), he maintains that the counterfactual conditional is "a useful but ontologically noncommittal turn of phrase" (PT: 25-26) that is to be "set outside the systematic fabric of science as a useful outrider" (FSS: 98). That is, the subjunctive idiom – while indispensable to scientific practice – need not be admitted into the canonical notation, which aims to clarify the ontological commitments of the true sentences of science. He takes counterfactual reasoning to be reasoning from false premises.

> The subjunctive conditional depends […] on a dramatic projection: we feign belief in the antecedent and see how convincing we then find the consequent. What traits of the real world to suppose preserved in the feigned world of the contrary-to-fact conditional can be guessed only from a sympathetic sense of the fabulist's likely purpose in spinning his fable (WO: 222).

In counterfactual reasoning we suppose a false antecedent and see what would follow from it given some set of background sentences, which are established according to the point of expressing the subjunctive conditional in the first place (e.g., refuting or proving some scientific hypothesis).

> The [counterfactual] conditional holds if its consequent follows logically from its antecedent in conjunction with background sentences that one's interlocutor is prepared to grant, or sentences that one has already set

> down or implicitly assumed in one's expository piece. The consequent of the conditional follows from the antecedent *ceteris paribus*, and those supporting sentences are the *cetera paria* (PT: 73-74).

For example, Harvey's purpose in expressing the counterfactual

> (13) If the heart pumped 2 ounces of blood per beat, it would pump 600 pounds of blood per hour,

is to refute the Galenic theory of the movement of the blood, formulated in the hypothesis:

> (14) Blood flow is not continuous: blood is created in the liver and sent throughout the body where it is absorbed.

In evaluating the counterfactual we feign belief in the antecedent of (13) and discern whether or not the consequent would follow if (14) were a sentence of theory. Supposing the Galenic hypothesis were true – i.e., blood were produced in the liver and absorbed throughout the body – the consequent does indeed seem to follow from the antecedent in (13). In evaluating the merits of counterfactual (13) we set up counterfactual situations and imagine what would follow from them and the force of the refutation then turns on the evidence for or against the consequent.

Accounting for the truth of the subjunctive conditionals found in established theory, however, does not require the use of modal notions and does not commit us to a modal ontology. These counterfactuals can be paraphrased (in Quine's sense of the word) in terms of Quine's preferred canonical notation and commit us to the existence of nothing more than the actual world and the physical objects found therein.

> The contrafactual case of the subjunctive conditional, however, must be treated as elliptical and occasion-dependent. A universally quantified truth-functional conditional is again implicit, I think, but with a complex antecedent some of whose clauses are left tacit, to be divined from the

> context and circumstances. It is along such lines that I would make sense of subjunctive conditionals, contrafactual or otherwise, without compromising extensionality (PE: 149).

The quantifiers of Quine's regimented language range over all objects across all time, and he paraphrases counterfactual conditionals as material conditionals with complex antecedents. For example, the counterfactual

(32) If the salt were placed in water, it would dissolve

can be expressed in the canonical notation as

(33) $\forall x \forall t$ (if x is a piece of salt and x is placed in water at some time t, x dissolves).

Counterfactual conditionals do not commit us to an ontology of possible worlds but merely physical facts about the world (albeit perhaps unknown). Counterfactual (32) is true not because in some possible world salt is placed in water and dissolves (or because it is supported by a law of nature), but because the actual world is such that objects with a given physical structure dissolve when placed in water. Our theory of the world contains a generalization to this effect, which we simplify here as

(34) Objects with physical structure *y* dissolve in water.

This generalization implies the categorical

(35) If *x* has physical structure *y* and is placed in water, it dissolves.

Salt has physical structure *y*, say, so any piece of salt that we place in water, at any time, will dissolve (subject to ceteris paribus clauses). How does this account of counterfactuals deal with the subjunctive conditionals employed by William Harvey? The counterfactual

(13) If the heart pumped 2 ounces of blood per beat, it would pump 600 pounds of blood per hour

can be disregarded – it is not a sentence of our theory of the world (and is not implied by current theory, though it would be if we accepted Galenic physiology) and need not be expressed in the canonical notation. However, the following counterfactual,

(16) If a ligature on Harvey's arm were slightly loosened, his lower arm would fill with blood

is a sentence of our theory of the world – given what we know about human physiology, tying a ligature to somebody's arm restricts blood flow in the arm. This counterfactual can be paraphrased as a material conditional with a complex antecedent, for example as

(35) $\forall x$ (if x is William Harvey and x ties a ligature to his arm, etc., x's lower arm fills with blood).

This material conditional is true not because in some possible world Harvey ties his arm and the blood is restricted but because the actual physical world is such that tying arms with ligatures restricts blood flow. In paraphrasing counterfactuals in this way Quine is not claiming to preserve synonymy or even logical equivalence but is concerned with clarifying the ontological commitments of theory – and his paraphrases lead him to believe that the prevalence of counterfactual conditionals in scientific theory provides no grounds for him to adopt a modal ontology or abandon his preferred notation in favour of a modal logic as the language of science.

Paraphrasing counterfactuals as complex material conditionals might seem ill-advised due to the role of counterfactuals in analysing dispositional terms. For example,

as we saw above, a counterfactual analysis seems required to account for the truth of sentences containing dispositional terms, such as

(18) Sugar cube *s* is soluble.

The truth value of (18) seems to depend on some possible world where the sugar dissolves when placed in water, which we express in the counterfactual

(19) If *s* were placed in water, it would dissolve

and analyse in terms of possible worlds. Along with natural law and subjunctive conditionals, however, Quine believes that he can account for dispositional terms without adopting a modal logic as the language of science. From an ontological point of view these terms have no place "as a technical idiom of scientific theory at all" (RR: 10) because they merely denote physical states, just like any other predicate of the canonical notation. He maintains that the reason dispositional properties appear remarkable to us is simply due to linguistic use – we specify these properties in a manner different from how we specify other properties.

> The seeming difference between dispositions and other physical properties resides merely in our way of specifying them. We call a property a disposition if we specify it by citing a symptom, or test. The paradigm of dispositions, solubility in water, is a recondite matter of microscopic structure, but it is one that we conveniently specify by just citing a symptom or test: the substance will dissolve on immersion (FSS: 21).

For example, we specify salt by a number of properties – colour, smell, taste, but we also say that it is soluble in water. The property of being soluble in water is in fact a complex fact of physical structure that chemists strive to understand (as are colour, smell and taste, for that matter, and which can also be construed dispositionally – see WO: 224). Solubility stands out because we specify it in terms of a symptom – what happens when salt is placed in water. So-called dispositional properties appear special due to the

manner in which we specify them – through some symptom or test, which is expressed in dispositional terms.

> By 'the general dispositional idiom' I mean the general technique of applying the suffix '-ile' or '-ble' to verb stems and of using the word 'disposition' and, for that matter, the corresponding intensional conditional. This general idiom is programmatic; it plays a regulative rather than a constitutive role. It forms families of terms on the basis not of structural or causal affinities among the physical states or mechanisms that the term refers to, but on the basis only of a sameness of style on our own part in earmarking those states or mechanisms (RR: 11).

Quine points to the dispositions 'soluble', 'portable', 'visible', 'ductile', 'fragile', 'combustible', and 'comestible'. These all "connote a sameness in the style of the cues or tests that we are offering for recognizing or identifying these seven physical attributes" (RR: 11), but physically speaking nothing separates this group of properties apart from other properties.

> The seven physical attributes that are more or less recognized through these cues can be conveyed in further detail in terms of size, shape, density, and minute physiochemical structure, and there is no significant physical principle that sets the seven apart from others. The dispositional idiom is indifferent to the physical subject matter and serves only to signal how we are getting at it (RR: 11).

We specify certain properties by the propensity of objects having those properties to act in certain ways. For example, we specify the property of being soluble by the propensity of objects having this property to dissolve when placed in water, or the property of being visible as the propensity to be seen when viewed under certain conditions. Yet there is nothing in the physical structure denoted by the terms 'soluble' or 'visible' (or the other dispositions mentioned above) that sets them apart from any other physical property.

Quine maintains that dispositional terms denote "just one or another physical property, one or another trait of the internal structure or composition of the disposed

object or related objects" (FSS: 21) – they do not denote some potentiality or any other modal notion. Although we specify dispositional properties in unique ways – and so they are unique from the standpoint of speech pragmatics – they are ultimately matters of physical structure (i.e., the physics of the actual world) and pose no special difficulties to Quine's reconstructed language of science. Since dispositional terms specify a physical state, once we discover the physical nature of the disposition the dispositional term can be discarded as a technical term from Quine's reconstructed language of science, which aims to clarify the ontological commitments of theory.

> Advances in chemistry eventually redeem the solubility idea, but only in terms of a full-blown theory. We come to understand just what there is about the submicroscopic form and composition of a solid that enables water to dissolve it. Thenceforward, solubility can simply be equated to these explanatory traits. When we say of a lump that it would necessarily dissolve if in water, we can be understood as attributing to the lump those supposedly enumerated details of submicroscopic structure – those explanatory traits with which we are imagining solubility to have been newly equated. A chemist can tell you what they are. I cannot (NT: 71-72).

We explain solubility in terms of microphysical structure – put simplistically, for example, we might say that salt is soluble in water because the molecular bonds of the salt are broken and sodium ions are surrounded (hydrated) by water molecules. Chemistry has reached a level of sophistication such that the physical structures specified by this dispositional term are discovered and the term is no longer needed in Quine's reconstructed language of science or is simply taken to imply that certain objects have that structure. The physical predicates corresponding to the microstructure "can thenceforward even take the place of the old disposition term, or stand as its new definition" (RR: 10) because they are all that is required to express the ontological

commitments of theory – what we are committed to is the existence of the physical structure. For example, the sentence

(18) Sugar cube *s* is soluble

does not commit us to the existence of some potentiality or possible and neither does it require the adoption of a modal logic as the language of science. Rather, the predicate 'soluble' commits us to some feature of the actual physical world – the physical structures that make sugar soluble. Reconstructed theory contains the generalization

(25) All objects with physical structure *x* dissolve in water.

Quine's language expresses the truth that some specific piece of salt *a* is soluble by the sentence

(26) $\exists x$ (*Mxa* and *x* dissolves),

where *M* stands for 'alike in molecular structure' (WO: 224). If *x* and *a* are alike in relevant molecular structure and *x* dissolves in water, *a* will as well. Dispositions do not commit us to an ontology containing potentialities and neither must we admit subjunctive conditionals (or the modal ontology these conditionals seem to presuppose) into the reconstructed language of science in order to account for them. Dispositions commit us to an ontology of physical states and sentences containing dispositional terms can be paraphrased in terms of indicative statements.

It might be thought that our ignorance of the physical structures denoted by some disposition terms presents a problem to Quine's analysis of them. This is not the case, however. Quine himself admits that we do not understand the physical mechanisms denoted by each dispositional term (or subjunctive conditional) that we may utter, and he suggests that there may well always be dispositions denoting physical structures (and

counterfactuals true because of physical structures) that we do not understand. One such disposition is intelligence, the physical workings of which "we can scarcely conjecture; the dispositional characterization is all we have to go on" (RR: 10). Quine maintains that such dispositions are "entitled to a place in our theoretical vocabulary [for] […] we do not restrict our theoretical vocabulary to things we understand completely" (RR: 11) – a key part of naturalism is doing what we can with the resources of current science. Yet we must not think that the dispositional term 'intelligent' denotes some special property or potentiality. The term denotes a physical state – a "hypothetical state or mechanism that we do not yet understand, or […] any of various such states or mechanisms, while merely specifying one of its characteristic effects" such as the ability to solve problems quickly (RR: 10). Neither does any sentence containing the term, such as

(36) Smith is intelligent,

commit us to the existence of some possible world (a world where Smith is in certain conditions and behaves in a certain way, for example). Sentence (36) is true because of a physical structure of the actual world – one which is found in the brains of some humans and enables them, for example, to solve problems quickly. When using such dispositional terms we accept that the ontological commitments involved in using them are not yet completely clear, but current theory dictates that such terms (and counterfactuals whose truth-makers are unknown) have a physical basis.

It might also be thought Quine's account of counterfactuals and dispositions faces problems when dealing with objects at the foundation of causal explanation, such as elementary particles. For example, imagine that physics is complete. It was completed by one final discovery – namely, that photons do *d* in conditions *c*. Since physics is

complete, there are no unknown physical structures to explain this behaviour (*d*). In light of this, what does the dispositional term *d-able* denote, if not a possible? For any given photon *p*, the sentence

(37) *p* is *d-able*

seems to commit us to some possible world, namely one where *p* is in conditions *c* and does *d*. The sentence implies the counterfactual

(38) If *p* were in conditions *c*, it would do *d*,

which, in the absence of any deeper physical structures, seems to be true because in some possible world *p* is placed in conditions *c* and does *d*. While Quine does not discuss this issue in his writings, he would likely maintain that such examples do not require the adoption of a modal ontology. Despite there being no 'deeper' structures to explain the behaviour of photons in conditions *c*, sentence (37) and counterfactual (38) are true in virtue of some feature (in the ontologically innocent sense) of the actual physical world – namely that photons do *d* in conditions *c*. Our completed physical theory contains the generalization

(39) Photons do *d* in conditions *c*.

This generalization is based on (or, if the discovery was implied by other sentences of theory, supported by) the known behaviour of photons in conditions *c* – when in *c*, photon *p1* did *d*, photon *p2* did *d*, and so on. Sentences (37) and (38) are true because it is a feature of the actual physical world that photons do *d* in *c*, and *p* is a photon – they do not imply any commitment to possible objects or worlds and neither do they require the adoption of a modal logic as the language of science. As with any other counterfactual, sentence (38) is evaluated in terms of reasoning from false premises and ceteris paribus

assumptions. These dispositional terms and counterfactuals are accounted for in the same manner as any other dispositional term and counterfactual used in scientific theory. At no point does Quine see any reason to abandon his preferred language of science or adopt a modal ontology.

Quine's account of dispositional terms seems to imply the existence of causes – being in conditions *c* causes *x* to do *d*. He maintains, however, that despite the utility of the notion of cause in scientific explanation, there is no need to posit causes in scientific ontology (and so no need to admit modal notions into the canonical notation to account for causal statements) because a cause-free ontology is simpler than one that contains causes and sacrifices none of the predictive success of science. In his view, although in less advanced science the notion of cause is still prevalent, "[s]cience at its most austere bypasses the notion and settles for concomitances" (PT 76) – it settles for certain events always occurring with other events but without admittance of causes into scientific ontology. Reconstructed theory (which is science at its most austere) can preserve all the truths of our theory of the world without employing the notion of cause – a point which Quine takes as showing that causes need not be admitted among our ontological commitments. Take a description of the workings of an hydraulic press as an example of a causal claim. When pressure is exerted on the smaller piston, the pressure is transmitted through the water and the larger piston rises. We might express this fact of nature in the following causal statement:

(40) Pressure exerted on the smaller piston causes the larger piston to rise.

In Quine's view, though, the causal claim is ontologically superfluous – eliminating the mention of cause takes nothing away from the prediction expressed in sentence (40). The

physics behind the workings of the hydraulic press are captured in Pascal's Principle, which Quine's reconstructed theory formulates as the following generalization:

(41) When additional pressure is put on a confined liquid, the pressure is transmitted equally to all parts of the liquid.

This generalization (along with other bits of theory) implies an observation categorical with respect to the hydraulic press before us:

(42) When pressure is applied to the smaller lever, the larger lever rises.

This categorical expresses the same prediction as sentence (40) but without the mention of cause – it settles for concomitances but sacrifices none of our theory's (or sentence (40)'s) truth in doing so (judged in terms of predictive success). Since the predictive success of our theory is not compromised by eliminating the notion of cause and a cause-free ontology is more parsimonious than one with causes, there is no evidence that compels us to posit causes in scientific ontology and no reason to accept modal operators in the canonical notation so as to account for causal statements – in Quine's view, first-order predicate logic is all that is required to clarify the ontological commitments of causal statements. In eliminating causes from scientific ontology Quine does not aim to reform the language of the scientist or the layman – he recognizes that explanation would be crippled without the mention of cause, but nevertheless maintains that causes need not be admitted into reconstructed theory or expressed in the regimented language of science, which aims to be an "ideal language for a finished theory of reality" (RR: 12) and whose paraphrases are in the name of ontological clarification. Quine does not intend mention of cause to be eliminated from scientific explanation. Rather, the fact that causes can be eliminated from scientific ontology without sacrificing any of the truths of science shows

that science is not committed to causes as entities and as a result there is no reason to adopt a modal logic to analyze causal statements.

Conclusion

This chapter has examined Quine's initial reasons for thinking there is no reason to admit the modalities into the regimented language of science. He accounts for our inclination to take logical and mathematical truths as necessary through is maxim of minimum mutilation – logical and mathematical truths are the sentences of theory that we are most reluctant to discard. Moreover, he maintains that natural laws, subjunctive conditionals, dispositional terms and causal statements can be accounted for without relying on modal notions. As we shall see in the chapters that follow, however, Saul Kripke presents several arguments that not only seem to respond effectively to Quine's most well-known criticisms of modal notions (which we also review) but also seem to demonstrate that Quine should accept modal metaphysics and adopt a modal logic as his language of science after all. In the following chapters I examine Kripke's arguments and elaborate a Quinean response to them. As we shall see, the central tenets of scientific epistemology reviewed in this chapter – empiricism, physicalism, regimentation and simplicity – serve to undermine Kripke's arguments and preclude Quine from accepting a modal logic as the language of science.

Chapter 2:

Quine's Referential Opacity Argument and Kripke's Reply

In his referential opacity argument, Quine claims that the notions of necessity and contingency are strictly verbal devices that do not represent genuine ontological features of the world. In one of the earliest and most forceful responses to this argument, Arthur Smullyan maintains that Quine's argument rests on a confusion of names and descriptions and takes insufficient attention to scope distinctions. While a sufficient response on technical grounds, Quine ultimately rejects Smullyan's approach because he believes it commits him to an unacceptable metaphysics. Some years later, Kripke resurrects Smullyan's strategy but strengthens his case by providing a philosophical theory that seems to show not only that the metaphysical commitments of modal logic are perfectly acceptable but also that these commitments should be accepted – a point which suggests that Quine should adopt a modal logic as his reconstructed language of science.

In this chapter, I first outline Quine's argument. I then examine Smullyan's response and explain why Quine finds it unacceptable – he sees no justification for the distinction between names and descriptions that Smullyan's account endorses and believes that *de re* modality involves untenable metaphysical commitments. Finally, I discuss Kripke's reply to Quine's argument and examine the philosophical theory he advances to justify the distinction between names and descriptions (Kripke's defence of essentialism is reserved for a later chapter). This chapter demonstrates the methods Kripke employs in his response as well as the force of that response if these methods are accepted. Moreover, by providing an overview of Quine's argument and Kripke's

response this chapter paves the way for the following one in which a Quinean response to Kripke is advanced.

Section 1: Quine's Referential Opacity Argument

Quine's referential opacity argument calls into question the ontological significance of statements containing modal operators. He maintains that attributions of necessity are strictly verbal affairs and have no ontological implications. He thinks this becomes clear once it is recognized that modal contexts are non-extensional, i.e. that co-referring singular terms are not always interchangeable in modal contexts. Since his philosophical project includes giving an account of the ontological commitments of the current scientific worldview, modal notions must be eliminated from his theory because they do not express genuine ontological claims.

At the time of Quine's formulation of his referential opacity argument, many philosophers understood necessity in terms of analyticity – the notions of necessity and analyticity were seen to be equivalent. For example, in *Meaning and Necessity* Carnap defines necessity in terms of analyticity (1988: 174):[2]

(1) For any sentence '…', '□ (…)' is true if and only if '…' is L-true,

where L-truth is Carnap's explication of analyticity. A consequence of assimilating necessity to analyticity is that the necessity operator is seen as attaching to sentences – necessity is understood *de dicto* as opposed to *de re*. In quantified modal logics, necessity *de dicto* is expressed by giving the modal operator wide scope while *de re* is expressed by giving the modal operator narrow scope. For example, giving the operator wide scope we get the sentence

[2] I use '□' as the necessity operator instead of Carnap's 'N' for the sake of convenience.

(2) $\Box \exists x\,(Hx)$,

where '*H*' is the predicate 'is human'. This sentence reads 'It is necessary that something is human' and is clearly false, as it could have been the case that no humans ever existed. On the other hand, giving the operator narrow scope, we get the sentence:

(3) $\exists x\,(\Box\, Hx)$.

This sentence reads 'Something is such that it is necessarily human' and (assuming the intelligibility of modality) is true, since for any human (say, Quine) it is necessary for him to be human. Perhaps due to the emphasis on *de dicto* necessity at the time of 'Reference and Modality', Quine assumes a wide scope (*de dicto*) reading of the modal operator in his referential opacity argument – a shortcoming that is seized upon by Smullyan in his response to Quine's attack.

Quine begins his referential opacity argument by pointing out some basic logical notions. The first notion is the principle of the substitutivity of identicals. This principle "provides that, given a true statement of identity, one of its two terms may be substituted for the other in any true statement and the result will be true" (RM: 139). For example, given the true statement

(4) Hesperus = Phosphorous

we can replace 'Hesperus' with 'Phosphorous' in the true statement

(5) Hesperus is the second planet from the sun

and the resulting statement,

(6) Phosphorous is the second planet from the sun

is also true. Adherence to the principle of substitutivity of identicals is fundamental to any extensional language. In an extensional language, a truth cannot be turned into a

falsehood by substituting co-referring terms. What is true of some object (in this case, the second planet from the sun) remains true of it, no matter what we call it.

There appear to be instances that violate the principle, however. For example, although

(7) Giorgione = Barbarelli

and

(8) Giorgione was so-called because of his size

are both true, we cannot substitute 'Giorgione' for 'Barbarelli' *salva veritate* in (8). If we do so, the result is the false sentence

(9) Barbarelli was so-called because of his size.

Giorgione was called 'Giorgione' because of his size, but Giorgione was not called 'Barbarelli' because of his size. Another example of failure of substitutivity of identity occurs when quotation marks are employed. Although

(10) Cicero = Tully

and

(11) 'Cicero' contains six letters

are both true, we cannot substitute Cicero with the co-referential Tully and preserve the truth value of (11). Doing so results in the falsity

(12) 'Tully' contains six letters.

'Cicero' does in fact contain six letters but 'Tully' contains only five. We have, then, observed two instances where the principle of substitutivity of identicals seems not to hold. Should the principle therefore be abandoned? Quine believes that we should keep the principle and explain away the counterexamples given above.

Substitutivity of identicals is violated in the above contexts because the names of certain objects do not occur purely referentially – that is, the names do not occur in such a way that they denote exclusively their normal objects of reference. We cannot substitute Tully for Cicero in the statement

(11) 'Cicero' contains six letters

because in (11) we are not concerned with the man Cicero (who is Tully) but with the names 'Cicero' and 'Tully'. This is indicated by the use of the quotation marks. Cicero and Tully are the same object: the ancient Roman orator. The names 'Cicero' and 'Tully' both denote the same object but the names are not one and the same object: they are completely different objects – different names. With this point understood, there is no longer any presumption that we should be able to substitute 'Tully' for 'Cicero' *salva veritate* in (11), which in fact we cannot do because the principle allows substitution of co-referring terms but 'Cicero' refers to a name that 'Tully' does not. So this is not a counterexample to the principle of substitutivity of identity – there only appears to be one because we are confusing use and mention.

Similarly, in the example of Giorgione, the reference of the terms is not what it at first seems to be. The sentence

(7) Giorgione = Barbarelli

is true. The names 'Giorgione' and 'Barbarelli' denote the same man. But the reference of 'Giorgione' in the statement

(8) Giorgione was so-called because of his size

is ambiguous. Certainly it was the man Giorgione who was so-called because of his size; but "the failure of substitutivity shows that the occurrence of the personal name in (8) is

not *purely* referential" (RM: 140). Quine believes that the occurrence of 'Giorgione' in statement (8) in fact refers to two objects, the man Giorgione and the name 'Giorgione'. Statement (8) can be translated into the clearer statement:

(13) Giorgione was called 'Giorgione' because of his size.

The name 'Barbarelli' may be substituted for the first occurrence of 'Giorgione' in (13) but not the second. The first occurrence refers to the man Giorgione and the second refers to the name 'Giorgione'. Giorgione (the man) was called 'Giorgione' (the name) because of his size. The same man, Barbarelli, was called 'Giorgione' because of his size. But the man was not called 'Barbarelli' because of his size. The names 'Giorgione' and 'Barbarelli' are two different objects and there is no reason why 'Giorgione' should be interchangeable *salva veritate* with 'Barbarelli' in (8) – we can only substitute co-referring terms and these two terms refer to different names. Once again there is no counterexample to the principle of substitutivity of identity – only a failure to distinguish between use and mention.

The Cicero and Giorgione examples are cases of referentially opaque contexts. Quine explains referential opacity as follows:

> Failure of substitutivity reveals merely that the occurrence to be supplanted is not *purely referential*, that is, that the statement depends not only on the object but on the form of the name. For it is clear that whatever can be affirmed about the object remains true when we refer to the object by any other name (RM: 140).

In both the Cicero and Giorgione examples we were concerned with the form of the names involved (what we call things) and not merely the references of the names (the things themselves). What is true of Cicero or Giorgione remains true regardless of how Cicero or Giorgione is specified. Instances that appear to violate the principle of

substitutivity of identicals are in fact not violations of the principle, since in such cases (as in the examples of Cicero and Giorgione) the terms are not occurring purely referentially. In the examples above, 'Cicero' is not interchangeable with 'Tully' and 'Giorgione' is not interchangeable with 'Barbarelli' because in the contexts under consideration these terms do not designate what they normally designate. The terms 'Cicero' and 'Tully' designate not the man Cicero but the names 'Cicero' and 'Tully', while the terms 'Giorgione' and 'Barbarelli' have an ambiguous reference: they designate both the man Giorgione and the name being used ('Giorgione' or 'Barbarelli').

Quine argues that modal contexts are referentially opaque. Whereas modal contexts purport to make ontological claims, they are in fact strictly verbal affairs. For example, the (*de dicto*) statements

(14) Necessarily, 9 is greater than 7

and

(15) Possibly, the number of planets is less than 7

are both true. The terms '9' and 'the number of planets' both refer to the same object,[3] so the statement

(16) 9 = the number of planets

is also true. Nevertheless, statements (14) and (15) appear to violate the principle of substitutivity of identicals. If we substitute 'the number of planets' for '9' in statement (14) and '9' for 'the number of planets' in statement (15), the resulting statements

(17) Necessarily, the number of planets is greater than 7

and

[3] Current astronomy maintains that there are 8 planets and 5 dwarf planets in our solar system. Nevertheless, I discuss Quine's argument as he presented it for the sake of convenience. Nothing in his argument turns on this question of fact.

(18) Possibly, 9 is less than 7

are both false – there might have been 7 or fewer planets and it is impossible that the number 9 is less than 7. How can this be, if 9 is the number of planets? Quine's answer is that modal contexts are referentially opaque. Similar to the Cicero and Giorgione cases discussed above, in modal contexts we are not concerned merely with the references of the terms involved but also with the terms themselves, with their "manner of referring" (RM: 148). The term '9' is not substitutable *salva veritate* with 'the number of planets' in the statement,

(14) Necessarily, 9 is greater than 7,

because the truth of this statement depends not only on the object specified – the number 9 – but also on the way it is picked out – our use of the name '9'. Whereas modal contexts appear to concern only the objects normally designated by such terms as '9' and 'the number of planets' (e.g., the number 9), they also concern the manner in which we specify these objects (e.g., the name '9' and the description 'the number of planets'). Whereas modal notions are supposed to say something about the world what they really show us is something about language. The terms '9' and 'the number of planets' refer to the same object and whatever is true of the number 9 should be true of it regardless of how it is specified or denoted. But the adverb 'necessarily' makes the context referentially opaque – it shifts the concern from being exclusively about objects to also being about how the objects are specified. That the context comes to be referentially opaque once the modal notions are inserted shows that modal claims do not express genuine ontological claims at all but merely concern linguistic usage.

Quine believes that modal notions are referentially opaque even when singular terms are not used in modal contexts. Moreover, he believes that we cannot quantify into referentially opaque contexts. In order to prove his case, he considers existential generalization, a rule of inference that states that from an open formula, say *Fa*, we can infer that some *x* is *F*. For example, from the statement

(19) Socrates is mortal

we can apply existential instantiation and infer that something is mortal:

(20) $\exists x$ (*x* is mortal).

(RM: 145). Quine maintains that referentially opaque contexts make nonsense of this principle. The instances discussed above involving Giorgione and Cicero remain problematic, even when we eliminate names from our language. The true statement

(8) Giorgione was so-called because of his size

becomes nonsense once we apply the rule of existential generalization. If we do apply the rule, we get the statement

(21) $\exists x$ (*x* was so-called because of its size).

Statement (21) is "clearly meaningless, there no longer being any suitable antecedent for 'so-called'" (RM: 145). The phrase 'so-called' is not applicable to a mere variable; the phrase is only meaningful in connection to some name (such as 'Giorgione', for example). The variable *x* is simply a placeholder for whatever object is referred to. In the predicate phrase, the term 'so-called' is intended to apply to the variable *x*, but the

formula does not mention anything that *x* was so-called. The application of 'so-called' to *x* without mention of what *x* was called is what makes the statement meaningless.[4]

Applying existential generalization to the Cicero example is likewise meaninglessness and makes nonsense of reference. Applying existential generalization to the meaningful statement,

(11) 'Cicero' contains six letters

yields the nonsensical statement,

(22) $\exists x$ ('*x*' contains six letters).

Perplexed by what statement (16) is supposed to mean, we could interpret it as

(23) There is something such that 'it' contains six letters,

(24) 'Something' contains six letters,

or even

(25) The 24th letter of the alphabet contains six letters,

each of which is clearly either nonsensical or false. This example illustrates again that referentially opaque contexts exist even when singular terms are eliminated and that they make nonsense of reference.

As in the examples of Giorgione and Cicero, Quine argues that modal contexts result in nonsense or falsehood when existential generalization is applied. For example, he maintains that if we apply existential generalization to the (*de dicto*) statement (14), namely

(14) Necessarily, 9 is greater than 7

[4] As Quine points out, we can apply existential generalization to a statement similar in intent to (7) but employing a purely referential occurrence of 'Giorgione'. For example, the statement "Giorgione was called 'Giorgione' because of his size" can be meaningfully rendered into quantificational form, as $\exists x$ (*x* was called 'Giorgione' because of its size) (see RM: 145). This strategy would be of no use to the proponent of modality, as it would be an admission that the modalities concern language.

the result is the nonsensical (*de re*) statement

(26) $\exists x (\Box Gx)$,

where *G* is the predicate 'greater than 7'. Similar to the case of applying 'so-called' to the variable, we encounter problems here with the use of 'necessarily'. "What is this number which, according to (26), is necessarily greater than 7? According to (14), from which (26) was inferred, it was 9, that is, the number of planets; but to suppose this would conflict with the fact that (17) [i.e., Necessarily, the number of planets is greater than 7] is false" (RM: 148). As in the example involving 'so-called', we cannot say whether statement (26) is true or false. This is because, as Quine seems to have shown in his examples involving propositional modal logic, "to be necessarily greater than 7 is not a trait of a number, but depends on the manner of referring to the number" (RM: 148), and in statement (26) the manner of referring to the number is absent. We could refer to it with the term '9', which would make the statement true, or we could refer to it with the term 'the number of planets', which would make the statement false. As the statement stands, however, there is simply no way to decide how to interpret it.[5] Moreover, such problems seem to remain even when the statements to which we apply existential generalization do not contain names. For example, the conditions

(27) $x = \sqrt{x} + \sqrt{x} + \sqrt{x} \neq \sqrt{x}$

(28) There are exactly *x* planets

[5] Quine points out that statement (20) is not to be confused with the intelligible *de dicto* statement '$\Box \exists x (x > 7)$'. "The difference [between the statements] may be accentuated by a change of example: in a game of a type admitting of no tie it is necessary that some one of the players will win, but there is no one player of whom it may be said to be necessary that he win" (RM: 148). This does not exonerate modality, since (in Quine's view) the necessity operator in *de dicto* position can simply be seen (and is best seen) as a semantical predicate expressing validity (see TGM: 165-171).

both specify the number 9. Condition (27), however, has '$x > 7$' as a necessary consequence while (28) does not. If we apply existential generalization to either of these statements, Quine maintains, we are left with the same problems as when we applied the rule to statements containing names. Using condition (27), statement (20), namely

(26) $\exists x (\Box Gx)$

(where G is the predicate 'greater than 7') is true, but using condition (28), statement (26) is false. Quine summarizes:

> [I]f to a referentially opaque context of a variable we apply a quantifier, with the intention that it govern that variable from outside the referentially opaque context, then what we commonly end up with is unintended sense or nonsense of the type (16)-(20). In a word, we cannot in general properly *quantify into* referentially opaque contexts (RM: 148).

It appears impossible to quantify into referentially opaque contexts without producing nonsensical statements. Quine claims that this is due to the referential opacity of modal contexts – they concern not merely objects (such as 9) but the manner of referring to objects (the name '9', the description 'the number of planets') so that quantifying into modal contexts is nonsensical because the manner of referring to the object is absent.

In Quine's view, over and above the fact that there is no compelling reason to adopt a modal logic as the language of science (discussed in Chapter 1), the referential opacity of modal contexts provides compelling grounds for not admitting modal operators into the canonical notation. The purpose of that language is to clarify the ontological commitments of theory, but modal notions confuse those commitments because they erroneously take matters of linguistic usage to represent genuine ontological features of the world.

Section 2: Smullyan's Response

Arthur Smullyan provides one of the earliest and most forceful responses to Quine's referential opacity argument. In his 1948 paper 'Modality and Description', Smullyan claims that Quine's argument fails as a criticism of modality for two interrelated reasons. First, Smullyan says, Quine treats descriptions as if they were names. Second, Quine fails to take into account the scope distinctions required when dealing with descriptions and modal operators.

Quine's argument, recall, runs as follows:

(14) Necessarily, 9 is greater than 7

(16) 9 = the number of planets

(17) Necessarily, the number of planets is greater than 7.

Despite the true premises, conclusion (17) is false. In Quine's view, this paradox exposes the incoherence of modal notions. However, Smullyan notices an ambiguity in Quine's argument – Quine treats the description 'the number of planets' as if it were a name and he fails to take the proper scope distinctions into account when employing it in his argument. Two readings can be assigned to the conclusion of the supposed paradox. On one reading, the modal operator in sentence (17) is given wide scope and is formalized as

(17a) $\Box \exists x\,(Gx \,\&\, \forall y\,(Gy \rightarrow x = y) \,\&\, Fx)$,

where *G* is 'the number of planets' and *F* is 'greater than 7'. On this reading we are speaking of *de dicto* necessity. That is, sentence (17a) reads

(29) It is necessary that the number of planets is greater than 7,

and is false – there could have been fewer than 7 planets. On another reading, the modal operator in sentence (17) is given narrow scope and is formalized as

(17b) $\exists x\,(Gx \,\&\, \forall y\,(Gy \rightarrow x = y)) \,\&\, \Box\, Fx)$.

On this reading we are speaking of *de re* necessity. Sentence (17b) reads

(30) The object *x*, which is the number of planets, is necessarily greater than 7, and is true – the number of planets is in fact 9, and 9 is necessarily greater than 7. Smullyan observes that Quine seems to be taking the *de dicto* reading of necessity in conclusion (17) – but this inference is fallacious. Formalizing Quine's argument from the first premise, namely

(14a) $\Box\,(Fa)$

(where *F* is 'greater than 7) and the second premise

(16a) $a = \exists x\,(Gx \,\&\, \forall z\,(Gz \rightarrow (x = z))$

(where *G* is 'the number of planets'), the following (*de dicto*) sentence does not follow:

(17a) $\Box\, \exists x\,(Gx \,\&\, \forall z\,(Gz \rightarrow x = z) \,\&\, Fx)$.

However, from (14a) and (16a), the following (*de re*) sentence does follow:

(17b) $\exists x\,(Gx \,\&\, \forall z\,(Gz \rightarrow x = z) \,\&\, \Box\, Fx)$

Instead of inferring (17a) Quine should conclude (17b) – but then no modal paradox remains, as (17b) is true. The number that the description 'the number of planets' specifies is 9, and that number is necessarily greater than 7. Quine's referential opacity argument is answered by clarifying the scope of the modal operator.

Smullyan maintains that Quine's failure to recognize scope distinctions stems from his treatment of descriptions as names.

> In the light of our discussion so far, it may suggest itself to the reader that the modal paradoxes arise not out of any intrinsic absurdity in the use of the modal operators but rather out of the assumption that descriptive phrases are names (Smullyan 1948: 34).

According to Smullyan, by treating descriptions as if they were names, Quine fails to see that he must take scope distinctions into account when dealing with descriptions. The ambiguities of scope that affect descriptions do not affect names. If the identity in premise (16) of Quine's argument, namely

(16) 9 = the number of planets

had been an identity between two names, Quine's conclusion could legitimately be in its original *de dicto* form, where the necessity operator takes wide scope. That is, assuming that 'IX' is another name for '9', Quine could argue the following:

(14) Necessarily, 9 is greater than 7

(16a) 9 = IX

(17c) Necessarily, IX is greater than 7.

This argument is of no real interest, as it is perfectly valid and obviously so. It poses no threat to the proponent of modality. According to Smullyan, it is precisely Quine's failure to recognize the difference between names and descriptions – and the scope distinctions that pertain to the latter type of term in modal contexts – that leads him to see some difficulty in modal notions and which renders his argument against modal notions ineffective.

Quine grants that Smullyan provides an effective response to his referential opacity argument, but only if certain basic assumptions of Smullyan's strategy are accepted. Quine's criticisms of these assumptions evolve through successive revisions of 'Reference and Modality'. In the initial draft, his remarks on essentialism are limited to just before the penultimate paragraph, where he refrains from criticising the doctrine and merely says that in order to answer the question of what is essential and accidental of

some object we "should have to be pretty explicit on the details of the theory and on the analysis, in quantificational terms, of whatever is to be based on the theory" (RM [1st Ed.]: 159). In this version he criticizes Smullyan on grounds that his argument depends on a fundamental division between names and descriptions and that he alters Russell's theory of descriptions. Whereas in Russell's theory of descriptions scope distinctions matter to the truth of a statement only when the description fails to name, Quine (incorrectly) maintains, Smullyan takes scope distinctions to affect truth even when the description refers. This criticism is repeated in the second version of 'Reference and Modality', but here Quine's response to Smullyan also includes a critical discussion of essentialism with the division between names and descriptions seen as part of the commitment to essentialism. Finally, in the third version, Quine retracts the criticism that Smullyan alters Russell's theory of descriptions (fully exonerating Smullyan on logical grounds) and limits his response to metaphysical considerations: he rejects Smullyan's argument on grounds that it presupposes the intelligibility of essentialism (a doctrine he rejects)[6] and that there is no basis for distinguishing between names and descriptions in the manner that essentialism seems to require. Quine (reluctantly) acknowledges Smullyan's point about the scope confusion in his modal paradox but maintains that

[6] As Sanford Shieh has pointed out to me, in Quine's reply to Sellars in *Words and Objections* he objects to Smullyan's use of *de re* modality on different grounds: "[…] when the description is in a non-substitutive position, one of the two contrasting applications of the contextual definition is going to require quantifying into a non-substitutive position. So the appeal to scopes of descriptions does not justify such quantification, it just begs the question" (338). That is, Smullyan's appeal to scope distinctions (i.e., the modal operator in *de re* position) requires quantifying into modal contexts and so presupposes the intelligibility of such quantifications. This objection does not refute Smullyan's use of *re de* modality, however, because Smullyan can claim that Quine is simply begging the question against the intelligibility of quantifying into modal contexts. The result is a stalemate that (I believe) paves the way to a discussion of the metaphysical and epistemological issues at play in evaluating the intelligibility of modality. Sanford Shieh provides an excellent analysis of the exchange between Quine and Smullylan, as well as the conceptions of and debates surrounding modality in the analytic tradition up to Kripke, in his entry 'Modality' in the *Oxford Handbook of the History of Analytic Philosophy* (forthcoming).

metaphysical considerations justify him in doubting the viability of modal logic as a regimented language of science.

As we saw above, Smullyan exposes the scope ambiguity in Quine's conclusion:

(17) Necessarily, the number of planets is greater than 7.

If the modal operator is given wide scope (which is what Quine gives it) the sentence reads

(17a) $\Box \exists x\,(Gx \,\&\, \forall y\,(Gy \rightarrow x = y) \,\&\, Fx)$,

and is false – but sentence (17a) does not follow from the premises of the argument and so there is no modal paradox. The narrow scope reading, however, does follow from the premises Quine lays out and reads

(17b) $\exists x\,(Gx \,\&\, \forall y\,(Gy \rightarrow x = y) \,\&\, \Box Fx)$

Unlike (17a), sentence (17b) is true (assuming that *de re* modality is intelligible) – the object that is the number of planets is necessarily greater than 7 – and so Quine's modal paradox dissolves. Admitting the logical error in his argument, Quine shifts his approach and rejects Smullyan's solution to the modal paradox on metaphysical grounds. That is, he believes that the *de re* necessity expressed in sentence (17b) presupposes essentialism – a metaphysical thesis he rejects. He understands essentialism as the doctrine stating that

> [a]n object, of itself and by whatever name or none, must be seen as having some of its traits necessarily and others contingently, despite the fact that the latter traits follow just as analytically from some ways of specifying the object as the former traits do from other ways of specifying it (RM: 155).

In Quine's view, attributions of essentialism depend on how we describe objects – if we describe an object one way, it follows (even apart from any commitment to analyticity)

that the object is essentially *F* and accidentally *G*, but if we describe the object differently it follows that the object is accidentally *F* and essentially *G*. Essentialist claims merely consist in privileging some traits of the object over others, when in fact there is no objective basis for the distinction. For Quine, essentialism is a metaphysical position totally unsuited to the modern scientific worldview. (Chapters 4 and 5 concern Quine's rejection of essentialism and Kripke's defence of the notion.) Related to the doctrine of essentialism is the notion that some terms denote essential traits of an object while other terms denote contingent ones. As Quine says (reflecting the tendency to associate necessity with analyticity) Smullyan's response "depends on positing a fundamental division of names into proper names and (overt or covert) descriptions, such that proper names which name the same object are always synonymous" (RM: 154). This distinction figures in Smullyan's response to Quine because he "draw[s] a sharp distinction between names and descriptions, treat[s] ordinary names as logically proper names, and contextually defin[es] definite descriptions" (Neale 2000: 307). As was discussed above, scope distinctions do not affect names – they denote their objects necessarily[7] – but they do affect descriptions. When dealing with descriptions, the scope of the modal operator affects the truth value of Quine's conclusion

(17) Necessarily, the number of planets is odd.

However, Quine is reluctant to embrace such a distinction between names and descriptions. Aside from seeing no need to do so, he sees two problems with this

[7] This phrase could be misread as attributing necessity to the fact that some term *t* denotes some object *o* – e.g., it might be read as making the (patently false) claim that the term '9' could not have been used to name 8 (or any other object). Current usage removes this ambiguity and says the intended point more clearly in terms of possible worlds or rigidity, i.e., 'they denote their objects in all possible worlds' or 'they denote their objects rigidly'. Nevertheless I preserve the ambiguous usage in this section so as to convey Quine's doubts over the intelligibility of Smullyan's response.

distinction. First, Frege's puzzle of informative identities shows that co-referential names are not synonymous and so (presuming that necessity is explicated as analyticity) co-referential names cannot be substituted salva veritate in modal contexts.[8] Second (and more pertinent to the Quine-Kripke debate), Quine thinks the notion that some terms denote their objects necessarily while others denote them contingently is barely intelligible and certainly has no place in reconstructed science. As he says, "[essentialism] means adopting an invidious attitude toward certain ways of uniquely specifying *x*, for example (28), and favouring other ways, for example (27), as somehow better revealing the 'essence' of the object" (RM: 155). That is, the proponent of modality accepts that '$x > 7$' necessarily follows from

(27) $x = \sqrt{x} + \sqrt{x} + \sqrt{x} \neq \sqrt{x}$,

but not from

(28) There are exactly *x* planets,

since condition (27) illustrates something essential about $x - x$ is necessarily the object which $\sqrt{x} + \sqrt{x} + \sqrt{x} \neq \sqrt{x}$, but *x* is only contingently the number of the planets. Condition (27) is thus a fundamentally different way of specifying *x* (i.e., a necessary way) than is condition (28) (i.e., a contingent way) and the necessary way is favoured as revealing something essential about the object. Similarly, there is a distinction between names and descriptions because names signify an object in a necessary way (e.g., 9 is necessarily self-identical) and descriptions signify an object in a contingent way (e.g., 9 is contingently the number of planets). Quine, however, rejects the essentialism motivating this approach and finds no basis for distinguishing between different ways of specifying the same object in the way Smullyan is proposing. As we see in what follows, however,

[8] See Shieh, 'Modality' in the *Oxford Handbook of the History of Analytic Philosophy* (forthcoming).

Kripke seems to provide convincing reasons for accepting a distinction between terms that necessarily denote their objects and terms that do so contingently – a point which not only seems to answer Quine's metaphysical objections to Smullyan's use of names and descriptions but also suggests that Quine should adopt a modal logic as his reconstructed language of science. (Kripke's defence of essentialism proper is discussed in Chapter 4.)

Section 3: Kripke's Vindication of Smullyan's Strategy

One aspect of Quine's reply to Smullyan demands that the defender of modality provide a convincing account for drawing a distinction between names and descriptions (or, more generally, between terms that necessarily denote their objects and terms that do so only contingently). It seems that Kripke meets this demand inasmuch as he does provide a basis for distinguishing between certain ways of specifying objects, one that seems to make a compelling case for the essentialism that Quine questions. He argues that there is good reason to regard some ways of specifying objects as applying necessarily to the object, and other ways as applying only contingently. He does this through his notion of rigid designation.

According to Kripke, certain terms necessarily designate their referents whereas others do so only contingently. He describes terms that necessarily designate their referents as *rigid designators* and those that contingently designate their referents as *nonrigid designators*. Kripke believes that the thesis of rigid designation rests on "an intuition about names" (NN: 6). He defines the notion as follows: "Let's call something a *rigid designator* if in every possible world it designates the same object, a *nonrigid* or *accidental designator* if that is not the case" (NN: 48). This definition can even be used

as an "intuitive test" for rigidity (NN: 48). That is, if we want to see if a term is rigid or not, we imagine possible worlds and see whether the term designates the same object in every possible world. Scott Soames sharpens Kripke's intuitive test to read:

> A singular term *t* is a rigid designator iff *the individual who is t could not have existed without being t, and no one who is not the individual who is t could have been t* is true; otherwise, *t* is nonrigid (2005: 16).

Take, for example, the description 'The first Prime Minister of Canada'. This term refers to John A. MacDonald, but John A. could have existed without being the first Prime Minister of Canada. The description 'The first Prime Minister of Canada' is, then, a nonrigid designator. The term 'John A. MacDonald', however, is rigid since John A. could not have existed without being John A (i.e., himself).

Kripke maintains that names are rigid designators and descriptions (typically) are nonrigid.[9] Take whichever name you want and a description that refers to the same object, you will find that the name is rigid and the description is (typically) nonrigid. Kripke uses Richard Nixon as an example. Clearly, Nixon could not have existed without being Nixon, and nobody else can be Nixon but Nixon. Thus, the name 'Nixon' is a rigid designator. Of course, we can imagine a world where Nixon is not called 'Nixon', but the arbitrariness of being given a certain name does not pose a problem for the notion of rigid designation. All that matters for rigid designation is what the object is *actually* named. Scott Soames explains:

> If *t* is rigid, then whatever object is actually designated by *t* is designated by *t* with respect to all possible states of the world in which that object exists, and nothing other than that object is designated by *t* with respect to any world-state (2003: 342).

Since Nixon is actually called 'Nixon', the name 'Nixon' is a rigid designator.

[9] Kripke admits that some descriptions, for example certain mathematical terms, are rigid designators. On this point, see Soames (2003: 342).

However, it is easy to imagine a case where the description, 'The President of the United States in 1970', is not true of Richard Nixon. In fact, for almost any description we think of that applies to Nixon, we can imagine a situation where that description does not apply. For example, we can easily imagine situations where Nixon is not a Republican, where he is not the successor of Lyndon Johnson, where he is not the scoundrel who occupied the White House between 1969 and 1974, and where he is not the husband of Thelma 'Pat' Ryan. There are some descriptions, however, that seem to always hold of Nixon. For example, we cannot imagine a world where Nixon is not human (assuming that he is in fact human) and neither can we imagine a world where Nixon is not his parents' son. Such examples are few and far between, though. Descriptions are typically nonrigid designators.

According to Kripke, the phenomenon of rigid designation shows that there is a philosophically important distinction between names and descriptions, and Kripke offers several arguments to further support this thesis. One argument focuses on a statement made by Ludwig Wittgenstein. In section 50 of the *Philosophical Investigations*, Wittgenstein says:

> There is one thing of which one can say neither that it is one meter long nor that it is not one meter long, and that is the standard meter in Paris. But this is, of course, not to ascribe any extraordinary property to it, but only to mark its peculiar role in the language game of measuring with a meter rule (NN: 54).

Drawing on this claim, Kripke asks not whether we can say that stick *S* is one meter long, but whether the statement 'stick *S* is one meter long' is a necessary truth. Kripke believes that it is not a necessary truth, and that the notion of rigid designation helps us to see why this is the case. He says that even if we stipulate that "one meter is to be the length of *S*

at a fixed time t_0", the statement is still contingent. This is because 'stick *S* is one meter long' is used to fix the reference of 'meter'. The man who fixes the referent of 'meter' with this description can still maintain that if heat were applied to the stick at t_0 it would not have been one meter long. The man can do this because of the differences between names and descriptions.

> Even if this is the *only* standard of length he uses, there is an intuitive difference between the phrase 'one meter' and the phrase 'the length of *S* at t_0'. The first phrase is meant to designate rigidly a certain length in all possible worlds, which in the actual world happens to be [contingently] the length of the stick *S* at t_0. On the other hand, 'the length of *S* at t_0' does not designate anything rigidly (NN: 55).

We can imagine possible worlds where the length of *S* is other than a meter – in these worlds, the stick is shorter or longer than it is in the actual world. However, the name 'meter' designates the same length in all possible worlds – that is, whatever the length of *S* is in the actual world, the name 'meter' designates that length in all possible worlds.

> There is no conflict between that counterfactual statement and the definition of 'one meter' as 'the length of *S* at t_0', because the 'definition', properly interpreted, does *not* say that the phrase 'one meter' is to be *synonymous* (even when talking about counterfactual situations) with the phrase 'the length of *S* at t_0', but rather that we have *determined the reference* of the phrase 'one meter' by stipulating that 'one meter' is to be a *rigid* designator of the length which is in fact the length of *S* at t_0 (NN: 56).

We fix the reference of 'meter' with the description 'length of *S* at t_0', but there is an important philosophical difference between these two terms. The name 'meter' denotes the same length in all possible worlds, but the description 'length of *S* at t_0' denotes different lengths in different possible worlds. The notion of rigid designation enables us to see why the statement 'stick *S* is one meter long' is not a necessary truth, and by doing so supports the philosophical plausibility of rigid designation.

Another argument Kripke advances in support of rigid designation concerns Aristotle. Here he claims that the failure to distinguish between names and descriptions gets the "modal facts" wrong (Fitch 2004: 34). On Quine's view, recall, descriptions such as 'the teacher of Alexander the Great' and 'the last great philosopher of antiquity' are referentially no different from the name 'Aristotle'. Each term denotes (for Quine) the same thing, namely Aristotle. Kripke points out, though, that we can imagine worlds where Aristotle does not fit any of these descriptions. In such worlds, however, Aristotle still remains Aristotle.

> Not only is it true *of* the man Aristotle that he might not have gone into pedagogy; it is also true that we use the term 'Aristotle' in such a way that, in thinking of a counterfactual situation in which Aristotle didn't go into any of the fields and do any of the achievements we commonly attribute to him, still we would say that was a situation in which *Aristotle* did not do those things (NN: 62)

The name 'Aristotle' is a rigid designator: we cannot imagine a world where Aristotle is not Aristotle. However, we can imagine worlds where the descriptions typically associated with 'Aristotle' do not hold. "Because the descriptions can designate someone other than Aristotle in different counterfactual situations, descriptions are not rigid designators" (Fitch 2004: 38). The Aristotle example thus further supports Kripke's rigidity thesis and his claims that there is a philosophically important distinction between names and descriptions.

Yet another argument Kripke advances to support the rigidity thesis concerns Kurt Gödel. Kripke explains that Gödel is known to most people as the man who proved the incompleteness of arithmetic. The name 'Gödel' and the description 'the man who proved the incompleteness of arithmetic' denote the same man, namely Gödel. But Kripke asks us to imagine that Gödel did not prove the incompleteness of arithmetic and

that instead a man named ‘Schmidt’ did it but died before he could either publish it or even tell anybody about it. Gödel discovered the work that Schmidt had done, published it as his own, and became famous for what is actually Schmidt’s work. If this were in fact the case, the terms ‘Gödel’ and ‘the man who proved the incompleteness of arithmetic’ would refer to different men. Whereas in the actual world the name ‘Gödel’ and the description ‘the man who proved the incompleteness of arithmetic’ refer to the same thing, there are possible worlds where this is not the case. In some possible worlds the description refers to Schmidt, but the name refers to Gödel in every possible world – a fact which further supports the phenomenon of rigid designation and shows that there is a philosophically important distinction between names and descriptions.

The notion of rigid designation gives philosophical justification to the distinction between names and descriptions and reinforces Smullyan’s strategy which shows that modal contexts are not, after all, referentially opaque. Looking again at Quine’s argument in light of Kripke’s definition of rigid designation, it is clear that ‘9’, like all names, is a rigid designator while ‘the number of planets’, like most descriptions, is not. This explains why we cannot substitute ‘the number of planets’ for ‘9’ in modal contexts *salva veritate*. The statement

(14) Necessarily, 9 is greater than 7

is true. The following statement

(16) 9 = the number of planets

is also true, but here some caution is called for. The statement is true in this world but false in some possible worlds. The description ‘the number of planets’ denotes 9 in our world, but in different worlds there are any number of planets – e.g. 2, 4, 11 – and in

those worlds statement (16) is false. This supports Smullyan's claim that it is invalid to infer the (*de dicto*) statement,

(17) Necessarily, the number of planets is greater than 7.

Because the terms '9' and 'the number of planets' differ with respect to their rigidity (as do names and descriptions generally), Quine errs in treating descriptions as if they were names. The phenomenon of rigidity shows that Quine is unjustified when he rejects Smullyan's response on the grounds that it "depends on positing a fundamental division of names into proper names and (overt or covert) descriptions" (RM: 154). Recognizing the rigidity of proper names also vindicates Smullyan's claim that Quine's argument would be sound if he used a name denoting 9 instead of the description 'the number of planets'. For example, using the name 'IX', the argument reads:

(14) Necessarily, 9 is greater than 7

(16b) 9 = IX

(17c) Necessarily, IX is greater than 7

But this argument is valid and poses no challenges to the proponent of modality, because 'IX' is a rigid designator and conclusion (17c) is true.

The phenomenon of rigid designation also helps to resolve the difficulties that Quine identifies with quantified modal logic. He maintains that existential generalization cannot be applied to the statement

(14) Necessarily, 9 is greater than 7

because the resulting quantified (*de re*) statement,

(26) $\exists x (\Box Gx)$

is nonsensical – referring to the number with the term '9', statement (26) is true, but referring to the number with the term 'the number of planets', the statement is false. However, Quine's challenge is answered once we recognize rigid designation. The name '9' rigidly designates 9 – that is, it designates 9 in all possible worlds. The description 'the number of planets' designates 9 nonrigidly – that is, in some possible worlds the description does not refer to 9. The number of planets is not necessarily greater than 7. Only terms that rigidly designate 9 can be used in place of *x* in statement (26), which makes the statement perfectly sensible.

Conclusion

Kripke's notion of rigid designation provides a philosophical justification for the basic strategy that Smullyan pursued years before in response to Quine's referential opacity argument. According to Kripke, Quine's argument fails because he refuses to differentiate between names and descriptions, which in fact do have different modal status. Names rigidly designate their objects, whereas descriptions (generally) designate their objects nonrigidly. What is more, Quine seems compelled to adopt a modal logic as his language of science so as to express the distinction between rigid and nonrigid designators and capture the ontological commitments they imply. Quine, however, thinks that the phenomenon of rigidity is irrelevant to ontology and doubts that it provides any grounds for adopting a modal logic as the regimented language of science. In the next chapter I examine Quine's theory of reference, discuss how it informs his referential opacity argument and explain why it leaves him unconvinced by Kripke's attempt to justify the metaphysics of modality.

Chapter 3:

A Quinean Response to Kripke's Rigid Designation

As noted in the previous chapter, Kripke employs the notion of rigid designation in responding to Quine's claim that the metaphysics of modality requires us to make a spurious distinction between names and descriptions. Kripke argues that names are rigid designators while descriptions are (generally, but not always) nonrigid – a point which seems to vindicate the notion of a modal distinction between names and descriptions. Aside from helping to justify the metaphysics of modality by showing that, contra Quine, the distinction between names and descriptions is perfectly legitimate, the phenomenon of rigidity seems to suggest that Quine should adopt a modal logic in order to clarify the ontological commitments of our theory of the world – that is, it suggests that he should adopt a modal logic in place of first order predicate logic as his regimented language of science so as to capture the ontological commitments (e.g., possible worlds) that rigid designation involves.

Quine, however, rejects Kripke's claim that the phenomenon of rigidity provides grounds for accepting modal metaphysics. He thinks the distinction between rigid and nonrigid designators is referentially insignificant and sees no place for rigidity in reconstructed theory. All this follows from the methodological constraints Quine abides by – empiricism, regimentation, physicalism and simplicity – and their epistemological basis. Quine outlines the aim of his project at its most general level as follows:

> I have sought a clearer view of the connections, logical and causal, between stimulation, language, and the natural world that language purports to describe. I have sought a clearer notion of why natural science

> turns out under experiment to be so largely true, and how much of it is imposed by man and how much by nature (Quine in Pyke).

As we saw in Chapter 1, Quine's central concern is to come to an understanding (based on knowledge of contemporary science, rightly reconstructed) of the relation between evidence and theory – that is, understanding how it is that we might construct our theory on the basis of the stimulations of our sensory receptors and discerning how much of our theory is of our own making as opposed to how much is imposed by the world that our science is about. Reference is an important part of this project – coming to understand "the development and structure of our own referential apparatus" (WO: ix). Quine wants to understand how it is that we come to posit the objects of our theory, and he does this by providing an account of the referential development of the normal English speaking human child. He also wants to clarify the ontological commitments of our theory, and he does this by means of a regimented language. Both of these lines of investigation help him to discern the ontology of science – the simplest ontology our theory must adhere to without sacrificing its predictive success. At no point in his account of the psychogenesis of reference does he see any need to employ the notions of necessity or contingency, nor does he see any reason to employ these notions in his regimented language of science. What is more, he also sees no need to recognize names or their purported rigidity – central elements in Kripke's reply to his challenge to modal metaphysics – as an ontologically significant feature of language and neither does he assign any epistemological status to the phenomenon of rigidity, as it plays no role in scientific epistemology and ontology as he understands it.

In this chapter, I examine Quine's account of reference in order to shed light on the considerations that motivate his rejection of rigidity. I argue that, from Quine's point

of view, Kripke's justification of the distinction between co-referential terms (usually names and descriptions) is unsuccessful because the phenomenon of rigidity is ontologically superfluous – the reconstructed language of science can express all the truths of our theory without it. In the first section I review Kripke's notion of rigid designation before outlining Quine's account of the psychogenesis of reference. Quine's account takes the pronoun to be primary to our referential apparatus in the sense that it is the singular term[10] that must be mastered before we can be said to refer at all and that it is the only singular term required to express the truths of theory – points which undermine distinguishing between names and descriptions by making them redundant to reference. This insight into the importance of the pronoun is carried over into the next section where I discuss the second aim of Quine's theory of reference – the clarification of the ontological commitments of theory – and his reasons for omitting Kripke's rigid designators from his language of science. I explain Quine's dismissal of our intuitions about rigidity through a consideration of his rejection of ordinary language in favour of a regimented idiom that takes the formal analogue of the pronoun (the variable) as its sole singular term. I then discuss Quine's choice of notation and his elimination of singular terms other than the variable. Addressing the question whether predicates may be rigid, I explain that rigidity has no place in Quine's reconstructed language of science because he thinks transworld identification is too problematic for possible worlds to be of any theoretical use – a consequence of his criterion of ontological commitment and physicalism. This chapter shows that Kripke's notion of rigid designation neither offers

[10] In this chapter I follow Quine's usage in *Word and Object*, where he refers to pronouns and variables as singular terms. This usage largely disappears in his later work.

Quine any reason to accept modal metaphysics nor provides compelling grounds on Quine's terms for abandoning his preferred regimented language of science.

Section 1: The Pronoun and Quine's Psychogenetic Project

Kripke's notion of rigid designation is part of a theory of reference that he develops in opposition to what he calls the 'Frege-Russell' (hereafter 'FR') view of reference. This view holds that "a proper name, properly used, simply [is] a definite description abbreviated or disguised" (NN: 27). For example, the name 'Wilfred Laurier' might be an abbreviation of the description 'the seventh Prime Minister of Canada'. What is more, the FR view holds that the description that a name abbreviates fixes the meaning of the name and determines its reference. That is, the description 'the seventh Prime Minister of Canada' is the meaning of the name 'Wilfred Laurier' ('Wilfred Laurier' simply means 'the seventh Prime Minister of Canada') and the description determines the reference of the name ('Wilfred Laurier' refers to whoever is the seventh Prime Minister of Canada).

Throughout *Naming and Necessity* Kripke offers several arguments to show that the FR theory of reference is false – that descriptions neither give the meaning of names nor determine their reference. These arguments lend support to his thesis that names are rigid designators. Some of these arguments were reviewed in the previous chapter. For example, his "modal argument" (Fitch 2004: 34), which concerns Aristotle, shows that descriptions do not give the meaning of names. On the FR view, the description 'the teacher of Alexander the great' might be the meaning of the name 'Aristotle'. However, we can imagine worlds where Aristotle does not fit this description (or any description

that we commonly associate with him) and it is even conceivable that the actual world is one of them. In these worlds, however, 'Aristotle' continues to designate Aristotle.

> Not only is it true of the man Aristotle that he might not have gone into pedagogy; it is also true that we use the term 'Aristotle' in such a way that, in thinking of a counterfactual situation in which Aristotle didn't go into any of the fields and do any of the achievements we commonly attribute to him, still we would say that was a situation in which *Aristotle* did not do these things (NN: 62).

Because 'Aristotle' continues to designate Aristotle even when he fits none of the descriptions commonly associated with him, the descriptions do not give the meaning of the name 'Aristotle'. Whatever the meaning of 'Aristotle' is, it appears that it is not any of the descriptions associated with the name – and so the FR claim that descriptions give the meaning of names is false. What is more, it appears that the name 'Aristotle' is a rigid designator because it designates the same man (Aristotle) in all possible worlds (where Aristotle exists).

Another claim of the FR view is that descriptions determine the reference of names. Kripke advances his "semantic argument" (Fitch 2004: 39), which concerns Kurt Gödel, to show that this contention is false. On the FR view, the description 'the man who proved the incompleteness of arithmetic' determines the reference of the name 'Gödel'. Kripke asks us to imagine that a man named Schmidt actually proved the incompleteness of arithmetic but that the proof was stolen by Gödel who published it as his own. In such a situation, Gödel is not the man who proved the incompleteness of arithmetic but the name 'Gödel' still refers to Gödel. If the FR view were correct the name 'Gödel' should refer to Schmidt, since he is the man who satisfies the description 'the man who proved the incompleteness of arithmetic'. This example shows that the FR view of reference is wrong to hold that descriptions determine the reference of names.

What is more, this example suggests that names are rigid designators ('Gödel' always refers to Gödel) while descriptions are (generally) nonrigid ('the man who proved the incompleteness of arithmetic' refers to Gödel in some worlds and Schmidt in others).

Kripke sees the reference of names as determined through an initial "baptism" (NN: 96). A speaker decides to call some object by a certain name – for example, Richard Feynman's parents name him 'Richard Feynman' – and this name is passed along from person to person. "A speaker who is on the far end of this chain, who has heard about, say Richard Feynman, in the market place or elsewhere, may be referring to Richard Feynman even though he can't remember from whom he first heard of Feynman or from whom he ever heard of Feynman" (NN: 91). The speaker might know nothing about Feynman – he associates no description with the man – that could serve to specify him apart from other physicists (for example, the speaker might only know that Feynman is a famous physicist) but his use of the name 'Feynman' designates the man nonetheless. There is no need to associate any description with the name in order for the name to refer – "instead, a chain of communication going back to Feynman himself has been established, by virtue of his membership in a community which passed the name on from link to link" (NN: 91). The name passes from person to person, and the reference of the name is determined by the initial baptism and by each speaker using the name to refer to the same object as the speaker from whom he learned it. The descriptions commonly associated with some name can all be shown not to hold of the object in question and the name will continue to refer to the object.

Kripke believes that the falsity of the FR theory and the truth of his picture of reference have wide-ranging implications not only for philosophy of language but for

epistemology and metaphysics as well. He also thinks that his investigations into reference have bearing on the work of philosophers not usually seen as adhering to this theory of reference – one such philosopher being Quine. He says:

> When I speak of the Frege-Russell view and its variants, I include only those versions which give a substantive theory of the reference of names. In particular, Quine's proposal that in a 'canonical notation' a name such as 'Socrates' should be replaced by a description 'the Socratizer' (where 'Socratizes' is an invented predicate), and that the description should then be eliminated by Russell's method, was not intended as a theory of reference for names but as a proposed reform of language with certain advantages. The problems discussed here will apply, *mutatis mutandis*, to the reformed language; in particular, the question, 'How is the reference of 'Socrates' determined?' yields to the question, 'How is the extension of 'Socratizes' determined?' Of course I do not suggest that Quine has ever claimed the contrary (NN: 29, note 5).

Quine refuses to acknowledge that the distinction between names and descriptions has ontological import – for him, names and descriptions are simply singular terms and there is no reason to distinguish between them in the referential opacity argument or anywhere else. As we saw in Chapter 2, Smullyan responds to the referential opacity argument by distinguishing between *de dicto* and *de re* readings of the statement

(1) The number of planets is necessarily greater than 7.

On the *de dicto* reading, namely

(2) $\Box \exists x\,(Gx \,\&\, \forall y\,(Gy \rightarrow x = y) \,\&\, Fx)$,

where '*G*' is 'the number of planets' and '*F*' is 'greater than 7', the statement is false but does not follow from Quine's premises. On the *de re* reading, namely

(3) $\exists x\,(Gx \,\&\, \forall y\,(Gy \rightarrow x = y) \,\&\, \Box\, Fx)$

the statement follows from Quine's premises but is true. On either reading there is no modal paradox. Quine objects to Smullyan's response on grounds that it "depends on positing a fundamental division between names into proper names and (overt or covert)

descriptions" and that it "means adopting an invidious attitude toward certain ways of uniquely specifying *x* […] as somehow better revealing the 'essence' of the object" (RM: 154, 155) – he sees no justification for distinguishing between names and descriptions in the manner Smullyan is proposing and he rejects essentialism. However, if Kripke's reflections on the nature of reference are correct, Smullyan's strategy is vindicated: there is a referential distinction between names and descriptions because names designate the same object in all possible worlds while descriptions (generally) do not. If names and descriptions differ with respect to their rigidity then Quine's refusal to recognize a referential distinction between them is misguided and one of his challenges to the metaphysics of modality (the other being the rejection of essentialism) has been answered. Recognition of the rigidity of names and the nonrigidity of descriptions helps us see that modal contexts are not referentially opaque and that Quine's objections to the metaphysics of modality are unfounded. What is more, the existence of rigidity suggests that Quine should adopt a modal logic as his reconstructed language of science so as to capture this feature of language.

Quine, however, remains unmoved by Kripke's arguments. He has his own account of reference that sees no reason to distinguish between rigid and non-rigid designators and takes names to be mere "frills" (PL: 25) – they are unnecessary in his reconstructed language of science in which the pronoun (or variable) is taken to be the only singular term required to express the ontological commitments of theory.

Quine deals with questions of reference naturalistically, from within our evolving scientific theory. He draws on the findings of natural science when accounting for the development and structure of our referential apparatus. As noted in Chapter 1, he thinks

that it has been firmly established by scientific research – and takes it to be one of the central tenets of current science – that we have nerve endings and that we come to know about the world through the stimulation of these nerve endings. Quine wants to know how speakers come to posit objects given the stimulation of their nerve endings. He calls his account of this positing of ontology the *psychogenesis of reference*. Understanding this psychogenesis enhances our "understanding of reference itself, and of ontology: of what it means to posit something" (RR: 84). Investigating the psychogenesis of reference helps us to understand how we refer to objects and informs the most general pursuit of Quine's project – understanding the relationship between evidence and theory. "By exploring [the psychogenesis of reference], science can in effect explore the evidential relation between science itself and its supporting observations" (RR: 37). By providing insight into the evidence-theory relation, the psychogenetic project contributes to clarifying "the connections, logical and causal, between stimulation, language, and the natural world that language purports to describe" (Quine in Pyke) – which helps us to understand how we posit objects on the basis of stimulation. Quine's psychogenetic account says that it is neither names nor descriptions but the pronoun that is central to the referential apparatus of science: it is the locution the child must learn in order to refer and the only singular term the child need learn in order to master the referential apparatus of science – facts which undermine drawing an ontologically relevant distinction between names and descriptions. Quine's ability to give an account of the psychogenesis of reference without making use of the notion of rigidity suggests that the phenomenon of rigidity is insignificant to ontology and that the application of rigidity to his language of science is not as straightforward as Kripke believes.

Quine's psychogenetic account of reference is not intended to discover the neural or psychological mechanisms at work when we come to refer (though he ultimately desires a neurological account). Rather, it is a part of his investigation into the epistemology of evidence – Quine reconstructs the linguistic development of the normal human child in the simplest manner possible (simplicity being a central tenet of the scientific worldview and naturalized epistemology) so as to better understand the relation of evidence to theory and determine how, on the basis of the available evidence, we come to posit objects. He "speculate[s] on the steps by which the child might progress from that primitive stage [i.e., having no competence in English] until we are satisfied by his easy communication with us that he has mastered our apparatus of reference" (RR: 83). By analyzing how the child comes to refer to objects from the basis of the stimulation of his or her sensory receptors – an investigation limited to behavioural evidence – Quine first of all learns that these objects are in fact posits, but he also comes to better understand what it means to posit objects. When discussing the development of the child's acquisition of our referential apparatus, Quine says:

> The child learns this apparatus by somehow getting a tentative and faulty command of a couple of its component devices, through imitation or analogy perhaps, and then correcting one against the other, and both against the continuing barrage of adult precept and example, and going on in this way until he has a working system meeting social standards. This is a vague picture of how it has to be. I want a less vague picture (RR: 84).

There is already general knowledge of how the child learns language. Having no innate mastery of English the child must first grasp the basic features of the English language – for example, its syntax and morphology – and develop and build upon this knowledge in becoming a competent English speaker. Quine wants to fill out the general outline of

language learning with a clearer and more detailed account that increases our understanding of the development of the referential apparatus of science. He starts with a description of language learning at the level of behaviour but ultimately desires an account in purely physiological terms – thus his investigations into the psychogenesis of reference remain naturalistic and within the confines of his physicalism (another central tenet of scientific epistemology) by not positing non-physical entities.

Whereas many philosophers throughout history have seen words as the fundamental building blocks of language, Quine's account of language learning takes sentences to be basic. Of course, at the beginning of the child's life, he does not speak at all. His responses to stimulation consist in inarticulate cries. Eventually, however, he makes noises that resemble English words. At this stage, the child is rewarded for making appropriate utterances, and this reinforces his behaviour and leads him to repeat the utterance when exposed to similar stimulation. Although these utterances might seem to be words, they do not refer and so are not words – they are sentences. Quine describes how the child may come to utter one of his very first sentences, 'Mama':

> The operant act may be the random babbling of something like 'Mama' at the moment when, by coincidence, the mother's face is looming. The mother, pleased at being named, rewards this random act, and so in the future the approach of the mother's face succeeds as a stimulus for further occurrences of 'Mama'. The child has learned an occasion sentence (WO: 81).

Quine's reflections on these early stages of language learning show the primacy of sentences – *observation sentences* – as opposed to terms (despite the fact that Mama believes the child to be naming her). These are the sentences of theory most "directly and firmly associated with our stimulations" (PT: 3). As noted in Chapter 1, they are *occasion sentences* because unlike statements such as 'John A. MacDonald is the first

Prime Minister of Canada', they are true on some occasions and false on others – in this way, they resemble the sentences 'It's raining' or 'Lo, a rabbit'. When the child first utters 'Mama' he is not, in fact, referring to his mother – he is not uttering a word. The child has not yet developed the linguistic machinery required to individuate objects, which involves locutions such as the definite and indefinite article and above all the use of the pronoun – his verbal behaviour reveals that he has not mastered those locutions. If he utters those terms at all his use is inconsistent and random or simply incorrect (e.g., he might say '*the* car is red' on some occasions but simply 'car is red' on others, or he might incorrectly say '*the* Mama'). His utterance of 'Mama' is an observation sentence, similar to 'Mama here', 'Mama now' or 'Lo, Mama'. The child's verbal behaviour provides no evidence for taking 'Mama' to be a name at this stage and neither does his behaviour provide evidence to suggest that he uses 'Mama' (incorrectly) as a general term – such as a count noun or a mass noun. In short, there is no evidence to suppose that he individuates Mama.

When the child first says 'Mama', he has stimulations not only of Mama but of many other things as well – say, the blue dress she is wearing, the rattle she is holding, and a light breeze. All of these stimulations are part of the observation sentence's *affirmative stimulus meaning*, where stimulus meaning is "[t]he range of stimulations associated with an observation sentence, affirmatively or negatively" (PT: 3). The affirmative stimulus meaning of 'Mama' is the class of all stimulations that prompt the child to assent to 'Mama?', and the negative stimulus meaning is the class of all stimulations that prompt dissent in response to the query (WO: 32). When uttering 'Mama' the child cannot – until we have behavioural evidence that he is doing so – be

said to discriminate between the mother, the dress, the rattle and the breeze, as at this stage they all form part of the affirmative stimulus meaning. But the stimulus meaning of 'Mama' gradually becomes for the child more and more precise. Subsequent utterances of 'Mama' are rewarded although no breeze is present, the mother holds no rattle and she wears red. The narrowing of the stimulus meaning is further reinforced by the lack of reward for uttering 'Mama' when there is stimulation of breeze but not of Mama.

> The tendency so to respond to subsequent breezes will die out for lack of further reward on later occasions; the tendency so to respond to the heard word 'Mama', however, will continue to be rewarded, for everyone will applaud the child's seeming mimicry (WO: 81).

Through the process of stimulus, response and reward the child learns the entering wedges into language (or *could* learn – not all observation sentences are learned by ostension but they could be learned in this way) – he learns precisely when and when not to utter 'Mama' and other observation sentences.

Although the child becomes more adept at learning utterances and comes to learn ever more utterances, it is some time before he can be said to refer to objects. It is some time before the utterances of the words 'Mama', 'red' and 'water', for example, cease being merely observation sentences and refer.

> [T]he mother, red, and water are for the infant all of a type; each is just a history of sporadic encounter, a scattered portion of what goes on [around him]. His first learning of the three words is uniformly a matter of learning how much of what goes on about him counts as the mother, or as red, or as water (WO: 92).

The child has not yet developed the linguistic devices required to individuate the mother as a body – like water and red, Mama is not an object but a passing feature of the environment. The child merely perceives successive occurrences of Mama (much like feeling successive breezes on one's skin), and having no command of definite articles or

pronouns there is no evidence that he recognizes the same Mama every time. The child uses 'Mama' in response to certain stimulations, but the term does not signify an object – it remains akin to the competent speaker's utterance of 'It's raining' in that it lacks individuation.

> For the very young child, who has not got beyond observation sentences, the recurrent presentation of a body is much on par with similarities of stimulation that clearly do not prompt reification. Recurrent confrontation of a ball is on par at first with mere recurrent exposure to sunshine or cool air: the question whether it is the same old ball or one like it makes no more sense than whether it is the same old sunbeam, the same old breeze (PT: 24).

There is no evidence to suggest that the child views Mama any differently than he views sunshine or cool air – experiences that do not prompt reification. There is simply no behavioural evidence that the child refers at this stage (as opposed to simply uttering observation sentences) and to maintain that he does in fact refer "would be to impute our ontology to him" (RR: 82) – something that Quine is unprepared to do as his account of reference must adhere to the same standards as any scientific theory, one of the principal standards being the refusal to accept theories without evidential support. At this stage the evidence suggests that the child merely "discriminates", or "recognizes" conditions that call for Mama as a response, but does not refer to her (RR: 82). This implies similarity among the occasions of use but not that there is a single object in each case being responded to.

In due course, however, the child does come to posit bodies and refer, and when this happens, his utterance 'Mama' is no longer a sentence but a term. He learns how to individuate objects, i.e., to discern when one object leaves off and another begins. This is essential to reference, since, for example, "[t]o learn 'apple' it is not sufficient to learn

how much of what goes on counts as apple; we must learn how much counts as *an* apple, and how much another" (WO: 91). The child has to learn which bodies count as apples, or Mama, or Fido in order to be said to refer when he utters 'apple' and 'Mama' and 'Fido'.

It is difficult to discern at what point the child can be said to refer. He is certainly well on his way once he begins using definite and indefinite articles as well as plural endings – *the* dog, *an* apple, toys – but Quine believes that the child has clearly posited bodies and is referring when he utters focal observation categoricals. These are refinements of observation categoricals, namely (as we saw in Chapter 1) two (or more) observation sentences combined in a 'Whenever this, that' type of construction (PT: 10). For example, the statement

(4) Whenever Mama watches the show, Mama laughs,

is an observation categorical. Uttering statements of such syntactic complexity is a great linguistic achievement for the young child, but nevertheless he cannot be said to refer when he utters (4). This is because the child could master statements like (4) without having the notion that Mama is one object – the utterance of 'Mama' in each clause could simply be in response to different Mama-like stimulations without any positing of the body Mama. For example, the sentence could be interpreted as follows:

(4a) Whenever there is Mama-stimulation of watching the show, there is Mama-stimulation of laughing.

In this statement, the child is not referring to Mama or to stimulations; he has posited nothing but is simply responding to stimulations. The child can be said to refer, however,

once he uses pronouns in observation categoricals. Quine calls such sentences *focal* observation categoricals, and the following is an example:

(5) Whenever Mama watches the show, she laughs.

Unlike the observation categoricals (as shown in (4) and (4a)) where the child may not be speaking of a single body but merely responding to different stimulations, in focal observation categoricals the child has clearly posited a body, as is evidenced by his use of the pronoun (e.g., 'she'). Unlike sentence (4), the focal categorical (5) "is not compounded of two self-sufficient observation sentences" (PT: 11). The term 'she' in (5) refers back to the term 'Mama', and without the antecedent clause the subsequent one would be unintelligible. Because the pronoun in the subsequent clause must refer back to 'Mama' in the antecedent clause it is clear that the child is speaking of one and the same object in both clauses. "The component observation sentences [in (5)] have to bear not just on the same scene, this time, but on the same part of the scene, the same [woman]" (PT: 11). It is a single body (Mama) that watches the snow and laughs. When the child begins uttering sentences like (5) we can be sure that he is individuating the terms he uses, at least the terms cross-referenced in such categoricals. At this point, the child has posited bodies and his utterances of such terms as 'Mama', 'Rattle' and 'Dress' can be said to refer (provided there is no evidence to suggest otherwise). Quine's psychogenetic account shows that the pronoun is basic to our referential apparatus. Without our use of the pronoun, we would have no reason to believe that responses to stimulations actually posit objects – central components of our theory of the world. The pronoun is the first construction mastery of which definitely demands denotation as a capacity. The psychogenetic account reveals the importance of the pronoun and focal observation

categoricals to understanding the relationship between stimulation and theory – but it also suggests that names and descriptions are referentially insignificant and that there is no reason to speak of rigid designation in accounting for reference. Having provided an account that takes mastery of the pronoun to be the central step in the psychogenesis of reference, Quine proceeds to argue that the pronoun is the only singular term the child need learn in order to master the referential apparatus of science.

Quine sees the pronoun as occupying a special place in our referential apparatus because unlike names and descriptions (which often convey additional information) its only function is to designate objects. He illustrates the primacy of the pronoun to reference by analyzing a common French construction. In French it is common to denote the object of a sentence "in a prefatory phrase before the grammatical subject is broached" (VPR: 165), as in the sentence:

(6) Ma pauvre tante, elle ne sort jamais.

Quine sees the phrases 'Ma pauvre tante' and 'ne sort jamais' as characterizing the object referred to because the pronoun 'elle' is all that is required to specify the object – a fact which Quine believes is (however dimly) recognized by the French speaker. "The French speaker is at pains to strip away all the information, identificatory and ampliative alike, and designate his protagonist by a purely referential, utterly uninformative *elle*" (VPR: 165). The phrases 'Ma pauvre tante' (the identificatory phrase, which identifies the object) and 'ne sort jamais' (the ampliative phrase, which provides further information about the object) both serve to characterize the object, while the pronoun simply refers to the object unadulterated by informative but ontologically redundant frills (such as the fact that she is somebody's aunt and never gets out). Although the turn of phrase is more

common in French, it is quite naturally (albeit rarely) employed in English as well. We sometimes say:

(7) My poor aunt, she never gets out.

Similar to (6), in this statement the pronoun is all that is required to designate the object, whereas the phrases 'My poor aunt' and 'never gets out' serve to offer ontologically irrelevant information about her. The French construction and its English equivalent illustrate Quine's conviction that the pronoun is the only singular term required to capture the ontological commitments of the referential apparatus of science, but he maintains that the centrality of the pronoun is more definitively seen by the use of the relative clause.

Quine maintains that the pronoun, when conjoined to the relative clause, is the only singular term required by the child to master the referential apparatus of science – it is the only singular term required to express the ontological commitments of theory. Relative clauses are statements beginning with pronouns like 'that', 'which' or 'who', and their intelligibility is dependent upon some antecedent phrase. For example, in the phrase

(8) The philosopher who doubted the existence of the world,

the phrase 'who doubted the existence of the world' is the relative clause. In Quine's view, relative clauses enable the pronoun to be the only singular term the child needs to master our referential apparatus because these clauses can act as general terms and thereby allow him, for any given sentence, to eliminate the noun in object position in favour of a pronoun while keeping the ontological commitments of the sentence intact. For example, Quine explains how by way of the relative clause the child can eliminate the object of the sentence

(9) Quine bought Fido from a man that found him.

The relative clause in this case "enables us to segregate the object from what the sentence says about it" (RR: 89). Replacing the noun 'Fido' with 'that which', and moving the pronoun phrase to the front of the sentence, the child gets the clause:

(10) that which Quine bought from a man that found him.

Even though the clause (10) does not contain the term 'Fido', when it is predicated of an object (e.g., Fido) it designates the dog and is true. Fido is the thing that Quine bought from the man that found him. Although cumbersome in practice, any sentences containing nouns can be transformed in this way – all occurrences of nouns in English sentences can be eliminated in favour of pronouns while denoting the same object(s) as the original sentence and preserving the original sentence's truth value. "Everything that any sentence says about something can be packaged thus in a single complex predicate; such is the relative clause" (VPR: 166). Clause (10) acts as a complex predicate and can figure in regimented statements (with slight variations) such as:

(11) $(\exists x)$ (x was bought by Quine from the man that found x).

Although statement (11) contains no name for Fido, it denotes the dog nonetheless and preserves the truth of the original sentence that contains the name, statement (9). Through mastery of the pronoun and the relative clause the child can express any truth of our referential apparatus – he need not master any names (of course, Quine is making an ontological point here and not recommending pedagogical techniques).

It might be wondered what the significance is of showing that the child need only master the pronoun and the relative clause in order to express the ontological commitments of theory. After all, statements (10) and (11) could be resolved back into

the original source sentence (i.e., the sentence containing the name 'Fido'), a fact which might be seen as suggesting that taking pronouns as the sole singular terms of our referential apparatus is an arbitrary decision – names would work just as well, so why not provide an account whereby the child uses names instead of pronouns and the relative clause? In general Quine answers such challenges by appealing to one of the central tenets of scientific epistemology – simplicity. A name-free language is syntactically simpler than a language that has them. Yet in the case of psychogenesis he has a further response: admitting names to the exclusion of mere pronouns would impede the child's mastery of the referential apparatus of science, because (unlike the case of statements (10) and (11)) not all relative clauses can be resolved back into some source sentence containing a name. "This happens, notably, when the substantivized relative clause 'things which' is used as the subject term of a categorical sentence – thus preceded by 'every' or 'some'" (VPR: 167). For example, the sentence

(12) Some thing has a heart and a kidney,

cannot be expanded into "some great conjunction or alternation of singular sentences" – e.g., 'Fido has a heart and a kidney, Mama has a heart and a kidney', etc. – because "usually we have no exhaustive fund of designations at our disposal for the several things fulfilling the relative clause" (VPR: 167). The child could not have mastered enough names – because there are not enough names – to designate every object that has a kidney and a heart (and even if there were, the sentence would be too long and cumbersome for practical purposes) so sentence (12) cannot be transformed into a single sentence containing names while continuing to designate all the objects in the universe that have a heart and a kidney. Many relative clauses – ones that designate objects for which we do

not have a sufficient fund of names – cannot be resolved back into sentences containing names (and even if they could, they would be too cumbersome). However, the pronoun along with the relative clause can designate any object and preserves the truth of all the sentences of the referential apparatus of science – a point which reinforces Quine's conviction that the child need not master names in order to master the referential apparatus of science. What is more, there seems to be no need to employ rigid designators (names or otherwise) in accounting for the psychogenesis of reference – all that is required is the pronoun and relative clause, and neither of these need be seen as rigid.

Kripke might concede that the pronoun is primary to the referential apparatus of science in the sense that it is the first construction that definitely demands reference, but he would reject Quine's claim that the pronoun is the only singular term the child must learn in order to master the referential apparatus of science and he would reject the claim that rigid designators are not needed in accounting for the psychogenesis of reference. In Kripke's view, the child must also master names because names are rigid designators while relative clauses are not. For example, while the name

(13) Gödel,

and the clause

(14) he who proved the incompleteness of arithmetic,

denote the same man in the actual world, there are possible worlds where they designate different men. The name 'Gödel' designates Gödel in every world where he exists, but clause (14) designates Gödel only in worlds where he proves the incompleteness of arithmetic – and in some worlds, Schmidt proves the theorem. Clearly, then, it is not the

case that the pronoun is the only singular term the child need learn in order to master the referential apparatus of science. He must also master names, because (for the most part) only names refer to the same objects across possible worlds.[11] In Kripke's view, Quine's psychogenetic account of reference is flawed because it fails to note an important fact about our referential apparatus: names refer rigidly whereas (most) relative clauses do not. Moreover, Quine's psychogenetic account contains an ontological assumption: he simply assumes that the actual world is the only world there is and that, consequently, terms only designate objects in the actual world. What is more, since names (which are rigid) cannot be eliminated in favour of pronouns and relative clauses (which are generally nonrigid), Quine's psychogenetic account fails to overcome Kripke's justification for the distinction between names and descriptions.

In order to provide a Quinean response to Kripke's claim that rigid designators (names or otherwise) are indispensable in mastering the referential apparatus of science, we must examine what Quine takes the referential apparatus of science to be. That is, we must examine his regimented language of science and explore in further detail why he thinks rigid designators are superfluous to that language. This we do in the next section.

Section 2: Rigid Designation and Quine's Canonical Notation

Having accounted for the centrality of the pronoun to the psychogenesis of reference, we may now turn to the second aim of Quine's theory of reference: clarifying the ontological commitments of theory by means of a regimented language. He sees no reason to employ modal notions in this language – in fact, he believes that given his

[11] Some relative clauses are rigid, e.g. "that which is the sum of 2 and 2". Like descriptions, however, they are generally nonrigid.

choice of language modal notions are not pertinent to ontology but only to how we characterize objects. What is more, he sees no reason to admit rigid designators into his canonical notation – the very terms that Kripke uses to justify assigning different modal status to names and descriptions. In this section I first examine Quine's rejection of ordinary language – a point which undermines Kripke's reflections on everyday linguistic usage as illustrating the intelligibility of certain modal notions – and his endorsement of regimented language in clarifying the ontological commitments of theory. I then explain why Quine prefers his reconstructed language of science over alternative regimented languages and why he sees no reason to include singular terms (other than variables) in the language. Finally, I explain Quine's belief that transworld identification is too problematic to be of any theoretical use and its bearing on his view that there is no use in admitting rigid designators (whether they be names or predicates) into the reconstructed language of science. From the point of view of Quine's approach to ontology and the tenets that guide his ontological investigations (e.g., simplicity, physicalism, and prediction as the test of truth), Kripke fails to provide a convincing justification for assigning different modal status to names and descriptions.

Similar to any other advanced science, Quine conducts his researches within a special, systematic idiom – regimentation is one of the central tenets of scientific epistemology. Regimented language supplies Quine's standard of ontological commitment as well as his standard of clarity for explication.

> We can very easily involve ourselves in ontological commitments by saying, for example, that *there is something* (bound variable) which red houses and sunsets have in common; or that *there is something* which is a prime number larger than a million. But this is, essentially, the *only* way we can involve ourselves in ontological commitments: by our use of bound variables (OWTI: 12).

When formulated in a regimented language, our ontological claims are unambiguous and clear. The language that Quine chooses as his regimented language – his "canonical notation" – is first-order predicate logic with identity. He maintains that he has to admit only two grammatical constructions into this language: a truth function and the universal quantifier, along with variables (PE: 143), but other constructions are added for the sake of convenience. He admits five truth functions, the existential quantifier, and identity as well (PE: 143).

> [The canonical notation] imposes a new and simple syntax on our whole language, insofar as our logic is to apply. Stripped down to the austere economy that I first described for predicate logic, our simple new syntax is as follows. The parts of speech are: (1) the truth-functional connective, (2) the universal quantifier, (3) variables, and (4) atomic predicates of one and more places (PE: 144).

Though Quine need only admit one truth-functional connective (e.g. the Sheffer stroke) into his language, for the sake of convenience he admits 'and', 'or', 'if…then', 'if and only if' and 'not' (symbolized as '&' 'v' '→' '↔' and '~', respectively), the universal quantifier ('∀') (as well as the existential quantifier '∃', though not stated in the above passage), variables ('*x*', '*y*', '*z*', etc.) and predicates of various places ('*F*', '*G*', etc.).

> The syntactic constructions are: (1) application of a predicate to the appropriate number of variables to form a sentence; (2) prefixture of a quantifier, with its variable, to a sentence; and (3) joining sentences by the truth-functional connective and the adjusting parentheses (PE: 144).

Predicates apply to variables to create open sentences, such as '*Fx*', and when they apply to variables preceded by a quantifier, the result is a closed sentence, such as $\exists x\,(Fx)$. Truth functional connectives and parentheses are used to construct and connect sentences, such as $\forall x\,((Fx \text{ v } Gx) \rightarrow Hx)$.

Given Quine's criterion of ontological commitment, we are committed to the existence of an object if it figures as a value of a variable in the canonical notation. For example, in ordinary language we often make claims such as:

(15) There are red apples.

Formulated in the canonical notation, this statement becomes

(16) $\exists x\,(Fx \,\&\, Gy)$,

where the predicate '*F*' stands for 'is an apple' and the predicate '*G*' stands for 'is red'. Statement (16) commits us to the existence of objects that are apples and red – namely, red apples – because in the absence of such objects the sentence is not true.

> To be assumed as an entity is, purely and simply, to be reckoned as the value of a variable. In terms of the categories of traditional grammar, this amounts roughly to saying that to be is to be in range of reference of a pronoun. Pronouns are the basic media of reference; nouns might better have been named propronouns. The variable of quantification, 'something', 'nothing', 'everything' range over our whole ontology, whatever it may be; and we are convicted of a particular ontological presupposition if, and only if, the alleged presuppositum has to be reckoned among the entities over which our variables range in order to render one of our affirmations true (OWTI: 13).

Quine's investigations into the psychogenesis of reference reveal the primacy of the pronoun for reference and he carries this insight over into the construction of his canonical notation. The pronoun 'it', for example, ranges over all the objects in the universe and specifies some definite object via a singular or general term. For example, the pronouns in the sentences

(17) It is Mama

(18) It is the first Prime Minister of Canada

(19) It is an apple

denote Mama, the first Prime Minister of Canada (John A. Macdonald) and an apple, respectively (presuming 'It' is not accompanied by some pointing to an object that is not Mama, John A. or an apple, which would make the sentences false). In the canonical notation Quine aims to "paraphrase the discourse into the most explicitly referential of locutions; this is where the relative pronoun comes into focus, or, ultimately, the variable" (VPR: 171). In Quine's regimented language the variable plays the role of the pronoun in his account of the psychogenesis of reference. The variable *x* ranges over all the objects in the universe and it denotes some definite object once a value is assigned to it – to be is to be the value of a variable. For example

(17a) ($\exists x$) (*x* is Mama)

(18a) ($\exists x$) (*x* is the first Prime Minister of Canada)

(19a) ($\exists x$) (*x* is an apple)

denote Mama, the first Prime Minister of Canada (John A. Macdonald) and an apple, respectively. Quine paraphrases ordinary and scientific language into his canonical notation and claims that "no theory is fully clear to me unless I can see how this syntax would accommodate it" (PE: 144).

The notion of rigid designation (aside from being a feature of some formal languages) is a thesis about "what we ordinarily call 'names' in natural language" and is grounded by an "intuition about names" (NN: 4, 6). Commentators sympathetic to Kripke have seen the phenomenon of rigidity as a definitive refutation of Quine's refusal to recognize any referential distinction between names and distinctions that would justify adopting a modal logic as the language of science. Leonard Linsky, for example, says that Kripke "holds that true statements of the form *a*=*b* are necessary truths when '*a*' and

'*b*' stand for ordinary proper names and this is a thesis about natural languages" and continues that "[i]f ordinary proper names are rigid designators, then every statement of the form *a=b* is a necessary truth, if true at all, when '*a*' and '*b*' are replaced by ordinary proper names" (1977: 141). The consequence to draw from the phenomenon of rigidity is that Quine's "arguments turning on singular terms turn out to be scope fallacies since they all involve definite descriptions […] All genuine identity-statements are necessarily true, if true at all" (Linsky 1977: 142). More recently, Jason Stanley outlines a possible challenge to the proponent of quantified modal logic (abbreviated as 'QML'):

> [I]f we wish QML to serve as a representation of ordinary modal discourse, then the rigidity constraint on terms may seem problematic. Without a philosophical justification of this restriction, or a semantical argument to the effect that natural-language terms are rigid, then the extra logico-semantical complexities which attend the addition of non-rigid terms into QML will either have to be accepted as realities or used as a basis for rejecting its coherence (1997: 563).

Stanley continues, however, that Kripke demonstrates that ordinary-language proper names are rigid, which responds to the concerns Quine voices in his referential opacity argument (1997: 563, 562). Even more recently, Scott Soames explains the importance of rigidity in responding to Quine's attacks on essentialism in particular:

> [Quine's] objection [to essentialism] relies on a false premise – namely, that there is no non-arbitrary way of selecting, for a given object *o* and property *P* expressed by a predicate *F*, what sort of term *t* designating *o* should be used to construct the statements, *It is necessary that if t exists, then t is F*, upon which the truth or falsity of essentialist claims about *o* depend. Kripke refutes this premise by showing that rigid designators and only rigid designators provide the connection between claims about the necessity of statements, on the one hand, and the essential properties of objects, on the other (2003: 350-351).

That is, the phenomenon of rigidity shows that Quine is wrong to see no referential distinction between the terms '9' and 'the number of planets', for the former is a rigid

designator (it refers to the object 9 in all possible worlds) and the latter is a non-rigid designator (it refers to the object 9 in some, but not all, possible worlds).

However, in contrast to Kripke (and commentators sympathetic to him), who takes the uses of ordinary language (e.g., rigid designation) to be relevant in evaluating the merits of the ontological notions of necessity and contingency, Quine attaches no weight to ordinary linguistic use when conducting ontological investigations. Here he sees himself as no different than the physicist generally who attaches no weight to our ordinary beliefs about the motion or composition of bodies. Of course, he *analyses* ordinary language in order to understand our referential apparatus – this shows him the importance of the pronoun – but in his view the fact that we use certain words as we do (e.g., rigidly or nonrigidly) is irrelevant to the ontology of theory. This is not to say that the locutions of ordinary language do not refer – many of them do. But ordinary language contains many terms that are unclear in their reference or simply do not refer at all.

> Ordinary language is intent on reference. First and foremost its objects are sensible bodies and sensible stuff. Such is its intentness on reference, however, that ordinary language presses its referential idioms far and wide, pursuing the most tenuous analogies […] An ironical effect of this referential expansionism, on the part of ordinary language, is that referential talk in its outer reaches ceases to be felt as seriously referential (VPR: 170).

Quine sees ordinary language as only a "loosely referential structure" (Hylton 2007: 280). Many terms that we routinely use in ordinary language (for example, 'sake', 'unicorn', etc.) simply do not refer, but when speaking ordinary language this failure of reference is often unclear – we are unsure which terms refer and which do not for want of

any built-in criterion. The above passage continues with a clear example of the referential vagueness of ordinary language:

> We say 'There is something about Lucy that fascinates me'; 'Lucy and Sally have only this in common.' In so saying we have no thought of recognizing these intangibles as part of the furniture or our world, nor any thought of what sort of things they might be (VPR: 170).

In saying the sentences

(20) There is something about Lucy that fascinates me

and

(21) Lucy and Sally have only this in common,

we do not give any thought to reifying the something spoken of in each sentence. The ontological commitments of statements (20) and (21) are unclear – does this something commit us to the existence of some property? The canonical notation enables Quine to discern "what to count as reification, and what to count rather as just a useful but ontologically noncommittal turn of phrase" (PT: 25-26) – it enables him to clarify statements (20) and (21) such that we do not have to posit some property for them to have truth value. For example, Lucy's deep blue eyes might be the 'something' that fascinates Quine about her – a trait that is also shared by Sally. In uttering statements (20) and (21) we are committed to Lucy and Sally both having deep blue eyes, not to the existence of the property 'blue-eyed' that both girls purportedly share. This is not to say, however, that Quine is bringing to light some ontology or some criterion of ontological commitment implicit in ordinary language, for he thinks there is none.

> We must recognize […] that a fenced ontology is just not implicit in ordinary language. The idea of a boundary between being and nonbeing is a philosophical idea, an idea of technical science in a broad sense. Scientists and philosophers seek a comprehensible system of the world, and one that is orientated to reference even more squarely and utterly than

> ordinary language. Ontological concern is not a correction of a lay thought and practice; it is foreign to lay culture, though an outgrowth of it (TPT: 9).

In Quine's view, ontology must be systematic, but our ordinary language, despite being rife with reification, is unsystematic. The regimented language is systematic in that it provides a criterion of ontological commitment which applies to the entire language. It is "a notation that is explicit in the matter of reference" (VPR: 171) – it states clearly the ontological commitments of our language. Since ordinary language is not systematic in this sense, the regimented language is the proper idiom in which to state the ontological commitments of our theory. The notation clarifies the ontological commitments of statements like (20) and (21) – what the statements must posit in order to be true.

As in physics generally – which is not beholden to our commonsensical beliefs about the world – Quine is free to depart radically from our ordinary language in constructing his canonical notation, as the concern of the notation is not to remain faithful to our manner of speaking in ordinary or even scientific discourse but to achieve ontological clarity while remaining consistent with predictions and the current state of knowledge – the sentences we hold to be true (though it may also show that certain commonsense beliefs might be wrongly held true, e.g. that there are properties or meanings). "[Quine's] translations are freely created, ontic-orientated analogues of the originals, which can supplant the originals because they share with the originals some partial parallel functions for which the originals were originally wanted" (Gibson 1982: 109). In ordinary language we speak of various objects – e.g., Mama is a woman, some dog is docile, apples are red – and the canonical notation clarifies what we are committed

to when speaking of them. For example, Quine's language paraphrases the sentences as follows:

(22) ($\exists x$) (x is Mama and x is a woman)

(23) ($\exists x$) (x is a dog and x is docile)

(24) (x) (if x is an apple then x is red)

The sentences 'Mama is a woman', 'some dog is docile' and 'apples are red' commit us to the existence of the objects Mama, women, dogs, apples, but not the properties docility or redness (rather, we are committed only to the class of docile objects and the class of red objects – see Chapter 5). As noted in Chapter 1, the explications of the notation are not synonymous with the original expressions. Quine "do[es] not claim to make clear and explicit what the users of the unclear expression had unconsciously in mind all along", and neither do his explications "expose hidden meanings, as the words 'analysis' and 'explication' would suggest" (WO: 258). In paraphrasing the above sentences as (22) – (24), for example, it is irrelevant whether the speakers of the sentences believe properties to exist. In the notation "[w]e fix on the particular functions of the unclear expression that make it worth troubling about, and then devise a substitute, clear and couched in terms to our liking, that fills these functions" (WO: 258-9). The explications are "dictated by our interests and purposes" and "we are free to allow the explicans all manner of novel connotations never associated with the explicandum" (WO: 259). The interests and purposes motivating Quine's construction of the canonical notation are ultimately epistemological – he wants to clarify our ontological commitments (while remaining faithful to the tenets guiding scientific epistemology – simplicity, physicalism, prediction) so as to better understand our knowledge of the world. He is permitted to

depart as radically as necessary from ordinary language in order to achieve these goals because ordinary language is a response to needs other than the pursuit of truth, whereas he stays firmly focused on what the pursuit of truth requires. For this reason he is not obligated to posit properties in the paraphrases (22) – (24) despite the fact that speakers of ordinary language might be compelled to do so. Various phenomena of natural language – e.g. tense, the plethora of non-referential phrases (e.g. 'sake', 'hello') the idiosyncrasies of dialect, and (as we shall see below) names and any other rigid designators as well as modalities generally – simply have no place in the canonical notation because they can be paraphrased away without sacrificing the truths of our theory (suitably reconstructed). The fact that we use names rigidly when speaking ordinary language does not by itself demonstrate the purported distinction between rigid and nonrigid designators should be admitted into the regimented language of science. In order for rigidity to express genuine ontological features of the world rigid designators must be shown to be indispensable to the canonical notation – and Quine, with his rejection of possible worlds, believes that this is not the case.

By rejecting ordinary language in favour of a regimented idiom when conducting ontological investigations, Quine also rejects Kripke's claim that everyday linguistic use shows rigid designation to be an ontologically significant feature of language. By itself the phenomenon of rigid designation provides no support for the notion that rigid designators should be admitted into the reconstructed language of science. In what follows I examine Quine's conviction that rigid designation has no place in his canonical notation. Before doing so, however, I examine why Quine takes first order predicate logic as his preferred regimented language of science and discuss the elimination of

definite singular terms from this language – all of the referential commitments of theory can be clarified through the use of the bound variable. I then explain that Quine rules out the notion that the predicates of his language may be rigid. To show this, I discuss his rejection of possible worlds, a consequence of which is that he views the purported rigidity of certain terms as merely reflecting different ways of denoting objects in the actual world (the only world Quine takes there to be) rather than as revealing an ontological point concerning the denotation of terms across possible worlds. In Quine's view, there is no reason to admit rigidity into the reconstructed language of science and no reason to admit a modal distinction between co-referential terms (or co-extensive predicates).

Quine adopts first-order predicate logic as his canonical notation for several reasons. He thinks the logic is neat and clear (PL: 77) and admires "the efficiency and elegance of the logic of truth functions and quantification" as well as the applicability (and agreement) of various definitions of logical truth in first-order predicate logic, a concurrence "that suggests we have hold of something solid and significant" (PL: 79). In contrast to many proponents of modality who turn to modal logics so as to account for tense, Quine admires first-order predicate logic for its "elimination of tense" (PL: 77). Yet his foremost reason for adopting first-order logic as the language of science is simply that he sees no reason to adopt any other. He maintains that this logic is the syntactically simplest language that suits the purposes and findings of naturalized epistemology and results in a more parsimonious ontology than its rivals while preserving the truths of theory (as defined in terms of predictive success). Quine takes the acceptance of a regimented language as "similar in principle to our acceptance of a scientific theory" in

that "we adopt […] the simplest conceptual scheme into which the disordered fragments of raw experience can be fitted and arranged" (OWTI: 16). His study of the epistemology of science concerns how the "disordered fragments of raw experience" are formulated into theory (an investigation discussed in Section 1 of this chapter, as well as in Chapters 1 and 5) and it suggests to him not only that first-order predicate logic is sufficient to capture the ontological commitments of theory but also that due to the distance of logic from stimulation the choice of logic is largely a practical one and justified in terms of the language's overall fit with the theory. Quine adopts first-order predicate logic because he believes it is the best overall fit with naturalized epistemology – a choice that is in turn justified in terms of how well his entire theory predicts observation sentences. He also admires first-order logic because of its extensionalism, a feature of the language that serves as his standard of theoretical clarity (PE: 144, CCE: 215) – he claims that no theory is fully clear to him unless it can be formulated in terms of his extensional language (PE: 144) – and is one of his deepest commitments. In his view, the requirement that a language be extensional is obvious, for "it is an affront to common sense to see a true sentence go false when a singular term in it is supplanted by another that names the same thing. What is true of a thing is true of it, surely, under any name" (FSS: 91). He believes that the principle of substitutivity of identity is simply obvious (though not in any technical sense of 'obvious'): it is basic to our theory of the world (SLS: 244) and is taken for granted by both the scientist and the layman, but most importantly Quine simply sees no reason to abandon it, irrespective of whether or not the scientist or layman should ever do so – certainly modal contexts provide him with no reason to abandon the principle (or accept an ontology of possible worlds to save it),

since modal logics are no simpler and issue in no more accurate predictions than his preferred canonical notation. Failures of substitutivity of identity are often the result of focusing not on what object a term denotes but on how it denotes the object – an issue that Quine's notation avoids because the name with which we denote an object is irrelevant to our commitment to the existence of that object (as is explained below).

> [Quine] takes as paradigmatically clear the situation in which a singular term functions simply by picking out an object. In that case, the truth or falsehood of a sentence as a whole depends on what object is picked out, not on *how* it is picked out. It is unsurprising that Quine should wish to avoid reference to *how* an object is picked out. By his standards, whether two ways of picking out an object count as the same is vague, unclear, and context-relative – just the sort of issue that canonical notation should enable us to avoid (Hylton 2007: 290).

Quine believes that ontological issues can be clarified (by his standard of clarity – first-order predicate logic) by omitting from the canonical notation certain idioms that we routinely use in ordinary language. He eliminates these locutions – including indexicals, tenses, counterfactuals, and the indefinite singular terms 'any', 'each', 'every' and 'no' – because it is syntactically simpler and the epistemology of science provides him with no reason to believe that doing so makes any difference to the predictions of our theory. Ordinary language is filled with vague and context-relative expressions that are very important to recognize in normal speech but, Quine maintains, are irrelevant from an ontological point of view. He also believes that his canonical notation has no need to address whether or not two ways of picking out an object (*how* they denote the object) count as the same. What matters to his notation is what objects terms pick out, not by what names they do so. For example, the terms 'Eric Arthur Blair' and 'George Orwell' refer to the same object. The sentences

(25) Eric Arthur Blair wrote *1984*

and

(26) George Orwell wrote *1984*

are both true, and the term by which we refer to George Orwell is irrelevant to their truth value. Of course, there may be contexts in ordinary language where it is not appropriate to use one of these co-referential terms. Orwell may have preferred to be called 'Eric' by his friends and perhaps became very angry when one of them called him by his pen name, 'George Orwell'. Quine does not discount the value of investigating the context sensitivities of linguistic use, but he would maintain that these are questions of speech pragmatics and not of ontology – so they are not addressed by his canonical notation which aims to clarify the ontology of our theory. That Orwell was called 'Eric' in some contexts (i.e., when around his friends) and 'George' in others (i.e., when around literary critics) is irrelevant to the ontological fact of the matter that he exists. Quine maintains that his adoption of an extensional language best suits his concern with the objects of our theory and not the names we use to refer to those objects. In fact, in order to keep his language extensional and as simple as possible (when faced with the difficulties of truth-value gaps associated with the use of non-referring names) Quine eliminates singular terms (other than the variable) from his canonical notation. What is more, he believes that rigidity is a feature of language that concerns how terms denote objects and not simply what they denote and so has no place in his regimented language of science. In what follows I discuss Quine's elimination of singular terms (other than variables) before proceeding to his rejection of rigid designation.

It is well known that names – in particular, non-referring names – lead to philosophical perplexities. For example, there is the problem of negative existential statements. Some philosophers – notably Alexius Meinong – believe that the statement

(27) Pegasus does not exist

commits us to the subsistence of Pegasus. They reason that Pegasus must be, in some sense, since if he was not we would not be talking about anything when uttering statement (27) and the sentence would therefore be nonsense. Negative existential statements are not the only instance of names causing ontological difficulties. We find such ontological problems whenever we find sentences containing non-referring names. Consider the statement

(28) Pegasus flies.

Because the subject of this sentence ('Pegasus') does not refer, it might be thought that the sentence suffers a truth value gap: it is neither true nor false (WO: 177). It might also be thought that in order for the sentence to have a truth value the subject must refer to something that may or may not fly. Many other names are also non-referring, of course, and consequently sentences containing them seem to suffer truth-value gaps as well. Many descriptions also fail to refer, as in the statement

(29) The King of France is bald,

which also suffers from a truth-value gap on this view. Philosophers have suggested many solutions to these problems, from claiming that 'Pegasus' refers to an idea in men's minds to holding that while the name does not refer to any existent thing it refers to an object that subsists – an unactualized possible object. Quine, however, believes that the better solution to these problems is the elimination of definite singular terms (other than

variables) altogether. He believes that his proposal of eliminating definite singular terms is better than the alternatives because it is syntactically simpler and results in a more parsimonious ontology (no subsistent entities need be posited) while making no difference to the predictions of our theory – that is, his name-free language captures all the truths of current scientific theory (as he reconstructs it).

The first step in Quine's resolution of the problems associated with statements (27) - (29) – and the step which resolves the problems facing non-referring descriptions – is found in Russell's theory of descriptions. In that theory, Russell claims that all statements containing definite descriptions, such as

(29) The King of France is bald

can be analyzed as

(29a) $\exists y\ (\forall x\ (Fx \leftrightarrow x = y)\ \&\ Gy)$,

where '*F*' stands for 'is King of France' and '*G*' stands for 'is bald'. The analyzed statement (29a) says that there is one and only one King of France and he is bald, and it is clearly false. There is no need to posit possible objects in order to explain the statement's falsehood. The variables *y* and *x* range over all the objects in the universe, and statement (29a) says that for some one object the predicates 'King of France' and 'is bald' apply – which in fact is not the case: there is no one object that is the King of France, so statement (29a) is false.

The term 'Pegasus' is a name, but Quine claims that Russell's theory can easily be made to apply to it (Russell himself recognizes this). This is because the name 'Pegasus' can easily be turned into a description. We could translate the name into the

definite description ‘the winged horse’ and analyze it as ‘there is one and only one thing that is a horse and has wings’. That is, the statement

(27) Pegasus does not exist,

can be paraphrased as

(27a) $\sim \exists y\ (\forall x\ (Fx \leftrightarrow x = y)\ \&\ Gy)$,

where ‘*F*’ stands for ‘is a horse’ and ‘*G*’ stands for ‘has wings’. There are no difficulties pertaining to the truth-status of (27a), for the statement is clearly true: there is no such object that is a horse and has wings. This route, then, resolves the problems besetting (27) – there is no ontological commitment to Pegasus as an object because the paraphrase makes no difference to the predictions of our theory and it is ontologically simpler.

Quine goes even further than Russell’s method and maintains that there is another route open to us in resolving the difficulties associated with statements (27) - (28). This is the “artificial and trivial-seeming device” of appealing to the “*ex hypothesi* unanalyzable, irreducible attribute of *being Pegasus*, adopting, for its expression, the verb ‘is-Pegasus’, or ‘pegasizes’” (OWTI: 8). We can translate the name ‘Pegasus’ into the verb ‘pegasizes’ since the terms are ontologically on par – the open sentence ‘*x* pegasizes’ is true of the same object that ‘Pegasus’ refers to, provided the object exists (which it does not). The ‘=’ (or the ‘is’) in statements such as ‘$(\exists y)$ (y = Pegasus)’

> is now treated as a copula which, as in ‘is mortal’ and ‘is a man’, serves merely to give a general term the form of a verb and so suit it to predicative position […] ‘Pegasus’ comes to play the role of the ‘*F*’ of ‘*Fa*’ and ceases to play that of the ‘*a*’ (WO: 179).

If we want to say that Pegasus exists, we simply write ‘$(\exists x)$ (Px)’, which translates to ‘something is Pegasus’ (or ‘something pegasizes’, see Quine OWTI: 8) which is of course false, for “‘Pegasus’ is now a general term which, like ‘centaur’, is true of no

objects" (WO: 179). "The noun 'Pegasus' itself could then be treated as derivative, and identified after all with a description: 'the thing that is-Pegasus', 'the thing that pegasizes'" (OWTI: 8). Following this method, we assert the existence of Pegasus by writing

(30) $(\exists x)\,(Px)$,

that is, 'something pegasizes', which is false but does not posit Pegasus or predicate subsistence or non-being of him. The quandary facing us with statement (27), namely

(27) Pegasus does not exist,

is solved using this method. We simply write

(41b) $\sim (\exists x)\,(Px)$,

where '*P*' stands for 'pegasizes'. The difficulty facing statement

(28) Pegasus flies

is resolved as well. It becomes

(28a) $(\exists x)\,(Px \,\&\, Fx) \,\&\, \forall y\,(Py \rightarrow y = x)$,

where '*P*' stands for 'pegasizes' and '*F*' stands for 'flies', and is false.

The constructions Quine proposes are no more problematic than any other legitimate statement of predicate logic, such as '$(\exists x)\,(Hx)$', where '*H*' stands for 'is hungry'. It would be highly unnatural and a great loss to actually speak in such a way that we did not use names (Quine himself uses them in his writings, e.g. he speaks of Carnap, Russell, Frege, as well as fictional characters like Wyman and Ortcutt), but the goal of Quine's notation is ontological clarification, not fidelity to intuitions grounded by the use of ordinary language. He admits that eliminating definite singular terms would be "disastrous in practice" and even that "[m]athematics would be paralyzed if we could not

freely substitute complex terms for variables and equals for equals" (VPR: 172), but this is inconsequential from the standpoint of his regimented language because its purpose is to "expos[e] the basic apparatus of reference" (VPR: 172). Quine eliminates definite singular terms from his regimented language of science because it is an uncontroversial technical move and doing so makes for a simpler language and ontology without sacrificing any of the truths of our theory. By eliminating the term 'Pegasus' in favour of the predicate 'pegasizes' we compromise none of the scientific purposes of employing the name, but we resolve the difficulties associated with using it. Whatever 'Pegasus' denotes, the predicate 'pegasizes' is true of (namely nothing) – so the elimination of 'Pegasus' in favour of 'pegasizes' preserves all the uses of the name. "A paraphrase into a canonical notation is good insofar as it tends to meet needs for which the original might be wanted" (WO: 182). Regimenting statements (27) – (29) into the canonical notation removes the difficulties associated with interpreting the statements but stays faithful to the scientific purpose of formulating them in the first place (i.e., saying something about the existence or non-existence of Pegasus). When paraphrased into regimented language, we no longer have to posit ideas or unactualized possible objects. We solve the problems associated with (27) by eliminating the name in question ('Pegasus') in favour of a corresponding description and general term. "[W]hen explication banishes a problem it does so by showing it to be in an important sense unreal; viz., in the sense of proceeding only from needless usages" (WO: 260). Phrasing these sentences in regimented language allows Quine to preserve the truth or falsity of what we say without cluttering our ontology with subsistent beings or other dubious entities. Eliminating definite singular terms from the canonical notation and replacing them with general terms solves the

problem of truth-value gaps – it shows the problem (and the related problem of possible objects) to be unreal.

> In all these cases, problems have been dissolved in the important sense of being shown to be purely verbal, and purely verbal in the important sense of arising from usages that can be avoided in favour of ones that engender no such problems (WO: 261).

Removing singular terms from the statement of our theory resolves the difficulties associated with non-referring names and preserves the parsimonious syntax of first-order predicate logic with identity – using names "can be avoided in favour of [usages] that engender no such problems". Because names can be eliminated from the canonical notation, they are mere "frills" (PL: 25) that only "characterize" the thing referred to. The elimination of singular terms other than variables is "motivated by the reflection that the pronoun or variable is the vehicle of pure reference, while names, like predicates, serve to characterize the thing referred to" (VPR: 172). Quine's account of the psychogenesis of reference and his reconstructed language of science hold that the pronoun (or variable) is the sole singular term required to state the ontological commitments of science – a fact which makes other definite singular terms redundant. Eliminating definite singular terms makes no difference to the predictions of theory and does not in any way pose difficulties to Quine's project of understanding the relation between evidence and theory. To be sure, many statements of unreconstructed science contain names, such as the sentence:

(31) Tavurvur is a stratovolcano,

However, the names in such statements can be eliminated without changing the truth value of the sentences or affecting any of the truths of theory. Formulated in reconstructed theory, statement (31) becomes

(31a) $(\exists x)\,(Tx \,\&\, Sx)$,

where '*T*' stands for 'tavurvurizes' and '*S*' stands for 'is a stratovolcano' – for some *x*, *x* is Tavurvur and is a stratovolcano. Regimenting statement (31) as (31a) preserves its truth value and so meets the scientific needs of the original sentence (e.g., saying something true about Tavurvur). By means of the variable (along with predicates and quantification) we can denote all the objects referred to with names but without the difficulties and ontological redundancies associated with names – and keep attention squarely on what terms denote and not how they denote them. Names are more trouble than they are worth: they complicate our syntax and often result in a bloated ontology (e.g., when they are non-denoting and we must posit objects as their referents), all while variables and predicates can serve their denotative functions (which is all Quine wants them for).

As there is no place for singular terms (other than variables) in Quine's reconstructed language of science, Kripke's justification of the distinction between names and descriptions appears to be moot. There is little philosophical interest in distinguishing between names and descriptions when they do not figure in the canonical notation. However, Kripke would (rightly) respond that the absence of names and descriptions does not repudiate the phenomenon of rigidity – some predicates may be rigid while others are nonrigid. The ad hoc predicates such as 'pegasizes' that Quine proposes to replace names could be just as rigid as the names. For example, the predicate

(32) nixonizes

could be said to denote Nixon rigidly – it denotes Nixon in all possible worlds. But the predicate

(33) is the president of the United States in 1970

could be said to denote Nixon nonrigidly – it denotes Nixon in the actual world but Humphrey in some possible worlds. The elimination of names does not eliminate the question of rigidity but merely moves the issue to the level of predicates.

Quine, however, believes that the distinction between rigid and nonrigid predicates is inadmissible in the reconstructed language of science because transworld identification faces too many difficulties to be of theoretical use. Before examining Quine's criticism of transworld identification it must be noted that Kripke believes that philosophical controversies surrounding this issue are misguided. In fact, he believes that identifying objects across possible worlds is quite simple.

> Those who have argued that to make sense of the notion of rigid designator, we must antecedently make sense of 'criteria of transworld identity' have precisely reversed the cart and the horse; it is *because* we can refer (rigidly) to Nixon, and stipulate that we are speaking of what might have happened to *him* (under certain circumstances), that 'transworld identifications' are unproblematic in such cases (NN: 49).

In Kripke's view, we need not make sense of identification across possible worlds in order to make sense of rigid designation; on the contrary, the existence of rigid designation enables us to denote objects across possible worlds. We do not have to describe the unique qualities of some object in order to specify it across possible worlds – for example, we do not specify Nixon in possible worlds by saying 'The object with black hair and such and such a height'. We simply determine the actual object under consideration and stipulate what is possible of it.

> We just say 'suppose this man had lost'. It is *given* that the possible world contains *this man*, and that in that world, he had lost. There may be a problem about what intuitions about possibility come to. But, if we have such an intuition about the possibility of *that* (*this* man's electoral loss), then it is a possibility about *that*. It need not be identified with the

> possibility of a man looking like such and such, or holding such and such political views, or otherwise qualitatively described, having lost. We can point to the *man*, and ask what might have happened to *him*, had events been different (NN: 45-46).

According to Kripke's view of possible worlds, discerning whether or not some object (say, Nixon) has some property necessarily or contingently is simple. There is no need to devise a set of necessary and sufficient conditions to specify the object across possible worlds. We simply say we mean Nixon and move on to consider what is necessary and contingent of him. "If we can't imagine a possible world in which Nixon doesn't have a certain property, then it's a necessary condition of someone being Nixon. Or a necessary property of Nixon that he has that property" (NN: 46). All we need in order to ask such questions about Nixon is to consider the man. We have no need for necessary and sufficient conditions for being Nixon. There may be such conditions, but in Kripke's view we do not have to work them out before we consider Nixon across possible worlds (NN: 47). "We can simply consider *Nixon* and ask what might have happened to *him* had various circumstances been different" (NN: 47). The fact that 'Nixon' is a rigid designator enables us to speak of him in counterfactual situations and makes transworld identification unproblematic.

Given Quine's methodological constraints, however, he cannot take cross-world identification to be as unproblematic as Kripke claims. Due to his criterion of ontological commitment – where ontological claims must be formulated in a regimented language – denoting Nixon across possible worlds cannot be done by simply pointing to or considering him and neither does the rigid designator 'Nixon' provide the means for denoting the man across possible worlds. Rather, we can specify Nixon across possible worlds only through the use of bound variables. When we regiment our discourse into

such an idiom, though, we see that transworld identifications have little theoretical use unless we betray central tenets of Quine's scientific epistemology. In what follows I articulate this Quinean rejection of possible worlds.

The most general Quinean objection to possible worlds is that first-order predicate logic expresses all the truths of our theory without them, and so there is no reason to complicate the ontology of reconstructed theory by admitting these entities. Kripke might object that this is simply question begging – e.g., the regimented language does not capture the modal truths about Nixon and so does not express all the truths of theory – but Quine is unmoved by this objection and does not think the fact that Nixon might have lost requires the adoption of a modal logic. His ability to account for counterfactuals and other notions that seem to presuppose the modalities in non-modal terms (discussed in Chapter 1) as well as the fact that *de re* modality (essentialism) seems to contribute nothing to reconstructed theory (discussed in Chapter 5) suggests to him that there is no need to posit possible worlds (or include modal notions generally) in reconstructed theory. In the absence of any compelling theoretical case for admitting possible worlds into the ontology of science, positing them would be simply gratuitous.

However, Quine's epistemology of science provides him with yet another reason for rejecting possible worlds – one which stems from his commitment to physicalism and makes transworld identification too problematic to be of any theoretical use. Quine scholars have not yet made this connection between his views on transworld identification and his broader methodological constraints and as a result their interpretation of his rejection of possible worlds is flawed. Alex Orenstein, for example, says that Quine rules out transworld identification on grounds of spatial and temporal

discontinuities:

> That Aristotle was a man and that water is H2O require an account of the identity over the histories of Aristotle and of water. In the actual world such cases of identity over time are matters of spatial and temporal continuity. There are no gaps and no lack of continuity in spatial and temporal history of such actual objects from the time they come into existence to the time they cease to exist. The modal claims that Aristotle necessarily has some characteristic or that water necessarily is H2O also require an account of identity, that is, that we can give an acceptable account of what it is to have the same individual such as Aristotle or an item of water in different possible worlds. However, for these modal cases, there are no notions comparable to spatio-temporal continuity to account for transworld identity, for example, of Aristotle or water from possible world to possible world (2003: 164).

In Orenstein's view, Quine maintains that transworld identification is impossible because objects have no spatio-temporal continuity across possible worlds – for example, we can account for the identity of some object in the actual world (say, a table) due to its spatial and temporal continuity (e.g., it is the table that Grandma owned and Mother brought home and put in the basement, etc.) but such continuity is nowhere to be found when speaking of objects across possible worlds. Whatever the merits of this as a criticism of transworld identification, however, it is not Quine's view. Orenstein overlooks the fact that for Quine, objects need not have any spatio-temporal continuity – Quine says that "the material content of any portion of space-time, however scattered and discontinuous" may count as an object (WA: 124). It is unclear, then, how the spatio-temporal discontinuity of objects across possible worlds could preclude us from identifying them, since such discontinuities do not preclude us from identifying objects in the actual world. What is more, in the very text Orenstein cites to support his interpretation, Quine acknowledges that transworld identification is analogous to identification of an object through time – he says that "identification of an object from moment to moment is indeed

on par with identifying an object from world to world" and that "both identifications are vacuous, pending further directives" (RH: 228). These "further directives" Quine alludes to are central to his criticism of transworld identification, but Orenstein neither explains them nor even mentions their importance.

Christopher Hookway seems to clarify these "further directives" when he interprets Quine as rejecting transworld identification on the basis that while the actual world is *ordered*, possible worlds are not.

> The point is that the different momentary cross-sections of our real world arrive *ordered*. Consequently, when we identify bodies by reference to slowly evolving parcels of matter, we have no choice as to which order to take the different momentary cross sections in. Possible worlds do not have a unique ordering imposed upon them, and this prevents our constructing a coherent modal concept of body (1988: 119).

According to Hookway's interpretation of Quine, the actual world is such that it presents us with conditions to individuate bodies. Possible worlds, however, can be ordered in any way the philosopher dreams up, which rules out identifying objects across them and results in there being no "coherent modal concept of body". Hookway presents an example to illustrate his point. He asks us to consider the biblical figures of Adam and Noah. In the actual world (*w1*) Adam lives for 930 years and Noah lives for 950. In some possible world (*w2*), Adam lives for 931 years and Noah lives for 949, in *w3* Adam lives for 932 years and Noah for 948 and so on, with Adam's age increasing and Noah's age decreasing by one year through each world until we reach some world where Adam dies at age 950 and Noah dies at age 930. We move further across worlds and trade some property of each man until we reach world *wn*, where Adam and Noah have exchanged all of their properties. But in such a case, Hookway maintains, it is impossible to say which object is Adam and which is Noah.

> If we follow this sequence of worlds, looking for the gradual evolution which makes up a Quinean body, it seems that the person in *wn* that we described above as Noah is in fact Adam: he is very similar to the Adam of the immediately preceding world, and very unlike the Noah of that world. Then it seems likely that, simply by ordering the worlds in different ways, we shall find that any body in this world will be part of a very large number of 'modal' bodies: there is no basis for saying whether a body or person in some world is me or Noah. Since *every possibility* is available to be included in one or other of these orderings, the modal notion of a body lacks the coherence of Quine's temporal notion. For the latter, we take account only of the events that actually occur, and their ordering is given (1988: 119).

In Hookway's view, Quine maintains that there is no coherent modal notion of body because the unordered nature of possible worlds prevents us from identifying objects across them (a point which Hookway illustrates with his Adam-Noah example). But Hookway's interpretation sheds little light on Quine's criticism of transworld identification. Hookway says that "the modal notion of body lacks the coherence of Quine's temporal notion" because Quine's notion "take[s] account only of the events that actually occur, and their ordering is given". But it is misleading for Hookway to speak of Quine's "temporal notion of body" and it is unclear how the "unordered" nature of possible worlds precludes us from being able to identify objects across them and why "the modal notion of body" is incoherent. As we saw in our discussion of Orenstein, Quine maintains that objects can be spatially and temporally discontinuous – any portion of space-time counts as an object for him because any portion of space-time can be quantified over. For example, Adam at age 5 and all of Canada in 2010 can count as one object. This point raises doubts over the significance of Hookway's Adam-Noah example as a Quinean objection to transworld identification and "the modal notion of body". Given Quine's notion of objecthood, there seems to be no reason why we cannot simply count Adam in *w1* and 'Adam' in *wn* (the 'Adam' with all the properties of Noah)

as the same body and it is unclear on what grounds Quine would object to doing so.[12]

Clearly, Quine's rejection of transworld identification has to be clarified. The "further directives" that he believes preclude the theoretical use of transworld identification have to be explained and situated within his broader methodological constraints. I do this in what follows. I explain how Quine's commitment to physicalism – one of the central tenets of scientific epistemology – informs his criticism of transworld identification. In his view, transworld identification is too problematic to be of any theoretical use.

As discussed above, first-order predicate logic supplies Quine's standard of ontological commitment. We are committed to the existence of an object if it figures as a value of a variable in the canonical notation. As noted in our discussion of Orenstein and Hookway, in Quine's view "the material content of any portion of space-time, however scattered and discontinuous" may count as an object (WA: 124). Not only do the ordinary bodies of common sense (such as Mama) count as objects in Quine's reconstructed language, but things that we would not normally consider bodies may count as objects as well – such as all the water in the world, or Mama taken together with the Eiffel Tower in its 3rd decade. Quine's rejection of possible worlds stems from the fact that physical theory supplies the predicates that figure in his regimented language – his reconstructed language of science employs only physical predicates (e.g. 'is a house', 'is

[12] David Lewis offers an interpretation of Quine's rejection of possible worlds that is similar to Hookway's. "To the extent that unification by similarity does enter into perdurance through time, what matters is not so much the long-range similarity between separated stages, but rather the linkage of separated stages by many steps of short-range similarity between close stages in a one-dimensional ordering. Change is mostly gradual, but not much limited overall. So any path is as good as any other; and what's more, in logical space anything that can happen does. So linkage by a chain of short steps is too easy: it will take us more or less from anywhere to anywhere. Therefore it must be disregarded; the unification of trans-world individuals must be a matter of direct similarity between the stages" (1986: 218). Lewis' interpretation fails for the same basic reason as Hookway's: for Quine, an object can be scattered through space and time and there need be no similarity or connection between its temporal stages.

a particle', etc.). For example, we denote some house through the predicate 'is a house' in the statement

(34) $(\exists x)$ (x is a house).

To say that houses are made of brick, we write

(35) $(\forall x)$ (x is a house $\rightarrow$ x is brick).

To say that water exists, we write

(36) $(\exists x)$ (x is water).

And to say that water is H2O, we write

(37) $(x)(y)$ (x is water = y is H2O).

Given that the predicates in each of these cases are supplied by physical theory, current physics is relevant to determining the objects that fall under the predicates – physical theory tells us what brick is and what water is, and our more general theory (still a branch of physics) tells us what houses are. The physical objects that matter in statements (34) – (37) are houses, bricks and water as understood by current theory.

The use of physical predicates enables objects to be individuated across space and time. Quine maintains that the "identification of a physical object from moment to moment makes sense only relative to the principle of individuation of one or another particular predicate – usually, though not necessarily, the predicate 'body' or one of its subordinates" (WA: 126). For example, the statement

(38) $(\exists x)$ (x is the Eiffel Tower)

commits us to the existence of the Eiffel Tower through its various decades (unless the predicate is modified to denote the tower at a certain time). As in the actual world, Quine maintains, the identification of objects across possible worlds requires the use of

predicates bound to a variable, e.g. '*x* is a house', '*x* is water', etc. Transworld identification would face no difficulties so long as "we could somehow extend our principle of individuation or integration of bodies so as to identify bodies not just from moment to moment, as we do so well, but from world to world" (WA: 126-7) – but this cannot be done, because possible worlds are not bound to the physics of the actual world. The predicates of the regimented language (which are supplied by current, actual world physics) do not apply to these worlds, as Quine explains:

> [O]ur cross-moment identification of bodies turned on continuity of displacement, distortion, and chemical change. These considerations cannot be extended across possible worlds, because you can change anything to anything by easy stages through some connecting series of possible worlds. The devastating difference is that the series of momentary cross sections of our real world is uniquely imposed on us, for better or for worse, whereas all manner of paths of continuous gradation from one possible world to another are free for the thinking up (WA: 127).

By moving from one possible world to another we can change anything to anything else – e.g., as Hookway points out, we can change Adam into Noah. But this in and of itself does not rule out possible worlds – and it cannot, because Quine's notion of objecthood can count anything as an object so long as it is the value of a bound variable. What rules out transworld identification is that it requires a departure from one of Quine's central tenets – physicalism – in order to be of any theoretical use. By their very nature, possible worlds are worlds that are (conceivably) physically different from our own. We can imagine worlds that differ substantially from our own, even worlds with very different physics – but once we vary our physics we lose our grip on individuation. We cannot make sense of what the predicates of our regimented language denote across possible worlds because what any predicate is true of loses sense once the physics varies. When considering possible worlds the principle of individuation is absent because the

denotation of the predicates of the regimented language is determined by the physics of the actual world, but possible worlds by their very nature are not bound to actual-world physics and so have different principles of individuation – a point which makes transworld identifications too problematic to be of any theoretical use. For example, consider the following observation categorical:

(39) When nitrogen is heated to –195.75° C, it boils.

Expressed in Quine's regimented language the statement becomes:

(39a) $\forall x ((Nx \,\&\, Hx) \rightarrow Bx)$,

where '*N*' is 'nitrogenizes', '*H*' is 'heated to –195.75 °C', and '*B*' is 'boils'. The proponent of modality might claim that the truth expressed in statements (39) and (39a) is necessary: that is, in all possible worlds, when Nitrogen is heated to –195.75 °C it boils. This truth as expressed as follows:

(39b) $\forall x \,\Box ((Nx \,\&\, Hx) \rightarrow Bx)$.

However, it seems impossible to evaluate the truth-value of this sentence because it is unclear what '*N*' denotes across possible worlds where the physical and chemical laws of the actual world do not apply. In some possible world physics, nitrogen is exactly what it is in our world. But in many other possible worlds nitrogen is not at all what actual-world physics takes it to be. In some worlds, physics holds 'nitrogen' to be not only the element as it is in the actual world but also iron (and takes this 'element' to boil at some temperature other than –195.75 °C). Kripke might object that the denotation of '*N*' across worlds is restricted to things with the same chemical composition as actual nitrogen, but Quine would see this restriction as unjustified. Kripke's move to restrict the denotation of '*N*' either narrows his speculations to possible worlds similar to ours in

chemical composition or restricts possible worlds to our physical understanding – but possible worlds should allow for different physics and in asking what is necessary for '*N*' we should consider '*N*' in worlds with different physics. Kripke's restriction amounts to an unjustified appeal to essence – a notion that Quine rejects (see Chapter 5) and which was supposed to be clarified by the very possible world theorizing that it is now invoked to vindicate.

None of the problems concerning transworld identification takes anything away from our ability to denote objects in the actual world, because the predicates of the regimented language are supplied by actual world physics. Categorical (39), namely

(39) When nitrogen is heated to –195.75° C, it boils

is unproblematic since the predicates employed pertain solely to the actual world and the physics found there. Since Quine's physicalistic reconstructed language of science cannot identify objects across possible worlds (and physicalism is a central tenet of scientific epistemology that he sees no reason to abandon) admitting possible worlds into the ontology of reconstructed theory would be a useless complexity that he believes should be avoided. What is more, there is no reason to think that some predicates denote rigidly while others do not. A consequence of Quine's rejection of possible worlds is that rigid designators concern not merely ontology (what we denote) but also language (how we denote).

As was noted above, Kripke's notion of rigid designation seems to justify the modal distinction between names and descriptions. Some terms designate rigidly (that is, they designate the same object in all possible worlds) and other terms designate nonrigidly (that is, they designate different objects across possible worlds). With a few

exceptions, most terms that designate rigidly are names, whereas descriptions normally designate nonrigidly – and the rigidity or non-rigidity of these terms would seem to be unaffected by Quine's elimination of names in favour of predicates. However, given Quine's misgivings about the ontological significance of ordinary language and his rejection of possible worlds it is clear why he doubts that rigid designation justifies the metaphysics of modality. Kripke maintains that we have intuitions about the rigidity of names (NN: 6), intuitions that that compel us to regard '9' as a rigid designator and 'the number of planets' as nonrigid. Quine does not doubt that we have these intuitions. He simply maintains that they are inconsequential because the linguistic usage that grounds them is ontologically insignificant – his physicalistic language of science precludes the possibility of transworld identification. Quine's reconstructed language of science admits no possible worlds to correspond to our intuitions of rigidity, and so from the standpoint of his language – the language that suits the epistemology of science and which he sees no reason to abandon – the terms '9' and 'the number of planets' simply refer to the same object. There are no grounds for taking one term to be rigid and the other nonrigid. The fact that we assign different modal status to these terms shows nothing ontologically significant about them but merely displays the waywardness of our intuitions of rigidity – these intuitions compel us to think that '9' and 'the number of planets' somehow differ in their reference, such that '9' denotes 9 in all possible worlds but 'the number of planets' denotes 9 only in some possible worlds. For Quine, the fact of rigidity does not show that modal notions concern more than language – rather, the fact that '9' and 'the number of planets', contrary to our intuitions of rigidity, denote the very same object (and not different objects across worlds) suggests that rigidity is itself a mere feature of language

with no ontological import. Quine's choice of language and his physicalism lead him to conclude that rigidity concerns linguistic use instead of ontology and consequently that rigid designators have no place in his regimented language of science – a circularity that Quine abides because given naturalized epistemology choice of language is largely a practical move that in turn serves as the standard of ontological clarification and because his rigid designator-free language expresses all the truths of science (suitably reconstructed) and facilitates the prediction of observation categoricals. Of course, Quine would be compelled to admit rigid designators (and the possible worlds they require) if his epistemology of science demanded that he do so. As things stand, however, he sees no reason to forsake his physicalism or complicate the syntax of his notation by admitting such terms (whether in the form of names or predicates) into the language and neither is he persuaded to do so by what Kripke finds to be an absurd consequence – e.g., that nitrogen and iron are the same element in certain possible worlds.

Conclusion

Kripke's response to the opacity argument is unsuccessful because there is no place for rigid designators in Quine's reconstructed language of science. The primary reason for their omission is that the language can get by perfectly well without them – it can express all the truths of our theory without recourse to such terms. Quine sees no reason to admit rigid designators into his theory of reference because his account of the psychogenesis of reference takes pronouns to be the primary singular terms of our referential apparatus as well as the only singular terms the child must grasp in order to master our referential apparatus. Kripke's application of rigid designation to Quine's

referential opacity argument is undermined by Quine's conviction that the peculiarities of ordinary language have no ontological import as well as his commitment to physicalism, which precludes the admission of possible worlds into reconstructed theory as a useless complexity because the physicalistic predicates of his language apply only to actual world physics and make transworld identifications too problematic to be of any theoretical use. With the metaphysical considerations supporting the notion of rigidity undermined, Quine sees no reason to distinguish between names and descriptions (or rigid and nonrigid predicates) in his regimented language of science and so believes that his referential opacity argument continues to provide compelling grounds for not admitting modal notions into the regimented language of science.

Chapter 4:

Quine's Mathematician-Cyclist Argument and Kripke's Reply

As was discussed in Chapter 2, Quine believes that attempts to save modal contexts from referential opacity by distinguishing between names and descriptions are committed to essentialism – a doctrine he rejects. His most famous criticism of essentialism is his mathematician-cyclist (hereafter MC) argument, which purports to show that essentialist claims merely reflect linguistic usage – favouring one manner of specifying an object over another – and do not express genuine ontological features of the world. In one of the earliest responses to this argument, Ruth Barcan Marcus maintains that Quine's argument is unsuccessful as a criticism of essentialism due to his failure to take *de re* and *de dicto* distinctions into account. However, I argue that Marcus' response ultimately misses the mark because she fails to appreciate that Quine's point is not a formal objection against modal logic but a question regarding the ontological significance of its interpretation. Some years later, Kripke responds to Quine's argument with metaphysical considerations that seem to show that the MC argument fails. Kripke seems to argue convincingly that Quine's MC argument is easily answered and that modern science is committed to essentialism.

In this chapter I first outline Quine's argument. I then examine Marcus' response and explain why it misses the mark – the MC argument constitutes not a formal objection to modal logic but questions the ontological significance of its interpretation. Finally, I discuss Kripke's reply to Quine's argument and examine the philosophical considerations he advances to demonstrate that it is unsound. This chapter explores the methods Kripke

employs in his response as well as the force of that response if these methods are accepted. Moreover, by providing an overview of Quine's argument and Kripke's response this chapter paves the way for the following one in which the methods and standards at play in Quine's rejection of essentialism are examined and a Quinean reply to Kripke is advanced.

Section 1: Quine's Mathematician-Cyclist Argument

Quine intends his MC argument to convey the "sense of bewilderment" he feels towards essentialism (WO: 199). He points to a case where we appear unable to decide which properties of a given object – a mathematician who is also a cyclist – are necessary (or essential) and which are contingent (or accidental). It just so happens that a given object (say, Smith) is a mathematician and a cyclist. What holds necessarily of Smith? Characterized as a cyclist, it follows that he is necessarily two-legged, characterized as a mathematician, it follows that he is necessarily rational.[13] The fact that what counts as necessary and contingent of Smith changes according to how he is characterized shows that these attributions of necessity are not determined by the way Smith is; they merely reflect features of language – how he is described – and thus have no ontological status.

> Just insofar as we are talking referentially of the object, with no special bias toward a background grouping of mathematicians as against cyclists or vice versa, there is no semblance of sense in rating some of his attributes as necessary and others as contingent. Some of his attributes count as important and others as unimportant, yes; some as enduring and others as fleeting; but none as necessary and contingent (WO: 199).

[13] Advances in prosthetic limbs have, of course, made it possible to be a one-legged cyclist. Nevertheless I preserve Quine's manner of presentation for the sake of convenience. Nothing in his argument turns on this question of fact.

Many properties are associated with Smith. He is a cyclist, a mathematician, two-legged, rational, a former student of the University of Ottawa, a human, the roommate of Matt and Jim, etc. Any of these properties are necessary of Smith if we characterize him in a certain way – e.g., as a mathematician, from which it follows that he is necessarily rational. If we do not privilege certain ways of characterizing Smith, it makes no sense to consider some of his properties to be essential and others to be accidental. Quine takes the example of Smith to be paradigmatic of the considerations that motivate all attributions of essentialism. The essentialist privileges certain ways of describing objects and considers these characterizations and what follows from them as constituting the essence of objects.

> Curiously, a philosophical tradition does exist for such a distinction between necessary and contingent attributes. It lives on in the terms 'essence' and 'accident', 'internal relation' and 'external relation'. It is a distinction that one attributes to Aristotle (subject to contradiction by scholars, such being the penalty for attributions to Aristotle). But, however venerable the distinction, it is surely indefensible, and surely then [the use of *de re* necessity] must go by the board (WO: 199-200).

The essentialist privileges certain characterizations of some object – e.g. the fact that the object is a mathematician and a cyclist – and, based on the chosen characterization, takes certain properties to be essential. While the essentialist thinks he is making an ontological point, Quine contends that he is merely pointing to features of language – what the essentialist classifies as essential or accidental depends on how he characterizes the object in question. What is true of an object should remain true of it regardless of how it is characterized. Quine is presenting two challenges – one epistemological and one ontological – to the essentialist in his MC argument. First, he demands that the essentialist provide some non-arbitrary grounds for distinguishing between essential and

accidental properties. Secondly, he challenges the essentialist to show that attributions of necessity reflect genuine ontological features of the object and not merely linguistic usage. As we shall see below, Kripke seems to answer both challenges. First, however, we examine Marcus' early response to Quine's argument and discuss its shortcomings in order to avoid confusing the MC argument as a technical challenge to the proponent of modality.

Section 2: Marcus' Response

Ruth Barcan-Marcus provides an early response to the MC argument. I argue that she misses the ontological import of Quine's argument and mistakenly sees him as making a formal point. She alleges that Quine's argument fails as a criticism of essentialism because it confuses scope distinctions (1993: 215-232). She maintains that the premises of the MC argument are as follows:

(1) Mathematicians are necessarily rational and not necessarily two-legged

(2) Cyclists are necessarily two-legged and not necessarily rational

(3) *x* is both a cyclist and a mathematician

If these are in fact the premises of Quine's argument, Marcus explains, it is flawed. This stems from the fact that there are two ways we can read the original argument, neither of which poses a difficulty to the advocate of essentialism. On one reading, the modal operator is given narrow scope. This is the *de re* reading of the argument, and it runs as follows:

(1a) $\forall x\,(Mx \rightarrow (\Box Rx \,\&\, \sim \Box Lx))$,

(2a) $\forall x\,(Cx \rightarrow (\Box Lx \,\&\, \sim \Box Rx))$

(3a) $\exists x\ (Mx\ \&\ Cx)$

Aside from the fact that the essentialist will not grant premises (1a) and (2a) – she does not think that every mathematician is necessarily rational or that every cyclist is necessarily two-legged (see Plantinga 1974: 25) – the argument is also flawed because the three premises are inconsistent. From (1a) and (3a) it follows that *x* is necessarily rational, but from (2a) and (3a) it follows that *x* is not necessarily rational. Surely, then, no proponent of essentialism would grant the argument as a compelling case against the doctrine.

On the second reading, the operator is given wide scope. This is the *de dicto* reading of the argument and it runs as follows:

(1b) $\Box(\forall x)\ (Mx \rightarrow Rx)\ \&\ \sim \Box(\forall x)\ (Mx \rightarrow Lx)$

(2b) $\Box(\forall x)\ (Cx \rightarrow Lx)\ \&\ \sim \Box(\forall x)\ (Cx \rightarrow Rx)$

(3b) $(\exists x)\ (Mx\ \&\ Cx)$

But "nothing baffling" follows from these premises (Marcus 1993: 227). The argument simply concludes that there is some object that is both a mathematician and a cyclist – there is no obligation to infer that the object is necessarily rational or two-legged and so there is no contradiction. Premise (1b) simply states that it is necessary for all mathematicians to be rational and that it is not necessary for all mathematicians to be two-legged. Premise (2b) simply states that it is necessary for all cyclists to be two-legged and that it is not necessary for all cyclists to be rational. From these premises the essentialist is under "no obligation to infer that such well-formed cyclists as [*x*] are essentially bipedal" (Plantinga 1974: 25). For example, all mathematicians are necessarily rational, and all cyclists are necessarily two-legged. But Smith, even though

he is a mathematician and a cyclist, is contingently rational and contingently two-legged – he could have been born a fool (precluding him from becoming a mathematician) and could have lost a leg in a car accident (precluding him from becoming a cyclist). The essentialist infers (3b) – there is some object that is both a mathematician and a cyclist, but there is no commitment as to whether or not the object is necessarily or contingently so. Although these responses do "not provide a positive case for essentialism" (Orenstein 2002: 159), they do appear to show that Quine's argument, on either reading, is unsuccessful as an argument against essentialism.

It might be thought that since the MC argument does not appear in Quine's later work, he must have been persuaded it was unsound (Orenstein 2002: 159; Marcus 1993: 227). I do not believe that this is the case, however. Rather than find her argument cogent, Quine's comments on Marcus' response indicate that he finds her strategy (and similar strategies) to be beside the point and hence ineffective. Marcus formalizes Quine's argument in modal logic to show its inadequacies, but the aim of the MC argument is to call into question the ontological significance of modal logic and the viability of essentialism as an ontological doctrine – Quine is not pointing to any technical problem in some formal system.[14] In an exchange between Quine and Marcus, Marcus claims that she knows of no modal system that includes a derivation from 'All mathematicians are rational' to 'It is necessary that John is rational' (Marcus 1993: 31). Quine responds by criticising Marcus' very construal of his argument against essentialism and his rejection of the doctrine:

> I've never said or, I'm sure, written that essentialism could be proved in any system of modal logic whatever. I've never even meant to suggest that any modal logician was even aware of the essentialism he was

[14] Burgess (1998: 44) also notes that Marcus misconstrues Quine's argument as a formal objection.

> committing himself to, even implicitly in the sense of putting it into his axioms. I'm talking about quite another thing – I'm not talking about theorems, I'm talking about truth, I'm talking about true interpretation. And what I have been arguing is that if one is to quantify into modal contexts and one is to interpret these modal contexts in the ordinary modal way and one is to interpret quantification as quantification […] then in order to get a coherent interpretation one has to adopt essentialism (Quine in Marcus 1993: 32).

In his MC argument, Quine is not attempting to level a formal objection against the proponent of quantified modal logic. Rather, he questions its ontological significance – and he believes that its commitment to essentialism is troubling from an ontological point of view. He claims that attributions of essentialism concern our use of language and not genuine features of the world. The MC argument is meant to show this and convey the "bewilderment" (WO: 199) he feels towards the doctrine.

In a reply to Marcus, Quine refers to the philosophical problems associated with essentialism that he is hinting at in the MC argument – suggesting that the point he was making with it is untouched by her counterarguments. Near the end of his response, he says:

> The only course open to the champion of quantified modal logic is to meet my structures head on: to argue in the case of 9 and the number of planets that this number is, of itself and independently of mode of specification, something that necessarily, not contingently, exceeds 7. This means a frankly inequalitarian attitude towards various ways of specifying the number. One of the determining traits, the succeeding of 8, is counted as a necessary trait of the number. So are any traits that follow from that one, notably the exceeding of 7. Other uniquely determining traits of the number, notably its numbering the planets, are discounted as contingent traits of the number and held not be belie the fact that the number does still necessarily exceed 7 (RPM: 184).

As we saw in Chapter 2, Smullyan points out that the statement

> (4) The number of planets is necessarily greater than 7

can be read in two ways. On the *de dicto* reading, the modal operator is given wide scope and the statement reads

(5) $\Box \exists x\,(Gx \,\&\, \forall y\,(Gy \rightarrow x = y) \,\&\, Fx)$,

where *G* is 'the number of planets' and *F* is 'greater than 7'. On this reading, the statement is false: it is not necessary that the number of planets is greater than 7. However, statement (5) does not follow from premises

(6) 9 is necessarily greater than 7

and

(7) 9 = the number of planets

and so there is no paradox. On the *de re* reading, the modal operator is given narrow scope and the statement reads

(6) $\exists x\,(Gx \,\&\, \forall y\,(Gy \rightarrow x = y) \,\&\, \Box\, Fx)$.

On this reading, the statement is true: the number of planets is in fact 9, and 9 is necessarily greater than 7. Moreover, this is the reading that follows from premises (6) and (7) and so there is no paradox. The proponent of the ontological significance of modality answers Quine by making recourse to essentialism – he claims that some properties are essential and others accidental of the object 9. The object that is denoted by '9' and 'the number of planets' is essentially greater than 7 but only accidentally the number of planets. Yet, as we saw in the passage above, Quine calls into question this "inequalitarian attitude towards various ways of specifying the number" (RPM: 184). He demands an explanation as to how the advocate of essentialism can privilege one manner of characterizing the object over another – aside from merely insisting that one characterization is more 'essential'. "This is how essentialism comes in: the invidious

distinction between some traits of an object as essential to *it* (by whatever name) and other traits of it as accidental" (RPM: 184). According to Quine, the application of modal logic as a language of science requires that we take certain ways of characterizing the object as corresponding to essential traits of the object. The challenge facing the proponent of modality concerns whether or not these traits are in fact essential and how he can demonstrate them to be so. The MC argument calls into doubt his ability to address these concerns by purporting to show that some ways of characterizing an object imply certain essential properties whereas other ways of specifying the object imply other essential properties – but the essential properties being inherent in the thing should be the same regardless of how the object is specified. The MC argument is meant to be understood informally as a point about what, philosophically, the modal logician is committed to if he uses his logic as a regimented language of science. Though Marcus' response contributes to the debate by making important logical distinctions (and so sheds light on the ontological issues in question) it does not answer the philosophical challenge Quine is advancing in the argument.

Even 30 years after his original presentation of the MC argument in *Word and Object*, Quine still felt it necessary to explain to Marcus that he is not making a formal objection to modal logic. He explains that "when modal logic takes on interest and utility, if ever, is when it is embedded in a general extra-logical vocabulary for possible application. Then you are going to have all the apparatus for essential properties" (COM: 244). Yet in the 1993 version of her 1967 paper, 'Essentialism in Modal Logic', Marcus does recognize the MC argument as a philosophical challenge. However, she nonetheless fails to reply to Quine's objection.

> The fact is that the traditional essentialist is *not* 'talking referentially of the object with no special bias toward a background grouping…' It is precisely certain kinds of background grouping with which he *is* concerned. Presumably his modalities would be relative to some initial set of *imported* nonlogical premises […] (1993: 51).[15]

But Marcus offers no account as to why and how those nonlogical premises are acceptable, nor does she show that the essentialist evades Quine's original objection: that so-called necessary and contingent properties do not inhere in objects objectively and absolutely but are relative to certain ways of describing those objects. Such philosophical issues arise when we attempt to see what scientific interest modal logic has, and it is this that the MC argument is intended to address. Quine thinks that the argument shows essentialism to be a flawed scientific theory, and he sees no sense or utility in dividing properties into those that are necessary and those that are contingent. In this sense the scope distinctions pointed out by Marcus are ineffective. The discussion of scope only obscures the fact that Quine is concerned with how we assign the essential and accidental properties to individual objects in the first place and whether essentialist attributions have any ontological status.

Section 3: Kripke's Response to Quine's Argument

In *Naming and Necessity*, Kripke presents a reply to the epistemological and ontological challenges posed by Quine's MC argument. He responds to them by presenting a metaphysical picture that seems to undermine certain fundamental presuppositions of Quine's view – and one that, I believe, remains misunderstood by

[15] This version of the passage contains a crucial revision. In the 1967 version the last sentence reads "Presumably his modalities would be relative to some initial set of premises" (1967: 96). The addition of "imported nonlogical premises" in the newer version indicates that Marcus had come to recognize the MC argument as a philosophical challenge.

many commentators on the debate. First, Kripke answers Quine's epistemological challenge by arguing for the methodological importance of intuition and its use in demonstrating the intelligibility of essentialism and providing non-arbitrary grounds for discerning the necessary and contingent properties of any given object. As we shall see, commentators sympathetic to Quine fail to see the force of Kripke's appeals to intuition because they misunderstand his conception of intuition as an epistemological faculty when it is merely intended to convey what is obvious to us when we are uncontaminated by any philosophical theory.[16] Second, Kripke answers Quine's ontological challenge by demonstrating that ordinary language and scientific practice presuppose the existence of natural kinds and essential properties – a facet of the debate that commentators sympathetic to Kripke generally do not recognize.[17] What is more, Kripke's arguments are more powerful than commentators sympathetic to Quine realize. By arguing that natural kinds and essential properties are presupposed in scientific language and practice Kripke seems to show that these entities must be included in any theory purporting to clarify the ontological commitments of theory.[18]

[16] Although Hylton (2007: 239-40, 380) and Kemp (2006) do not specifically mention Kripke, I believe that they see their criticisms of intuition as applying to him as well. Presumably Creath (1990: 62) includes Kripke among those "many modal logicians especially those of realist proclivities" who fully embrace the role of intuition in philosophy. Though not from any specifically Quinean point of view, Hintikka (1999) also rejects Kripke's intuition on grounds that it is an opaque epistemological faculty.

[17] In their discussions of Quine's rejection of essentialism, Burgess (1998), Rocca (1996) and Soames (2003) focus on the epistemic challenge. As I show below, Kripke's response to the ontological challenge – in particular his arguments for natural kinds and essential properties – is at least as forceful as (and in all likelihood more forceful than) his arguments in favour of intuition because it seems to meet Quine on his own terms (i.e., clarifying the ontological commitments of science). For this reason, any discussion of Kripke's response to Quine's MC argument should include a consideration of Kripke's views on natural kinds.

[18] See Hookway (1988: 121-122) and Hylton (2007: 354) for Quinean dismissals of essentialism on grounds that the doctrine has no place in modern science.

Kripke discusses the issues raised by Quine's MC argument through an example of his own – a consideration of Richard Nixon. He describes a Quinean approach to the question of the necessary and contingent properties of Richard Nixon:

> And so it's thought: Was it necessary or contingent that Nixon won the election? (It might seem contingent, unless one has some view of some inexorable process…) But this is a contingent property of Nixon only relative to our referring to him as 'Nixon' (assuming 'Nixon' doesn't mean 'the man who won the election at such and such a time'). But if we designate Nixon as 'the man who won the election in 1968', then it will be a necessary truth, of course, that the man who won the election in 1968, won the election in 1968. Similarly, whether an object has the same property in all possible worlds depends not just on the object itself, but on how it is described. So it's argued (NN: 40-41).

According to Quine, which properties we believe to hold necessarily of the object, Nixon, and which ones we believe to hold contingently depend on a "special bias towards a background grouping" of the object as 'Nixon' instead of 'the winner of the election' or vice versa (WO: 199). Which grouping we choose depends on our interests at the time and does not represent anything essential about Nixon.

In his answer to Quine, Kripke points to what we actually do and intuitively believe. He explains that opponents of essentialism often regard the doctrine as simply a confused philosophical notion:

> It is even suggested in the literature, that though a notion of necessity may have some sort of intuition behind it (we do think some things could have been otherwise; other things we don't think could have been otherwise), this notion (of a distinction between necessary and contingent properties) is just a doctrine made up by some bad philosopher, who (I guess) didn't realize that there are several ways of referring to the same thing (NN: 41).

According to Kripke, though, it is the opponents of essentialism who are confused.

He maintains that essentialism contains a great deal of intuitive plausibility (NN: 41) and that it is the opponents of modality who are resting their position on an obscure and untenable philosophical theory. He describes an exchange between two men:

> Suppose that someone said, pointing to Nixon, 'That's the guy who might have lost'. Someone else says 'Oh no, if you describe him as "Nixon", then he might have lost; but, of course, describing him as the winner, then it is not true that he might have lost'. Now which one is being the philosopher, here, the unintuitive man? It seems to me obviously the second. The second man has a philosophical theory (NN: 41).

The first man is a common, everyday person; the second is the philosopher, an opponent of essentialism and apparently quite convinced by Quine's MC argument. Nevertheless, Kripke maintains, it is clearly the philosopher who has the confused view. He describes how the common man would reply to the philosopher:

> The first man would say, and with great conviction, 'Well, of course, the winner of the election *might have been someone else*. The actual winner, had the course of the campaign been different, might have been the loser, and someone else the winner; or there might have been no election at all. So, such terms as "the winner" and "the loser" don't designate the same objects in all possible worlds. On the other hand, the term "Nixon" is just a *name* of *this man*'. When you ask whether it is necessary or contingent that Nixon won the election, you are asking the intuitive question whether in some counterfactual situation, *this man* would in fact have lost the election (NN: 41).

Here the opinion of the common man is based on an intuitive, pre-philosophical view that we all share before being exposed to philosophers and their fantastic theories. Kripke observes the obvious fact that the man under consideration, who is called 'Nixon', might have lost; and even if we refer to Nixon as 'the winner of the election', we all understand that we are referring to Nixon, who, although he in fact won the election, might have lost. "When you ask whether it is necessary or contingent that *Nixon* won the election, you are asking the intuitive question whether in some counterfactual situation, *this man* would in

fact have lost the election" (NN: 41). This is what the question means, according to Kripke, and there seems no denying that it is a perfectly intelligible question. Kripke concludes that it is the philosophical opponent of essentialism whose perspective is confused:

> If someone thinks that the notion of a necessary or contingent property (forget whether there *are* any nontrivial necessary properties and consider just the *meaningfulness* of the notion) is a philosopher's notion with no intuitive content, he is wrong. Of course, some philosophers think that something's having intuitive content is very inconclusive evidence in favour of it. I think it is very heavy evidence in favour of anything, myself. I don't really know, in a way, what more conclusive evidence one can have about anything, ultimately speaking. But, in any event, people who think the notion of accidental property unintuitive have intuition reversed, I think (NN: 41-42).

Our essentialist convictions are clear, intelligible and obvious. Given this fact, the epistemological challenge that the MC argument is supposed to convey is founded on philosophical confusion. Moreover, Kripke claims, our intuitions are the proper guides in questions like these – they supply the firmest possible evidence. Quine and his sympathizers are simply wrong to assert, as Hylton does, that "the sense of necessity which philosophers have emphasized, what Quine calls 'an absolute mode of truth', has no real role to play in ordinary knowledge. The notion is a philosophers' invention" (2007: 350). Essentialism clearly plays a very real role in ordinary knowledge. Quine's MC argument fails as a criticism of essentialism because it is intuitively implausible and contradicted by what we would naturally think and say. It merely illustrates how philosophers can reason themselves into bizarre – counterintuitive – positions and be led to ignore evident facts (e.g., that Nixon might have lost).

The obviousness of these facts about Nixon shows that Quine errs in thinking there is some deep problem regarding the intelligibility of essentialism. While

determining which properties of an object are necessary and contingent may at times be difficult, it is clear that the distinction is intelligible. Not only does Quine's MC argument fail to show that there is some problem with the intelligibility of essentialism, but it is obvious which properties of the mathematician-cyclist are necessary and which are contingent. When advancing the argument, Quine says:

> But what of an individual who counts among his eccentricities both mathematics and cycling? Is this concrete individual necessarily rational and contingently two-legged or vice versa? Just insofar as we are talking referentially of the object, with no special bias toward a background grouping of mathematicians as against cyclists or vice versa, there is no semblance of sense in rating some of his attributes as necessary and others as contingent. Some of his attributes count as important and others as unimportant, yes; some as enduring and others as fleeting; but none as necessary and contingent (WO: 199).

The question Quine raises concerning this object (Smith), i.e., what is necessary and contingent of him, is obviously intelligible and easy to answer. Clearly, Smith is contingently a cyclist as well as contingently a mathematician, since we can imagine cases where Smith has taken up neither of these activities. Moreover, he is contingently two-legged and contingently rational, since we can imagine a situation where Smith is one-legged as well as a situation where Smith is an irrational man. However, Smith is necessarily human, since (given that Smith is in fact human) he could not be non-human and continue to be Smith. Unless we are contaminated by some philosophical theory, it is obvious to us that the distinction between Smith's necessary and contingent properties is clear and intelligible.

Kripke's demonstration that essentialism is intelligible and that reliance on pre-philosophical intuitions provide all the justification we need to distinguish between necessary and contingent properties does not fully vindicate the doctrine – there still

remains the ontological challenge to essentialism. Quine claims that attributions of essentialism merely concern how the object is characterized and have no ontological status. What is more, as commentators friendly to Quine have pointed out, there seems to be no place for essentialism in modern science (Hookway 1988: 121-122; Hylton 2007: 354). Kripke, however, believes that Quine (and philosophers sympathetic to his views) is wrong in seeing attributions of essentialism as mere features of language and for finding no place for essence in modern science. Kripke argues that modern science posits natural kinds and that it discovers the essential properties of kinds. The fact that there are such kinds and that they have essential properties seems to show that Quine's MC argument is wrong – it is not the case that the necessary and contingent properties of an object depend on how an object is described, because some ways of characterizing an object correspond to the natural kind(s) to which the object belongs, and each kind has some properties necessarily and others contingently. What is more, given that kinds and essential properties seem to be presupposed in modern science, they must be posited in any project (such as Quine's) aiming to clarify the ontological commitments of theory.

One example Kripke discusses to show the existence of natural kinds involves gold. He begins by asking whether or not gold could fail to be a yellow metal, and he describes the following situation to frame the question he is addressing:

> Suppose an optical illusion were prevalent, due to peculiar properties of the atmosphere in South Africa and Russia and certain other areas where gold mines are common. Suppose there were an optical illusion which made the substance appear yellow; but, in fact, once the peculiar properties of the atmosphere were removed, we would see that it is actually blue. […] Would there on this basis be an announcement in the newspapers: 'It has turned out that there is no gold. Gold does not exist. What we took to be gold is not in fact gold' (NN: 118).

In relation to the MC argument, we may ask if the fact that we can describe things according to different background considerations refutes the notion of kind altogether. Kripke believes that it does not. He claims that, in the case of gold above, instead of concluding that gold does not exist the scientists would (and should) conclude that the metal is in fact not yellow but blue. Kripke thinks this is the case because gold is a natural kind.

> [W]e use 'gold' as a term for a certain *kind* of thing. Others have discovered this kind of thing and we have heard of it. We thus as part of a community of speakers have a certain connection between ourselves and a certain kind of thing (NN: 118).

The existence of the kind 'gold' is established not only by our discovering that there is such a thing as gold but also by the obviousness of what we mean and intend by the term. Kripke continues:

> The kind of thing is thought to have certain identifying marks. Some of these marks may not really be true of gold. We might discover that we are wrong about them. Further, there might be a substance which has all the identifying marks we commonly attributed to gold and used to identify it in the first place, but which is not the same kind of thing, which is not the same substance. We would say of such a thing that though it has all the appearances we initially used to identify gold, it is not gold (NN: 118-19).

What we mean and intend by the term demonstrates the existence of the natural kind gold. If we came across fool's gold, which looks like actual gold, we would refuse to admit it as real gold. Gold is a different kind of thing than fool's gold. In addition to Kripke's claim that the existence of the kind gold is obvious, he thinks that it is a scientific discovery that gold is a natural kind.

> We can say this not because we have changed the meaning of the term gold, and thrown in some other criteria which distinguished gold from pyrites. It seems to me that that's not true. On the contrary, we *discovered* that certain properties were true of gold in addition to the initial identifying makes by which we identified it. These properties, then,

> being characteristic of gold and not true of iron pyrites, show that the fool's gold is not in fact gold (NN: 119).

It is not simply because we talk a certain way that supports the existence of natural kinds. According to Kripke, the notion that gold is a natural kind is presupposed by scientific practice and scientific investigation has discovered that gold is in fact a natural kind. Quine's own criteria appear to commit us to the existence of kinds because it seems required to posit them in order for certain sentences of science (and ordinary discourse) – e.g. those concerning the periodic table – to be true.

Another example Kripke uses to support his belief in natural kinds concerns a discussion of tigers. Referencing a passage by Paul Ziff, Kripke asks us to imagine a scenario where we discover that tigers are three-legged. All along it was simply an optical illusion that made us think that tigers had four legs, Kripke asks us to imagine, and we finally discover that in fact tigers only have three legs. The question that he poses to us is whether, in such a situation, we would conclude that the things we were calling tigers all this time were not in fact tigers. He claims that we would not do this; we would say that we were simply wrong in thinking that tigers had four legs and we would admit that the three-legged felines are tigers. Kripke believes this is so because tigers are a natural kind. Reflection on our discourse about the world reveals that we are committed to the existence of kinds.

Kripke asks us to imagine a situation where some other creature had all the properties by which we usually designate tigers:

> We might find animals in some part of the world which, though they look just like a tiger, on examination were discovered not even to be mammals. Let's say they were in fact very peculiar looking reptiles. Do we then conclude on the basis of this description that some tigers are reptiles? We don't. We would rather conclude that these animals, though they have the

> external marks by which we originally identified tigers, are not in fact tigers, because they are not of the same species as the species which we called 'the species of tigers' (NN: 120).

For example, we can imagine a situation where a mad scientist creates a creature that has all the external characteristics of a tiger, but internally has all the features of a reptile (cold-blooded, etc.). In such a situation, we would reject the notion that the scientist's creature was a tiger. We do so not because our intuitive, everyday conception of tiger has been replaced by some scientific notion, but because the tiger-kind is built into the logic of our language. Kripke explains:

> Now this, I think, is not because, as some people would say, the old concept of tiger has been replaced by a new scientific definition. I think this is true of the concept *before* the internal structure of tigers has been investigated. Even though we don't know the internal structure of tigers, we suppose – and let us suppose that we are right – that tigers form a certain species or natural kind (NN: 120-21).

Even before we have done any rigorous investigation into the nature of tigers, we speak of tigers as if they formed a natural kind – the kind is presupposed in our everyday understanding of the world.

> We can then imagine that there should be a creature which, though having all the external appearance of tigers, differs from them internally enough that we should say that it is not the same kind of thing. We can imagine it without knowing anything about this internal structure – what this internal structure is. We can say in advance that we use the term 'tiger' to designate a species, and that anything not of this species, even though it looks like a tiger, is not in fact a tiger (NN: 121).

Our use of the term 'tiger' shows that we are committed to the existence of the kind. Even before we know the internal structure of tigers, we use the term in such a way that tigers form a kind. We may discover that tigers are very different from what we initially suppose, but we continue to be committed to the kind nevertheless.

> Just as something may have all the properties by which we originally identified tigers and yet not be a tiger, so we might also find out tigers had *none* of the properties by which we originally identified them. Perhaps *none* are quadrupedal, none tawny yellow, none carnivorous, and so on; all these properties turn out to be based on optical illusions or other errors, as in the case of gold. […] [P]ossession of most of these properties need not be a necessary condition for membership in the kind, nor need it be a sufficient condition (NN: 121).

We might find out that tigers are actually two-legged, that they are blue and that they do not have stripes. If we did discover such things, however, we would continue to speak as if tigers formed a kind and include these blue, stripeless, two-legged creatures as tigers – and the fact that we would speak this way shows that we are committed to the kind. What science discovers about the world, however, does have bearing on how we construe kinds (whether tigers or other kinds) and may prompt a change in what we consider kinds.

> Since we have found out that tigers do indeed, as we suspected, form a single kind, then something not of this kind is not a tiger. Of course, we may be mistaken in supposing that there is such a kind. In advance, we suppose that they probably do form a kind. Past experience has shown that usually things like this, living together, looking alike, mating together, do form a kind. If there are two kinds of tigers that have something to do with each other but not as much as we thought, then maybe they form a larger biological family. If they have absolutely nothing to do with each other, then there are really two kinds of tigers. This all depends on the history and on what we actually find out (NN: 121).

Scientific investigation sometimes confirms what we take to be kinds (in this case, it confirms our supposition that tigers are a kind), and at other times it reveals that we erred in taking some objects as belonging to a kind. As Quine himself argues while discussing kinds, whereas we once included marsupial mice and ordinary mice in the same kind, we no longer do so – we now include marsupial mice in the same kind as kangaroos and opossums but exclude ordinary mice from this kind (NK: 128). However, such scientific

discoveries do not call into question the existence of kinds. Rather, our everyday and scientific discourse commits us to the existence of these entities.

Kripke's examination of natural kinds extends into a discussion of essential properties. He seems to have showed that we are committed to kinds, such as gold. He then considers whether gold has any necessary properties. Gold has properties that seem to be contingent; for example, it seems to be a contingent property that gold is yellow. However, gold appears to have at least one necessary property: the property of having the atomic number 79. Kripke seems to show that we are committed to this necessary property by noting that we would not admit something as gold unless it had this property. In these considerations, just as in his argument for the existence of natural kinds, intuition, ordinary discourse and scientific practice play key roles.

The first consideration in Kripke's argument concerns a case where we find a substance that resembles gold in all the properties by which we usually identify gold:

> Let us suppose the scientists have investigated the nature of gold and have found that it is part of the very nature of this substance, so to speak, that it have the atomic number 79. Suppose we now find some other yellow metal, or some other yellow thing, with all the properties by which we originally identified gold, and many of the additional ones that we have discovered later. An example of one with many of the initial properties is iron pyrites, 'fool's gold'. As I have said, we wouldn't say that this substance is gold (NN: 124).

Although some substance might be yellow and shiny, unless it has the atomic number 79, we would not admit it as gold. We simply understand that such stuff is not gold. Next, Kripke considers a possible world in which all the places where we find gold deposits in the actual world turn out to contain a substance lacking the atomic number 79 but resembling gold in all other respects.

> Consider a counterfactual situation in which, let us say, fool's gold or iron pyrites was actually found in various mountains in the United States, or in areas of South Africa and the Soviet Union. Suppose that all the areas which actually contain gold now, contained pyrites instead, or some other substance which counterfeited the superficial properties of gold but lacked its atomic structure. Would we say, of this counterfactual situation, that in that situation gold would not even have been an element (because pyrites is not an element)? It seems to me that we would not (NN: 124).

Kripke maintains that in such a counterfactual situation we would not say that the stuff is gold. He claims that instead we would say that a certain substance different than gold "would have been found in the very mountains which actually contain gold and would have had the very properties by which we commonly identify gold" (NN: 124). We describe the counterfactual situation as one in which gold ceases to be found in the places where we find it in the actual world, and some other substance, resembling gold, is found there. "Given that gold *is* this element, any other substance, even though it looks like gold and is found in the very places where we in fact find gold, would not be gold" (NN: 125). On the basis of these considerations, Kripke concludes that we are committed to gold having the atomic number 79 as a necessary property – we (ordinary folk and scientists alike) simply treat it as such and it makes sense to do so, regardless of what philosophers (like Quine) might think. He also suggests that "statements representing scientific discoveries about what [some] stuff *is* are not contingent truths but necessary truths in the strictest possible sense" (NN: 125). For example, that water is H2O and that heat is kinetic energy are both scientific discoveries, and these discoveries represent necessary properties of water and heat – water is necessarily H2O, and heat is necessarily kinetic energy. Contrary to what Quine maintains, it seems that science itself reveals the existence of necessary properties and is committed to them.

Kripke discusses another example to emphasize that essentialism is presupposed in our discourse and has a place in modern science, this time discussing a table in front of him. It is a scientific discovery that the table is composed of molecules, as opposed to being composed of "some ethereal entelechy" (NN: 126). Kripke then asks us to consider a possible world in which there is a table before him that is an ethereal entelechy. We can imagine such a scenario, but we cannot imagine a situation in which the actual table before him is composed of an ethereal entelechy.

> The vicissitudes of *this thing* might have been very different from its actual history. […] But whatever we imagine counterfactually having happened to it other than what actually did, the one thing we cannot imagine happening to this thing is that *it*, given that it is composed of molecules, should still have existed and not have been composed of molecules (NN: 126-27).

Given that the table is composed of molecules, we cannot imagine it not being so composed while remaining the same table. Of course, we could have discovered that the table was not composed of molecules; but once we know that it is in fact composed of molecules we cannot imagine it composed of anything else. Being composed of molecules, then, is an example of a necessary property of the table – one discovered by science (in this case particle physics). As in the two previous cases, Kripke comes to this conclusion through an examination of our intuitions (it is simply obvious that the table must be composed of molecules) as well as scientific practice (science discovers that the table is composed of molecules and that without any molecules there would be no table).

Kripke's demonstration that natural kinds exist and that they have essential properties seems to meet the ontological challenge expressed in Quine's MC argument. What counts as a necessary property clearly does not depend on how the object in question is characterized. Natural kinds take ontological priority over mere descriptions,

and natural kinds have essential properties. For example, Quine's mathematician-cyclist belongs to the kind *human*, and certain properties are essential to humans (e.g., having a certain genetic code). What is more, essentialism clearly has a place in modern science – the doctrine is presupposed in everyday and scientific discourse and must be expressed in any theory purporting to clarify the ontological commitments of our theory.

Conclusion

Kripke recognizes the epistemological and ontological challenges posed by Quine in the MC argument and he seems to show that these challenges are met once we reflect on our pre-philosophical intuitions and examine the ontological commitments of ordinary language and scientific practice. Kripke seems to show that the intelligibility of essentialism is obvious and that, although determining the necessary properties of an object can sometimes be difficult, there is no question as to which properties are necessary and which are contingent of Quine's mathematician-cyclist. Moreover, he seems to show that Quinean claims that essence has no place in science are wrong. Natural kinds and essentialism are presupposed in our discourse and scientific practice. Quine appears to be wrong to think that the necessary properties of an object depend on how we characterize the object – the natural kinds to which the object belongs take metaphysical priority over mere descriptions. What is more, the fact that natural kinds and essentialism are presupposed in ordinary and scientific discourse suggests that Quine should accept these ontological commitments and express them by adopting a modal logic as his regimented language of science. Quine, however, disagrees with the claim that natural kinds and essential properties are presupposed in current science and he sees

no reason to abandon his preferred reconstructed language of science in favour of a modal logic. In the next chapter I present a Quinean response to Kripke's attempt to justify essentialism and I discuss the theoretical commitments that inform Quine's MC argument.

Chapter 5:

A Quinean Response to Kripke's Essentialism

In his response to Quine's MC argument, Kripke takes intuition and everyday language as methodological starting points that serve as reliable guides to solving philosophical problems. First, in response to Quine's epistemological challenge, he argues that the intuitiveness of certain judgments makes evident the intelligibility of essentialism and provides a basis for deciding which properties of an object are essential and which are accidental. Next, in response to the ontological challenge, Kripke maintains that the existence of natural kinds and essential properties is implied by certain statements of science – a point which not only seems to show that attributions of necessity concern genuine features of the world but also suggests that Quine should adopt a modal logic as his language of science. Quine, however, is unconvinced by Kripke's defence of essentialism. He rejects intuitiveness as a source of evidence and as a test of truth and maintains that natural kinds and properties (essential or otherwise) are not presupposed by theory. In this chapter I examine these points and discuss their relevance to Quine's rejection of essentialism as well as their role in his MC argument.

This chapter is divided into two sections. In the first section I examine Quine's treatment of intuitiveness and its relevance to his rejection of essentialism. The naturalized epistemology of science undermines Kripke's use of intuitiveness by taking all evidence to be stimulation and prediction to be the sole test of truth in science (central tenets of current theory), a discovery which also suggests that there is no reason to admit essentialism into scientific ontology. Essentialism is further called into question by

physicalism – another central tenet of current theory – which precludes there being any facts of the matter to essences. The role of prediction also figures prominently in the second section, where I respond to Kripke's arguments in support of natural kinds and essential properties. I explain the Quinean view that these entities should be eliminated from theory because doing so results in a simpler ontology (the desire for simplicity being one of the deepest tenets of the current scientific worldview) without sacrificing any of the predictive success of science. I then explain how Quine can account for Kripke's thought experiments in terms of his maxim of minimum mutilation, which shows that so-called 'necessary' truths (e.g. gold is necessarily the atomic number 79, water is necessarily H2O) are in fact not necessary but rather the sentences of theory that we are least likely to eliminate in the face of recalcitrant data. Finally, I examine how the aforementioned considerations – the rejection of intuitiveness, natural kinds and properties – inform Quine's MC argument. Once we clarify the standards by which Quine approaches the issue of essentialism it becomes evident that Kripke does not provide him with a compelling reason to accept the doctrine or to adopt a modal logic as his regimented language of science.

Section 1: Quine's Rejection of Intuition and Essentialism

Kripke places a great deal of weight on the importance of pre-philosophical intuitiveness and everyday language use to philosophical theorizing. In his view, the intuitive plausibility of modal claims is evidence of their intelligibility and truth. In response to Quine's epistemological challenge to essentialism – which demands that the essentialist provide some non-arbitrary grounds for distinguishing between essential and

accidental properties – Kripke refuses to be misled by speculative philosophical theories and appeals to what is simply reasonable to judge in light of linguistic facts. As we saw in the previous chapter, he first argues that essentialism is intelligible. He says that "it is very far from being true that this idea [i.e., that a property can meaningfully be held to be essential or accidental to an object independently of its description] is a notion which has no intuitive content, which means nothing to the ordinary man" (NN: 41). Though Quine never denies that essentialism has intuitive force behind it (and nothing Kripke says suggests that he attributes this view to him), in Kripke's view the fact that the doctrine is intuitively plausible suggests that Quine is wrong to reject it. He describes a conversation between two men regarding Richard Nixon in order to show that essentialism is not "just some doctrine made up by some bad philosopher, who didn't realize that there are several ways of referring to the same thing" (NN: 41). Kripke believes that the situation illustrates the contrast between Quine's approach to modality and our pre-philosophical approach to these questions – and in so doing shows that Quine's view is misguided. As we saw in the previous chapter, the situation runs as follows:

> Suppose someone said, pointing to Nixon, 'That's the guy who might have lost'. Someone else says, 'Oh no, if you describe him as "Nixon", then he might have lost; but, of course, describing him as the winner, then it is not true that he might have lost' (NN: 41).

The second man believes that the intelligibility of saying that Nixon lost depends on how we specify him. If we specify Nixon by the term 'Nixon', then it is intelligible and true that he might have lost. However, if we describe Nixon as 'The winner of the election' then we cannot intelligibly say that he might have lost, his reasoning being that the statement

(1) The winner of the election might have lost the election

is a contradiction. Kripke believes that the second man is clearly confused. Aside from the fact that making the proper scope-distinctions reveals that the above statement is perfectly true (at least when the modal operator is given narrow scope),[19] it is simply obvious that there is nothing confused in the first man's claim that Nixon might have lost.

> Now which one is being the philosopher, here, the unintuitive man? It seems to me obviously to be the second. The second man has a philosophical theory. The first man would say, and with great conviction, 'Well, of course, the winner of the election *might have been someone else*. The actual winner, had the course of the campaign been different, might have been the loser, and someone else the winner; or there might have been no election at all. So, such terms as "the winner" and "the loser" don't designate the same objects in all possible worlds. On the other hand, the term "Nixon" is just a *name of this man*' (NN: 41).

The first man recognizes the obvious fact that Nixon could have been either the winner or the loser. How we describe Nixon – whether as the winner or the loser or some other description – does not alter the fact that he could have lost the election. This compels Kripke to conclude that if "someone thinks that the notion of a necessary or contingent property (forget whether there *are* any nontrivial necessary properties and consider just the *meaningfulness* of the notion) is a philosopher's notion with no intuitive content, he is wrong" (NN: 41-42). The notion of necessary and contingent properties clearly makes sense, since the modal reasoning demonstrated in the Nixon example comes so naturally to all of us – we use such terms in everyday speech all the time. In Kripke's view, the fact that it has intuitive force lends a great deal of support to the truth of doctrine (a line

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[19] That is, we can give the modal operator in the statement either wide scope or narrow scope. Giving it wide scope (where 'W' is 'the winner of the election', the sentence reads

(1a) $\Diamond \exists x (Wx \,\&\, \forall y (Wy \rightarrow x = y) \,\&\, \neg Wx)$,

which is false, as it is not possible that some object both wins and loses. Giving it narrow scope, the sentence reads

(1b) $\exists x (Wx \,\&\, \forall y (Wy \rightarrow x = y) \,\&\, \Diamond \neg Wx)$,

which is true, since any object *x* that wins the election could have lost the election.

of reasoning that Quine rejects, as we see below). In addition to showing the intelligibility of essentialism, our pre-philosophical intuitions and everyday language seem to provide non-arbitrary grounds for distinguishing between necessary and contingent properties. Although sometimes it is difficult to decide which properties are necessary and which are contingent of some object, it seems clear what is necessary and contingent of Quine's mathematician-cyclist. In Kripke's view, it is obvious that he is only contingently rational, two-legged, a mathematician and a cyclist; and it is just as obvious that he is necessarily human.

Some commentators find Kripke's use of intuition to be completely persuasive as a response to Quine's attack on essentialism. Scott Soames, for example, says:

> We began with an intuitive, pre-philosophical distinction the intelligibility of which is recognized by nearly everyone. Quine offers an objection. He purports to show that there is something incoherent in the way we have all been looking at things. The burden of proof is then on him to demonstrate that there is some internal incoherence in our thinking, some conflict between different aspects of our view that we had not noticed (2003: 351).

Following Kripke, Soames takes agreement with our pre-theoretical intuitions as the "burden of proof" that Quine must answer. Quine, however, does not accept Kripke's (or Soames') methodological standards and neither does his rejection of essentialism contain any claim about internal incoherence or conflict in our thinking. In contrast to Kripke (and Soames), who takes fidelity to what is reasonable and plausible as the standard to judge a philosophical theory, Quine rejects intuitiveness as a test of truth as well as a source of evidence and believes that the reasonableness and plausibility of essentialism provides no compelling reason to admit the doctrine into scientific ontology. He believes that his standards are superior to Kripke's because the epistemology of science – the science of science – shows them to be the very standards of science itself.

Quine's rejection of intuition has been noted by several scholars, but while they discuss aspects of his approach that make intuition a dubious notion they do not (in my view) elaborate in sufficient detail the precise features of his system that rule out intuitiveness and Kripke's use of it. For example, Gary Kemp explains that Quine's rejection of intuition is rooted in his understanding of the history of science:

> The reason [for rejecting intuition] is the sheer fact that what seems clear and obvious does not remain static; it changes. It changes with the advance of knowledge. At each stage of our knowledge, we may well be subject to the illusion that our questions (expressing curiosity about what we don't know) are clear and have definite answers, and that the concepts in terms of which they are asked will be retained in the statements that answer them […] The progress of science is partly progress of recognizing that mere familiarity and fluency with certain concepts is not well correlated with actual clarity and explanatory value, together with acquiring sharper standards for what clarity and explanatory value are. The progress of science partly is a matter of learning what rigorous knowledge is and how to get it (2006: 157).

Although one could possibly make a case against intuition in the manner Kemp is proposing, Quine himself never makes such a case and it is unclear how such an argument is derived from the principles of his system. What is more, it is unclear in what sense this criticism of intuition applies to Kripke, as he bases his intuitive judgments of essentialism on our present language use and scientific facts. He also admits that developments in science can (and do) influence our understanding of essential properties – but this is no different from what we take to be true generally (e.g., our understanding of the universe changes with advances in astronomy, but this does not call into question the fact that there is a universe or that it has certain properties). Peter Hylton identifies Quine's rejection of intuition in the Carnapian strain of his thought (in the sense that what justifies a regimented language are considerations of simplicity and convenience, not fidelity to intuitions) and claims that, due to the fact that all knowledge claims are

embedded in theory, "[t]here is no immediate knowledge – in that sense, no intuition" (2007: 240). Yet it is unclear how this applies to Kripke, as he examines our theory when asking whether essentialism is intelligible – and he seems to find that it is completely intelligible and even presupposed by modern science (for example, by modern chemistry). Richard Creath sees Quine's rejection of intuition as based in his naturalistic empiricism:

> Quine's anti-foundationalism by itself undermines the motivation behind the idea that intuition is a source of knowledge. Moreover, Quine believes, we are far enough into the enterprise of science to have learned therefrom that the only medium of news about the outside world is observation itself. All the rest he characterizes as clairvoyance, which he rightly dismisses. Nor does it seem that the content or character of our pre-reflective beliefs determines to any appreciable extent the outcome of our science (1990: 60-61).

Although Creath is correct in pointing to the role of Quine's naturalistic empiricism in his repudiation of intuition, without further elaboration it is unclear how this refutes Kripke's use of the notion. At face value, there is nothing specifically foundationalist about Kripke's employment of intuition – he simply examines our language and knowledge claims and asks if they commit us to essentialism. Moreover, Kripke can fully accept that "the only medium of news from the outside world is observation itself". We observe certain facts of the world (e.g., that Nixon could have lost, that he has certain parents, that water is H2O, etc.) and when reflecting on these facts (call this using our 'intuition') we see that they commit us to essentialism. What is more, Kripke can agree that our pre-reflective beliefs do not determine the outcome of our science – his claim is that in the face of scientific findings and the workings of language our intuitions compel us to accept essentialism.

Clearly, Quine's rejection of intuition has to be clarified. This is not to say that the scholars discussed above are wholly misguided in their approach to Quine's rejection of the notion. Kemp is right to look towards Quine's understanding of science, Hylton is correct to look towards Quine's views on theory and Creath is right to look towards Quine's naturalized epistemology – but they fail to pinpoint and discuss the precise feature of his system that rules out intuition: prediction. Quine studies the physiology of evidence and discovers that prediction is the sole test of truth in science – and quite simply, beliefs based on intuitions (whether pre-philosophical or epistemologically robust) often prove to be wrong when checked against predictions. Reliance on intuition (that is, on what is reasonable and plausible) may be admissible where there is no direct evidence – in the higher reaches of abstract theory – but it is hardly a constraint on theorizing, or else science would not posit such entities as black holes, anti-matter, or transfinite numbers. Kripke might think that the failure to make accurate predictions is more or less irrelevant to judging the merits of our intuitions (with regard to necessity in particular), but for Quine – and, in his view, for science in general – it is critical. The ability to make accurate predictions (not intuitive plausibility) is crucial for something to count as a viable theory – it is crucial for a theory to count as true. What is more, the ability to make accurate predictions (along with considerations of simplicity) is the deciding factor in what to admit into scientific ontology – anything may be eliminated from reconstructed theory so long as doing so does not sacrifice the predictive success of science. In what follows I review Quine's reasons for taking prediction to be the sole test of truth and explain its relevance to his rejection of essentialism.

As noted in Chapter 1, Quine takes it to be a finding of physical theory that we come to know the world solely through the stimulation of our sensory receptors. Naturalized epistemology aims to discern how we construct our theory of the world from the basis of these stimulations and how our theory turns out to be true – in particular, the logic of evidence strives to account for the link between stimulation (which is non-linguistic) and theory (an apparatus made up of sentences). As he conducts his investigations from within our theory of the world, Quine strives to offer the simplest explanation of the link between evidence and theory possible – simplicity being one of the central tenets of current science and a crucial constraint in speculations at the highest reaches of theory such as his quest to understand how we construct our theory (and, as we shall see, crucial as well to the question of whether or not to admit essentialism into scientific ontology, which is itself a question at the highest reaches of theory).

As noted in Chapter 1, observation categoricals account for the link between evidence and theory – a point which reveals the role of prediction to science. Observation categoricals are predictions and are the sole means by which we judge a theory's evidential support.

> [W]hen I cite predictions as the checkpoints of science […] I see it as defining a particular language game, in Wittgenstein's phrase: the language game of science, in contrast to other good language games such as fiction or poetry. A sentence's claim to scientific status rests on what it contributes to a theory whose checkpoints are in prediction (PT: 20).

The ability to make successful predictions is the deciding factor in whether or not we accept some sentence (or group of sentences) into our theory of the world. While the goals of current science are usually technology and understanding, prediction "is what decides the game, like runs and outs in baseball" (PT: 20) – it is the criterion of truth, and

it is because our theory is true that it increases understanding and leads to technological advancements. Intuition may be a viable source of conjecture (e.g., a chemist has a hunch there will be an explosion if some two chemicals are mixed) but it is no test of truth. This is the case whether in ordinary situations or austere science. The reliance on intuition as a test of truth is misguided in either context – it is only more apparent in scientific investigation because that is where our commonplace methodological standards are more refined.

> [S]cience is itself a continuation of common sense. The scientist is indistinguishable from the common man in his sense of evidence, except that the scientist is more careful. This increased care is not a revision of evidential standards, but only the more patient and systematic collection and use of what anyone would deem to be evidence (SLS: 233).

Quine's account of the relation between evidence and theory sees science as developing and refining the practices of common sense. His study of the epistemology of science (and in particular his investigation into the physiology of evidence) clarifies the notion of evidence – it shows that "what anyone would deem to be evidence" should be the stimulation of our sensory receptors – not intuitiveness – as this is what current science itself teaches (whether or not this truth is always recognized by practicing scientists). Scientific epistemology also shows that although people sometimes rely on their intuitions in everyday life (perhaps when discussing whether Nixon could have lost, for example), intuitiveness is no test of truth in everyday affairs or in science – prediction (formulated in observation categoricals and tested against stimulation) serves as the test in both cases. Our (often unrecognized) employment of prediction to evaluate beliefs in everyday life has shown the inefficacy of intuition, and prediction in science has long since shown intuition to be an unreliable test of truth as well as proving itself to be the

only test of truth – all this is supported by Quine's study of the epistemology of evidence, which discovers that the observation categorical is the test of theory. The scientific study of science – by discovering that stimulations are our sole contact with the world and identifying the observation categorical as the link between evidence and theory – shows that the ability to make accurate prediction is the deciding factor in whether or not to accept a theory as true and one of the central tenets guiding the modern scientific enterprise.

In Quine's view, the logic of scientific evidence consists in testing observation categoricals, which a certain theory (often together with some hypothesis) implies. As noted in Chapter 1, Quine describes a test conducted by a group of mineralogists in order to illustrate this process. The scientists have discovered some pink material (which they call 'litholite'), and one of them guesses at its chemical composition. In order to check if his hypothesis is correct the mineralogist proposes an experiment. By taking into account his background theory (e.g., the current state of chemical knowledge) he is able to predict that if the pink mineral has the composition in question it will emit hydrogen sulphide when it is heated above 180° C. That is, the body of accepted chemical theory and the hypothesis concerning the composition of the mineral imply the following observation categorical:

(2) When litholite is heated above 180° C, it emits hydrogen sulphide.

The group of scientists performs a test to discern the truth of the categorical and by extension test the hypothesis. They heat the litholite and observe what happens. If the material does not emit the gas when heated, the hypothesis is discarded. If, on the other hand, it does emit the gas, the hypothesis is accepted, however provisionally. While the

mineralogist might base his hypothesis on some sort of intuition (an intuition derived from his knowledge of chemical theory), the intuition is not the test of the hypothesis' truth. His hypothesis is tested by the predictions it issues, in this case the observation categorical (2) – a procedure which Quine takes as paradigmatic of the logic of science. The essentials of this procedure (hypotheses tested against predictions, as formulated in observation categoricals) are at the root of all methodologically sound scientific investigation (and common sense as well, Quine maintains).

Besides casting doubt on the soundness of Kripke's appeals to intuitiveness, the discovery that prediction is the test of truth calls into question the place of essentialism in scientific ontology. This point has not been noted by Quine scholars, who tend merely to claim that modern science has no place for essentialism (evidently begging the question against Kripke's claims about gold and species and the like) and as a result offer little insight into Quine's rejection of the doctrine or how he could respond to Kripke's arguments in support of it. Peter Hylton, for example, says:

> Quine holds that questions about which traits are essential and which accidental are barely intelligible. From his point of view, such questions are wholly pointless. He simply takes it as evident that the idea of essence has no serious scientific use; modern science, unlike Aristotelian science, simply has no place for the notion (2007: 354).

Hylton is correct that Quine sees essentialism as having no scientific use, but he does not explain why Quine thinks this. In Christopher Hookway's opinion, Quine maintains that "the notion of essence has been left behind with Aristotelian science" (1988: 121). Hookway says that "[i]f they [essential properties] are not required for describing 'the facts', then the Quinean logician can ignore them" and that "[e]ssence belongs with the concept of substance which […] is viewed by Quine as dispensable for scientific

purposes", as well as that Quine's "constant pairing of 'essentialism' and the name or Aristotle indicates that he sees essentialism as belonging with a discarded scientific tradition" (1988: 122). However, Hookway's contention that Quine sees essentialism as dispensable for scientific purposes, while correct, requires elaboration. What is more, Kripke seems to show that essential properties are required for describing 'the facts' – for example, we seem committed to the claim that water is necessarily H2O – and so Quine's reasons for rejecting Kripke's view must be examined. Peter Kemp argues that Quine's main argument against essentialism is that "science itself does not provide any encouragement: the modal adverbs 'necessarily' and 'possibly' simply do not figure in the theoretical language of physics or natural science generally" (2006: 148). This, however, cannot be Quine's main argument against the doctrine because he is not committed to adopting the vocabulary that scientists happen to employ at any given time – he aims to reconstruct scientific theory and in so doing changes the vocabulary of current science as he sees fit, whether by eliminating or adding locutions (and thereby perfecting the vocabulary of current science). Moreover, Kripke seems to show that essentialism is presupposed in many scientific claims. In a somewhat different vein, Roger Gibson points to Quine's views about theory to support the contention that essentialism should not be admitted into scientific ontology. He says:

> [E]ssentialism is not something Quine can accept, given his commitment to the NB [naturalist-behaviouristic] conception of language. That conception of language has led him to the view that what objects there are, together with their properties, is a question to be settled only relative to some theoretical framework that itself is underdetermined by experience; moreover, it is a question to be settled only relative to some translation of that theory into the *purely extensional* canonical notation (1988: 15-16; see also 1982: 155).

However, I believe that this portrayal of Quine's rejection of essentialism is flawed. It is unclear how Quine's view that ontological claims are "to be settled only relative to some theoretical framework that itself is underdetermined by experience" rules out Kripke's version of essentialism (or any other version). Although Quine believes that theory is underdetermined, he takes the truths of theory to be true in the truest sense of the word until we have reason to discard them – but essentialist claims need not be different than any other truth of theory in this regard, and so they seem perfectly compatible with the underdetermination of theory. As Kripke shows, an essentialist can be a fallibilist – he can admit that science sometimes compels us to refine our essentialist convictions. What is more, while it is true that Quine sees no reason to modify his preferred language so as to accommodate essentialism, his reasons for believing this must be examined. Given Kripke's argument that essentialism is presupposed in current science, it seems as if Quine should translate essentialism into the canonical notation – he seems compelled to accept a modal logic as the reconstructed language of science. It is not enough for Quine (or Gibson, as an expositor of Quine's views) to assert that essentialism is ruled out simply because it cannot be translated into his preferred regimented language. The challenge is to show why it need not be admitted into the canonical notation. In what follows I explain the role of prediction and then the role of physicalism in there being no reason for Quine to admit essentialism into scientific ontology (or adopt a modal logic), and in the next section I examine how Quine could respond to Kripke's arguments purporting to show the existence essential properties and natural kinds.

As noted in Chapter 1, Quine sees our theory as a web of interconnected sentences. The place of any sentence in this web represents its proximity to stimulation

and how central it is to our theory. Sentences at the periphery are most likely to be revised or eliminated in the face of recalcitrant stimulation, whereas sentences at the core are deeply held convictions and least likely to be revised or discarded. Whether among the sentences at the periphery or the core of our theory, however, eliminating essentialist claims seems to sacrifice none of the predictive success of science – a fact which suggests that admitting essentialism into theory is a needless complexity (and considerations of simplicity are decisive when addressing questions at the highest reaches of theory, such as the question of whether or not to admit essentialism into our theory). First I consider what essentialism might contribute to the sentences near the periphery of theory. Suppose that some material – say, litholite – has the chemical composition *x*. This means that the sentence

(3) Litholite has chemical composition *x*

is included in our theory of the world. When taken with other sentences of theory, such as

(4) All materials with the chemical composition *x* emit hydrogen sulfide when heated above 180° C,

sentence (3) implies the categorical

(2) When litholite is heated above 180° C, it emits hydrogen sulphide.

However, it is unclear what admitting essentialism into theory would add to this prediction. Suppose, following Kripke, we take theoretical identifications to be necessary. We add a modal operator (in *de re* position) to sentence (3), with the resulting sentence being included in our theory:

(5) Litholite necessarily has chemical composition *x*.

But when taken with other sentences of theory (perhaps also amended to admit modal operators), sentence (5) seems to imply the same categoricals as (3). That is, it implies

(2) When litholite is heated above 180° C, it emits hydrogen sulphide.

But if (5) implies the same categoricals as (3), there appears to be no reason to complicate our theory by admitting the essentialist claim (5) into it – sentence (5) seems to add nothing to the truth of our theory. However, it might be objected that first impressions notwithstanding, sentence (5) does not in fact imply all the same categoricals as (3). That is, sentence (5) (along with other sentences of theory, suitably amended) implies categoricals that contain modal operators, such as

(6) Necessarily, when litholite is heated above 180° C, it emits hydrogen sulphide.

But it is unclear what the addition of the modal operator contributes to the predictive power of the sentence. Categorical (6) might be said to differ from the original one (2) in that it concerns the behaviour of litholite in all possible worlds. However, the predictions of science concern only the actual world and so the addition of the modal operator to the categorical contributes nothing to the predictive success of theory (see also Chapter 3 for Quine's rejection of possible worlds) and it is unclear how we can test whether litholite emits hydrogen sulphide necessarily (or in all possible worlds).

Eliminating essentialism from reconstructed theory also seems advisable given the fact that contradictory essentialist claims seem to imply the same categoricals. As we saw above, when taken together with other sentences of theory, the sentence

(3) Litholite has chemical composition *x*,

implies the categorical

(2) When litholite is heated above 180° C, it emits hydrogen sulphide.

On the other hand, the negation of sentence (3), namely

(7) Litholite does not have chemical composition *x*,

implies the categorical

(8) It is not the case that when litholite is heated above 180° C, it emits hydrogen sulphide.

(We suppose for the sake of simplicity that only substances with chemical composition *x* emit hydrogen sulphide when heated above 180° C.) The scientists studying the material can test categoricals (8) and (2) and decide whether statement (7) or (3) should be admitted into theory – they decide whether (7) or (3) is true. However, it seems impossible to decide between competing essentialist claims on these grounds because they imply either the same observation categoricals or ones that are neither acceptable (given Quine's commitment to physicalism) nor testable. For example, take the competing essentialist claims,

(5) Litholite necessarily has chemical composition *x*,

(9) Litholite contingently has chemical composition *x*.

Where these sentences conflict is not on the question of whether or not litholite has a certain chemical composition, but whether or not it has this composition necessarily – a significant difference from the modal metaphysician's point of view. However, when taken with other sentences of theory, these sentences seem to imply the very same observation categoricals, one being the sentence

(2) When litholite is heated above 180° C, it emits hydrogen sulphide.

If (5) and (9) imply the same categoricals, then there is no conflict between them and the locutions that lead us to believe they were conflicting (the modal operators) have no bearing on the truth of our theory – a point which suggests that the operators should be eliminated because doing so makes for a simpler theory with no sacrifice of predictive power. It might be objected that (5) and (9) do in fact imply different categoricals. For example, taken with other sentences of theory sentence (5) implies

> (10) In all possible worlds, when litholite is heated above 180° C, it emits hydrogen sulphide,

and (9) implies

> (11) In some (but not all) possible worlds, when litholite is heated above 180° C, it emits hydrogen sulphide.

However, as stated above, the predictions of theory concern only the actual world and so (10) and (11) are not admissible into reconstructed theory. What is even more problematic, however, is that given Quine's naturalistic account of evidence it is unclear how we could decide which categorical is true – since the categoricals agree that litholite emits the gas but conflict on whether or not it does so necessarily, any stimulatory conditions that prompt assent to (10) also prompt assent to (11), and any conditions that prompt dissent from (10) also prompt dissent from (11). Because of these difficulties, there appears to be no way to test whether litholite is essentially or accidentally *x* – if the question cannot be decided on the basis of observation categoricals it cannot be decided at all. There appears to be no conflict between sentences (5) and (9) and so the locutions that lead us to believe that they do conflict (the modal operators) have no bearing on the

truth of our theory – a point which suggests we should eliminate essentialism from theory and the modal operators from the language of science.

Kripke might respond that the scientific use of essentialism is demonstrated by the periodic table of elements, which is a theory about the essential properties of substances and has given rise to inferences involving laws of nature and counterfactuals and has proved successful in making predictions. Quine, however, argues that viewing the periodic table in this way adds nothing to the truth of theory and so considerations of simplicity counsel us to avoid doing so (see his rejection of natural kinds and properties, below) and, moreover, that his regimented language accounts for laws of nature and counterfactuals in non-modal (or essentialist) terms (see Chapter 1).

It might be objected that attributions of essentialism are not the sort of claims that are straightaway tested or that obviously contribute to the predictions of theory, not even in the sense of the periodic table. Rather, like the truths of mathematics and logic they figure at the very center of our theory and in a more or less indirect way contribute to its predictions. Even in this case, however, it appears that (unlike the truths of mathematics and logic) essentialism can be removed from our theory without sacrificing any of the predictive success of science. We seem unable to eliminate central mathematical and logical truths from our theory without jeopardizing its predictive power. For example, elimination of the principle of non-contradiction would result in admitting contradictory statements into theory and would jeopardize the role of prediction as a test of theory as well as the predictive power of our theories. The truth of the categorical

(2) When litholite is heated above 180° C, it emits hydrogen sulphide

would not rule out its negation – making it impossible to determine whether or not any given hypothesis were true. However, elimination of essentialism from theory seems to have no such consequences. For example, it is unclear how eliminating the principle of the necessity of identity,

(12) $(x = y) \rightarrow \Box (x = y)$

in any way sacrifices the predictive success of science. In Quine's view, there are fundamental principles concerning identity the removal of which would jeopardize the predictions of science (as would, for example, removal of the principle of the indiscernibility of identicals), but the necessity of identity does not seem to be one of them. Kripke might respond that attributions of essentialism have content beyond what is entailed by observation sentences – as is typical in theoretical claims of advanced science – and are valuable additions to our theory because they contribute to our understanding of the world. For example, while the sentence

(5) Litholite necessarily has chemical composition *x*,

cannot be tested on the basis of observation categoricals, it is nevertheless true and adds to our understanding of litholite – it tells us that having the chemical composition *x* is part of the very nature of the material. As was noted above, however, while Quine admits that one of the purposes of science is understanding, he maintains (and Kripke would agree) that for a sentence to contribute to our understanding it must be true – but his study of the epistemology of science shows that the only way to determine whether a sentence is true is to test it or the observation categoricals it implies. Since essentialist claims cannot be tested on the basis of observation categoricals there is no reason to take them as true or false – and consequently no reason to think that they add to our understanding of the

world. Quine advocates eliminating essentialism from theory since doing so results in a more parsimonious ontology (considerations of simplicity being paramount in the higher reaches of theory) without sacrificing any of the truth of science (judged in terms of predictive success).

The role of prediction is not the only tenet of current science that serves to call into question the purpose of admitting essentialism into theory. Physicalism does so as well, because it results in there being no fact of the matter to essence.

Being internal to our theory of the world, Quine's epistemology of science takes the standards and the findings of the natural sciences into consideration when regimenting theory and clarifying the ontological commitments of science. He believes that science shows us "in a general way what the world is like, with its light rays, molecules, men, retinas and so on" (SLS: 229), and so his naturalism "looks only to natural science, however fallible, for an account of what there is and what what there is does" (SN: 9). Investigating the best natural science of the day so as to inform his clarification of the ontology of theory (clarifications which in turn contribute to the best science of the day that scientific epistemology studies), Quine finds that one of the central tenets guiding current science is that physics studies the most fundamental features of the world and that causal explanation ends at the physical level:

> The terms that play a leading role in a good conceptual apparatus are terms that promise to play role in causal explanation; and causal explanation is polarized. Causal explanations of psychology are to be sought in physiology, of physiology in biology, of biology in chemistry, and of chemistry in physics – in the elementary physical states (FOM: 168-9).

Our theory (when properly reconstructed) holds, for example, that the explanation of a certain mental illness (at the psychological level) is found in a neurological disorder (the

physiological level), which has its origin in some genetic trait (the biological level). The particular nature of these genes is explained at the chemical level (e.g., in terms of amino acids) and the explanation of the workings of these chemical entities is sought in physical terms (e.g., atoms or lower). Because it is a central tenet of science itself, Quine's reconstructed theory maintains that there is no change without some change at the level of microphysical states:

> Why […] this special deference to physical theory? […] The answer is not that everything worth saying can be translated into the technical vocabulary of physics; not even all good science can be translated into that vocabulary. The answer is rather this: nothing happens in the world, not the flutter of an eyelid, not the flicker of a thought, without some distribution of microphysical states. It is usually hopeless and pointless to determine just what microphysical states lapsed and what ones supervened on the event, but some reshuffling at that level there had to be; physics can settle for no less. If the physicist suspected there was any event that did not consist in a redistribution of the elementary states allowed for by his physical theory, he would seek a way of supplementing his theory. Full coverage in this sense is the very business of physics, and only of physics (GWW: 98).

By accepting that there is no change without some change at the physical level – a finding of science itself – Quine does not claim that all science – or, for that matter, all statements of his canonical notation – can be reduced to the technical language of current physics. Nor does he claim to be able "to sort out the pertinent distributions of microphysical states and relations" for any given change (TPT: 23). Physicalism is the ontological doctrine which simply states that there is no change (whether at the chemical, biological or psychological levels of study, for example) without some change at the physical level. The doctrine is a part of physics, in that the aim of physics is to discover the fundamental features of all reality – it provides "full coverage". There may be practicing physicists who believe in non-physical entities (minds and the like) but in this

case (unless they are actively trying to understand such entities in physical terms or have evidence to support their position) they misunderstand or simply reject current theory. Quine comments, "[a]nyone who will say, 'Physics is very well in its place' – and who will not? – is then already committed to a physicalism of at least the nonreductive, nontranslational sort stated above" (GWW: 98). Acceptance of physics brings with it an acceptance of physicalism – and anybody who accepts physics (and by extension physicalism) should reconsider his commitment to essentialism.

As I argue below, one implication of Quine's physicalism is that there is no fact of the matter to essentialism – there is no physical difference between competing essentialist claims and so it is unclear what essentialism adds to the ontology of theory. In what follows I discuss Quine's understanding of physical difference and explain its application to essentialism.

The fact that there is no change without some change at the physical level is the basic tenet of physicalism – the position that "there is no difference in matters of fact without a difference in the fulfillment of the physical-state predicates by space time regions" (FOM: 166).[20] That is to say, in order for there to be a difference between two statements in the canonical notation, the regions to which the predicates in the respective statements correspond must differ in some way. For example, in order for there to be a difference between *Fx* and *not Fx*, the space-time regions that are true of the sentences must be different. Quine maintains that it is not up to him to decide what counts as a physical difference – it is up to physics to do so (subject to his canonical reconstruction, which is on the same epistemological level as high-level physical theory). He sees this

[20] Quine's physicalism must not be confused with materialism, the doctrine that only material things exist. Physicalism admits the existence of mathematical objects, which are changeless and are not causes of physical changes and so are not ruled out by the definition of the doctrine.

view as uncontroversial, because part of the very goal of physics down the ages has been to discover what counts as a physical difference (FOM: 163-4). At one time in the history of science physicalism would have been formulated with reference to bodies – such as atoms or elementary particles – but present science compels Quine to formulate the doctrine in terms of space-time regions. He describes this ontology as follows:

> There are the real numbers, needed to measure the intensity of the various states, and there are the space-time regions to which the states are ascribed. By identifying each space-time point with a quadruple of real or complex numbers according to an arbitrary system of coordinates, we can explain the space-time regions as sets of quadruples of numbers. The numbers themselves can be constructed within set theory in known ways, and indeed in pure set theory; that is, set theory with no individuals as ground elements, set theory devoid of concrete objects (FOM: 164).

This ontology contains no bodies but is "the purely abstract ontology of pure set theory, pure mathematics" (FOM: 164). His reconstructed language of science contains all the predicates we would expect it to have – 'is a rabbit', 'is a person', 'is water', etc. – as well as variables and truth functions. The variables range over sets. "The predicates comprise the two-place mathematical predicate 'ε' of set membership and, for the rest, physical predicates. These will serve to ascribe physical states to space-time regions, each region being a set of quadruples of numbers" (FOM: 165). The predicates are true not of bodies but of space-time regions (instead of speaking of a rabbit, for example, we speak of a space-time region that fulfills the predicate 'rabbit'). Quine gives two examples of physical predicates, one involving leftward spin and the other involving temperature. To say that some object has leftward spin we write '*Fx*'. The values of the predicates of Quine's notation are sets of quadruples of numbers, and the predicate '*F*' reads 'leftward spin in region…'. The statement

(13) $\exists x\,(Fx)$

is true so long as some object has leftward spin in the region specified. We can also ascribe temperature to a certain region. The two-place predicate '*Fxy*' is read as 'the temperature in degrees Kelvin of the region…is…' (FOM: 166). The statement

(14) $\exists x \exists y\ (Fxy)$

is true so long as the temperature in the specified region is the specified degree. Quine's physicalism compels him to admit only physical predicates into his canonical notation – predicates which are fulfilled by space-time regions – and holds that there is no difference without a difference in the fulfillment of these physical-state predicates by space-time regions. For example, for there to be a difference between the sentences

(15) $\exists x\ (Rx)$,

where '*R*' is the predicate 'is a rabbit' and

(16) $\neg\ \exists x\ (Rx)$,

there must be a difference in space-time regions specified by the sentences: sentence (15) is true if there is some space-time region that fulfills the predicate 'rabbit', whereas (16) is true if there is no space-time region that fulfills the predicate. While physicalism is a basic tenet of current physical theory, Quine admits that the formulation of physicalism in terms of space-time regions is subject to revision (as physical science is unfinished) but believes that it is the best we have for the time being. According to this formulation, "a predicate is only acceptable if the difference between the situation in which it holds of a given object at a given time and the situation in which it does not is a *physical* difference" – a difference in space-time regions (Hylton 2007: 312). For example, since there is a difference between *Rx* and *not Rx* – the open sentences are true of different space-time regions – the predicate *R* may be admitted into the canonical notation.

Quine's regimented language can admit many of the predicates we employ in ordinary language, but in what follows I argue that his physicalism rules out essentialism from scientific ontology. This is because there is no fact of matter to attributions of *de re* modality – the space-time regions true of the open sentence '□ *Fx*' are no different than the space-time regions true of the sentence '*not* □ *Fx*'. To show that this is the case I turn to one example that Kripke takes to show the truth of essentialism: the humanity of Nixon.

In Kripke's view, Richard Nixon is essentially human (assuming that Nixon is in fact human). That is, where '*H*' is the predicate 'human' and '*n*' is 'Nixon' he takes statement

(17) □ *H*(*n*)

to be true and he takes the negation of the *de re* modality, namely statement

(18) ¬ □ *H*(*n*)

to be false. From the point of view of Quine's physicalistic canonical notation, however, there is no fact of the matter to these modal claims. Quine's notion of a matter of fact is "not transcendental or yet epistemological, not even a question of evidence; it is ontological, a question of reality, and to be taken naturalistically within our scientific theory of the world" (TPT: 23). There is a fact of the matter to a sentence when there is a physical difference between the states the sentence and its negation represent. There is a physical difference between the sentence 'Nixon is human' and the sentence 'Nixon is not human': the former is true of some space-time region but the latter is not. However, there is no physical difference between statements (17) and (18) – both are fulfilled by the same space-time regions. In these sentences, the fact that Nixon is human is not in

question. Rather, the question concerns whether or not he is necessarily human – and there is no fact of the matter to this issue because the same space-time regions pertain to (17) and (18) and decide nothing (nor can the essentialist respond that the space-time regions true of them differ across possible worlds, as physicalism rules out these entities – see Chapter 3 – and moreover observation categoricals concerning possible worlds cannot be tested). Neither does there seem to be a fact of the matter to any essentialist claims we can think of (for example, the necessity of gold being the atomic number 79 or the necessity of heat being the motion of molecules). Since there is no fact of the matter to essence, there seems to be no reason to admit essentialism into scientific ontology.

In Quine's view, Kripke's response to his epistemological challenge is undermined by central tenets of the current scientific worldview (that are likewise adopted by naturalized epistemology) – prediction, physicalism and a desire for simplicity – which form the burden of proof that Kripke must satisfy in order to justify essentialism (as they must be satisfied in any theoretical investigation, Quine's included). Kripke's reliance on intuitiveness as providing non-arbitrary grounds for deciding between competing essentialist claims is undermined by the role of prediction, which the epistemology of science shows to be the sole test of truth. Once we recognize the role of prediction in science, we see that it is impossible to decide between competing essentialist claims and that we should eliminate essentialism from theory because doing so simplifies ontology without sacrificing any of the predictive success of science. As a consequence of physicalism there appears to be no facts of the matter to essences – a point which further supports eliminating essentialism from scientific ontology.

Interestingly, Kripke seems to agree with Quine that physicalism and essentialism are incompatible. For example, the very last paragraph of *Naming and Necessity* reads:

> I suspect, however, that the present considerations tell heavily against the usual forms of materialism. Materialism, I think, must hold that a physical description of the world is a *complete* description of it, that any mental facts are 'ontologically dependent' on physical facts in the straightforward sense of following from them by necessity. No identity theorist seems to me to have made a convincing argument against the intuitive view that this is not the case (NN: 155).

While Quine distinguishes between physicalism and materialism and admits non-material entities (e.g., mathematical objects) – and nothing Kripke says suggests he takes Quine to think otherwise – the above passage can be seen as a criticism of Quine because his physicalism holds that a physical description of the world is a complete description of it. The passage illustrates Kripke's conviction that the conflict between essentialism and physicalism should not worry the proponent of modal metaphysics. In his view, when faced with a conflict between physicalism and essentialism, it is physicalism that should be discarded from science – he takes this as a consequence of the fact that science presupposes natural kinds and essential properties (as well as further considerations regarding a priori and a posteriori truths). Quine, however, believes Kripke errs in thinking that science presupposes these entities and so his reasons for accepting essentialism and rejecting physicalism are unsound. In the next section I examine how Quine could respond to Kripke's arguments in support of kinds and essential properties.

Section 2: Quine's Rejection of Properties and Natural Kinds

Kripke responds to the ontological challenge to essentialism presented in the MC argument by turning to an analysis of everyday and scientific language that seems to

support the existence of natural kinds and essential properties. In his view, a thorough examination of what scientists actually do and say reveals that natural kinds and essential properties are presupposed in current scientific theory. If this is right, it seems Quine's own standards ought to compel him to admit natural kinds and essential properties into scientific ontology – it appears that Quine should adopt a modal logic as his canonical notation after all. When confronted with Kripke's defence of essentialism, however, Quine stands fast to his rejection of the doctrine. In his view, Kripke's arguments for admitting natural kinds and essential properties into scientific ontology are misguided and provide no compelling reason to adopt a modal logic as the language of science. Although Kripke may be right that practicing scientists routinely speak in terms of properties and natural kinds (or speak in ways that seem to require a commitment to them), he is wrong to think that they are presupposed by statements of scientific theory. For Quine, we are not committed to the existence of natural kinds or properties because eliminating them from theory results in a simpler ontology without sacrificing any of the predictive power of science. In this section, I first explain Quine's contention that properties and kinds should be eliminated from theory. I then show how Quine can account for Kripke's thought experiments in support of these entities in terms of his maxim of minimum mutilation. Finally, I re-examine the MC argument in light of the issues discussed in this chapter.

As we saw in Chapter 4, when responding to Quine's challenges to essentialism Kripke places a great deal of weight on what scientists mean when they speak and what their statements imply. He believes that reflecting on linguistic use reveals that statements of science presuppose essentialism. In Quine's estimation, however, Kripke's

discussion of linguistic use fares no better than his reliance on intuition. This is because, as was noted in Chapter 3, Quine does not admit pre-philosophical language as a definitive guide in ontological investigations – although he uses terms found in common discourse, he never relies on everyday ways of speaking (whether the language found in the marketplace or the laboratory) to decide ontological issues. While ordinary language has its place as a theoretical starting point, its philosophical significance should not be overestimated.

> There are, however, philosophers who overdo this line of thought, treating ordinary language as sacrosanct. They exalt ordinary language to the exclusion of one of its own traits: its disposition to keep on evolving. Scientific neologism is itself just linguistic evolution gone self-conscious, as science is self-conscious common sense. And philosophy, in turn, as an effort to get clearer on things, is not to be distinguished in essential points of purpose and method from good and bad science (WO: 3-4).

Quine would not accuse Kripke of being an ordinary language philosopher, but he would see Kripke's analysis of how laypeople and practicing scientists speak pre-philosophically as having no special significance for philosophy or ontology. In his view, the fact that practicing scientists employ certain idioms or speak of certain entities in their researches does not by itself imply that these idioms should be admitted into the regimented language or that these entities should be admitted into scientific ontology. As noted in Chapter 1, for example, Quine recognizes that scientific theorizing is rife with counterfactual reasoning and that the counterfactual idiom is "the indispensable vehicle of thought experiment" (FSS: 98). But he also maintains that counterfactual conditionals need not be admitted into the canonical notation, the aim of which is to clarify the ontological commitments of current scientific theory. For example, consider a counterfactual that is implied by current theory. The statement

(19) Sugar cube *s* might have dissolved

implies the counterfactual

(20) If sugar cube *s* had been placed in water, it would have dissolved,

which in turn seems to be true because in some possible world, *s* is placed in water and dissolves. It might also be thought that statement (19) and the corresponding counterfactual (20) imply the existence of kinds – i.e., sugar cube *s* would dissolve in water because it is a member of the kind 'sugar', and sugar dissolves in water. Yet Quine maintains that accounting for the truth of (20) (and other counterfactuals implied by current theory) does not require the use of modal notions and does not commit us to a modal ontology. Counterfactual (20) can be paraphrased in terms of the material conditional with a complex antecedent, for example

(21) $\forall x$ (if x is a piece of sugar and x is placed in water at time t_0, x dissolves),

a statement which is true not because there is a possible world in which the sugar cube is placed in water and dissolves but because the actual world is such that if the antecedent is true the cube dissolves. Neither does (21) involve commitment to natural kinds (as is discussed below).

Though Quine does not propose eliminating counterfactuals from scientific practice, his paraphrases reveal that using counterfactuals in scientific experiment commits us ontologically to nothing more than the actual physical world and the objects found therein. At first glance this appears not to be the case. For example, imagine a sport nutritionist (Charlie, say) is considering the best diet for 100-metre sprinters. His test subject, Ben, can run 100 metres in 10 seconds. Charlie hypothesizes that ingesting a

certain dose of amino acids before a race can improve a runner's best (amino acid free) sprint by more than .20 of a second. That is, he proposes the counterfactual:

(22) If some runner *r* were to ingest amino acids before racing, his best (amino acid free) time would be improved by more than .20 seconds.

With respect to his test subject, this means that if Ben were to ingest amino acids before racing, he would shorten his (amino acid free) running time to less than 9.80 seconds. Charlie conducts a simple experiment to prove his hypothesis. He gives Ben a placebo but Ben's sprint is no faster. He then has Ben ingest the required dose of amino acids before racing again, and Ben runs the 100-metre in 9.79 seconds – a personal best (and world record) which supports the truth of counterfactual (22) and vindicates Charlie's hypothesis. Charlie has Ben race once again, this time without the dose of amino acids, and his sprint time is back to 10 seconds, further strengthening Charlie's hypothesis. Though central in framing experiments, counterfactuals such as (22) can be paraphrased in terms of the material conditional without sacrificing the truths that they represent. That is, counterfactual (22) can be paraphrased as

(23) $\forall x$ (if x is a sprinter and x ingests amino acids before a race, etc., then x will improve x's time up to .20 seconds).

Of course, Charlie will not use this conditional in framing or performing his experiment because doing so would be too cumbersome, but Quine's aim is to clarify the ontological commitments of science and not to adhere to the idioms that practicing scientists use in conducting experiments or anywhere else. The fact that (22) (and other counterfactuals) can be paraphrased in this way shows that the counterfactuals scientists use in their experiments do not commit them to a modal ontology – these usages that suggest we

must bloat our ontology with possible worlds "can be avoided in favour of ones that engender no such problems" (WO: 261).

Just as science generally is free to develop and revise its vocabulary (and continually does so), naturalized epistemology is free to depart from the language of practicing scientists (and what that language implies) when doing so is warranted – e.g., to ensure predictive success or to simplify theory. It is no constraint on physics that it preserve the locutions it employs at any given time, and Quine's reconstructed language of science – as the branch of physics that reconstructs physical theory – is not constrained by the language used by practicing physicists either. In Quine's view, Kripke's desire to take the language of practicing scientists as a guide veers close to mere "steadfast laymanship" that fails "to appreciate that it is precisely by showing how to circumvent the problematic parts of ordinary usage that we show the problems to be purely verbal" (WO: 261). While Kripke might show that scientists speak in a way that seems to commit them to the existence of essential properties and natural kinds – these scientists might even intend to posit these entities – Quine maintains that this linguistic use (or the intentions of practicing scientists) provides no compelling reason to admit these entities into theory. In his view, their place in theory is determined by their role in the predictive success of science – and because properties and natural kinds can be removed from reconstructed theory without sacrificing any of the truth of science (judged in terms of predictive success), they should not be admitted into theory.

Properties cannot be individuated in Quine's canonical notation because there are different properties that have the same extension in his language. For example, we may suppose that the property of being a creature with a heart (*H*) is different from the

property of being a creature with a kidney (*F*), but *Hx* and *Fx* are true of all the same objects – every creature with a heart is also a creature with a kidney. Moreover, admitting properties into Quine's notation would result in failures of extensionality. For example, the statement

> (24) The property of being a creature with a heart = the property of being a creature with a heart,

is true (assuming for the sake of argument that properties exist). However, given that the property of being a creature with a heart has the same extension as the property of being a creature with a kidney, we should be able to replace one side of the identity statement with 'the property of being a creature with a kidney' without altering the truth value of the sentence. This cannot be done, however, since the resulting statement

> (25) The property of being a creature with a heart = the property of being a creature with a kidney,

is false – the property of having a heart is (supposedly) different from the property of having a kidney. Quine recognizes that he could individuate properties by adopting a different canonical notation – say, for example, a modal logic:

> Such distinctions [between coextensive attributes] are indeed present and called for in modal logic. Also, as we saw, the acceptance of modal logic carries with it the acceptance of a way of individuating attributes. Anyone who rejects this way of individuating attributes also rejects modal logic, as I do (OIA: 107).

Although 'having a heart' and 'having a kidney' apply to all the same objects in the actual world, modal logics can individuate these properties because they are not coextensive in all possible worlds – there are worlds where creatures with hearts have no kidneys and vice versa. In Kripke's view, Quine's discussions concerning the difficulty

of admitting properties into the canonical notation simply shows the inadequacy of his notation as a language of science. Kripke takes his reflections on everyday and scientific language use to show that properties (in particular essential ones) are implied by statements of science. Consequently, it seems as if Quine should accept the metaphysics of modality and a modal logic as his regimented language.

As I explain below, however, Quine maintains that there is no need for scientific ontology to admit properties (essential or otherwise) and no reason for him to adopt a modal logic so as to clarify our (supposed) commitment to these entities. Eliminating properties from theory might come as a surprise to many philosophers because talking of properties comes so naturally to us (and perhaps even to scientists) – a fact that helps to make Kripke's endorsement of them seem plausible. Quine does not doubt that talk of properties strikes us at an intuitive level. In fact, his account of the psychogenesis of reference explains how we quite naturally come to posit these entities, thereby showing them to be posits but also accounting for their intuitiveness. In what follows I examine Quine's psychogenetic account before I discuss his contention that properties should not be admitted into scientific ontology.

Quine maintains that the psychogenesis of properties occurs through two linguistic developments, namely the shift from concrete general to abstract singular terms and the use of the relative clause. His explanation of how we posit properties begins with how we posit objects in general. As discussed in Chapter 3, Quine's account of the psychogenesis of reference is a reconstruction of the linguistic development of the normal human child – an idealization of how the child might come to posit objects on the basis of the child's capacities. The first phrases that the child utters appear to be singular terms,

such as ‘Mama’ or ‘Fido’. When the child first makes these sounds, though, they are in fact not terms but observation sentences. When the child first says ‘Mama’, he (we will assume that the child we are considering is male) is not referring to Mama since he has not yet learned to individuate objects. The phrase ‘Mama’ is a response to a barrage of stimulations – a face, a blue dress, a smell – but does not specify any particular object. At this stage, the utterance is merely an observation sentence, similar to the sentence ‘It’s raining’ in that ‘Mama’ is true of certain situations but does not individuate or imply any object any more than the term ‘It’ does in ‘It’s raining’. We saw in Chapter 3 that the child can be said to refer only once he begins using pronouns – specifically, pronouns figuring in focal observation categoricals. After the child has accomplished this feat we can assume that he is beginning to individuate objects with the other terms he utters. Quine thinks that after the pronoun, general terms (in particular, count nouns such as ‘apple’ and ‘rabbit’) are the next words the child uses to individuate objects (RR: 85).

Whereas the child for quite some time says ‘Mama’ and ‘Fido’ without actually referring to Mama or Fido, he must come to individuate bodies in order to use general terms (such as ‘apple’ and ‘rabbit’) without being reprimanded by the competent speakers present. In response to stimulation of Mama’s face, her blue dress, her touch and her perfume, the child can utter the observation sentence ‘Mama’ and no witnesses will know that the child is not in fact referring to Mama (though they might suspect it, given that the child shows on other occasions that he has not mastered the referential apparatus of English – for example, he shows no mastery of plural endings). The child will consequently be congratulated for speaking correctly despite the fact that he employs ‘Mama’ as a sentence and not a term (although the fact that he does not individuate

Mama can be weeded out behaviourally through query and response). But it is much more difficult for lack of individuation to go unnoticed when it comes to the use of certain general terms – namely count nouns like 'apple' and 'rabbit'. If the child does not individuate objects when using these terms it quickly becomes clear to proficient speakers. The reason for this concerns the nature of count nouns, namely their built-in propensity for individuation.

> It is in full-fledged general terms like 'apple', or 'rabbit', that peculiarities of reference emerge which call for distinctions not implicit in the mere stimulatory occasions of occasion sentences. To learn 'apple' it is not sufficient to learn how much of what goes on counts as apple; we must learn how much counts as *an* apple, and how much as another. Such terms possess built-in modes, however arbitrary, of dividing their reference (WO: 91).

These general terms are such that they carry individuation with them in their proper use. The child can use 'Mama' without actually referring to Mama, but while he can utter the observation sentence 'apple' he cannot learn the term 'apple' without individuating instances. Even the most rudimentary use of count nouns involves individuation, demarcating where one body leaves off and another begins. The child learns to individuate cases falling under count nouns, and only once mastering these general terms does he come to individuate when uttering singular terms such as 'Mama'.

Eventually the child comes to individuate objects when uttering not only general terms but singular terms as well. This is when he begins to posit properties. He does this by transforming concrete general terms into abstract singular ones. Quine explains this process by pointing to the development of the abstract singular 'squareness'. The child learns 'square' first as a general term. It refers to all the squares in the world. Just as the child can point to a dog and say 'This is a dog' or 'This is the same dog as this', so can he

point to a square and say ‘This is a square’ or ‘This is the same square as this’” (RR: 86). As with any other general term, with ‘square’ we English speakers “have to learn when we are pointing twice to the same square and when to two squares” (RR: 86). The word ‘square’, however, can also be used as a singular term. Just as one may say about the object Fido that ‘Fido is a dog’, one may also say that ‘Square is a shape’. It is the possibility of using ‘square’ in singular position that compels (reflective) English speakers to believe in an abstract object, the property squareness. The word ‘squareness’ is an abstract singular term, different from concrete singular terms like ‘Mama’ and ‘Fido’. ‘Square’ has moved from being a concrete general term (referring to all the squares in the world) to the abstract singular term ‘squareness’ (referring to the property squareness). “Here is that first portentous step down the primrose path of abstract ontology. Shapes are abstract objects, universals; and squareness is one of them” (RR: 86-87). Many other properties are posited by moving terms from the general to the subject position. For example, from

(26) The table is red,

we can move the term ‘red’ to the subject position and say

(27) Red is a colour.

When uttering this sentence, we posit the property redness in order for the statement to have a truth value and make sense. Similarly, from the statement

(28) Fred is humble,

we can move ‘humble’ to the subject position and say

(29) Humility is a virtue.

Likewise, we posit a property, humility, in order for (29) to have a truth value.

Quine regards this shift from concrete general to abstract singular as one of the ways by which English come to believe in the existence of properties. The other way they do so is through the use of the relative clause. As noted in Chapter 3, relative clauses are statements beginning with pronouns like 'that', 'which' or 'who', and their intelligibility is dependent upon some antecedent phrase. For example, in the phrase

(30) The philosopher who doubted the existence of the world

the phrase 'who doubted the existence of the world' is the relative clause. One of the reasons why relative clauses are significant in the psychogenesis of reference is that they can act as general terms, enabling the speaker to eliminate the noun in the object position in any given sentence while keeping the reference intact. For example, Quine explains how by way of the relative clause we can eliminate the object of the sentence

(31) I bought Fido from a man that found him.

The relative clause, says Quine, "enables us to segregate the object from what the sentence says about it" (RR: 89). Replacing the noun 'Fido' with 'such that' (here I choose 'such that' over simply 'that' because of its clearer connection to quantified statements – the sentences of the canonical notation), and moving the pronoun to the front of the sentence, we get:

(32) such that I bought him from a man that found him.

Even though the phrase (32) does not contain the term 'Fido', when used as a predicate (as in '*x* is such that I bought him from a man that found him') it denotes the dog. Fido is the thing such that Quine bought him from the man that found him.

The child comes to learn the relative clause through an "equivalence transformation" (RR: 94). That is to say, he learns that certain constructions are

interchangeable. For example, the child learns that he can interchange 'I see the moon' with the construction 'The moon is a thing that I see' (RR: 94). He learns these substitution transformations inductively by noticing that people will "assent to '*Fa*' in all and only the situations where they will assent to '*a* is a thing such that *Fx*'" (RR: 94). In this way, the child learns the relative clause 'thing that I see' and the general construction 'thing *x* such that *Fx*'.

We saw above that shifting from concrete general to abstract singular terms is the first way English speakers posit properties. The relative clause is the second linguistic device they use to posit these entities, and these clauses enable this due to their close connection to general terms.

> Anything we can say about an object is treated as assigning an attribute to it. This highly creative doctrine of attributes is the inevitable outcome of two factors. One factor is the shift from concrete general to abstract singular; it is thus that we project attributes from all our general terms. The other factor is the relative clause; for it assures a general term encapsulating anything we say about an object. We thus end up with attributes corresponding to everything we can say about anything (RR: 101-2).

With the relative clause we can make statements about the object that can be transformed into general terms and further transformed into abstract singular terms. For example, the relative clause in the sentence

(33) The man who drinks 2 litres of pomegranate juice every morning is healthy,

can stand alone as a general term, namely

(34) such that it drinks 2 litres of pomegranate juice every morning.

When predicated of some object, statement (34) denotes any object that drinks 2 litres of pomegranate juice every morning. The general term can easily be placed in the subject position, in which case we have

(35) Drinking 2 litres of pomegranate juice every morning is healthy.

In order for statement (35) to have a truth value, we posit a property, namely drinking 2 litres of pomegranate juice every morning. In similar fashion as statements (33) – (35) we can turn any relative clause into a general term and then into an abstract singular – a property. Even in scientific practice, properties are posited along similar lines – although here they often figure as, what Quine calls, "pronouns of laziness" (FSS: 39). For example, a zoologist discovers a strange characteristic in some exotic animal by the sea and remarks, 'It is true as well of the horseshoe crab'. Quine explains that the 'it' in the zoologist's sentence is a pronoun of laziness – the scientist utters it so he does not have to repeat himself – but it also enables him to dream up "a second-order predicate such as a 'property' or 'attribute' to denote objects of a new kind, abstract ones, quantified over as values of variables" (FSS: 40). What with our tendency to turn relative clauses and general terms into abstract singular terms – along with our lazy uses of 'it' – we can make anything we say about an object into a property. Performing these slight linguistic manoeuvres comes naturally to us – a fact which helps account for the intuitiveness of talking about properties – but Quine regards the intuitiveness of properties as no argument to support admitting their existence. In his view, although people – scientists and laypeople alike – speak of properties, these entities can be eliminated from theory without jeopardizing its truth.

Various statements of science seem to commit us to the existence of properties. For example, returning again to Quine's example of litholite, the sentence

(3) Litholite has chemical composition *x*,

seems to commit us to the existence of the property 'having chemical composition *x*'. Similar sentences are found throughout scientific discourse and scientists even use the term 'property' – facts which seem to show that current theory carries commitment to these entities. Quine, however, eliminates properties by instead speaking of sets (or classes). That is, instead of sentence (3) committing him to the existence of the property 'having chemical composition *x*', it commits him to the set of all objects that have chemical composition *x*. Doing so has no untoward consequences – sentence (3) is still true (litholite is a member of the class of objects with chemical composition *x*) – because classes serve all the purposes of properties required by the epistemology of science (such as contributing to predictive success) but are extensional – which is the one point that (in Quine's view) distinguishes properties from classes (ML: 289). Unlike properties – where two or more properties that are true of the same object can be different – any classes with the same members are identical. Unlike properties, classes "raise no perplexities over identity, being identical if and only if their members are identical" (WO: 209). For example, we can replace the second instance of 'the class of creatures with a heart' with 'the class of creatures with a kidney' in the true sentence

(36) The class of creatures with a heart = the class of creatures with a heart,

and the resulting sentence is true:

(37) The class of creatures with a heart = the class of creatures with a kidney.

This can be done with any extensionally equivalent classes because any classes with the same members are identical. Kripke might respond that his arguments support the notion that some objects necessarily belong to certain classes, but Quine sees no reason to accept the notion of essential class membership. His reasons for rejecting the notion are similar

to the difficulties facing essentialism that we reviewed in the previous section. For example, consider the sentence:

(38) Gold necessarily has the atomic number 79.

Aside from being impossible to test or implying observation categoricals that are impossible to test (we can observe that gold has the atomic number 79 or frame categoricals to test this, but how can we observe the necessity or test through categoricals that it is necessary?) the sentence seems to add nothing to our theory that is not already contained in the simpler

(39) Gold has the atomic number 79,

a point which suggests that admitting essentialism is needless complexity. By showing that science can (and should) reject properties in favour of sets – and by showing that there is no reason to speak of objects belonging necessarily to some sets and not to others – Quine undermines Kripke's arguments in support of essential properties. Kripke's arguments provide Quine with no compelling reason to accept the metaphysics of modality or to adopt a modal logic as his language of science – and since Quine's standards are not arbitrarily imposed but rather derived from the epistemology of science (the scientific study of science) he can claim that Kripke's views are at odds with the worldview of contemporary science.

Quine also remains unconvinced by Kripke's arguments in support of natural kinds. Kripke takes kinds to involve a commitment to essentialism (e.g. objects *x* and *y* belong to the same kind because they share the same essence), but Quine eliminates kinds from scientific ontology because the notion of "kind" is unclear from the point of view of his regimented language of science and, as with properties, he believes that they can be

eliminated in favour of classes – the notion of class involving no commitment to essence. In what follows I discuss the difficulties Quine sees associated with admitting kinds into the canonical notation. Then, in response to Kripke's claim that science presupposes these entities, I explain how it follows from naturalized epistemology that kinds (despite the fact that scientists might often speak of them) should be eliminated in favour of sets because doing so sacrifices none of the truth of theory (judged in terms of predictive success) and results in a more parsimonious ontology and a simpler regimented language.

Quine observes that kind and similarity "seem to be variants or adaptations of a single notion" (NK: 117). We often attempt to explain similarity by reference to kinds – we say that two things are similar if they are of the same kind (e.g. piece of metal *m1* and piece of metal *m2* are similar in that they both belong to the kind gold). Likewise, we attempt to explain kind by reference to similarity – we say that two things are of the same kind (e.g. gold) if they share such and such a resemblance (e.g. being yellow). However, there appears to be no way to give a sufficient account of this notion within the confines of Quine's preferred language of science.

> For we are baffled when we try to relate the general notion of similarity significantly to logical terms. One's first hasty suggestion might be to say that things are similar when they have all or most or many properties in common. Or, trying to be less vague, one might try defining comparative similarity – '*a* is more similar to *b* than to *c*' – as meaning that *a* shares more properties with *b* than with *c*. But any such course only reduces our problem to the unpromising task of settling what to count as a property (NK: 117).

For example, we may explain the resemblance between two objects in terms of properties: the chair in my living room is similar to the one in my kitchen because they both have the same height (1 metre), the same color (brown), the same number of legs (4), and they are made of the same material (wood). The chair in the living room is more

similar to the one in the kitchen than to the one in the basement because the one in the basement is made of a different material (steel) and is a different colour (black). If this explication of kind were successful, Quine might be compelled to admit not only kinds into scientific ontology but properties as well. However, Quine thinks that this route to explicating similarity is misguided because when asked what a property is, we fall back on the notion of similarity and kind. He explains how an explication of property might proceed, comparing properties to the relatively unproblematic notion of sets:

> Things are viewed as going together into sets in any and every combination, describable and indescribable. Any two things are joint members of any number of sets. Certainly then we cannot define '*a* is more similar to *b* than to *c*' to mean that *a* and *b* belong jointly to more sets than *a* and *c* do. If properties are to support this line of definition where sets do not, it must be because properties do not, like sets, take things in every random combination. It must be that properties are shared only by things that are significantly similar. But properties in such a sense are no clearer than kinds. To start with such a notion of property, and define similarity on that basis, is no better than accepting similarity as undefined (NK: 117-18).

A 'set' (despite being an abstract object that Quine only reluctantly admits) is an unproblematic notion. Sets are collections of objects; for example, there is the set containing all the chairs in the universe, the set containing all the chairs in the universe and Barack Obama, the set containing all the politicians in the universe and the chair in my living room, etc. Sets can admit any combination of objects, no matter how dissimilar. Any two things can count as members of the same set. We cannot explain '*a* is more similar to *b* than to *c*' through recourse to sets because members of any given set (*a* and *b*) can be completely dissimilar (though they have membership in common) and we can easily construct more sets such that *a* and *c* belong jointly to more sets than *a* and *b* – a fact that would make *a* more similar to *c*. If properties are to serve some purpose in

explicating similarity, it must be because unlike sets, they do not admit objects in just any combination – any given property generally reflects some purported similarity that the objects having the property share. For example, Barack Obama is more similar to John McCain than to a table because he shares more properties with John McCain than he does with the table. But how do we describe what a property is? It is the attribute that any objects have in common. For example, Obama and McCain each have two legs – they have their 'two-leggedness' in common. But here, of course, we fall back onto the notion of similarity, which is what we had set out to explicate in the first place. Quine might be forced to abide the circularity if he found the similarity-kind notion indispensable to science, but – as we shall see below – he believes sets can replace kinds because they result in a simpler ontology without sacrificing any of the predictive success of science.

At times we also speak of degrees of similarity – of a triadic relation of similarity, for example. That is, we speak of *a* being more similar to *b* than to *c*, which allows some kinds to be contained in others. For example, the set of all red things can count as a kind that is contained in the kind of all coloured things – and "all coloured things can now be counted as resembling one another more than some things do, even though less, on the whole, than red ones do" (NK: 119). But when we allow for degrees of similarity and the containment of some kinds in others our initial understanding of kind in terms of similarity encounters even more problems, as Quine explains:

> [O]ur trivial definition of similarity as sameness of kind breaks down; for almost any two things could count now as common members of some broad kind or other, and anyway we now want to define comparative or triadic similarity. A definition that suggests itself is this: *a* is more similar to *b* than to *c* when *a* and *b* belong jointly to more kinds than *a* and *c* do. But even this works only for finite systems of kinds (NK: 119).

In line with this approach, John McCain would be more similar to Barack Obama than to the Queen of England because McCain and Obama belong to more of the same kinds than McCain and the Queen of England do. For example, all three people are included in the kind *human being*, but only McCain and Obama are included in the kinds *male*, *American*, and *politician*. However, unless we beg the question at hand and admit some limited number of natural kinds, there appear to be countless kinds to which each of the people in question belongs: McCain and the Queen belong to the over-60 kind, the at-49-degrees-latitutude-on-August-10-2008 kind, etc; Obama and the Queen belong to the likes-duck kind and the enunciates-words-distinctly kind. McCain and Obama belong to no more of the same kinds than do McCain and the Queen or Obama and the Queen. Once again, we appear unable to clarify the notion of similarity from the standpoint of Quine's regimented language.

We might revise our approach and attempt to define kind in terms of similarity. Quine explains that there are two ways we might try to do so. The first he describes as the *paradigm and foil* approach:

> One may be tempted to picture a kind, suitable to a comparative similarity relation, as any set which is 'qualitatively spherical' in this sense: it takes in exactly the things that differ less than so-and-so much from some central norm. If without serious loss of accuracy we can assume that there are one or more actual things (paradigm cases) that nicely exemplify the desired norm, and one or more actual things (foils) that deviate just barely too much to be counted into the desired kind at all, then our definition is easy: *the kind with paradigm a and foil b* is the set of all the things to which *a* is more similar than *a* is to *b*. More generally, then, a set may be said to be a *kind* if and only if there are *a* and *b*, known or unknown, such that the set is the kind with paradigm *a* and foil *b* (NK 119:-20).

We decide to demarcate what counts as an object of a certain kind, say *apple*. We pick an actual apple as the paradigm, and choose a cherry and a red pepper as the foils. What

is therefore included in the kind *apple* are all the objects that the apple is more similar to than it is to the cherry and the red pepper. But this approach to explicating kind is a dead end. Quine explains this with regards to an apparently simple norm, the colour red:

> Let us grant that a central shade of red can be picked as norm. The trouble is that the paradigm cases, objects in just that shade of red, can come in all sorts of shapes, weights, sizes, and smells. Mere degree of overall similarity to any one such paradigm case will afford little evidence of degree of redness, since it will depend also on shape, weight, and the rest. If our assumed relation of comparative similarity were just comparative chromatic similarity, then our paradigm-and-foil definition of kind would indeed accommodate redkind. What the definition will not do is distil purely chromatic kinds from mixed similarity (NK: 120).

Although such an approach may be successful in attempting to determine similarity of colour, it is in fact unsuccessful in our attempted explication of the kind *apple*. In the paradigm and foil case described above, we took similarity of colour and size for granted, but there are so many other ways in which an apple is more similar to some object *x* than it is to a cherry or a red pepper. The apple may in fact be more similar to a cherry or a red pepper in terms of texture or taste than to object *x* – a fact which would exclude, say, extremely sour apples from the kind *apple*. Quine cannot accept the paradigm and foil approach as a suitable explication of kind because it breaks down when faced with the richness of similarity.

Another method of defining kind in terms of similarity is similar to the paradigm and foil approach but simply employs sets. It runs as follows:

> [A] set is a kind if all its members are more similar to one another than they all are to any one thing outside the set. In other words, each non-member differs more from some member than that member differs from any member (NK: 120).

For example, imagine all the apples in the world and the all the oranges and bananas in the world. All the apples are more similar to one another than they are to the oranges or

the bananas; each orange or banana is more different from any one of the apples than that one apple is from any other apple. All the apples in the world therefore form a kind, namely *apple*. However, Quine explains, this approach is also flawed, as is exposed by Goodman with his problem called "the difficulty of imperfect community". Quine describes the problem:

> Thus consider the set of all red round things, red wooden things, and round wooden things. Each member of this set resembles each other member somehow: at least in being red, or in being round, or in being wooden, and perhaps in two or all three of these respects or others. Conceivably, moreover, there is no one thing outside the set that resembles every member of the set to even the least of these degrees. The set then meets the proposed definition of kind. Yet surely it is not what anyone means by a kind. It admits yellow croquet balls and red rubber balls while excluding yellow rubber balls (NK: 120-21).

As with our example of the apples, all the objects in the apple set resemble one another more than any object outside of the set, namely the oranges and the bananas. However, the set also admits objects that we would never think to include as apple-kind, such as tomatoes and red peppers because of their similarities to apples in terms of color, size and edibility. Due to the failure of this method and the above approaches to explicating kinds, Quine concludes that "kind" is a notion that is insufficiently clear to gain admittance into his canonical notation – the notation makes due with classes, which do not imply any commitment to essentialism.

As we saw in Chapter 4, however, Kripke believes that Quine errs in not admitting kinds into his regimented language. He takes his reflections on what scientists actually think and say to demonstrate that kinds are presupposed by certain statements of science – a finding that suggests Quine should adopt a modal logic that can admit these entities. Quine agrees with Kripke that scientists and laypeople routinely speak of kinds.

Though the kind-notion is not required to learn language (as it is not required in Quine's account of the psychogenesis of reference), he recognizes that it plays a prominent role in actual language learning where we routinely sort things into kinds which are identified by general terms. In learning to use a word, we rely on similarity when we notice a resemblance between present and past circumstances that call for use of the word (e.g. the word 'dog' in the presence of dogs) and we notice phonetic similarities between present utterances and past utterances of the word (NK: 117). Moreover, our ability to group objects into kinds seems to be central to everyday induction (every cherry – a natural kind – in the past has been red so we induce that the next cherry will be red) – which enables us to learn words but also seems central to scientific practice.

Quine agrees with Kripke that scientists often speak as if kinds are implied in their reasoning (or even that scientists posit kinds outright) and believes (as does Kripke) that science continually reformulates its kinds. However, in his view, recognizing that science continually reformulates – and even eliminates – kinds helps us to grasp the plausibility of eliminating kinds from theory altogether. As science advances we reformulate kinds so as to improve the predictive power of science.

> Living as he does by bread and basic science both, man is torn. Things about his innate similarity sense that are helpful in the one sphere can be a hindrance in the other. Credit is due [to] man's inveterate ingenuity, or human sapience, for having worked around the blinding dazzle of colour vision and found the more significant regularities elsewhere. Evidently natural selection has dealt with the conflict by endowing man doubly: with both a colour-slanted quality space and the ingenuity to rise above it (NK: 128).

The world is filled with colours, and our recognition of colour contrasts (which is possibly due to our 'quality space' – our capacity to notice similarities and differences) enabled us to categorize objects into different sorts, which in turn aided in our learning of

language and adapting to our environment. We feel compelled to speak of these different sorts of things as belonging to different kinds (e.g., blue things, red things, etc.). These colour-kinds figure prominently in our commonplace description of the world and have been indispensable in the survival of our species – we recognize red things and blue things, and this helped our ancestors to distinguish between safe and dangerous foods as well as construct kinds such as raspberries and blueberries. But these colour-kinds, which are so central to everyday inductions, often find no place in the predictions of scientific theory (as is discussed below with respect to certain branches of physics). Colour kinds provide just one example of the disparity between the kinds we employ in everyday discourse and what is found in scientific theory – science goes beyond our commonsense understanding of the world and in so doing has led to the development of many different 'kinds' which are often remarkably different from those found in everyday language.

> [Man] has risen above [his colour-slanted quality space] by developing modified systems of kinds, hence modified similarity standards for scientific purposes. By the trial-and-error process of theorizing he has regrouped things into new kinds which prove to lend themselves to many inductions better than the old (NK: 128).

When investigating the world scientists continually reformulate ordinary kinds so as to improve the predictive power of theory. For example, although we originally included whales in the kind 'fish', we learned (in 1778, thanks to Linnaeus) that whales are in fact mammals and modified out zoological kinds accordingly (NK: 128). Another example is grouping kangaroos, opossums and marsupial mice into a single kind, but excluding ordinary mice. "By primitive standards the marsupial mouse is more similar to the ordinary mouse than the kangaroo; by theoretical standards the reverse is true" (NK:

128). Some branches of science go beyond simply reformulating everyday kinds and eliminate them from their inductions – it is discovered that there is no need to admit these kinds into theory in order to ensure predictive success. For example, though central to our everyday understanding of the world, colour kinds have long been irrelevant to the predictive success of certain branches of physics (NK: 127).

> Colour is helpful at the food-gathering level. Here it behaves well under induction, and here, no doubt, has been the survival value of our colour-slanted quality space. It is just that contrasts that are crucial for such activities can be insignificant for broader and more theoretical science. If man were to live by basic science alone, natural selection would shift its support to the colour-blind mutation (NK: 127-8).

In our everyday life colour-kinds are unproblematic and perhaps indispensable, but they are often best dispensed with to improve the predictions of theory (as in Galileo's accounts of the motion of bodies, for example). Quine believes that reformulating everyday kinds and the elimination of kinds from certain branches of theory so as to improve the predictive power of science are the first steps in the elimination of all kinds from theory. He maintains that naturalized epistemology shows that like properties, kinds should be eliminated from theory in favour of sets because doing so results in a simpler ontology and language of science without jeopardizing the truth of our theory.

Quine views his wholesale elimination of kinds as merely an extension and development of the scientific practice of reformulating and eliminating kinds to improve and better suit the predictions of theory. The epistemology of science – which, as science gone self-reflective, is theory at its most advanced – reveals that kinds are not needed to ensure the predictive success of theory and so should be eliminated.

> In general we can take it as a very special mark of the maturity of a branch of science that it no longer needs an irreducible notion of similarity and kind. It is that final stage where the animal vestige is wholly absorbed

> into the theory. In this career of the similarity notion, starting in its innate phase, developing over the years in the light of accumulated experience, passing then from the intuitive phase into theoretical similarity, and finally disappearing altogether, we have a paradigm of the evolution of unreason into science (NK: 137-8).

As noted above, kinds are useful in everyday language and in primitive scientific theory. Prior to the discoveries of modern chemistry concerning solvents, for example, the (unreduced) kind 'water soluble' was of significant theoretical use and provided a means of grouping objects that would dissolve in water. "Intuitively, what qualifies a thing as soluble though it never gets into water is that it is of the same kind as the things that actually did or will dissolve; it is similar to them" (NK: 130). However, now that chemistry has explained solubility in chemical terms there is no need to admit the kind any longer into theory – the similarity between solutes can be accounted for without relying on the kind.

> Comparative similarity of the sort that matters for chemistry can be stated outright in chemical terms, that is, in terms of chemical composition. Molecules will be said to match if they contain atoms of the same elements in the same topological combinations (NK: 134-5).

With the findings of modern chemistry at hand, Quine's canonical notation can determine how comparatively similar object *a* is to object *b* by examining how many matching, and how many unmatching, molecules each object shares. It can also determine relative similarity by this method – *a* is more similar to *b* than to *c* when *a* and *b* contain more pairs of matching particles than do *a* and *c*. Eschewing the notion of kind in accounting for similarity, we move away from "the immediate, subjective, animal sense of similarity to the remoter objectivity of a similarity determined by scientific hypotheses and posits and constructs" (NK: 133). While a certain notion of kind can be constructed on this basis using the paradigm-and-foil approach discussed above (e.g. objects *a* and *b* are

included in the same kind because *b* shares more molecules with the paradigm *a* than it does with the foil *c*), there is no reason to do so. Chemistry provides "a full understanding of the mechanism of solution" (NK 135) – it explains that water molecules are attracted to and surround the molecules of the solute – and the epistemology of science shows that when grouping soluble objects together we need not posit any kinds and can simply speak in terms of classes. There is no reason to posit some entity (a kind) over and above the class nor is there any reason to view the members of some class as sharing some essence – any characteristic that sorts classes correctly suffices for the purposes of Quine's extensional regimented language. For example, in order for the categorical

(40) When sugar is placed in water, it dissolves

to be true we need not posit any sugar-kind or water-soluble-kind, and neither must we consider certain molecules to be of the same kind. The truth depends on whether every piece of sugar – every member of the class sugar, which in turn is a member of the class 'water soluble' (and other classes, such as 'carbohydrate') – dissolves when placed in water, which is a fact about physical microstructure. There is no need to speak of the kinds 'sugar' or 'water soluble' over and above the classes (and, as noted above, no need to speak of essential class membership) – suggesting that positing kinds (and committing ourselves to essence) would be a pointless complexity in such a case. Neither do counterfactuals require commitment to kinds. For example, it might be thought that the counterfactual

(41) If sugar *s* were placed in water, it would dissolve,

commits us to the kind 'sugar' – i.e., sugar *s* would dissolve in water because it is a member of the kind 'sugar', and sugar dissolves in water. But counterfactual (41) involves no commitment to kinds (and so no commitment to essence). Rather, it need only commit us to the class 'sugar' – we know that sugar *s* will dissolve because it is a member of the class 'sugar' (and accounting for the truth of the counterfactual commits us not to possible worlds but to the actual physical world and the objects found therein, as noted above and in Chapter 1). Quine takes these examples of sugar as paradigmatic of the case generally in science that there is no need to speak of kinds over and above sets, whether we are talking about soluble objects or proteins or photons – we group certain objects into the same classes (e.g. the class 'photon') but this does not involve a commitment to essence. Even if Kripke is correct in his portrayal of what scientists would say in certain situations, Quine shows that kinds (as Kripke understands them) are not presupposed by scientific theory because eliminating them sacrifices none of the predictive success of science – and considerations of simplicity compel him to think that they should be eliminated from theory, as doing so results in a more parsimonious ontology. The standards central to Quine's rejection of natural kinds – simplicity and prediction – are among the basic tenets of the current scientific worldview and so not imposed arbitrarily by him. Kripke's endorsement of the existence of these entities (contrary to what he suggests in his writings, where he strives to show that current science presupposes kinds) is in fact at odds with the worldview of contemporary science, as articulated by Quine's account of epistemology – an account rooted in that very worldview and from which Quine derives his methodological constraints.

However, in light of Quine's elimination of kinds and properties, what are we to make of the force of Kripke's thought experiments that purport to demonstrate our commitment to these entities? If scientists actually reason in the manner Kripke describes, might not theory be committed to essentialism? In what follows I examine how Quine could account for the seeming plausibility of Kripke's thought experiments in terms of his maxim of minimum mutilation.

In Kripke's view, science discovers kinds and their essential properties. He says, for example, that "[i]n general, science attempts, by investigating basic structural traits, to find the nature, and thus the essence (in the philosophical sense) of the kind" (NN: 138) and he provides various thought experiments to show that these basic structural traits constitute the essence of kinds. For example, he runs through several thought experiments to show that having the atomic number 79 is (at least part of) the 'essence' of gold. We can imagine a possible world where we find a substance that resembles gold in all respects except for having the atomic number 79. In this case, we would not admit this substance as gold. We can also imagine a possible world where a substance has none of the properties by which we commonly identify gold – it is blue and slimy, say – but has the atomic number 79. We (ordinary folk and scientists alike) would admit this stuff as gold precisely because it has the atomic number 79 – to our amazement, there is blue, slimy gold. It appears that having the atomic number 79 is essential to gold.

Quine, however, believes that the plausibility of Kripke's thought experiments can be accounted for by other means than positing essences – namely through his maxim of minimum mutilation. He counsels that we heed this principle when, due to some failed prediction, we must give up some sentence of our theory: we should give up the

sentence that causes the least amount of mutilation to our theory. For example, take an observation categorical concerning gold which runs:

(42) If *x* is gold, it has the atomic number 79 and is bright yellow.

Our theory states that anything that is gold is bright yellow. Kripke asks us to imagine a case where we discover that something has the atomic number 79 but is not bright yellow (and is not white gold) – it is blue. In such a case, the categorical is false – we appear to have discovered some gold that is not yellow, making the consequent of the categorical (and the categorical as a whole) false. Kripke says that we would nevertheless admit the substance as gold and that this is because having the atomic number 79 is the essence of gold whereas being yellow is only a contingent property. Quine agrees that we would admit the stuff as gold, but thinks that this is because we desire the least amount of change to our theory when confronted with a false observation categorical. Some group of sentences implied categorical (42), so we turn to that set of sentences with the aim of removing certain sentences so that the categorical is no longer implied. Quine describes our selection procedure:

> We exempt some members of *S* from this threat on determining that the fateful implication still holds without their help. Any purely logical truth is thus exempted, since it adds nothing to what *S* would logically imply anyway; and sundry irrelevant sentences in *S* will be exempted as well. Of the remaining members of *S*, we rescind one that seems most suspect, or least crucial to our overall theory (PT: 14).

We examine the members of *S* and decide what sentences to eliminate form our theory. Sentences of particular relevance are the following:

(43) All gold has the atomic number 79

(44) All gold is yellow

After careful deliberation we decide to rescind (44) – we agree that not all gold is yellow. Removal of this sentence brings with it far fewer difficulties than if we removed sentence (43) because removal of sentence (43) would require substantial revisions to chemical theory – for example, we would have to revise the number of protons in the nucleus in an atom of gold, which would require further revisions of our theory (e.g. everything that made us believe there were that many protons to begin with). In making these decisions we adhere to the maxim of minimum mutilation. Determining what sentence to remove is usually a trial and error process: we eliminate a sentence and see if a false categorical is still implied and if so, we try rescinding another sentence. We continue this process until no false categorical is implied. After we have removed the appropriate sentence, however, further eliminations are in order. We have to find and eliminate the sentences that imply the sentences we have removed "until consistency seems to be restored" (PT: 15). The aim is "so to choose the revision as to maximize future success in prediction" (PT: 15) and the guiding principle in all of this is the maxim of minimum mutilation (which is connected to considerations of simplicity) – a consideration which compels us to admit the blue substance as gold and rescind sentence (44). Our choice to admit some blue substance with the atomic number 79 as gold is not because the atomic number 79 is the essence of gold. Rather, sentence (43),

(43) All gold has the atomic number 79

is the sentence among the set implying the observation categorical that we are least willing to rescind. This is the case of all attributions of essentialism – they are accounted for by our adherence to the maxim of minimum mutilation. As the maxim explains Kripke's thought experiments, they provide no reason to admit essentialism into the

reconstructed language of science – Kripke's thought experiments do not prove the existence of essences but merely show our reluctance to abandon certain sentences of theory.

Quine's elimination of natural kinds and properties in favour of sets as well as his rejection of intuition and endorsement of prediction as the test of truth in science are at the basis of his rejection of essentialism. These tenets of scientific epistemology also inform the MC argument and shed light on the sense of bewilderment that Quine tries to express therein. In that argument, he says:

> Mathematicians may conceivably be said to be necessarily rational and not necessarily two-legged; and cyclists necessarily two-legged and not necessarily rational. But what of an individual who counts among his eccentricities both mathematics and cycling? Is this concrete individual necessarily rational and contingently two-legged or vice versa? (WO: 199).

From the standpoint of the reconstructed language of science we can specify an object, say Smith, in any number of ways. We can specify him via the predicate 'is a mathematician' or via the predicate 'is a cyclist'. The set of mathematicians is a subset of the set of rational objects, so if we specify Smith as a mathematician it follows that he is rational – a fact which might compel us to view rationality as 'essential' to Smith and two-leggedness as 'accidental'. The set of cyclists is a subset of the set of two-legged objects, so if we specify Smith as a cyclist it follows that he is two-legged – a fact which might compel us to view two-leggedness as 'essential' to Smith and rationality as 'accidental'. It is of course impossible for Smith to be essentially and accidentally rational or essentially and accidentally two-legged. Yet this would follow if we admitted these modal notions into the canonical notation because Smith does in fact belong to these classes and there is no criterion besides prediction to evaluate what is necessary or

contingent of him – but on the basis of prediction, determining what is necessary and contingent of Smith is impossible. For the sake of some predictions we specify Smith as a mathematician and here his rationality figures more prominently than his two-leggedness; in other predictions we specify him as a cyclist and here his two-leggedness figures more prominently than his rationality. "Relative to a particular inquiry, some predicates may play a more basic role than others, or may apply more fixedly; and these may be treated as essential" (IR: 121). From the standpoint of the reconstructed language of science our intuitions of essence and accident simply express the traits that are important to a certain inquiry. As Quine says when presenting the MC argument:

> Just insofar as we are talking referentially of the object, with no special bias toward a background grouping of mathematicians as against cyclists or vice versa, there is no semblance of sense in rating some of his attributes as necessary and others as contingent. Some of his attributes count as important and others as unimportant, yes; some as enduring and others as fleeting; but none as necessary and contingent (WO: 199).

Our theoretical interests at any particular moment dictate how we characterize an object – whether as a mathematician, a cyclist, a mammal or a Canadian with average income. In each case some traits will be more important for our investigation than others, but they are not thereby 'essential' – their importance is relative to the investigation at hand. The depiction of essentialism offered in the MC argument is no doubt foreign to our everyday intuitions (a fact exploited by Kripke) but it is the account that follows from Quine's reconstruction of science – which is based on the resources afforded by that same science – and is an account that perfectly suits his goal of clarifying the ontological commitments of theory while keeping the truths of our theory of the world intact. From the standpoint of self-reflective science, we can understand so-called essential and accidental properties simply as traits that figure more or less prominently in certain investigations. This is a

take on essentialism that not only keeps all of our predictions in check but also serves the predictions of theory better than essentialism does because Quine's account makes for a simpler reconstructed language of science (no modal operators are required) – considerations of simplicity being definitive in deciding such issues at the highest reaches of theory – and a more parsimonious ontology (no essences or possible worlds need be posited) without ever deviating from the same science that Quine desires to understand.

Conclusion

From Quine's point of view, there is no need to admit essentialism into the reconstructed language of science. Kripke's reliance on the intuitiveness of modal judgments is flawed because intuitiveness is not evidence and is no test of truth – all evidence is stimulation and prediction is the sole test of truth in science. Essentialism appears to add nothing to our predictions and competing essentialist claims cannot be settled on the basis of prediction. Since the reconstructed language of science is physicalistic (as is science generally, rightly understood) there is no fact of the matter to essentialist claims, even though our intuitions and everyday language use suggest otherwise. Quine also sees Kripke's reflections involving kinds and properties as misguided efforts to vindicate essentialism because (contrary to what Kripke seems to show) these entities have no place in his reconstructed language of science – they are eliminated in favour of sets – and Kripke's thought experiments are accounted for in terms of the maxim of minimum mutilation. All of these considerations – derived from the discoveries of the epistemology of science – inform Quine's MC argument, which is best seen not as an argument to be met by the essentialist on the essentialist's terms but as

an illustration of why, from the standpoint of Quine's project and the standards it adheres to (the standards of science, rightly understood), essentialism is a flawed doctrine and an unnecessary addition to the reconstructed language of science. Quine's rejection of essentialism comes from within science itself – science's own principles make it an unacceptable notion.

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