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Future Contingents, Freedom, And Foreknowledge

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FUTURE CONTINGENTS, FREEDOM, AND FOREKNOWLEDGE

by

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PREFACE

This project addresses the freedom/foreknowledge problem through an analysis of future contingents. A few points are worth making before starting the essay. This preface discusses the approach used here and introduces the reader to some mechanisms used to enhance the clarity of this work.

Degrees of Formality

Formal apparatus are often helpful for designating a succinct picture without the limitations inherent in visuals. However, formality comes with at least two drawbacks. First, formal systems have limited (although important) use. Selecting a particular formal system can bury crucial philosophical issues as assumptions lurking behind the system. This phenomenon is fine when understood, for then the system can be used to test and analyze the underlying views. The risk is that, occasionally, thinkers do not pay enough attention to the assumptions of the system. In such cases, formal systems are merely blind mechanisms supporting various results. There should instead be a dynamic justificatory relationship between results, which may be plausible or implausible for reasons independent of the system, and the system itself.

Second, too many symbols can generate unnecessary confusion. Although writers may have steeped themselves in the formal mechanisms and particular statements they are writing about, it takes some effort for readers to understand a string of symbols. Natural language correlates are often easier to comprehend. Indeed, not all readers interested in a subject want to intimately acquaint themselves with a formal system.

Regarding the topic of discussion, the philosophical literature contains two relatively separate branches. The future contingents literature is more formal. The freedom/foreknowledge literature, on the other hand, involves only minimal formalism. Yet, as those in the future contingents literature are fond of pointing out, the two problems are closely related. In the

freedom/foreknowledge literature, the lack of references to important work by, say, Belnap or Øhrstrøm is suspicious. To make the situation worse, both areas in the philosophical literature tend to ignore relevant scholarship in linguistics.

Attempting to render this document relatively accessible to all parties, formalism is portrayed in varying degrees. Throughout most of the essay, symbolism is restricted to a level approximating that in much of the freedom/foreknowledge literature. The less formal results should stand on their own. Formal systems are relegated to Chapter 8. Several mechanisms are in place to facilitate efficient transitions between related areas of the text. There is a system of inter-text references with hyperlinks, an index, a set of bookmarks, and of course a table of contents. Obviously, some of these devices are only available in digital versions of the file.

Where somewhat informal presentations are given, it is assumed that formally inclined readers can generate an appropriate formalization. Informal portrayals should be unambiguous to a point of either isolating a particular formalization or a class of adequate formalizations. Usually, this goal is achievable without dense symbolization in the text. Exceptions are made where necessary. For instance, using brackets "⌜" and "⌝" tends to be excessive in this sort of text; but these brackets are used where it is important to separate certain elements of metatheory from propositions or forms, as in the discussion of supervaluationism.

Figures

The discussion contains several figures and illustrations. Visual illustrations, while often helpful, have certain obvious limitations. For instance, unbounded lines cannot be depicted perfectly by a bounded image. To enhance clarity, the illustrations given here are further simplified in the following ways.

(0.1) Figures involving modal or temporal relations typically do not depict all of possible relationships between nodes. For instance, all nodes are logically

accessible to one another, but figures usually do not represent this accessibility relation. Completely connected graphs can be very confusing with more than just a few nodes. Transitivity can also be quite a mess, so it is often not directly illustrated.

(0.2) Despite appearances, temporal structures are unbounded both from above and from below. This holds for both linear and branching temporal structures.

(0.3) Figures involving temporal structures depict moments discretely. Removing this discrete representation would make it difficult to represent the relations between nodes. However, temporal structures are presumably continuous.

The following is an example of an image that demonstrates the aforementioned simplifications. Not all relations are depicted (transitivity is left out). The tree is presumably unbounded although not depicted as such. Additionally, the temporal structure is continuous even though only certain nodes are emphasized.
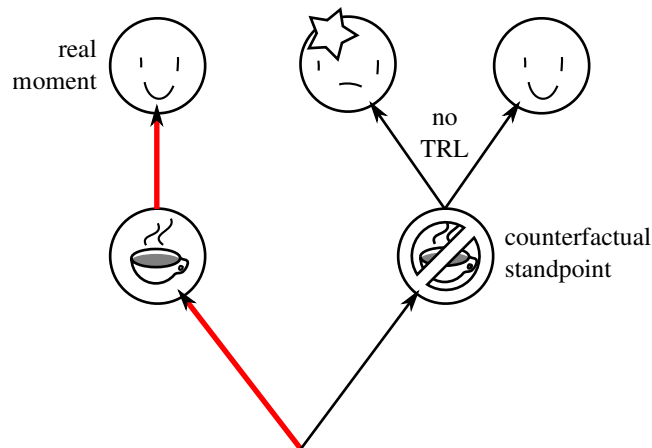
Acronyms and Symbols

Acronyms are useful for some purposes. For example, if one uses "non-bivalent open futurism" several dozen times in a chapter, it might be a good idea to introduce an acronym to represent the term. To avoid obscurity, acronyms should remind the reader of the terms

they represent. In the case of non-bivalent open futurism, NBɪᴠOF might be appropriate. Additionally, one should try not to introduce too many acronyms.

In a work this size, the collection of acronyms can be quite large. The reader is reminded of what acronyms represent where appropriate. Some other mechanisms are also used to make it easier for the reader to use acronyms. The appendix contains definitions for acronyms and symbols used in this document. Once can also look up acronyms alphabetically in the index, where each acronym is also defined. Readers using the digitized version of the document will find that each acronym links to the page on which it is defined in the appendix. That makes it easier to use a PDF reader to hop to appendix, then use a *back* button to return to the main text.

Jones, Smith, and God

Unfortunately, English uses a bifurcated notion of gender. English lacks adequate neuter pronouns, for instance. The characters that appear most often in this text are Jones, Smith, and God. The (perhaps only) upshot to English's gender-dependence is that gender makes it easier to disambiguate between individuals using pronouns. In this essay, Jones is given a feminine gender. Most of the examples involving Jones have to do with whether or not she has drunk, is drinking, or will drink coffee; and the contingency of her actions or possible actions. Smith has a masculine gender. He typically predicts that Jones will drink coffee. God is assigned the masculine gender in accordance with the Abrahamic tradition. Pronouns referring to God are not capitalized here. Fortunately, it is easy to tell the difference between Smith and God, so there is no need to use "he" for one and "He" for the other.

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Chapter 1

Introduction

1.1 Summary of Results

This essay proposes developments for branching temporal logics, using the enhanced systems to address logical and theological fatalism. The theory endorsed is dubbed standpoint inheritance. Standpoint inheritance allows branching temporal logics to avoid wantonly changing perspectives by making a perspective or standpoint parameter explicit in the truth function. Below is a list of this project's major results. More explanation is given in upcoming sections.

(1.1) Standpoint inheritance allows true futurism and open futurism to avoid significant linguistic problems and clarifies the semantics for those views.

(1.2) Under open futurism with standpoint inheritance, all strings of consecutive *will*'s and *was*'s are reducible to at most two such operators.

(1.3) Standpoint inheritance enables supervaluationism to have an open-futurist basis rather than the usual true-futurist basis.

(1.4) Under open futurism, standpoint inheritance commandeers the best semantic evidence for true futurism. Standpoint inheritance accounts for the evidence

but the evidence does not support true futurism's stronger claims.

(1.5) Theistic eternalism is incompatible with dynamic/branching time.

(1.6) In the context of dynamic/branching time, true futurism does not avoid the generalized grounding problem, by which true futurism is either *ad hoc* or entails fatalism.

(1.7) If true futurism is viable at all, it is so only within an absolutist framework employing general eternalism and the B-theory.

(1.8) Standpoint inheritance shows that Ockhamism is not viable by clarifying how Ockhamism requires that God's beliefs are drastically unlike normal beliefs.

(1.9) Based on the preceding results, the only way to avoid logical fatalism given dynamic/branching time is with open futurism; and the only way to avoid theological fatalism within that framework is with open theism.

1.2   From the Beginning

Arthur Prior, notorious for his work on temporal logic, was drawn to philosophy through the challenges of reconciling predestination and foreknowledge with freedom and contingency.[1] William Rowe gave a pleasantly concise rendition of the freedom/foreknowledge problem, an argument for theological fatalism:

(1.10) God knows before we are born everything we will do.

(1.11) If God knows before we are born everything we will do, then it is never in our power to do otherwise.

(1.12) If it is never in our power to do otherwise, then there is no human freedom.

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[1][Hasle(2012)]

(1.13) Therefore, there is no human freedom.[2]

Prior's interest in freedom, foreknowledge, and morality led to his development of temporal logic. He passionately maintained that formal analyses could yield great insight into those and other problems.[3] Since Prior, much of the scholarship on theological fatalism has neglected the relevance of temporal logic and logical fatalism, the latter being the view that everything is either accidentally necessary or accidentally impossible. Recent literature on the freedom/foreknowledge problem developed largely in isolation of the future-contingents literature. Lack of communication has led to some embarrassing results. For instance, Ockhamists in the freedom/foreknowledge literature have failed to capture the hard/soft fact distinction[4] although Peter Øhrstrøm developed a well-known system for it three decades ago.[5] Fortunately, renewed interest in both theological fatalism and Prior's work has led a few scholars to return to logical fatalism—and how to avoid it—to handle theological fatalism.[6]

This essay is a contribution to the new trend and old tradition of analyzing theological fatalism in light of its relationship to logical fatalism. The project focuses on two kinds of views about branching time. One position is true futurism, which designates what will occur regardless of contingency. The opposing view is open futurism, by which no possible course of events is privileged over others; that is, there are no soft facts.

Along the way, a contextualist theory of temporal standpoints is designed to enhance Priorian temporal logics. The proposal helps all branching time systems, not only those with an open future. Despite the fact that an account of temporal standpoints goes a long

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[2][Rowe(2007)], p. 166

[3][Copeland(1996)]

[4]Soft facts are facts about the contingent future. Soft facts correspond to what will happen contingently or what agents will do freely, where freedom is taken in the libertarian sense. Hard facts are not contingent, although they may have been so. See Section 2.7.

[5]See [Todd(2012)] for the problems with explicating the hard/soft fact distinction, [Øhrstrøm(1981), Øhrstrøm(1983), Øhrstrøm(1984)] for Øhrstrøm's most notable early contributions to Ockhamist temporal logic, and [Øhrstrøm(2009), Øhrstrøm and Hasle(2011)] for updated synopses of those systems.

[6]Most of the push to reconnect logical and theological fatalism is by some open theists. See, for instance, [Boyd(2003), Rhoda et al.(2006)Rhoda, Boyd, and Belt, Tuggy(2007), Rhoda(2003), Boyd(2010), Arbour(2013)].

way towards aiding various analyses from a linguistic standpoint, theories that designate a true future ultimately succumb to philosophical difficulties. Attempts to explain why one timeline is privileged as the actual future lead to fatalism. Open futurism and a related kind of open theism are the only viable alternatives under dynamic, branching time. If true futurism is feasible at all, it is so only with a static or eternalist basis.

1.3   Fatalism

The problems of logical and theological fatalism have provoked scholars for millennia. Logical fatalism is the view that whatever happens was necessary in some disconcerting sense. For instance, start with the premise that either Jones will drink coffee tomorrow or she will not. Suppose that she will drink coffee. Were it to be the case that she does not drink coffee, then it would be false that she was going to drink coffee. Thus, it is not possible that she does not drink coffee given that she will. What is impossible is necessarily not the case, so it is necessary that Jones drinks coffee. In general, whatever will be the case must be so, which is fatalism.

No one, presumably, accepts the fatalistic conclusion. Thinkers have proposed various ways of avoiding fatalism. The response endorsed by Prior and (arguably) Aristotle is to deny that Jones either will drink coffee or she will not.[7] Another way of dismantling the argument is to reject the connection between time and modality, a tactic associated with Ockham. An important task of this essay is to analyze and critique those two views, open futurism and true futurism, respectively.

Addressing logical fatalism is important because the task demands a refined explication of temporal language. There are some conflicting intuitions about time brought out by the argument for logical fatalism. The tension needs to be sorted out for several reasons. One motivation is to develop an adequate theory that represents actual use and speakers' presuppositions as well as possible. Another reason is that decision-making procedures, for-

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[7][Prior(1967)] contains a mature formulation of Prior's view.

mally represented by decision theory and game theory, require a coherent analysis integrating time and modality. Decision-making presupposes future-contingency, at least epistemically. So avoiding logical fatalism is necessary to adequately represent decision-making processes. Some thinkers also maintain that libertarian freedom, which involves future-contingency, is important for responsibility; in which case logical fatalism challenges not only decision-making, but the basis of morality itself.

There is some division on whether or not theological fatalism is related to logical fatalism. There are two kinds of argument for theological fatalism. One type develops theological fatalism from logical fatalism in that God's comprehensive foreknowledge resuscitates some otherwise-avoidable argument for logical fatalism. This approach was taken by Edwards and Prior, and more recently by open theists like Gregory Boyd, Alan Rhoda, and Dale Tuggy.[8] The second kind of position takes arguments for logical and theological fatalism separately. There is something special about God's comprehensive foreknowledge, perhaps that he has it necessarily. This sort of incompatibilism fueled much of the freedom/foreknowledge scholarship in the second half of the twentieth century. Opponents of theological fatalism may need to address both types of argument but this essay emphasizes only the first type.

Theological fatalism is not relevant to many influential varieties of theism. Providentialism is stronger than fatalism, so providentialists like Luther and Calvin need not worry about fatalism *per se*. Providentialism aside, many contemporary theists hold views contrary to fatalism, like libertarian freedom, close to their hearts. These theists must find a way to dismantle arguments for theological fatalism. One route, open theism, denies that God has comprehensive foreknowledge. Other theists, freedom/foreknowledge compatibilists, maintain God's comprehensive foreknowledge. Some compatibilists follow Ockham and Lavenham in separating time from modality while retaining God's temporality. Theistic eternalists advocate compatibilism for different reasons. According to theistic eternalists, God is outside of time; so he does not have foreknowledge as such.

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[8][Prior(1967), Rhoda et al.(2006)Rhoda, Boyd, and Belt, Tuggy(2007)]

This project emphasizes the connections between logical and theological fatalism. The analysis draws out a number of common elements in scholars' responses to arguments for those fatalisms. This observation is hardly new. The future-contingents literature emphasizes those similarities. The soft facts of Ockhamists in the freedom/foreknowledge literature are necessary and sufficient for specifying the temporal relation used by true futurists (frequently also called "Ockhamists", but not here) in the future-contingents literature. At the end of the day, the evidence weighs in against true futurism and Ockhamism. The biggest problem faced by true futurists has to do with attempts to identify a specific, privileged future over merely possible futures. Under the dynamic framework used here, any such attempt is either *ad hoc* or leads to fatalism. In terms of the freedom/foreknowledge literature, the criticism pertains to the existence of soft facts; in terms of the future-contingents literature, the issue is the temporal relation, the so-called "thin red line".

1.4   Temporal Standpoints

Traditional branching-time theories for open- and true futurism encounter some linguistic difficulties. All of these theories yield unsavory results. True futurism has yet to overcome Nuel Belnap and Mitchell Green's criticism that the theory cannot handle some combinations of past and future operators (*was* and *will*) at counterfactual scenarios. Suppose that a coin toss did in fact come up heads. Consider the counterfactual situation in which the toss came up tails. Of that circumstance, true futurism yields the following awkward result:

> The coin came up tails, but this is not what was going to happen. The coin was going to come up heads. It's just that it didn't.[9]

The issue is further complicated when God is around. Ockhamists maintain that if the coin had come up tails, then God would have believed that it was going to come up tails. Branching true futurism does not accommodate this result. The coin was going to come up

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[9][Belnap and Green(1994)], p. 380.

heads even if it had not done so. As such, if the result of the toss had been tails, then God would have held the incorrect belief that the coin was going to come up heads, not tails.

For similar reasons, open futurism (and supervaluationism) give incorrect results for predictions of future-contingent events. Suppose that Jones drank a cup of coffee although she might have done otherwise, and that Smith predicted that Jones would do so. Smith's prediction was correct, but not according to traditional open futurism.

The source of these problems is that traditional systems do not account for perspective. Without explicitly acknowledging temporal standpoints, branching time logics effectively shift perspective too frequently. The unhappy results of traditional systems indicate that a more conservative approach is warranted. One should only change to a new standpoint when absolutely necessary; that is, when evaluating at a relatively counterfactual node. The examples that raise difficulties for canonical theories show that, in English, temporal operators are limited by perspective in ways that their genuinely modal counterparts are not. In Belnap and Green's coin toss example, the perspective throughout the example is one in which the coin came up tails. Traditional true futurism gets the wrong answer because it abandons the tails perspective in the middle of the proposition:

(1.14) The coin was going to come up heads,

which should only be true from the heads perspective. True futurism can avoid this problem by retaining the tails perspective rather than abandoning it. Traditional open futurism suffers from essentially the same difficulty. From the perspective in which Jones drank coffee, she was going to do so and hence Smith's prediction was correct. The traditional theory abandons the perspective in which Jones drank coffee in the middle of the proposition:

(1.15) Jones was going to drink coffee.

(1.15) is untrue in traditional open futurism since, from the perspective before Jones drank coffee, it was untrue that Jones would drink coffee. These wanton shifts in perspective are not only troublesome but seem outright baseless when made explicit.

A temporal standpoint is a moment representing a perspective in time. The theory of temporal standpoints proposed here is called "standpoint inheritance". Under standpoint inheritance, standpoints limit temporal operators—*was, will, was-always,* and *will-always.* These operators never yield an evaluation that is counterfactual with respect to their standpoints. Modal operators—*necessarily, possibly, was-inevitably,* and *will-inevitably*—are not so restricted and can access counterfactual nodes, thereby forcing occasional standpoint shifts. All operators pass their standpoints down to their sub-propositions.

Standpoint inheritance has a number of advantages. The theory is very general. It is applied to every system discussed in this analysis to handle shortcomings of traditional logics. With standpoint inheritance, true futurism avoids the criticism given by Belnap and Green while open futurism accounts for predictions. Standpoint inheritance helps clarify what it is for characterizations of God's beliefs to be soft and how his beliefs must differ from normal beliefs to retain softness. For open futurism, all strings of consecutive *will*'s and *was*'s can be reduced to at most two such operators under standpoint inheritance, but not under traditional theories. The open futurist distinction between *will* and *will-inevitably* is clarified, too. Standpoint inheritance allows for a supervaluationist semantics using open futurism as its basis instead of the usual true futurism. The theory of standpoint inheritance enhances dynamic, branching accounts of time to better compete with their static correlates.

1.5   Background Assumptions

This project devotes significant effort towards clarifying analyses that play important background roles in debates on fatalism and temporal semantics. These underlying views make a difference although they are often relegated to the sidelines, as if they were someone else's problem. Logical and theological fatalism draw a lot from many areas of study. Some steps are taken here to further work done by others towards integrating relevant areas of study.

With so many relevant background views, it is important to specify a framework for the discussion. Much of the future contingents literature takes a Priorian view of modality and time. Time is dynamic, represented by branching time structures. Additionally, the Priorian approach is endurantist, presentist, and emphasizes the A-theory of time. These views are assumed for this project without much in the way of argument. Chapter 2 provides some explanation of the dynamic approach to modality and time.

The conclusions derived here should be taken in the context of the aforementioned background assumptions. For instance, if the dynamic view of time holds, then true futurism is not the best theory and open futurism/theism win the day. Put in other terms, true futurism is incompatible with the dynamic view; and true futurism entails the static view. Static or absolutist views like (general) eternalism, the B-theory, and perdurantism call for substantial treatment that is beyond this project.

1.6   Overview

Part I develops relevant background assumptions and preliminaries for other aspects of the analysis. Chapter 2 is about modality and time. There are various types of possibility and necessity, but familiar genuine modalities tend to be captured by sets of principles. These principles yield accessibility relations depicting their corresponding modalities. Besides this propositional modality, there are other senses in which a relation can be modal. Four types of modality are formal, grammatical, propositional, and ontological. Only the latter two directly bear on contingency and fatalism. Chapter 2 also sheds light on the dynamic view of modality that is used to explicate necessity *per accidens*, which is opposed to future-contingency. An adequate representation of necessity *per accidens*, in turn, easily captures the hard/soft fact distinction.

Chapter 3 discusses the role of *will* in English. *Will*, like *can* and *should*, is grammatically modal. This is an important point about how *will* should be analyzed but does not in

itself threaten contingency. After all, *should* does not interfere with contingency although the term is grammatically modal. Nevertheless, *will*'s grammatical modality is later seen to favor a variety of open futurism over other theories. The next portion of Chapter 3 characterizes some future-oriented laws of excluded middle. The subtle distinctions among excluded middles constitutes a significant difference between open futurism on the one hand, and true futurism and supervaluationism on the other. These future excluded middles play substantial roles in analyzing particular theories. Finally, there is an introduction to temporal standpoints and standpoint inheritance. Some of the features and advantages of standpoint inheritance are given, although many details and view-specific descriptions are reserved for later chapters.

With much of the background out of the way, Chapter 4 returns to freedom and fatalism. Arguments for logical and theological fatalism are given in more detail than before, together with popular responses to those arguments. Chapter 4 also discusses the importance of fatalism to libertarians and freedom/determinism compatibilists alike.

Specific views are assessed in Part II. Chapter 5 is about theistic eternalism, sometimes called "Boethianism", according to which God is outside of time. Some work is done to capture what God's atemporality amounts to. Varieties of theistic eternalism are described and critiqued. Outside of a more general eternalism, theistic eternalism does not appear to work. Regardless of its viability or lack thereof, theistic eternalism entails true futurism. Even if God is outside of time, there is a relevant sense in which it is true that he knows what will occur even though he does not apprehend future events as such.

True futurism is the topic of Chapter 6. True futurists identify a particular course of events as actual, privileging this timeline over merely possible ones. The actual timeline, called the "thin red line", is equivalently identified by a comprehensive set of soft facts together with facts about the past and present. The thin red line plays a semantic role as the temporal relation behind *will*, *was*, and other temporal operators. According to true futurists, the thin red line is not modal in any sense that interferes with contingency, separating

temporal operators from genuinely modal operators. This distinction between temporal and modal operators is what allows true futurists to reject both logical and theological fatalism. Although true futurism has been challenged on linguistic grounds, standpoint inheritance allows the view to handle some of the most pressing criticisms. True futurism nevertheless faces insurmountable difficulties. On one hand, true futurists cannot explain *will*. Interpreting *will* as *will-actually*, as some authors have proposed, does not avoid fatalism.[10] On the other hand, there is the problem of explaining the thin red line or, equivalently, the dependence of soft facts on future things and events. Any such explanation opens the door to fatalism. Molinism is a case in point. The only alternative left for true futurists is to abandon the dynamic framework and turn towards a general eternalism. An additional difficulty is encountered by Ockhamists, who maintain that characterizations of God's past or present beliefs can themselves be soft facts. Standpoint inheritance clarifies that just as soft facts are standpoint-dependent, God's beliefs must be standpoint-dependent in order to be soft. Under Ockhamism, God's beliefs are radically different from those of typical agents. Ockhamists have yet to explain this peculiarity.

Chapter 7 is about open futurism and related views; in particular, supervaluationism and open theism. Those theories are described along with their most influential variations. Open futurism and supervaluationism maintain that there is no privileged future when genuine future-contingency is involved. Open theism is the view that God does not have comprehensive foreknowledge. Assuming that God exists, open theism follows from open futurism (but not conversely). Hence, endorsements of open futurism are likewise of open theism. In support of open futurism and open theism, a few arguments are given to challenge intuitions that appear to favor the strong future law of excluded middle, the principle by which a given event either will occur or it will not. For instance, either Jones will drink coffee or she will not. Additionally, a significant problem with traditional kinds of open futurism is that they do not adequately handle predictions. This issue with predictions is symptomatic of the fact

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[10][Malpass and Wawer(2012)] is especially clear about endorsing this interpretation of *will*. See also [Øhrstrøm(2009)].

that canonical depictions of open futurism do not capture the wait-and-see semantics that is supposed to characterized the view. Open futurism can represent predictions using wait-and-see semantics by incorporating standpoint inheritance. Standpoint inheritance also allows open futurism to reduce all strings of consecutive *will*'s and *was*'s to at most two operators. Additionally, standpoint inheritance, which is independently required by true futurism, allows open futurism to accommodate what otherwise appears to be logico-linguistic evidence for true futurism.

The formal details are given in Chapter 8. A generic multi-modal system is developed from which particular systems are individuated. All of the major logics discussed in preceding chapters are given some formal treatment. The generality of the multi-modal system helps with comparing various logics and also in depicting the general character of standpoint inheritance. After traditional systems are given, standpoint inheritance is added and applied to the major systems. Most of the results in Chapter 8 are intended to clarify the discussions in earlier chapters for the formally inclined reader.

Chapter 9 summarizes important results and suggests avenues of research. The analyses in preceding chapters indicate that under a dynamic conception of time and modality, open futurism and a corresponding version of open theism are the best options. If true futurism and freedom/foreknowledge compatibilism work at all, it is under a static view of time and general eternalism. Although this project introduces standpoint inheritance and uses it to solve a number of problems, there is still a lot more to be said about the theory and how it benefits the A-theory in general. Static views like eternalism, the B-theory, and perdurantism are not addressed here.

Overall, this project emphasizes Prior's contributions, both in the choice of puzzles assessed and in the use of logic to handle those challenges. Old and recent developments are inspected in the context of a unified analysis; even a single, general formal system. In addition to the formal system developed here, this essay makes a number of other valuable contributions. Several new arguments are given for or against certain views, while some

familiar arguments are cast in a new light. The most important contribution may be the theory of standpoint inheritance. The theory greatly improves the linguistic standing of all branching time logics, open- and true futurist alike, enabling those theories to better challenge their static, two-dimensional counterparts.

Part I

Preliminaries

Chapter 2

Modality and Time

Kripkean modal logics have four basic components: nodes, accessibility relations, propositions, and truth functions. Modal systems can illustrate many different kinds of items. These systems have been used in analyses ranging from metaphysics to ethics, mathematics to finite state machines. Modal logic's fruitfulness, breadth of application, theoretical generality, and connection to graph theory testify to the fascinating character of modal systems. The significance of modal systems, what the components of models represent, may change from one application to another. This chapter aims to clarify how modal systems are used in this project, shedding light on how to understand nodes, different ways of viewing accessibility relations, what sorts of propositions are involved here, what kind of system forms the basis of this analysis, and the fundamentals of how to depict time and modality.

Philosophically (as opposed to, say, grammatically[1]), modalities are modes of possibility and necessity. There are various ways in which events, propositions and things can be possible or necessary. Types of possibility and necessity are discussed in Section 2.1.

Modalities are formally represented using so-called "accessibility relations". However, not all accessibility relations correspond to modalities. Determining which accessibility relations are modalities, which are not, and in what sense is the topic of Section 2.2. Four senses of *modality* are distinguished: formal, propositional, ontological, and grammatical.

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[1]See Section 3.1 for more on grammatical modality.

An important type of possibility/necessity, the foundation of the dynamic branching structure used in many temporal logics, is here called all-things-considered (ATC) possibility/necessity. ATC necessity is sometimes called necessity *per accidens* or hypothetical necessity. The characteristics of the ATC relation are the topic of Section 2.3.

Contingency and fatalism are obviously important facets of this analysis. In section 2.4, contingency and fatalism are defined in terms of the multi-modal approach outlined in the preceding sections, emphasizing logical and theological fatalism. Section 2.4 concludes with some remarks on the distinction between fatalism and determinism within temporally-sensitive modal logics.

Section 2.5 contains a discussion of how to interpret accessibility between possible worlds or moments. Static accessibility can be explicated by taking consistency as the starting point. Dynamic accessibility, on the other hand, begins with the flow of time along the ATC relation. More and less stringent accessibilities can be derived from ATC accessibility, thus allowing for a dynamic account of other types of accessibility.

Section 2.6 provides a rough categorization of views about time. This taxonomy is used throughout the project. The three most important views discussed here are open futurism, supervaluationism, and true futurism. These positions are explicated in terms of branching time semantics. Section 2.6 gives a basic description of those positions while some details are reserved for later chapters.

Ockhamists in the freedom/foreknowledge literature have failed to provide an adequate explication of the hard/soft fact distinction. Meanwhile, true futurists in the future contingents literature, who share the Ockhamistic belief that the hard/soft fact distinction holds, seemed unconcerned. The difference between hard and soft facts turns out to be relatively simple to portray in terms of branching time. Section 2.7 contains definitions for hard and soft facts, and a discussion of the characteristics of those definitions.

2.1   Types of Possibility and Necessity

Modalities (in the philosophical sense) correspond to types of possibility and necessity. When something is necessary, it is necessary in some sense or other. There are different modes or ways in which a proposition, event, or thing can be necessary. For instance, physical determinists hold that events, things, or propositions are physically necessary given their antecedent conditions. The modality in this case is physical or material, as encapsulated by physical principles. Physical laws on this view determine whether or not the sun will rise next Tuesday and whether or not Jones will have a cup of coffee tomorrow.

Physical modality is a good example because the notion is fairly ordinary. One way of capturing physical modality is in terms of consistency with physical laws expressed as propositions. A proposition is physically possible if and only if it is consistent with the laws of nature (perhaps given some antecedent conditions about the current and past state of the world). A proposition is physically necessary if its opposite is inconsistent with the laws of nature. There is a close relationship between physical modality and physical laws.

Natural laws *could* be different. The modality selected by *could*, in this case, is presumably not along the lines of physical modality. Physical possibility operates under the stipulation that physical laws remain unbroken and are thus unaltered across possibilities. That the laws of nature could be other than they are requires a change in physical principles across possibilities. Whenever physical laws are not held constant across possibilities, the modality involved is at least partially non-physical. Logically, the laws of nature could be different. There are other consistent sets of physical principles aside from those that actually obtain.

Hence, there are different ways in which events, propositions and things can be possible or necessary. The example of physical modality also indicates that modalities can often be analyzed in terms of consistency with a set or sets of principles expressed as propositions. Logical possibility involves consistency with logical principles, which is consistency simpliciter. Metaphysical possibility involves consistency with metaphysical principles. Physical possibil-
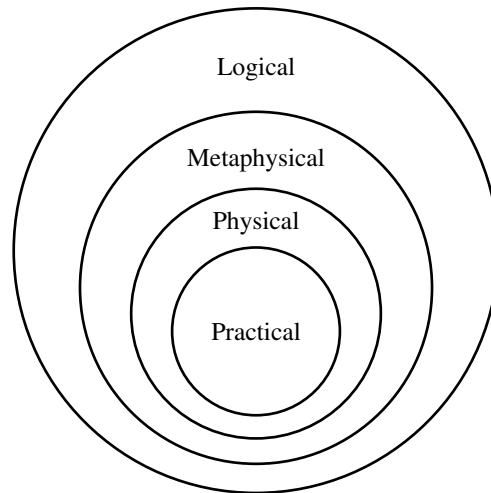
Figure 2.1.1:   Intensional categorization of types of possibility/necessity. This is one way in which some kinds of possibility and necessity may be categorized. The principles of each inner set are properly contained in the principles of each respective outer set.

ity involves consistency with physical principles. Permissibility, ethical possibility, involves consistency with a set of moral rules. Legality, legal possibility, involves consistency with a set of legal principles. Practical possibility involves consistency with a set of practical principles. *Et cetera.*

Figure 2.1.1 shows a taxonomy of a few common varieties of possibility/necessity in terms of their basic principles. Some philosophers treat metaphysical and logical possibility identically. If logical possibility is associated with consistency, then metaphysical possibility is more restrictive than logical possibility. Metaphysical possibility requires some extra principles, like that no object can be two different colors all over at the same time. Such laws are not true on account of their structure; that is, not logically true. The truth of metaphysical laws depends on their content. One might stipulate that metaphysical rules hold in all possible worlds. In that case, logical and metaphysical possibility would be extensionally equivalent since every world would be logically and metaphysically accessible to every other world, although logical principles are a proper subset of metaphysical principles. For this project, modalities are primarily classified intensionally, in terms of the strictness of their defining principles. So metaphysical possibility is a proper part of logical given that

the rules of the former contain and are stricter than the those of the latter.

Here are some examples illustrating the distinction between types of possibility.

(2.1) *An object can be red and green all over at the same time.*

This proposition is logically possible, but not metaphysically possible.

(2.2) *A glass marble dropped in a vacuum near the Earth's surface will fall away from the Earth.*

This proposition is logically possible, but not physically possible.

(2.3) *If Jones punches her boss in the face, she will not be fired.*

This proposition is physically possible, but perhaps not practically possible.

(2.1) is logically possible since there is no logical rule by which an object cannot be red and green all over at the same time. However, given the metaphysical rule that *being red* and *being green* are contrary properties, (2.1) is not metaphysically possible. In the case of (2.2), it is not logically absurd that the marble would fall away from the Earth, but for the marble to do so would be inconsistent with the laws of physics. Granted, if the universe were relevantly different—if there were an incredibly massive object whose center of gravity is close enough to the marble—then the marble might fall away from the Earth. One might want to block such possibilities by involving antecedent conditions about the way the world is or similarly by using *ceteris paribus* clauses. Finally, in (2.3), the laws of physics do not entail that Jones will be fired if she punches her boss in the face. There might be some other set of rules, like laws or mores, by which she cannot drive the punch home and still retain her job.

The propositions corresponding to a modality may even be world-dependent. For instance, different sets of possible worlds may vary in their physical laws. It is logically possible that empirical constants are other than they are, such as that the speed of light in a vacuum is faster than 3.00×10^8m/s. What is physically possible with respect to worlds

with one set of physical principles is not the same as what is physically possible from worlds with different physical laws.

A set or sets of principles need not be given explicitly to designate a modality. It is not a requirement that one knows everything about physical laws to speak meaningfully about physical possibilities. It is enough that there is a cohesive set of principles even if no one knows exactly what they are. A thousand years ago, most natural science was relatively underdeveloped. That does not entail that the same physical laws that hold today did not hold a thousand years ago. A thousand years from now, natural science may adhere to different theories than the ones held today, but it does not follow that the natural world would operate differently in the future than it does now.

One type of modality that is especially important for this project is all-things-considered (ATC) possibility/necessity. ATC necessity goes by several other names, including necessity *per accidens*, hypothetical necessity, and antecedent necessity. ATC possibility is whatever is required for an event to occur, be actualizable, or be realizable. For instance, Jones can drink coffee tomorrow if and only if, all things considered, it is possible for her to do so. ATC possibility is at least as stringent as physical possibility in the sense that ATC possibility requires physical possibility; so the former incorporates the principles of the latter. Unlike some renditions of physical possibility, ATC possibility/necessity changes over time.

Again, ATC possibility is accidental possibility, whatever that amounts to. The most plausible explication of ATC possibility is that the things to be considered are the principles relevant to determining whether or not Jones' coffee-drinking, for instance, is genuinely possible, actualizable, or realizable. Physical principles and antecedent conditions are of course relevant. One might impose additional factors when determining things like whether or not Jones will inevitably be fired if she punches her boss, but the context-sensitivity of "all things considered" is ignored here for simplicity. It is assumed that there is only one ATC possibility.

Officially, ATC possibility is defined broadly. The reason for the nebulous definition
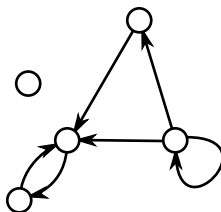
Figure 2.2.1: Graphical structure of a modal logic model. Possible worlds are nodes and accessibility relations are directed edges between nodes.

of ATC possibility is that what exactly it consists of is at the heart of the debate about logical fatalism. Some readers may find it convenient to think of ATC possibility as physical possibility in the sense described for branching time systems in Section 2.4.3. Presumably, laws and antecedent conditions should be enough to dictate ATC possibility. It will be made clear when ATC possibility threatens to elude capture by principles and antecedent conditions. ATC possibility will be discussed further throughout this project.

2.2   Types of Modality

Formal systems are very general. They need not have anything to do with modality despite involving accessibility relations. Structurally, models of modal logic are just graphs like the one shown in Figure 2.2.1. "Possible worlds" are just nodes or vertices, abstracta lacking inherent meaning, and "accessibility relations" are sets of directed edges between nodes.

The rest of the semantics has no more intrinsic meaning. A "truth function" is a function taking two parameters, a "proposition" and a "possible world", and mapping them to things called "truth values". For any application, it is important to explicate the parts of a modal system and give some details about how models relate to the analysanda.

Logical systems can be helpful for creating explicit illustrations and analytic mechanisms. In this sense, logical systems need not attend to propositions, possible worlds, truth values, accessibility relations, or even logic. Suppose, for instance, that one wants to develop a system for bags of colored marbles. Non-modal "propositions" represent colors and "possible

worlds" represent sizes. Colors can be manipulated by taking their complement with ¬ or their combination with ∧. The accessibility relation between sizes is understood as *is larger than*. The "truth function" may be partial, mapping size/color pairs to "true" just in case there is a marble of that color and size. The modal operator ◇ is used to indicate that there is a larger marble. For instance, ◇*red* holds at 1.5cm if there is a red marble larger than 1.5cm.

There is nothing wrong with using modal systems to represent one thing as opposed to another, although it is desirable to avoid confusion no matter how a logical system is applied. The marble example is not evidently harmful, illustrating that modal systems can by interpreted in ways having little to do with modality or propositions. Anything that can be depicted using an accessibility relation may be called *formally modal* to distinguish the mere formality of accessibility in the technical sense from more modal senses of "modal". Formal systems can be applied in various ways and formally modal elements of a system need not be modal in other senses of the term. It may therefore be desirable to identify criteria for separating genuinely modal accessibility relations from simply formal ones.

As indicated in Section 2.1, genuine modalities like logical, metaphysical, and physical are explicable in terms of a set or sets of principles expressed as propositions. Such relations may be called *propositionally modal*. The structure of propositional modalities reduces to consistency with the laws characterizing those modalities. This is not to say that propositional modalities themselves reduce to consistency. Rather, the accessibility relations used to illustrate those modalities can be defined using consistency.

Propositional modalities always unambiguously pick out an accessibility relation. Here is an explication for the formally inclined. Let L_p be the set of laws corresponding to a propositional modality. For a given language in which L_p is expressible, each model has a unique accessibility relation, R_p, such that:

(2.4) $R_p = \{\langle m, m' \rangle \,|\, L_p \text{ is satisfied at } m\}$[2]

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[2] This definition assumes that moments are characterized by the set of propositions that are true there.

Again, this definition just states that the laws L_p characterize the modality, which in turn is represented by the accessibility relation R_p. For instance, consider physical modality. Physical laws dictate what is physically possible or necessary. Nodes respecting physical principles can only physically access certain other nodes. As a more concrete example, stipulate a modality, Sisyphean modality, having a single law:

(2.5) The deceitful necessarily roll boulders.

(2.5) holds at moments at which no one is deceitful. (2.5) is also satisfied by moments at which there are deceitful individuals provided that those moments only access moments in which the deceitful persons roll boulders. The most inclusive accessibility relation satisfying those criteria represents the Sisyphean modality.

There are two cases of propositional modality. On the one hand, the set of laws may be node-independent. Logical possibility is the prime example here. Given that all nodes are consistent, each node relates to every other. The principles of logic are not world- or moment-dependent. Additionally, there may be no need to consider more than one set of physical laws. These laws are presumably the actual physical laws, although they do not have to be. On the other hand, it may be important to represent different logically possible physical laws, legal laws, moral rules, *et cetera*. It would thus be appropriate to refer to the laws *at a world* rather than the laws simpliciter. World- or moment-dependent accessibility relations will play an important role in this analysis (although there will be no need to employ node-dependent laws).

All propositional modalities are formal modalities. The converse is false; that is, not all formal modalities are propositionally modal. Unlike formal modality, propositional modality

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It is also assumed that there is a moment corresponding to each set of propositions that is both consistent and closed under entailment.

Note that the definition does not directly require that L_p is also satisfied at m'. Consider the case of physical laws. Standard physical laws seem to be physically necessary in that if $\phi \in L_p$, then physically-necessarily:$\phi \in L_p$. In this case, if L_p is satisfied at m and mR_pm', then L_p is satisfied at m'. However, it is possible that the current physical laws change; for instance, if there were another big bang and some constants change. So it is not in the nature of physical modality, and thus propositional modality generally, that the same laws must be satisfied at both nodes. Only the source node must satisfy the modality's laws.
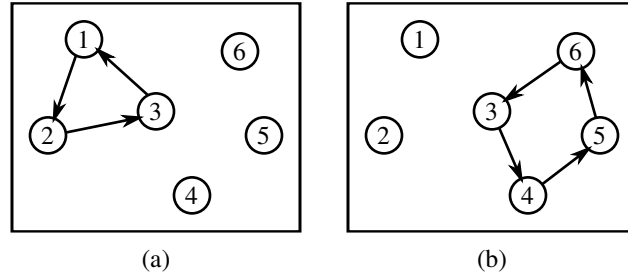
Figure 2.2.2: A formal modality that is not propositional. The modality F is represented by an accessibility relation, R_F, such that R_F consists of one simple cycle. (a) and (b) depict two candidates for R_F in otherwise identical models. This ambiguity shows that F is not propositionally modal.

necessarily involves what is true at nodes (possible worlds/moments). Formally modal relations might have little or nothing to do with principles given that these rules are propositions represented by the object language. Put another way, propositional modality has to do with what is going in at nodes, their content. Formal modality is not so limited.

A formal modality that is not propositional is such that no set of laws is both necessary and sufficient to characterize the modality. It is a simple matter to create a modality that is formal but not propositional. Let F be a modality with a corresponding accessibility relation R_F. R_F is a subset of logical accessibility having just one simple cycle of nodes. The scenario is illustrated in Figure 2.2.2. There may be several options for R_F in a given model, one of which must be chosen arbitrarily. F is not characterized by a set of principles.

The thin red line, the temporal relation of true-futurist theories, is supposed to be a formal modality that is not propositional. The thin red line is a linear subset of ATC accessibility.[3] Whenever contingency plays a role, there is more than one possible thin red line but there is no special rule for prioritizing one timeline over others.

Although propositional modality is stricter than formal modality, propositional modality is still not enough to pick out all and only genuine modalities. A case in point is permissibility, which does not amount to any sense of genuine possibility. Even assuming that permissibility is propositionally modal and that only possible acts are permissible, permissibility is not

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[3]In the case of indexical true futurism, the arbitrariness stems from the assignment of timelines to nodes; that is, the precedence of one thin red line over another.

necessary for any genuine possibility. Genuine modality ultimately stems from the object of analysis, the philosophical interpretation of the formal system. Physical possibility, for instance, can be represented in terms of consistency with propositions corresponding to the laws of nature. That the representation is of physical possibility depends on identifying the relation's characterizing propositions as the laws of nature, and that is something that must be done outside of the system. So propositional modality is not sufficient for genuine modality. Nevertheless, familiar genuine modalities are propositionally modal, making propositional modality an indicator of genuine modality.

An empiricist might insist that propositional modalities are the only genuine modalities. Propositional modalities are characterized by a set of principles. "Principles" in that sense denotes propositions; but the term may also pick out mechanisms. Here is a candidate example. It is logically possible that some physical mechanism is entirely arbitrary, objectively random. There is a possible universe in which physical determinism holds except that there is a special, troublesome machine. This machine periodically outputs a binary digit, 0 or 1. The catch is that the number chosen by the machine is objectively random. The arbitrariness of the selection process renders the mechanism impossible to describe using a law. The machine ensures that the universe, which would otherwise be physically determined, is indeterministic. It is possible that the next number will be 0, and it is possible that the next number is 1. So there is a mechanism, a principle in the ontological sense, that significantly alters the physical accessibility relation for that universe. Propositional modality cannot account for this accessibility relation because the indeterminism generated by the machine cannot be depicted by laws. A new sense of modality is required, *ontological modality*.

One might object that ontological modality is nonsense if taken apart from propositional modality. A genuine mechanism can always be captured by propositions in a sufficiently rich language. Objective randomness stems from an absence of mechanisms, of principles in the ontological sense, not their presence. The contrived example of the indeterministic machine is indeed representable as a physical modality. The propositions representing physical laws

must become as contrived as the objective principles themselves: some laws must contain clauses exempting the machine. These exemptions correspond to an absence of principles in the ontological sense.

If ontological modality can be explicated in terms of propositional modality, the former may be considered a subtype of the latter. Under such a taxonomy, propositional modalities may be divided into two groups, ontological and artifactual. Artifactual modalities stem from human artifice or convention, including legal laws and mores. Ontological modalities, in this pacified sense, may simply be non-artifactual or they might be explicated positively. This pacified notion of ontological modality is not used in this essay.

Even if all legitimate instances of ontological modality are reducible to propositional modality, the ontological sense of modality is nevertheless intensionally distinct from the propositional sense. As such, ontological modality is here added to the list of types of modality. The arguments given later in this essay do not hinge on the legitimacy of ontological modality.

Finally, terms can be *grammatically modal*. Familiar grammatical modalities include *could*, *would*, *should*, *can*, *might*, and so forth. Interestingly, *will* and *shall* are also grammatically modal, as discussed in Section 3.1. Ignoring terms like *will* and *shall* to avoid begging the question here—those terms are primary analysanda of this essay—other stock grammatical modalities are propositionally modal and hence formally modal. Such terms are propositionally modal in that they can be represented by operators defined using propositionally modal accessibility relations, although those accessibility relations may depend on the context of utterance. *Can*, for instance, might address logical or physical possibility.

2.3   Temporally Sensitive Modality

Nodes are accessible with respect to a set of propositions or laws if and only if those propositions hold at those worlds and consistency is maintained. For example, the node

representing the actual world physically accesses any node that satisfies the actual physical laws as long as such accessibility does not yield inconsistency. This characterization of accessibility is fairly simple and also popular, but it turns out to be quite distant from the ordinary sense if nodes are taken to span time. As such, it is important to be more specific about the type of node under discussion before moving on.

The notion that nodes span time leads to problems when accessibility needs to change over time. When nodes span time, it does not make sense to use principles to specify different accessibility relations at different times. For instance, suppose a stone is dropped from atop a building and nothing can interfere with its descent. If a single node represents both the scenario before the stone was dropped and the situation afterwards, then one cannot formulate:

> (2.6) It is necessary that the stone will hit the sidewalk, yet before the stone was dropped it was not necessary that it would hit the sidewalk.

> (2.7) (necessarily: will: *hit*) and (was: not necessarily: will: *hit*)

Accessibility is defined between nodes; so if nodes span time, accessibility cannot change over time.

There are two common ways to depict temporally-specific nodes. Some analysts prefer a two-dimensional system in which the parameters are time and possible world.[4] Note that "possible world" in this case does not refer to a node that spans time, but rather a parameter. On this view, nodes amount to world-time pairs. The other representation of temporally-specific nodes uses branching time. The branching interpretation is emphasized here.

2.3.1   Necessity *per Accidens*

Temporally sensitive characterizations of the world—metaphorically, snapshots of possible worlds—are here called *moments*. Temporal sensitivity is required to account for ATC

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[4]See [MacFarlane(2012)] for a synopsis of the two-dimensional view that is relevant to this discussion.

(all-things-considered) necessity, necessity *per accidens*, an important component of (libertarian) freedom and contingency. According to the principle of the fixedness of the past, facts about the past (and present) are now unalterable. Such facts are physically necessary insofar as physical principles require that these facts cannot be altered once their corresponding events occur, but not in that these facts are logically necessary, nor in that they must be physically determined before the respective associated events happen. The fixedness of the past generates a type of necessity that is quite different from logical necessity. Ockham made the distinction as follows:

> I claim that every necessary proposition is *per se* in either the first mode or the second mode. This is obvious, since I am talking about all propositions that are necessary simpliciter. I add this because of propositions that are necessary *per accidens*, as is the case with many past tense propositions. They are necessary *per accidens*, because it was contingent that they be necessary, and because they were not always necessary.[5]

Some facts about the past are such that they were contingent and became necessary. Considering both physical principles and antecedent conditions, states of the world become unalterable once the events they capture have occurred. The notion of modality behind necessity *per accidens* is here called ATC (all-things-considered) modality, which constitutes the basis of branching time systems. All of the things to be considered include some modalities and, as a result, antecedent conditions describing the state of the world up to and at the time at which necessity *per accidens* is being evaluated. The modalities in question are all of the relevant ones, which presumably include propositional modalities like logical, metaphysical, and physical. ATC modality might not be stronger than temporally sensitive physical modality, but the possibility is left open.

As in Ockham's description of necessity *per accidens*, ATC necessity changes with time. Thus, it may have been contingent that a stone was dropped from atop a building, as illustrated in Figure 2.3.1. Physical considerations entail that such facts cannot be undone once they are complete. After the stone has been dropped, nothing respecting the physical

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[5]Ockham *Ordinatio* I Prologue q.6

principles that do in fact hold, in which causes are not preceded by their effects in accordance with the arrow of time (or light cones), can make it the case that the stone was not dropped.

Examples like that of the stone dropped from atop a building indicate not only that temporally sensitive nodes are crucial for representing cases in which accessibility changes over time, but also that the state of the world (that the stone was dropped) is relevant to accessibility. The current state of the world is that the stone has been dropped. Physical laws, which are statements involving modal and temporal operators, dictate that the stone will hit the sidewalk in a few seconds. So of the moments at which it is a few seconds from now, only (but not all) those moments in which the stone hits the sidewalk are accessible from the current moment. Thus, the stone will necessarily hit the sidewalk, as far as physical possibility is concerned. Logical laws do not require that the stone will hit the sidewalk in a few seconds. So there are some logically accessible moments at which it is a few seconds from now and the stone does not hit the ground.

One popular way to represent ATC modality is to use branching time systems. The branching structure of those logics is designed to model ATC modality. Although branching is used to represent ATC modality here, other depictions are possible. That said, branching systems are the most sensible choice given a dynamic understanding of accessibility.[6]

2.3.2   Antecedent Conditions

A lot has been said thus far about the importance of antecedent conditions. The remainder of this section clarifies the role of antecedents for nodes in general, temporal sensitivity aside, then returns the discussion to how antecedent conditions are relevant to ATC modality in particular.

In moving towards a unified explication of accessibility, there are two cases to consider, the general case of formal modalities and the special case of propositional modalities. Assuming that there are no inconsistent nodes, consistency is the only limitation on accessibility

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[6]See Section 2.5 for more on dynamic accessibility.
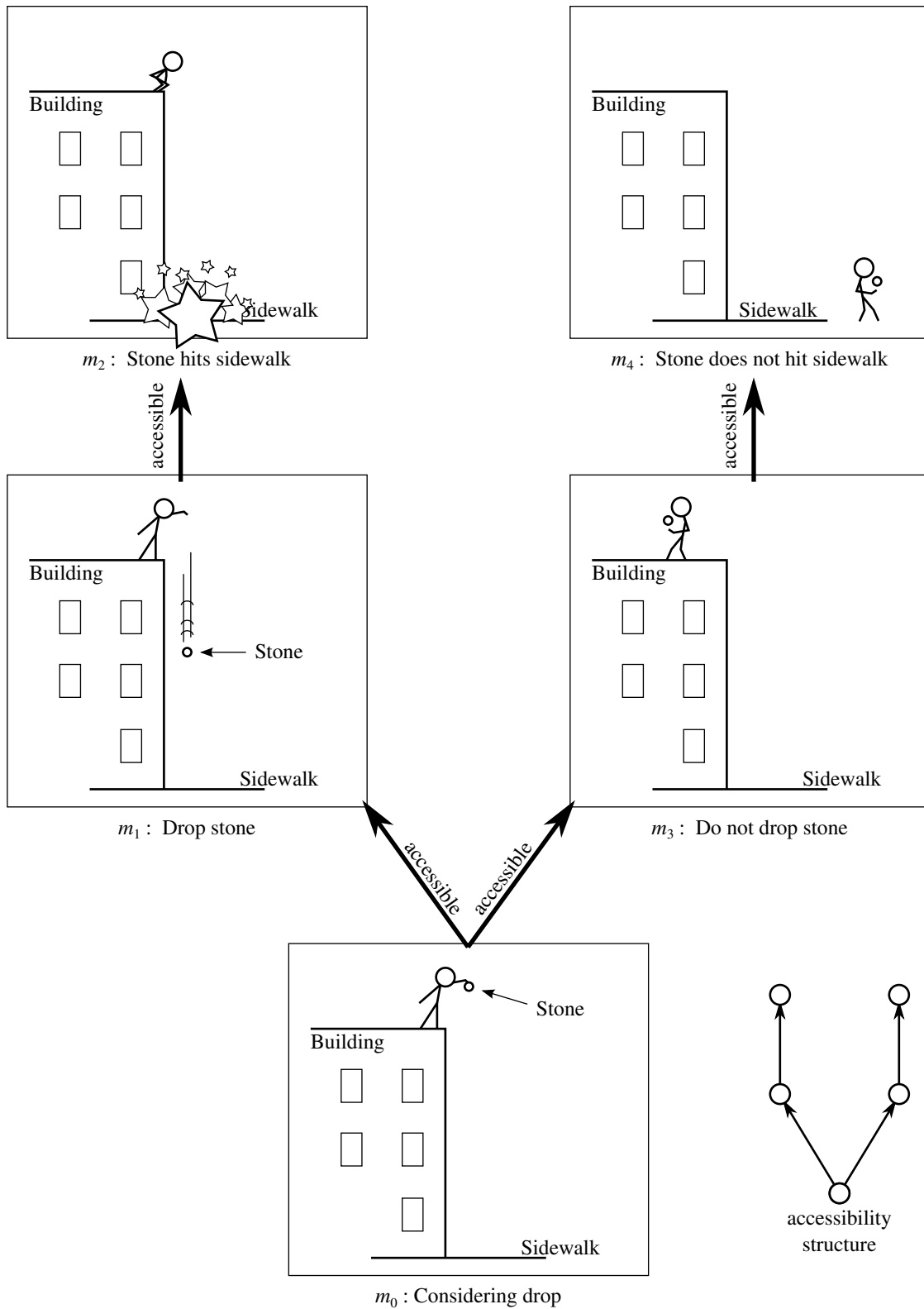
Figure 2.3.1: Dropping a stone from a building. Before the stone is dropped (m_0), it is possible that it will not hit the ground (m_4). Once the stone is dropped (m_1), it will inevitably hit the ground (m_2). m_4 is inaccessible from m_1. Although not physically, all nodes are *logically* accessible from one another.

pertaining to all formal modalities. For instance, if

(2.8) M-necessarily:ϕ holds at moment m,

(2.9) $\neg\phi$ holds at moment m',

then m cannot be related to m' by M's accessibility relation, R_M. Otherwise, both ϕ and $\neg\phi$ would hold at m' since (2.8) entails that ϕ is true at all nodes accessible from m. In more concrete terms, something like the following absurdity would hold at m if m relates to m':

(2.10) It is necessary that Jones will drink coffee, but she might not.

If M is a propositional modality, then M is characterized by a set of laws, L. One node M-accesses another just in case L is satisfied at the first while consistency is maintained. The consistency requirement plays a significant role in determining both the structure of M-accessibility and the relevance of antecedent conditions. Examples like the one above involving (2.8) and (2.9) show that consistency may rule out reflexivity, for instance, if m is identical to m'.

Antecedent conditions are important because they can determine modal statements when combined with certain laws. Physical modality serves as a helpful example. Suppose that a stone is dropped from atop a building. Physical considerations may require that the stone will inevitably hit the sidewalk. It is assumed that many physical laws assert that particular consequents, like the stone's hitting the sidewalk, necessarily follow from certain antecedent conditions, like that the stone was dropped. Physical laws, although typically stated in general terms, entail a set of conditionals, like:

(2.11) If a stone is dropped from the building, the stone will inevitably be falling at 9.8m/s in one second;

(2.12) If a stone is dropped from the building, the stone will inevitably hit the sidewalk in two seconds;

and so forth. Such conditionals help bring out the role of antecedent conditions. If the antecedent in (2.12) is not satisfied, (2.12) generates no modal requirements. The circumstance is different if the antecedent is satisfied, in which case

(2.13) The stone will inevitably hit the sidewalk in two seconds

follows. (2.13) is akin to (2.8), which limits accessibility based on the consistency requirement. Moments in which the stone does not hit the sidewalk in two seconds are not accessible from a node satisfying (2.13). (2.13) follows from (2.12) combined with the antecedent that the stone was dropped but not from (2.12) alone. Thus, antecedent conditions can determine modal relations for propositional modalities.

Antecedent conditions tend to be relevant to propositional modalities broadly. If moment m relates to m' by modality M, then one might say that the state of the world at m provides M-antecedent conditions for the state of the world at m'. This sort of M-antecedence is more general than what is typically meant by "antecedent conditions". In the usual sense, antecedent conditions involve something like temporal or causal antecedence.

2.4   Contingency and Fatalism

Contingency and fatalism must be explicated in terms of the current analysis. The parameterization given in this section allows for more explicit definitions of future-contingency, logical fatalism, and theological fatalism in terms of different modalities.

Start with a familiar notion of contingency defined in terms of propositions:

contingent proposition a proposition ϕ is contingent if and only if it is neither necessary nor impossible. Put another way, both ϕ and $\neg\phi$ are possible. That is,

$$\text{possibly:}\phi \wedge \text{possibly:}\neg\phi$$

Fatalism is taken to be the view that there are no contingencies. Thus:

fatalism the thesis that no ϕ is contingent. For any ϕ,

$$\text{necessarily:}\phi \vee \text{necessarily:}\neg\phi$$

2.4.1   Contingency and Fatalism in Multi-Modal Branching Time

The preceding definitions of contingency and fatalism need to be improved in two ways. First, there are different types of modality and ways in which a proposition, event, or thing can be possible.[7] A statement might be logically possible but not physically possible, for instance. Correspondingly, a statement can be logically contingent yet not physically contingent. A formal modality is anything that can be represented using an accessibility relation.[8] So the definitions of contingency and fatalism should make explicit the type of formal modality, M, involved. Second, in the branching time semantics used here, truth is defined with respect to moments, temporally specific possible worlds. Something may be contingent at one moment and not at another. Thus, the second parameter is the moment, m, at which contingency is evaluated.

M-**contingent proposition** For formal modality M and moment m, a proposition ϕ is M-contingent at m if and only if ϕ is neither M-necessary nor M-impossible at m. Put another way, both ϕ and $\neg\phi$ are M-possible at m. That is, the following holds m:[9]

$$M\text{-possibly:}\phi \wedge M\text{-possibly:}\neg\phi$$

M-**fatalism** For formal modality M, the view that no proposition is M-contingent at any moment, in which case everything is either M-necessary or M-impossible.[10] That is, for any ϕ, the following holds at all moments:

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[7]See Section 2.1.

[8]Of course, formal modalities need not be modal in other senses. For a discussion of formal modality, see Section 2.2.

[9]Regarding this and upcoming definitions, it may be better to bring the main connective—$\wedge$ for contingency and $\vee$ in the case of fatalism—into the metatheory if supervaluationism is under consideration. The shift is not used here for clarity.

[10]It may be desirable to further restrict fatalism to particular sets of moments. This may be desirable if, for instance, different sets of physical laws are taken into consideration. In this case, there are also various types of (moment-specific) ATC modality corresponding to different sets of physical laws. Some sets of laws, physical or otherwise, may yield fatalism while others do not. This notion of restricted fatalism could be defined without much trouble, but it is unnecessary here.

$$M\text{-necessarily:}\phi \vee M\text{-necessarily:}\neg\phi$$

This project emphasizes future-contingency. Future-contingency uses *all-things-considered* (ATC) modality. Although it is not standard practice, one might use "ATC-contingency" or "accidental contingency" instead of "future contingency".

future contingent a proposition ϕ is future-contingent at moment m if and only if ϕ is neither ATC-necessary nor ATC-impossible. Put another way, the following holds at m.

$$\text{ATC-possibly:}\phi \wedge \text{ATC-possibly:}\neg\phi$$

Instances of future contingency are opposed to ATC-fatalism.

ATC-fatalism For any proposition ϕ and moment m, ϕ is either ATC-necessary or ATC-impossible at m. That is, the following holds for all ϕ and m:

$$\text{ATC-necessarily:}\phi \vee \text{ATC-necessarily:}\neg\phi$$

Consider a specific example. Suppose that it is contingent whether or not Jones has a cup of coffee tomorrow. The event of Jones' coffee-drinking may come to pass and it may not. In terms of propositions,

(2.14) possibly:*coffee* $\wedge$ possibly:$\neg$*coffee*,

where possibility is understood as ATC-possibility.

2.4.2 Explicating Logical and Theological Fatalism

The preceding discussion aside, varieties of fatalism tend not to be named after their associated modalities in the philosophical literture. For example, *logical* fatalism is not the view that all truths are *logically* necessary. The threatening variety of modality is instead the more stringent ATC modality. Similarly, theological fatalism is not the view that all truths are theologically necessary, whatever that means. What distinguishes theological fatalism

from logical fatalism is that in the theological case but not the logical case, God plays an essential role through his comprehensive foreknowledge or atemporal direct apprehension of events.

Types of fatalism are instead named after the *considerations* that render some type of contingency inconsistent, regardless of the type of contingency or necessity involved. Physical fatalism is based on considerations about the physical world and about natural laws. Logical fatalism is based on logical and linguistic concerns, especially worries pertaining to time. Theological fatalism has to do with theological considerations, plus those of logical fatalism.

logical fatalism ATC-fatalism stemming from the incoherence of future-contingency.

theological fatalism ATC-fatalism stemming from God's comprehensive foreknowledge or his atemporal direct apprehension of events.

2.4.3 Fatalism and Determism

A final point worth mentioning here pertains to the distinction between fatalism and determinism. "Determinism" is typically understood as physical determinism although the notion can be generalized to M-determinism just as contingency and fatalism were. The difference between fatalism and determinism is often said to be that antecedent conditions are relevant to determinism, not fatalism. Some elaboration is called for.

Using the definitions of the preceding sections, one might stipulate that fatalism simpliciter is logical fatalism while determinism simpliciter is just physical fatalism. This way of making the distinction shifts emphasis away from antecedent conditions and towards laws. There is not in general anything special about antecedent conditions. They are always lurking and which conditions obtain need not have any bearing on fatalism. The issue is whether or not the relevant set of laws is enough to defeat contingency given the antecedent conditions. In the case of determinism, laws together with antecedent conditions block contingency. In the case of fatalism, laws together with antecedent conditions do not entail

necessity. Necessity, lack of contingency, is rather arbitrary.

Modalities can be distinguished by their characterizing principles and whether or not there are such principles. In the context of a branching system, both determinism and fatalism involve a linear modality. The ATC tree may collapse into a line. Suppose that ATC-possibility is physical possibility. In this case, ATC modality is propositional. If this modality linearizes the tree, it is because physical laws together with antecedent conditions are sufficient to determine the future. This kind of entailment may be used characterize determinism: the principles of the modality together with antecedent conditions generate necessity. Next, suppose that physical possibility is not sufficient for ATC-possibility and that ATC-modality is not propositionally modal. In this case, there is no characterizing set of laws which, when combined with antecedent conditions, yield necessity. If the relation is nevertheless linear, involving necessity, then it is fatalistic. The necessity of fatalism does not stem from principles, but is instead arbitrary. While a determined future event is present in its causes, a fated future event need not be.

The fatalism/determinism distinction may also be stated in terms of which considerations are relevant. Logical fatalism has nothing to do with what physical laws are or whether or not attitudes towards science engender physical determinism. Physical principles are relevant to time flow, the rule that effects cannot precede their causes, and perhaps other considerations relevant to logical fatalism. Although some such physical rules are at work behind the logic of temporal statements through which logical fatalism is studied, physical determinism involves much more. A pointed example is the rule that every event has a cause. Some such law is relevant to physical determinism, but logical fatalism is compatible with uncaused events.

Consider again the example of Jones' coffee-drinking. If her coffee-drinking is physically determined, then prior conditions together with physical laws are sufficient for her coffee-drinking, and her choice stems from physical causes. Now, suppose that physical determinism is false. Whatever the physical laws are, they are not enough to determine Jones' coffee-drinking from the relevant antecedent conditions. Logical or theological fatalism may still

hold. Neither logical nor theological fatalism require that Jones' actions are caused by something, let alone something physical. It may be that Jones' coffee-drinking or abstinence is ATC-necessary on account of a basic assumption about temporal propositions, such as that she will either drink coffee or she will not do so, or that *will* is covertly modal—not the sort of thing one worries about when dealing with physical determinism—thus yielding logical fatalism. In the theological case, the ATC-necessity of her coffee-drinking or abstinence may follow from God's comprehensive foreknowledge or atemporal apprehension of all events, again not the sort of consideration that is relevant to physical determinism.

2.5   Dynamic Accessibilities

Various notions of accessibility appear in the literature. Accessibility is given a particular understanding in this essay, in keeping with the tradition of branching time logics. Roughly, a node—for clarity, call it the target node—is accessible from another node—call it the source node—just in case the target is realizable or actualizable from the source; that the source might transition into the target. For instance, there is a genuine transition or potential transition between the states depicted in Figure 2.3.1 on page 30. This notion of accessibility will be called the dynamic account of accessibility. The dynamic account is relatively intuitive and has been the prevalent take on accessibility in branching time logics, used heavily throughout this essay. Such focus, especially in the field of temporal logic, is no doubt influenced by Prior, to whom Peter Geach suggested this understanding of accessibility for temporal logics.[11]

There is no pretension that the brief discussion here proves that the dynamic notion of accessibility is the best. Officially, the dynamic account is taken as a background assumption. It is nevertheless worthwhile to clarify Priorian accessibility, comment on its generality, and explain why it is relevant to this project.

In ordinary language, a thing is accessible to someone if and only if the person can get to

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[11][Copeland(1996)]

it. If and only if Jones can reach a book on a shelf, the book is accessible to her. Provided that the book is inaccessible to her, then she cannot get to it, perhaps because it is locked in a vault. One might say that a target node is accessible from a source node if and only if the source can get to the target. This portrayal makes it look as if nodes are like people in space, some of whom can touch some others. Another analogy might convey nodes as places, like Detroit and Chicago. Detroit and Chicago are connected by the interstate highway. They are accessible from one another; that is, people can go from one to the other. Maybe a target node is accessible from a source node if and only if one can go from the source to the target.

These analogies provide an intuitive start, but they appear circular if mistaken for explications. Accessibility is itself a modal notion, indicating that a (grammatical) subject *can* access an object, and was just described using modal terms; in this case, *can*. The course *can* get to the target, one *can* go from the source to the target, and so forth. Modality, in turn, is explicated using accessibility; hence the apparent circularity.

Seeking to avoid circularity, many philosophers nowadays use consistency as the foundation of accessibility.[12] Propositional modality plays a significant role here. The weakest form of accessibility is just logical accessibility. Every node is accessible to every other node. For propositional modalities in general, a source node accesses a target node just in case the source satisfies the laws of the modality, given that consistency is not violated. This definition makes it so that accessibility depends on what is true at nodes, with modal statements playing an especially important role in limiting accessibility; even though modal operators are characterized in terms of accessibility.

There is no circularity, at least no vicious circularity, in interdefining accessibility relations and modal operators using the above method; but such definitions do not capture very much in the way of content. That is exactly what one would expect for accessibility and modality. Propositional modalities specify accessibility structure in connection with true propositions.

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[12]This is not to say that those scholars think that there is no more to modality than consistency. One must know what the laws are, which laws are relevant to *genuine* modality (whatever that means), how a formal system must be developed to represent modal statements involving individuals, and so forth. Such issues are tangential to this discussion.

There is no more content to be found when accounting for propositional modality because those modalities are so diverse. For instance, physical and deontic modality may not have much in common besides the fact that both lend themselves to this type of characterization in terms of propositional modality. Additional content, accounts of accessibility relations and modal operators, is only to be found when addressing those rather different modalities individually, not in a more general account including both. The sources of content for physical and deontic modality, if not independent, are at least disparate.

The account of accessibility indicated so far is static. The static notion is based primarily on consistency, which generates no flow or movement, not even possible flow or movement. The ordinary notion of accessibility, to the contrary, involves *accessing*.

It has been argued that the dynamic content associated with nodes accessing each other is only metaphorical.[13] There are, however, reasons to include dynamic content. Many philosophers, especially those who use branching time systems, hold that time flows.[14] In branching time logics, the present moves along accessibility paths. The debate about whether or not time flows has a very long history, dating back at least to Heraclitus and Parmenides in the Western canon, and remains too contentious to address in satisfactory detail here. The dynamic view of time is taken as a background assumption for most of this essay.

The problems of logical and theological fatalism are in part about what might *become* the case or, put in terms of agents, what is within an agent's power to *bring about*. If it is within Jones' power to drink coffee tomorrow, then she can make her coffee-drinking real or actual tomorrow. Put in terms of moments, there is some moment in which Jones drinks coffee tomorrow and it is in her power to make that moment real. Agents aside, if some event is future-contingent, then there is a moment representing its occurrence that might become real. A static account of accessibility is insufficient to explicate libertarian freedom and future contingency, which have dynamic content. Freedom and contingency are not just

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[13]See, for instance, [Smart(1949), Nerlich(1998), Sider(2003)].

[14]This idea is prevalent in Prior. See, for instance, [Prior(1957), Prior(1967)]. McCall also advocates time flow [McCall(1998)].

a matter of consistency, but of change or potential change.

A good candidate source of accessibility's dynamic character is the so-called flow of time. In branching time models, present moments move along the tree as if it were a road.[15] The notion of time flow works well with the ordinary idea of accessibility and has been used in formal settings involving both branching time logics and relativistic branching space-time logics.

A common question (or criticism) is, how fast does time flow? The standard answer is, one second per second.[16] Consider an analogy. One might watch a film at various speeds— fast, slow, even backwards. The characters do the same things, although faster, slower, or backwards. Similarly, one can imagine present moments moving through a branching time model at different speeds—again faster, slower, or even backwards. That movement is faster, slower, and backwards is only in comparison between the time scale of the film or the model to another, relatively external time scale of the viewer. From the perspective of the film characters or someone in the model, there is no difference in time flow—it flows at one second per second. From the perspective of the viewer, time also flows at one second per second, although the viewer apprehends that the film's time scale can differ. This analogy illustrates two points. First, no matter how the viewer plays the film or the logician imagines the model, it makes no difference to those in the film or model. Second, no matter which frame of reference one is in, time flows at the same rate—one second per second, although the rate at other frames may appear different.

A more rigorous account of dynamic accessibility is called for. Such an explication might be given by just tacking on the property of being dynamic to the static account; but that approach is misleading, if not backwards. The static account may be taken to start with logical accessibility, using it to build stronger types. This direction of construction is not appropriate for the dynamic account because it is not evident how movement is supposed to

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[15]The same may be said of branching space-time models, although past, present, and future are frame specific. See, for instance, [Belnap(1992), McCall(1976), McCall(1994), McCall(1998)].

[16]See [Prior(1967), McCall(1998)]. Cf. [Smart(1949), Nerlich(1998)].

come from logical accessibility.

Whatever accessibility is involved in future contingency and libertarian freedom might be called *all-things-considered* (ATC) accessibility. It was indicated above that ATC accessibility has a dynamic character that goes beyond mere consistency. Future contingency is about what might *become* the case; libertarian freedom is about what an agent can *bring about*. Time flow is part of ATC accessibility. So ATC accessibility, not logical accessibility, is the starting point of the dynamic account. Other propositional modalities are derived from ATC modality, and the former inherit the latter's dynamic character.

Suppose that ATC accessibility is propositional. In fact, physical accessibility is a good candidate for ATC accessibility, although the issue is officially left open here. Given that ATC accessibility is propositional, its structure can be represented in terms of consistency just as in the static account described above. The structure of ATC accessibility is represented using consistency, but ATC accessibility is not derived from logical accessibility *per se*. It follows that ATC accessibility is free to retain its dynamic character. ATC accessibility is more than its structure.

Let P be the set of laws characterizing ATC accessibility. P represents all of the rules to be considered in all-things-considered accessibility. Thus, if S is a nonempty subset of P, then S generates a some-things-considered accessibility. If S is the empty set, then S leads to a no-things-considered accessibility, which is just logical accessibility. If S is a proper superset of P, then S yields an extra-things-considered accessibility. *Et cetera.*

Here are some examples. It is not ATC-possible to drop a stone from atop a building without it falling. However, ignoring physical principles, it is possible to drop the stone without it falling. Considering only some principles or no principles at all, the type of accessibility can be weakened. Suppose that it is ATC-possible for Jones to punch her boss in the face without getting fired. Given extra considerations, like the rules of her workplace, Jones will inevitably get fired for punching her boss. So it is not possible in this stronger sense for Jones to punch her boss without getting fired.

ATC accessibility can be weakened, strengthened, or some combination thereof to construct any propositional modality. The dynamic character of ATC accessibility is inherited by those accessibility relations derived from it. Thus, propositional modalities in general are dynamic under this interpretation of accessibility. It does not follow that all formal modalities are dynamic, nor that propositional modalities are dynamic if they are given a different interpretation, one by which ATC modality is not taken as primary. The dynamic interpretation is nevertheless the most appropriate for considering future contingency and libertarian freedom.

2.6   Views about Time and Temporal Language

Scholars propose many different accounts of time and temporal language. Several of these analyses are portrayed as responses to the problems of logical and theological fatalism, although these theories have implications that go beyond directly addressing fatalism. At least, logical and theological fatalism involve a lot more than fatalism. Historically, the many views on time and temporal language can be divided into two categories: open futurism (OF) and true futurism (TF). A third approach, supervaluationism (SUP), falls somewhere in between. These theories are discussed throughout most of this essay. At this point, only preliminary descriptions are in order.

One influential account is open futurism (OF), the topic of Chapter 7. OF is a doctrine by which contingent futures should be left open in all senses. Open futurists hold that designating an actual or otherwise privileged future makes that future the only genuinely actualizable possibility. Statements involving *will*, like:

(2.15) Jones will drink coffee

single out a particular future. If Jones were to not drink coffee, then (2.15) would be rendered false. So if (2.15) is true, Jones cannot fail to drink coffee, where the modality of *cannot* is ATC. Thus, there is a conflict between statements like (2.15) and contingency/freedom.
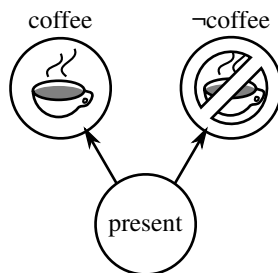
Figure 2.6.1: Open futurism: Jones might drink coffee and she might not. Open futurists hold that assigning a privileged future conflicts with contingency and freedom. It is neither true that Jones will drink coffee nor that she will not. The temporal relation is ATC accessibility.
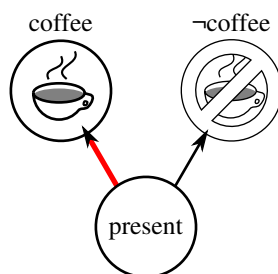
Figure 2.6.2: True futurism: Jones will contingently drink coffee. True futurists designate an actual timeline (TRL); in this case, the left branch. It is nevertheless possible that Jones will not drink coffee. Both future moments are ATC-possible, but only the left one will occur.

It follows that there is no fact of the matter regarding what will happen until contingency is resolved, and no particular future can be singled out. This notion is illustrated in Figure 2.6.1. Friends of OF would say that it is neither true that Jones will drink coffee nor that she will not. Note that only some—not all—forms of OF involve rejecting bivalence or the law of excluded middle. Prior ultimately held a form of OF that retains bivalence and excluded middle.[17]

True futurism (TF) is the topic of Chapter 6. Adherents seek to divorce *will* from possibility/necessity. On this account, Jones might drink coffee tomorrow and she and might not, although she will drink coffee. That is, Jones will contingently (or freely) drink coffee. This notion is illustrated in Figure 2.6.2.

TF interprets *will* as something like *will-actually*. *Will* is not modal, at least not in any

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[17][Prior(1967)]

sense required by freedom or future contingency. This move is accomplished by defining a separate, linear temporal relation on top of ATC-accessibility. This temporal relation is often called the thin red line (TRL). ATC accessibility is what is required for contingency and freedom. *Will* does not affect ATC accessibility, but only follows the TRL.

Supervaluationism (SUP), discussed briefly in Section 7.2.3, has elements of OF and TF. Acknowledging that TF and OF both have virtues and shortcomings, SUP is an attempt to combine the advantages of both theories while minimizing their disadvantages. SUP friends retain all of TF's intuitively plausible validities, such as:

(2.16) Either Jones will have coffee or she will not

which OF does not account for. Nevertheless, SUP does not assign a privileged future, thereby avoiding some of TF's most troublesome criticisms.

2.7   Hard and Soft Facts

Most scholars in both the future contingents and freedom/foreknowledge debates acknowledge necessity *per accidens*, here represented in terms of ATC modality, discussed in Section 2.3. Suppose that whether or not Jones drinks coffee tomorrow is ATC-contingent. That is,

(2.17) Jones might drink coffee and she might not

Jones' coffee drinking is not ATC-necessary. In other words, her coffee drinking is not ATC-necessary *now*. Tomorrow, whatever Jones decides to do will become necessary. Her choice cannot be undone once she implements it.

Following Ockham and others, TF maintains that there are facts about the future, soft facts, that are nevertheless contingent. For instance,

(2.18) Jones will drink coffee.

TF supplements an account of ATC necessity with a stronger distinction between hard and soft facts. Roughly, soft facts are those facts about the future that are not necessary while hard facts are about the past or present, which are always ATC-necessary. Having enough soft facts to specify a particular future as the actual one is equivalent to using a thin red line (TRL) as illustrated in Figure 2.6.2. Ockhamists in the freedom/foreknowledge literature talk about soft facts and their counterparts in the future contingents literature use the TRL. The former type of Ockhamism also involves the more stringent requirement that characterizations of God's past or present beliefs about soft facts are themselves soft.

2.7.1   Soft Facts in the Freedom/Foreknowledge Scholarship

Over some decades, Ockhamists in the freedom/foreknowledge literature struggled to characterize the hard/soft fact distinction. Patrick Todd recently provided an insightful analysis in which he observed that these attempts meet with severe difficulties.[18] Despite Todd's concerns, it is possible to explicate the hard/soft fact distinction using entailment, although no successful analysis is given in the freedom/foreknowledge literature.

Ockhamists in the freedom/foreknowledge literature emphasize whether or not a given fact is at least in part about the future. On this characterization, soft facts are in part about the future while hard facts are not. Such an analysis was endorsed by Marilyn Adams and came to be the dominant notion of soft factuality in the freedom/foreknowledge literature. Adams provided the following characterization of what it is for a statement to be about a time.

> Statement p is at least in part about a time $t =_{def}$ The happening or not happening, actuality or non-actuality of something at t is a necessary condition of the truth of p.[19]

Adams proposed that soft facts are those true statements that are at least in part about a future time while hard facts are not. Adams gave an illustrative example:

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[18][Todd(2012)]

[19][Adams(1967)], p. 493

"Caesar died in 44 B.C." expresses a "hard" fact about 44 B.C. But the statement "Caesar died 2009 years before Saunders wrote his paper" does not, since it is at least in part about 1965 A.D.[20]

Notice that Adams spoke of hard facts *about* times, not hard facts about times *at* other times. *Caesar died in 44 B.C.E.* expresses a hard fact after 44 B.C.E., but *Caesar will die in 44 B.C.E.* may well be soft before 44 B.C.E. Whether or not a proposition is a soft fact depends on when (or, more specifically, at which moment) it is evaluated. Adams' definition, by which soft facts are about *future* times, indicates that she was aware that soft factuality changes over time. She nevertheless did not incorporate ATC modality, by which soft factuality changes over time.

The literature contains many criticisms, attempted fixes, and analyses of Adams' proposal. John Fischer introduced an especially illuminating type of counterexample.[21] He pointed out that any hard fact about a past occurrence entails something about the future. For example,

(2.19) Jones had coffee yesterday (hard fact)

entails that

(2.20) Jones will not have coffee for the first time tomorrow.

(2.20) is in part about the future and (2.20) is necessary for (2.19), so (2.19) is a soft fact on Adams' account. A similar trick can be used to show that on Adams' definition, all facts are soft facts. The resulting attempts to fix Adams' explication of the hard/soft fact distinction are *ad hoc* and not particularly helpful to this discussion. The problems facing Adams' view and its successors led Todd to claim that "the notion of entailment is insufficiently discriminating to capture the relevant notion of dependence"; that is, the dependence of soft facts upon the future.[22]

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[20][Adams(1967)], p. 494
[21][Fischer(1983)], p. 75
[22][Todd(2012)], p. 8.

2.7.2   Explicating Soft Facts in a Temporally Sensitive Framework

Meanwhile, logicians advocating TF did not seem particularly concerned about the hard/soft fact distinction. Using the temporal logics developed by Prior and others, it is quite easy to represent Ockham's solution to the freedom/foreknowledge problem. Not only was Prior aware of Ockham's position, but he formalized it.[23] Priorian Ockhamism was developed further by Øhrstrøm.[24] It is disappointing that many scholars in the freedom/foreknowledge literature have and continue to ignore such important developments in the future contingents literature.

The problem with attempts to explicate hard/soft facts in the freedom/foreknowledge literature is that such efforts fail to account for ATC-modality. ATC-modality is a prerequisite of the hard/soft fact distinction. The dependence of the hard/soft fact distinction on ATC-modality is clear in Ockham's work on theological fatalism. Recall that propositions describing events can change modal status over time, so that an event that was future-contingent (Jones will drink coffee) eventually becomes ATC-necessary, part of the unalterable past (Jones drank coffee). It was argued in Section 2.3 that temporally sensitive possible worlds, here called moments, are crucial to representing ATC-modality. In fact, the fundamental structure of branching time is designed to represent ATC-modality. Thus, scholars working on temporal logics were in the best position to handle this sort of problem.

Armed with a temporal-modal structure representing ATC-modality, one can explicate the hard/soft fact distinction. Note that truth is moment-specific since ATC-necessity changes over time.

soft fact   A proposition ϕ is a soft fact at moment m if and only if the following hold

(i) ϕ is true at m

(ii) ϕ entails will:ψ for some proposition ψ.

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[23]See [Prior(1962)] and, for additional developments, [Prior(1967)].

[24]See [Øhrstrøm(1981), Øhrstrøm(1983), Øhrstrøm(1984)]. For a more recent synopsis, see [Øhrstrøm(2009)].

(*iii*) ψ is future-contingent (not ATC-necessary, not necessary *per accidens*)

hard fact A proposition ϕ is a hard fact at moment m if and only if ϕ is true at m and ϕ is not a soft fact at m.

(*i*) accounts for the factuality of soft facts, (*ii*) introduces factual future content, and (*iii*) pertains to softness. Observe that ATC-necessity is relevant to (*iii*). It is (*iii*) that Adams' definition is missing. While Adams defined a soft fact as a fact that entails something about the future, the definition given here adds that a soft fact entails something *contingent* about the future. Soft facts are soft, and not just any future content can serve to make them so.

2.7.3   Comments on the Definition

This explication of the hard/soft fact distinction has some interesting features. First, the analysis is immune to the formal criticisms of Adams' view, with or without the epicycles later appended to her definitions. Second, the analysis partitions the space of facts along different lines than many other attempts. Third, as desired Ockhamists in the freedom/foreknowledge literature, characterizations of God's past and present beliefs about the future turn out to be soft facts. Fourth, the explication nudges discussions of Ockhamism back to more relevant ground.

Recall Fischer's criticism of Adams' definition. Given that Jones had coffee yesterday, it is not future-contingent but inevitable that Jones will not have coffee for the first time tomorrow. Thus, (*iii*) fails for Fischer-style counterexamples. Todd more recently pointed out that Adams' account cannot differentiate between God's foreknowledge and his decrees. However, if God decrees that Jones will have coffee tomorrow, then it is inevitable that Jones will have coffee tomorrow. Again, (*iii*) fails.

There is a prevalent view in the freedom/foreknowledge scholarship that soft facts pertain to the future while hard facts depend only on the past and present. The definition proposed here does not carve up facts in this way. There can be hard facts about the future. For

instance, suppose the laws of physics determine that the sun will rise tomorrow. It is not future-contingent, but inevitable that the sun will rise tomorrow. Thus, that the sun will rise tomorrow is a hard fact. Hard facts can be about the future only insofar as the events they pick out, if future events, are already present in their causes, so to speak. Soft facts are never present in their causes—otherwise, they would be inevitable and hence not soft.

Ockhamists in the freedom/foreknowledge literature insist that characterizations of God's past and present beliefs about the future are soft facts. Most others find this view awkward, at best, on the grounds that past beliefs do not seem future-contingent. On the definition given here, theistic Ockhamists get their wish. If God knows all and only truths, propositional characterizations of God's past and present beliefs about the future are soft facts. Unlike normal past/present beliefs, God's beliefs are infallible, entailing that their content is true. Thus, statements characterizing God's beliefs about the future satisfy (*ii*) while normal, fallible beliefs do not. There is nothing new about this distinction between God's beliefs and normal beliefs. For instance, Nelson Pike indicated that this difference is the source of the incompatibility between freedom and foreknowledge.[25] Although the softness of God's beliefs is what freedom/foreknowledge compatibilist Ockhamists have wanted all along, it may turn out to work against them, as in Pike's argument.

One could debate about whether or not characterizations of God's beliefs *should* count as soft facts, or if something in the analysis needs to change. That issue will come up later. It will be seen that there are difficulties for TF in the context of traditional branching time semantics. An account of temporal standpoints, standpoint inheritance, is introduced in Section 3.4 and goes a long way towards helping TF in branching time. Standpoint inheritance also brings out nuances in the semantics of soft and hard facts, including those describing God's and others' beliefs. God's beliefs must be quite different than those of everyone else if his beliefs are to retain their softness, which is required to truth-track soft facts. The demand for handing temporal standpoints thus revitalizes the debate about

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[25]That is, under Pike's assumptions. See [Pike(1965)].

whether or not characterizations of God's beliefs should count as soft. The topic will be discussed further in Sections 3.4 and 6.3.4.

If successful, this definition of soft facts allows discussions of Ockhamism to return to the central questions. How can any past or present belief be soft? Why do soft facts pick out one contingent future over another? What is the mysterious dependence relation of the past upon some contingent future by which soft facts are true? Does it make sense to hold that characterizations of God's past and present beliefs are soft facts? What is the relationship between logical and theological fatalism? *Et cetera*. TF, and with it Ockhamism, is the topic of Chapter 6. Various sorts of TF are discussed there. Scholars have also provided several formal representations of TF theories. Some of these systems are illustrated and discussed formally in Chapter 8.

2.8   Branching Time and Relativity

Some thinkers have voiced concerns to the effect that branching time systems fail to account for relativity.[26] These worries may be distracting for this project given the importance of branching time to the literature on future contingents and freedom/foreknowledge. It is nevertheless worthwhile to briefly clarify the position taken here on relativity.

Some criticisms are not against branching time *per se*, but some associated views. On the one hand, there is the A-theory, which is the view that relational temporal operators cannot (or should not) be reduced to atemporal operators. The A-theory may be considered a semantic thesis. On the other hand, there is the A-theory's metaphysical counterpart, the view that past, present, and future are fundamental features of reality instead of, say, mere artifacts of subjective experience.

Here is one way of putting the criticism from relativity against the reality of past, present, and future. In the theory of relativity, observers in different reference frames may record the time of a given event in ways that are incompatible with branching time systems. One

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[26]See, for instance, [Smart(1963)].

event may appear to come before another in one reference frame; in a second reference frame, the events are perceived in reverse order. In one frame, one event may be past while the other is present; while in the second frame, the order is reversed. No event can be past and present at the same time. So, assuming that pastness, presentness, and futurity are frame-independent, the result is absurdity. The same event is both present and past, thus present and not present.

Prior gave a rather strong reply. He concludes that

> [W]e may say that the theory of relativity isn't about *real* space and time, in which the earlier-later relation is defined in terms of pastness, presentness, and futurity; the 'time' which enters into the so-called space-time of relativity isn't this, but is just part of an artificial framework which the scientists have constructed to link together observed facts in the simplest way possible, and from which those things which are systematically concealed from us are quite reasonably left out.[27]

Prior argues that genuine temporal relations (those associated with the A-theory) cannot be reduced to atemporal earlier-later relations (those associated with the B-theory), although the reduction works in the other direction.[28] If the A-theory is indispensable and if, in light of considerations like ATC modality, the A-theory yields branching time, then branching time systems are the only viable alternative. Scientists or their philosophical interpreters who claim that observations supporting relativity are incompatible with branching time are mistaken, according to Prior.

Prior's view may be difficult to accept. Fortunately, there are other (perhaps less committed) alternatives supporting branching time analyses. The official position taken in this essay involves a few parts:

(2.21) It is possible to construct a branching space-time system that is compatible with relativity.

(2.22) Relativistic interpretations conflict with ordinary assumptions to the effect

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[27][Prior(1996)], p. 51.

[28]See esp. [Prior(1957), Prior(1967)], although he provides a synopsis of the argument in [Prior(1996)]. See [McTaggart(1908)] for McTaggart's labeling of "A-theory" and "B-theory".

that temporal order is retained between reference frames. For convenience, it may be assumed that all reference frames are equivalent under Galilean transformation. In effect, there is only one reference frame.

(2.23) The branching time system presented here can be transformed into a branching space-time system compatible with relativity by dropping the assumption that there is effectively one reference frame and making additions to the theory as needed.

Even if traditional branching time systems conflict with relativity, they can be generalized to account for relativity. Branching space-time systems allegedly compatible with relativity have been proposed and defended successfully. The most influential branching space-time systems are given in [Belnap(1992), McCall(1994)]. A recent synopsis of the status of branching space-time projects is given in [Müller and Strobach(2012)].

One of the primary desiderata of this essay is to provide a reasonable semantic account of temporal language. An ordinary assumption, outside of the context of discussions about relativity, is that there is effectively just one reference frame. In special relativity, the distinction between reference frames together with fascinating observations about light's behavior that yield the result that the temporal order of events is frame-dependent. The frame parameter is typically irrelevant to temporal order. There is no good reason to think that ordinary speakers really mean to parameterize temporal order with respect to reference frames. The semantics of temporal language do not involve such a parameterization.

Although the systems used here do not account for shifts in reference frame that are not order-preserving, temporal standpoints may be considered a step towards more general reference frames. A theory of temporal standpoints is presented in Section 3.4 and more formally in Section 8.3. This theory involves parameterizing the temporal relation in a way that allows propositions to shift standpoint (or not, as the case may be). The result is something like a frame-relative system; however, the sort of frame shift inspected here preserves temporal order unless further generalized.

What is desirable for this essay is a system that can provide a refined semantic account in simple terms—as simple as the subject matter allows, at least. This account should be generalizable to accommodate more nuanced observations that may conflict with usual presumptions about the world. The system used here should fulfill those needs. Strictly speaking, branching time systems may be inaccurate, as is Newtonian mechanics. Like Newtonian mechanics, it is fine to use simplified branching time systems for many purposes as long as it is understood that some analyses require dropping the simplifying assumptions. There is no need for branching *space*-time systems in decision theory or game theory, let alone accounts of ordinary language, and that is what is relevant here. It may be assumed that, in all examples given in this essay, Jones is not moving too much faster than Smith.

Chapter 3

The Future of English

Linguistic considerations play an important role throughout this project. This chapter conveys a few observations about the grammatical nature of *will* and, on a somewhat different note, perspectival shifts associated with temporal statements. Section 3.1 contains a discussion of *will* as grammatically modal. The sense in which *will* is evaluated in this project, the bleached sense, is distinguished from other notions associated with the term. In Section 3.2, various types of excluded middle are enumerated. Aside from the usual law of excluded middle, there are three kinds involving the future: a weak, a medium, and a strong future excluded middle. The weak and medium varieties are typically equivalent and usually innocuous, but the strong type is more contentious. Section 3.3 sets out a method for distinguishing between corresponding instances of weak and strong future excluded middle. Finally, Section 3.4 introduces temporal standpoints. Temporal standpoints are moments determining perspectives. Traditional branching time logics are unable to account for several important types of statements because, in effect, those systems change standpoints too frequently. The theory of standpoint inheritance is introduced in a general form, while theory-specific and formal accounts are reserved for later chapters. Standpoint inheritance resolves many linguistic inaccuracies of traditional branching time logics in a way that is general, simple, and intuitive.

3.1   Grammatical Modalities and Bleached *Will*

In the philosophical literature, "tense" seems to refer to the manifestation of temporal relations in language. Linguists often use the term differently, focusing on verb forms. Consider a simple example.

(3.1) Jones runs.

(3.2) Jones ran.

In (3.1), *runs* is a present tense verb. *Ran* in (3.2) is past tense. There is there no future tense rendition of the verb in English. In general, English is a two-tense language. The two tenses are past and present. There is no future tense.

(3.3) Jones will run.

It is tempting to think that (3.3) is in the future tense, but there is no future tense modification of the main verb. So-called future tense in English is not grammatically analogous to past and present tense. Rather, futurity is expressed with modal auxiliary verbs like *will*. Compare (3.3) with:

(3.4) Jones should run.

(3.5) Jones can run.

(3.6) Jones must run.

Should, *can*, and *must* are all grammatically modal. Grammatically (if not also philosophically), *will* is also modal. This simple fact is often ignored, or perhaps swept under the rug, in most philosophical literature. Indeed, many philosophers use "temporal logic" and "tense logic" interchangeably. It is not tense logic that philosophers and logicians are particularly concerned with; for they largely focus on how to account for the future using grammatically modal terms like *will*. Rather, these scholars are interested in a logic of time, preferably one

that accords well with natural language usage, avoids disastrous metaphysical consequences, accounts for scientific and other applications, and so forth.

Acknowledging the grammatical modality of *will* may be an important step towards resolving philosophical issues surrounding how to represent temporal relations involving the future. *Will*, although grammatically modal, has some characteristics that differentiate it from other grammatical modalities. One such candidate is will-not commutativity, discussed in Sections 6.3.1 and 7.3.1.

Semantically, *will* has several dimensions and senses. Only a rudimentary, "bleached" sense is inspected within this project. Other content of *will* is mentioned here for two reasons. The first reason is to shed light on the bleached content by way of contrast. The second goal is to point towards additional criteria of adequacy for the analysis of this essay. A good analysis of bleached *will* should be compatible with and perhaps generalize to other senses of the term, if possible.

Often, *will* expresses something like determination or intention.

(3.7) I *will* win the contest although the odds are against me.

In (3.7), *will* expresses (among other things) the speaker's determination or intention to win the contest. Notice that the speaker's expression of determination runs counter to her perceived small likelihood that the speaker will in fact win. One might even interpret this use of *the odds are against me* as conveying something like *there are significant obstacles, I will not win without great determination and effort, but I am likely to win with enough determination and effort*. In that case, the speaker uses (3.7) to proclaim her intention to put forth the determination and effort necessary for her to win.

Compare (3.7) to:

(3.8) I *will* win the contest although it is impossible for me to do so.

Although (3.7) is acceptable, (3.8) is self-contradictory. The speaker may again be expressing determination to win the contest, but such intention presupposes the ability, or at least the

perceived ability, to accomplish the goal. Nothing impossible will ever be. Thus, insofar as *will* is about determination or intention, *will* involves certain assumptions about the future or possible future. If those assumptions are denied, determination seems absurd.

Will often has probabilistic content. For instance,

(3.9) The incumbent mayor will win the election.

As the philosophical literature has shown, there are several ways to interpret probabilities: as frequencies, as subjective estimates, as objective mechanisms, to mention a few influential views. That debate is beyond this analysis. One can in any case observe that *will*, taken probabilistically, is compatible with *might not*, even under open futurism.[1] This is not to say that (3.9) would not become false should the incumbent lose the election, but such issues can be handled using shifts in context or temporal standpoint, discussed in Section 3.4.

The bleached content of *will*, the sense inspected in this essay, does not immediately accommodate either determination/intention or probabilities. Nevertheless, bleached *will* should be both compatible with determination content and generalizable to encompass probabilities. Bleached *will* itself is difficult to isolate without begging the question in favor of one theory or another. One of the tasks of this project is to analyze different ways of explicating bleached *will*. Those theories were briefly introduced in Section 2.6 and are given a more detailed treatment in Part II.

3.2   Future Excluded Middles

The law of excluded middle (LEM) is one of the cornerstones of classical logic. The rule may be stated as follows.

law of excluded middle (LEM) For any proposition, ϕ, $\phi \vee \neg\phi$ is valid. That is,

$$\vDash \phi \vee \neg\phi$$

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[1]Cf. Section 7.2.1.

LEM is typically associated with its metatheoretic compatriot, the principle of bivalence, which asserts that every proposition is either true or false.[2] LEM and bivalence are equivalent in every system presented here except one. LEM is valid in supervaluationism, but bivalence does not hold in that system.

If LEM is valid and the future is unbounded, then LEM instances *will* hold. (In fact, they will always hold.)

weak future law of excluded middle (W-FLEM) For any proposition, ϕ, $\phi \vee \neg\phi$ will be true. With some symbols,

$$\vDash \text{will:}(\phi \vee \neg\phi)$$

For example,

(3.10) Jones will either have coffee or not.

or the logically equivalent yet somewhat more pedantic:

(3.11) It will be the case that either Jones has coffee or she does not.

W-FLEM is closely related to another principle, also closely linked to LEM.

medium future law of excluded middle (M-FLEM) For any ϕ representing a proposition,

$$\vDash \big(\text{will:}\phi \vee \neg\text{will:}\phi\big)$$

where *will* has higher precedence than $\vee$. For example:

(3.12) Jones will have coffee or it is not the case that she will have coffee.

M-FLEM is a particular case of LEM. W-FLEM is nearly always equivalent to M-FLEM. There is only one system discussed in this essay in which M-FLEM is stronger than W-FLEM,

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[2]For a description of LEM and bivalence in the context of temporal logic, see [Lucas(1989)], pp. 72–8.

a non-bivalent variety of open futurism. Outside of discussing that system, W-FLEM and M-FLEM are here treated as equivalent principles.

(3.10)–(3.12) are relatively innocuous given LEM. True futurists and open futurists who assent to LEM and bivalence agree on W-FLEM and M-FLEM. There is, however, contention about a stronger principle:

strong future law of excluded middle (S-FLEM) For any ϕ representing a proposition,

$$\vDash (\text{will:}\phi \vee \text{will:}\neg\phi)$$

Again, *will* is understood with smaller scope that $\vee$. Notice that in S-FLEM, $\neg$ has smaller score than *will* in the right disjunct; but in M-FLEM, $\neg$ has larger scope than *will*. That is the only difference between M-FLEM and S-FLEM. Here is an instance of S-FLEM.

(3.13) Jones will have coffee or she will not have coffee.

Typical English usage indicates that the disjuncts of M-FLEM and S-FLEM instances are about the same time or interval unless otherwise specified. For instance, the disjuncts of (3.13) are presumably about the same time or interval, where this time or interval can be designated by the context in which the statement occurs. Speakers do not assume that the first disjunct might be about, say, this afternoon, while the second might be about next Thursday.[3]

LEM is neither sufficient nor necessary for S-FLEM. S-FLEM therefore may not be as logically evident as W-FLEM and M-FLEM. That said, friends of S-FLEM (true futurists and supervaluationists) contend that their principle is linguistically accurate and fruitful both within and outside of philosophy.[4] [5] According to true futurists and supervaluationists, such considerations warrant accepting S-FLEM as a logical rule.

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[3]This issue is addressed formally in Section 8.1.3.

[4]See, for instance, [Hasle and Øhrstrøm(2004)].

[5]Some reasons for accepting S-FLEM's validity are given in Section 6.3.1.

English speakers often use instances of W-FLEM, like (3.10) and (3.11), interchangeably with corresponding instances of S-FLEM, like (3.13). The two types of sentences are nevertheless quite different. Disjunction ($\vee$) is the main operator in M-FLEM and S-FLEM, but *will* is the main operator in W-FLEM. The distinction between W-FLEM, M-FLEM, and S-FLEM is further evidenced by the grammatical modality of *will* and other future designators in English. Section 3.3 clarifies the distinction between instances of W-FLEM and those of S-FLEM for the interested reader.

3.3   Identifying Instances of W-FLEM and S-FLEM

An understanding of grammatical modalities, modal auxiliary verbs, is sufficient for distinguishing instances of W-FLEM from those of S-FLEM. Nevertheless, some readers may be interested in clarifying the differences between the two types of propositions. In this section, a method for identifying corresponding instances of W-FLEM and S-FLEM is applied to a couple of simple examples.

The first order of business is to show that (3.13) is definitely an instance of S-FLEM, not W-FLEM. Grammatically, conjunctions and disjunctions are very similar in English. Indeed, linguists use "conjunctions" both for what philosophers call "conjunctions" (linguistic entities whose main connective maps to $\wedge$) and for disjunctions (linguistic entities whose main connective maps to $\vee$). The procedure given here for identifying (3.13) and other instances of W-FLEM as such relies on the assumption that conjunctions and disjunctions are grammatically analogous.

Define:

(3.14) $c :=$ Jones is having coffee.

(3.15) $b :=$ Jones is having biscuits.

Start with a simple, relatively innocuous case. Consider:

(3.16) Jones will have coffee and she will have biscuits.

(3.17) will:c ∧ will:b

(3.18) will:$(c \wedge b)$

Does (3.16) amount to (3.17) or (3.18)? Additional information may be appended to (3.16), yielding:

(3.19) Jones will have coffee and she will have biscuits, but not at the same time.

Using metric future operators, (3.19) can be represented as:

(3.20) will-in-t_1-units:c ∧ will-in-t_2-units:b ∧ $t_1 \neq t_2$.

Just as (3.16) is adjusted to yield (3.19), (3.17) can be modified to produce (3.20). (3.19) requires two future operators in order to represent that Jones' coffee-having and her biscuit-having occur at different times. (3.18) has just one future operator and implies that Jones will have coffee and biscuits simultaneously. Thus, (3.18) cannot be morphed to represent (3.19). In fact, (3.18) is outright inconsistent with (3.19). Uniformly interpreting (3.16) therefore requires (3.17), not (3.18).

The next example is a step closer to (3.13).

(3.21) Jones will have coffee and she will not have coffee.

(3.22) will:c ∧ will:$\neg c$

(3.23) will:$(c \wedge \neg c)$

Observe that (3.21) is self-contradictory given that the two events in the proposition—Jones' having coffee and her doing otherwise—occur at the same time. That is, the two instances of *will* are about the same time. The absurdity is reflected in both candidate interpretations, (3.22) and (3.23). Assuming the law of non-contradiction, (3.23) cannot be true. (3.22) is also impossible by non-contradiciton, provided that the two temporal

operators are about the same time. This last supposition, that the two temporal operators are about the same time, can be derived from something like conversational implicature; but the assumption is not an essential part of (3.22) itself. Additional information can nullify the assumption and make distinct times salient. (3.21) can be modified to:

(3.24) Jones will have coffee and she will not have coffee, but not at the same time.

(3.24) is similar to (3.19). (3.24) can only be represented by a modification of (3.22) like

(3.25) will-in-t_1-units:c ∧ will-in-t_2-units:¬c ∧ $t_1 \neq t_2$.

(3.23) cannot be adjusted to represent (3.24). (3.24) requires two temporal operators to account for the fact that the two events occur at distinct times. As such, a uniform interpretation of (3.19) requires (3.22), not (3.23).

Recall the initial question, Which of the following does (3.13) amount to?

(3.26) will:c ∨ will:¬c [an instance of S-FLEM]

(3.27) will:$(c ∨ ¬c)$ [an instance of W-FLEM]

Conjunctions and disjunctions are grammatically similar. Except that (3.21) is a conjunction while (3.13) is a disjunction, the two propositions are the same. Therefore, since (3.21) amounts to (3.22), (3.13) should be interpreted as (3.26), not (3.27).

Roughly the same procedure can be used to mark instances of W-FLEM, like (3.10) and (3.11). As above, consider an independent case for clarification.

(3.28) Jones will have coffee and biscuits.

(3.29) It will be the case that Jones has coffee and she has biscuits.

(3.28) and (3.29) should be represented as (3.18), not (3.17). To see why, append extra information to (3.28) and (3.29) as follows.

(3.30) Jones will have coffee and biscuits, but not at the same time.

(3.31) It will be the case that Jones has coffee and she has biscuits, but not at the same time.

(3.30) and (3.31) are self-contradictory,[6] for (3.28) and (3.29) imply that there is a time at which Jones is having both coffee and biscuits. Contrast (3.24) with (3.30) and (3.31). Only (3.24) is consistent.

(3.32) will-in-t-units:$(c \wedge b) \wedge t \neq t$

(3.32) is therefore the correct interpretation of (3.30) and (3.31). As such, (3.18) rather than (3.17) is the right depiction of (3.28) and (3.29). Moving a step closer to (3.10) and (3.11), consider:

(3.33) Jones will have coffee and not have coffee.

(3.34) It will be the case that Jones has coffee and she does not.

(3.33) and (3.34) are self-contradictory. These sentences may be appended as follows.

(3.35) Jones will have coffee and not have coffee, but not at the same time.

(3.36) It will be the case that Jones has coffee and she does not, but not at the same time.

Recall that appending the same information to (3.21), forming (3.24), yields a proposition that is not self-contradictory. In that case, the appended information makes salient two temporal operators picking out distinct times. This is not so for (3.35) and (3.36), which remain self-contradictory despite the change because there is only one temporal operator. The correct representation of those sentences is therefore:

(3.37) will-in-t-units:$(c \wedge \neg c) \wedge t \neq t$

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[6]The result assumes that *and* is interpreted as the unordered conjunction, $\wedge$, not something like *and then*. An example of *and* representing *and then* is *Jones ate breakfast and left to work*, in which case the *and then* interpretation makes the most sense.

Thus, a unified approach requires that (3.33) and (3.34) are represented by (3.23) instead of (3.22). The grammatical similarity of conjunctions and disjunctions yields that (3.10) and (3.11) should be represented by (3.27), not (3.26). That is, (3.10) and (3.11) are instances of W-FLEM rather than S-FLEM.

3.4   Temporal Standpoints and Standpoint Inheritance

This section introduces temporal standpoints and the theory of standpoint inheritance here used to represent standpoints. The emphasis at this point is on describing temporal standpoints, providing a brief history, and explaining the basics of tree-pruning and standpoint inheritance. What cannot be done in this section is address problems for specific theories. Those issues are mentioned here but not explained. Without going into more depth on particular theories, one cannot see how they fail and how exactly standpoint inheritance is supposed to help.

Suppose that Jones drank coffee. Yesterday, Smith claimed that Jones would drink coffee. This arrangement, illustrated in Figure 3.4.1, renders the following true:

(3.38) Smith correctly predicted that Jones would drink coffee.

It is also true that:

(3.39) Had Jones not drunk coffee, Smith's prediction would have been incorrect.

Theists may also assent to the following:

(3.40) God believed that Jones would drink coffee.

(3.41) Had Jones not drunk coffee, God would have believed that Jones would not drink coffee.

Traditional theories have difficulty with many of the preceding statements. For instance, (3.38), which depends on:
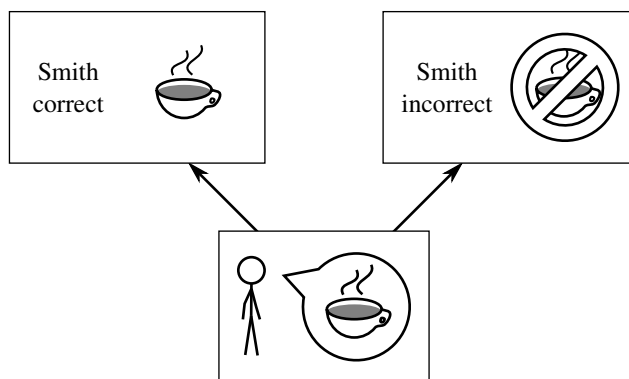
Figure 3.4.1: Smith predicts that Jones will drink coffee. Given that Jones is drinking coffee, Smith's prediction was correct. Given that Jones has not drunk coffee, Smith's prediction was incorrect.

(3.42) Jones was going to drink coffee

(3.43) was:will:*coffee*

Traditional branching time logics switch perspectives in the middle of (3.43), between *was* and *will*. The mechanics of the change in perspective are given in more detail below. It will be seen that true futurism renders (3.42) and hence (3.38) true even from the counterfactual perspective in which Jones did not drink coffee, making (3.39) and (3.41) false.[7] Traditional open futurism makes (3.42) and hence (3.38) untrue, although such statements appear true.[8]

To inspect and account for statements like (3.38)–(3.43) in branching time systems, one can utilize the notion of temporal standpoints. A temporal standpoint is a moment representing perspective in time.

The importance of temporal standpoints is not a new discovery although analyses have developed only slowly. In 1947, Hans Reichenbach provided an insightful analysis differentiating between not only the time at which a temporal statement is made (S) and the time when the proposition affected by a temporal operator is evaluated (E), but also a point of reference (R) that may differ from the other two contexts.[9] Consider two examples.

(3.44) Jones drank coffee. (simple past)

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[7]See Section 6.3.3.
[8]See Section 7.3.2.
[9][Reichenbach(1947)]
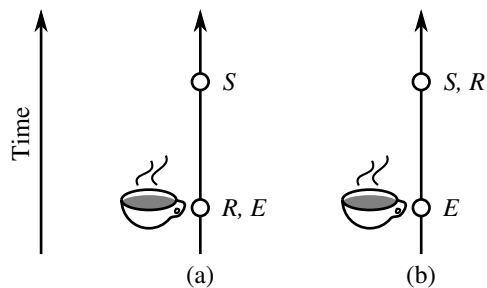
Figure 3.4.2: Reichenbach's standpoints. (a) Jones drank coffee. (b) Jones has drunk coffee.

(3.45) Jones has drunk coffee. (present perfect)

In (3.44), the statement is given now (S); but both the time of reference (R) and the time of evaluation (E) are in the past. In (3.45), both S and R are present, while only E is in the past. This scenario is depicted in Figure 3.4.2.

Unfortunately, Reichenbach's work has been underutilized by logicians working with temporal systems. Prior says that it is

> [...] unnecessary and misleading to make such a sharp distinction between the point or points of reference and the point of speech; the point of speech is just the *first* point of reference. [...] This makes pastness and futurity *always* relative to *some* point of reference—maybe the first one (i.e. the point of speech) or maybe some other. Because Reichenbach's analysis fell short of this generalization, it was in some ways a hindrance rather than a help to the construction of a logic of tenses; at all events, no such logic could get going until this generalization had been made.[10]

Even if Reichenbach's analysis is not itself as general as a temporal logic, some of his observations can be integrated into a more general system. Ironically, temporal standpoints are especially important to Priorian branching time systems.

Temporal standpoints and related notions have made appearances in the literature since Prior. In his seminal 1970 article introducing supervaluationist temporal logic, Richmond Thomason developed a little bit of semantics leaning towards a theory of temporal standpoints.[11] Ultimately, he utilized his observations to create a temporal rendition of supervaluationism, not accommodate temporal standpoints. Later, in 1989, John Lucas acknowledged

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[10][Prior(1967)], p. 13
[11][Thomason(1970)], §3–4

the importance of Reichenbach's proposal and set up some machinery to represent temporal standpoints, but standpoints were not adequately built into the logic Lucas constructed and their ramifications for other important systems were unmentioned.[12] Recent work on relativism acknowledged something like temporal standpoints in the context of two-dimensional systems.[13] These studies typically focused on issues apart from temporal logic, like whether or not a particular sandwich is tasty and to whom. A theory of temporal standpoints has yet to be satisfactorily applied to branching time semantics.

This project utilizes Reichenbach's observations and integrates them into the temporal logics developed here, enabling those systems to better handle statements like (3.38) and (3.39). This task is accomplished in more detail for particular views in their respective chapters and formally in Section 8.3. The remainder of the current section provides a more general and less technical explanation of the logic of temporal standpoints.

In modal and temporal logics, one (metaphorically) hops from moment to moment (or world to world) in order to evaluate propositions. For example, in order to evaluate whether or not (3.44) is true today, one must (metaphorically, in the model) step back to yesterday to see whether or not Jones drank coffee. If she did, the proposition is true; otherwise, it is false.

Recall that necessity *per accidens* involves changes associated with a certain kind of modality, here called ATC (all-things-considered) modality. Yesterday, Jones' coffee-drinking may have been contingent; but today it is resolved that she drank coffee yesterday. ATC possibility changes over time.

The term *temporal standpoint* is supposed to conjure images of how someone would view the world from a particular moment. The past is unalterable from that standpoint, but the future may be open. A temporal standpoint designates a part of the great tree of possible moments, the part containing that standpoint's past and possible future.

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[12][Lucas(1989)]

[13]These systems have a world parameter and a time parameter. See [MacFarlane(2008), MacFarlane(2012)].
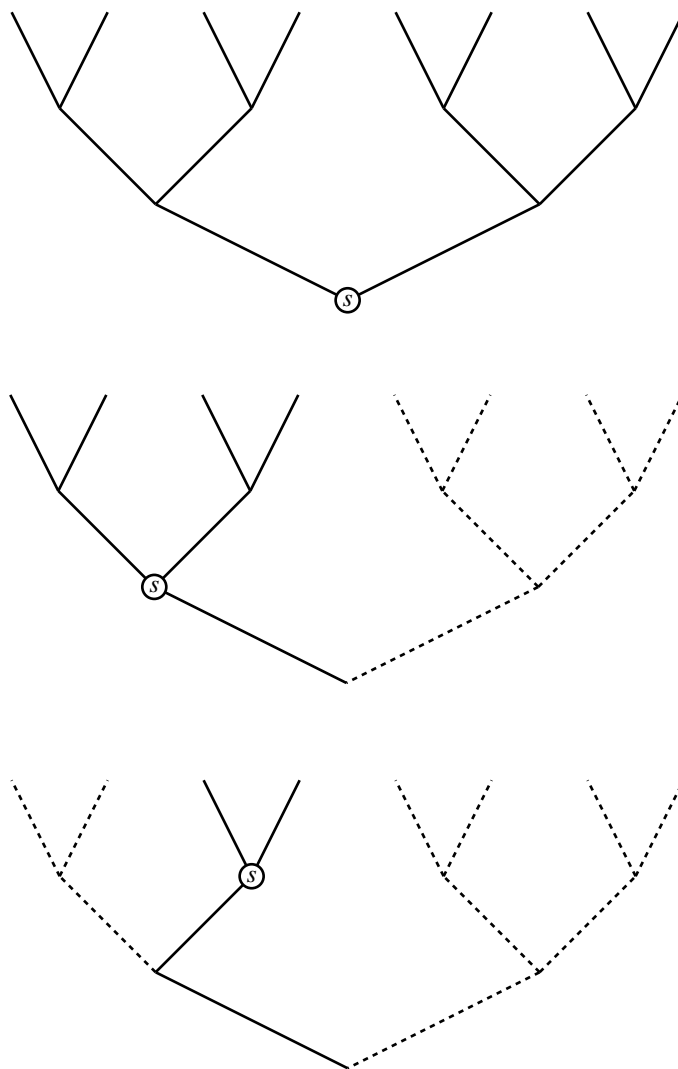
Figure 3.4.3:   Standpoint tree pruning. The standpoint (s), analogous to Reichenbach's reference point (R), may occupy various positions in the ATC modality tree. Each standpoint designates a subtree. The standpoint may be distinction from both the moment at which truth value is assigned and those at which sub-propositions are evaluated.

The structure of ATC possibility is tree-like. Over time, options (branches) that were once accessible are no longer so. Jones might not have drunk coffee, but that is no longer an option given that she drank coffee. A given tree effectively shrinks as time passes, as depicted in Figure 3.4.3. In typical branching time systems, this pruning only occurs with respect to points at which propositions are evaluated, for those points function as successive standpoints. Standpoint inheritance generalizes this notion, introducing a standpoint parameter by which a proposition can receive a truth value at one moment but utilize another moment as a standpoint while a third moment may serve as a point of evaluation, just as Reichenbach proposed. Notice that from a given standpoint, the past is linear. This fact ensures that whatever is was going to be.

True futurism (TF) effectively designates timelines, so-called "thin red lines", across the underlying tree structure. In this case, temporal standpoints pertain to the relationships between those timelines in addition to the underlying tree structure. Temporal standpoints are of little help to TF otherwise.

Recall (3.44) and (3.45). In the first case, the standpoint R is contemporaneous with E; in the second case, R is instead contemporaneous with S. Generally, respective trees designated by various standpoints might be quite different in the context of a branching time semantics (or any system of representing ATC modality), as indicated in Figure 3.4.3. A difference in moment-specific trees occurs whenever the earlier standpoint has access to a node that the later standpoint does not; that is, whenever future-contingency is involved.

Suppose that Jones drank coffee but it was not inevitable that she would drink coffee. Figure 3.4.4 illustrates the scenario for open futurism. Recall (3.42) and (3.43) (was: will: *coffee*). The initial standpoint of (3.42) is this moment, a today-moment in which Jones drank coffee. The corresponding subtree is represented in Figure 3.4.4 (a). The outer *was* of (3.42) projects the point of evaluation to a past moment, labeled "p" in Figure 3.4.4. The question is, what is the standpoint of the interior temporal statement:

(3.46) will:*coffee*
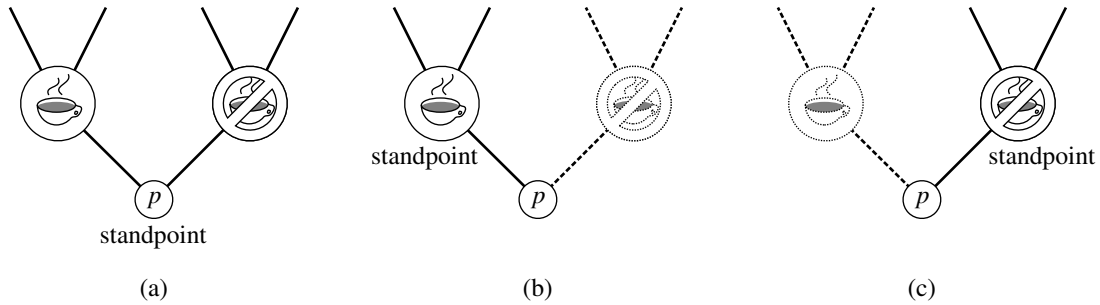
Figure 3.4.4: Coffee with standpoints and open futurism. (a) illustrates the subtree with the standpoint before Jones drank coffee and her coffee-drinking is still future-contingent. That subtree contains the moment at which Jones does not drink coffee. (b) illustrates the subtree from todays standpoint in which Jones is drinking or just drank coffee. That subtree does not contain the node at which Jones did not drink coffee. In (c), the standpoint is the node in which Jones did not drink coffee. The subtree does not include the the node in which Jones drank coffee.

Traditional temporal logics treat (3.46) as if the standpoint were the last point of evaluation, namely, the past moment before Jones drank coffee. The corresponding subtree is depicted in Figure 3.4.4 (a). Under OF, (3.46) is not true from that earlier standpoint. Thus, (3.42) is not true from the standpoint shown in Figure 3.4.4 (b).

TF suffers from a related difficulty. In the counterfactual scenario in which Jones did not drink coffee, (3.42) turns out true although Jones was not going to drink coffee given that she did not. Again, the outer *was* shifts the point of evaluation to before Jones drank coffee. The standpoint follows. Since Jones actually drank coffee, (3.46) is true when evaluated from the past standpoint.

All traditional branching time logics switch standpoints in the middle of (3.42), yielding similar issues for of those theories. The theory-specific issues described above and are discussed further once particular theories have been introduced in more detail.[14] Suffice it to say for now that all major views miss (3.38), (3.39), or both. Such analyses are untenable. The right answer is achieved when the standpoint of (3.46) is not (3.43)'s point of evaluation, node p, but (3.43)'s standpoint. The standpoint should remain as in Figure 3.4.4 (b) when evaluating the sub-proposition (3.46), not switch to node p as shown in Figure 3.4.4 (a).

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[14]For open futurism, see Section 7.3.2. Generating the problem for TF requires the initial point of utterance to be counterfactual. See Section 6.3.2

There is no need to abandon the initial standpoint when moving from the outer statement, (3.43), to the inner statement, (3.46). Traditional theories effectively change standpoints wantonly, leading to mistaken accounts of propositions like (3.43).

English no doubt allows many ways to affect standpoints. The simplified mechanism given here may be called "standpoint inheritance". OF uses the ATC possibility tree to account for temporal statements, so standpoints pertain to that tree. TF employs timelines overlaying the tree to handle temporal statements. In that case, standpoints must affect the relations between those timelines. Standpoint inheritance is fundamentally the same for both OF and TF despite the fact that those views use different temporal relations.

Standpoint inheritance divides operators into two categories. The first category includes those operators that use moment-specific accessibility relations. Temporal operators (like *will*, *was*, *will-always*, and *was-always*) are standpoint-sensitive. The specific temporal relation used by an operator—a subtree in the case of OF and a timeline in the case of TF—is designated by a standpoint. Operators that are not standpoint-sensitive still transmit standpoints to sub-propositions. The rule for standpoint transfer is:

(3.47) Only change standpoint when absolutely necessary—when evaluation is only possible by shifting standpoint.

For example, given that Jones drank coffee,

(3.48) *Had Jones not drunk coffee ...*

requires a standpoint shift. Without changing standpoints, the initial standpoint at which Jones drank coffee combined with the counterfactual clause by which Jones did not drink coffee yields that Jones both did and did not drink coffee, which is absurd. In terms of Figure 3.4.4, the inconsistency is represented by the fact that the non-coffee node is not on the subtree of Figure 3.4.4 (a). Meaningful evaluation is impossible until this conflict is resolved, which can be accomplished by switching the standpoint to a counterfactual node.[15]

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[15]Technically, there may be a whole collection of such counterfactual nodes.

The result of the standpoint shift is illustrated in Figure 3.4.4 (c). Of course, counterfactual clauses serve this kind of node-switching function by default, but there are other ways to force a standpoint shift. As an example,

(3.49) Jones was inevitably going to drink coffee

is not true. The statement is not true because

(3.50) Jones might not have drunk coffee.

(3.50) holds because there is a today-moment—the same counterfactual node picked out by (3.48)—in which Jones did not drink coffee. As above, evaluations at that node require a standpoint shift. Granting explosion,[16] the following would hold without a standpoint shift:

(3.51) It was inevitably going to be the case that either Jones drank coffee coffee or carnivorous elves are attacking Jerusalem.

$$(\text{was:will-inevitably:}(coffee \lor elfAttack))$$

The assumption that Jones drank coffee yields absurdity when considering a node at which Jones is not drinking coffee. So, at the inner points of evaluation (for *will-inevitably*), either Jones drank coffee or there is an absurdity. The absurdity disappears with a switch in standpoint, removing the problematic hypothesis that Jones is drinking coffee.

In traditional branching time systems, standpoints effectively shift to the point of evaluation. This tactic avoids statements like (3.51), yet it was mentioned at the beginning of this section that traditional systems fail to accommodate a number of other important results. The rule (3.47) is general and implements standpoint shifts as needed, but does so more conservatively than traditional branching time semantics to handle statements like (3.42). It may also be argued that (3.47) accords with the psychology of ordinary speech. Speakers do not seem to switch perspectives as long as the one they are using works just fine.

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[16]Explosion aside, this is not an appropriate place to find a truth glut.

Several results of accounting for temporal standpoints are view-specific. Those points are reserved for Part II. A few elementary results common to all views are given here. Suppose again that Jones is drinking coffee, that she might not have been drinking coffee, and that Smith predicted that she would drink coffee. Whether or not this coffee-drinking scenario is counterfactual, standpoint inheritance yields correct results for the following statements.

(3.52) True: Jones was going to drink coffee. (was: will: *coffee*)

(3.53) False: Jones was inevitably going to drink coffee. (was: will-inevitably: *coffee*)

(3.54) True: Jones might not have drunk coffee. (was: possibly: ¬*coffee*)

(3.55) True: Smith correctly predicted that Jones would drink coffee.

(3.56) True: Had Jones not drunk coffee, Smith's prediction would have been incorrect.

(3.57) True: God believed that Jones was going to drink coffee.

It is not entirely clear how to handle (3.41). From the counterfactual standpoint at which Jones did not drink coffee, the following holds:

(3.58) Jones was going to not drink coffee. (was: will: ¬*coffee*)

God believes all and only truths. So the following holds from that same counterfactual standpoint:

(3.59) God believes that Jones was going to not drink coffee.

(God believes: was: will: ¬*coffee*)

(3.41) is more like the subtly different:

(3.60) God *believed* that Jones would not drink coffee.

(was: God believes: will: ¬*coffee*)

(3.59) pertains to God's current beliefs. (3.41) and (3.60), meanwhile, has to do with God's past beliefs taken from the current standpoint. Ockhamists want statements like (3.41) and (3.60) to be true while open theists may reject those statements.

Beliefs—God's, Smith's, or anyone else's—are formed with respect to a given perspective or standpoint. This is usually not a difficulty. God's beliefs are peculiar because they are truth-tracking. Taken simply, omniscience is the characteristic of believing all and only truths. One can find out what God believes at this or that node by looking at what is true at that node. Considerations leading to standpoint inheritance indicate that there is more going on than *truth at a node*. There is *truth at a node from a standpoint*. That is why (3.46) varies in truth depending on whether or not it is in the context of (3.43). Likewise from the standpoint at which Jones did not drink coffee. (3.58) holds. The inner statement:

(3.61) Jones will not drink coffee. (will: ¬*coffee*)

inherits the standpoint of the outer *was*, namely, the scenario in which Jones did not drink coffee. (3.61) is true at the past node from the standpoint, so (3.58) is true. Consider the corresponding interior statement of (3.60):

(3.62) God believes that Jones will not drink coffee. (God believes: will: ¬*coffee*)

God did not form his belief with respect to the node in which Jones did not drink coffee. On true futurism, that node is counterfactual; so, if anything, he believes that Jones will have coffee. God formed his belief from the perspective of that past node, before Jones skipped the coffee.

Open futurists will be happy with that result. Those who want God's beliefs to be properly soft need (3.62) to be true in (3.60) just as (3.61) holds in (3.58). Thus, open theists affirm while Ockhamists deny:

(3.63) From any standpoint, God's beliefs at a moment are evaluated with that moment as the standpoint.

(3.63) seems plausible in branching time systems. The topic will be discussed further when dealing with open- and true futurism in particular.

Even without going into much detail about particular views, it is already evident that something like temporal standpoints must be considered to account for many temporal statements. The theory of standpoint inheritance proposed here is very general, applying to all major varieties of branching time systems. In addition to its generality and fruitfulness, standpoint inheritance is simple and intuitive. The theory is simple because it can be encapsulated by designating standpoint-sensitive (in this case, just temporal) operators and stipulating that one should only change standpoints when necessary. Traditional branching time logics effectively change standpoints too frequently, although these theories do not incorporate a standpoint parameter. Standpoint inheritance intuitively accords with ordinary speech granting that speakers do not switch perspectives as long as the ones they are using work just fine. Using standpoint inheritance to account for temporal standpoints is an important part of this project and is developed more rigorously in later chapters.

Chapter 4

Freedom and Fatalism

One pervasive reason for rejecting logical fatalism is that fatalism should not follow merely from an analysis of *will*. That is, if an account of *will* is incompatible with future-contingency, then that account is mistaken. Sometimes, concerns about freedom and responsibility also motivate scholars to care about fatalism. There are notions of accountability, especially those held by many contemporary theists, requiring that actions of persons are neither fated nor determined. Indeed, freedom is presupposed by formal and informal analyses of how we should act. Even freedom/determinism compatibilists must strive to secure coherent decision-making procedures although these compatibilists might not worry that fatalism threatens accountability.

Section 4.1 individuates libertarian freedom and epistemic freedom. Libertarian freedom requires contingency and is therefore incompatible with fatalism and determinism. Contingency is irrelevant to epistemic freedom. Section 4.2 contains a discussion about how freedom is important to responsibility and decision-making procedures. While physical determinism might not worry freedom/determinism compatibilists, logical fatalism still poses significant difficulties. Compatibilism, if true, grants accountability independently of determinism or fatalism. Nevertheless, compatibilism requires that there is a consistent process by which agents may decide what to do, and that consistency is what logical fatalism threatens.

Two related challenges are the problems of logical and theological fatalism. Indeed, many scholars think that the two issues are fundamentally the same. The consensus is that logical fatalism, the position that the semantics of time renders a particular future unavoidable, does not hold. Even if some sort of determinism or fatalism obtains, the fixity of the future does stem from mere temporal semantics. Not all thinkers, however, reject the position that God's infallible, comprehensive foreknowledge (or eternal apprehension of all events) leads to a fatalism similar to the logical variety. A common tactic, and the one used in this essay, is to argue for a particular solution to logical fatalism, then see whether theological fatalism is avoidable under the proposal in question. Given the branching framework used here, the way out of logical fatalism does not escape theological fatalism.

Sections 4.3 and 4.4 respectively inspect logical and theological fatalism in more detail, sketching out arguments for those positions. The arguments given there are further clarified throughout this essay. Various ways of addressing those fatalisms are given. For logical fatalism, the two responses emphasized here are true futurism and open futurism. True futurists maintain that *will* is non-modal while open futurists hold that no particular future will occur insofar as contingency is involved. Theists may either accept or reject theological fatalism. Providentialists accept a stronger doctrine than theological fatalism, so the latter may not be a concern for them. Many contemporary theists deny theological fatalism using theistic eternalism, Ockhamism, or open theism. Theistic eternalism is the view that God is outside of time. Ockhamism, in the sense used here (as in the future contingents literature), draws from true futurism. Finally, open theists hold that God does not have comprehensive foreknowledge when future contingents are involved.

4.1   Libertarian and Epistemic Freedom

Before discussing logical and theological fatalism, it is important to explain how freedom comes into the picture. It is enough for this project that the reader understand that there is

an important notion of freedom, typically dubbed "libertarian freedom", entailing that there are future contingents. Consider two well-known types of freedom. The first is libertarian freedom, which may be called freedom of action. The second is epistemic freedom, also known as compatibilist[1] freedom or freedom of will.

libertarian freedom a type of freedom by which it is possible for the freely acting agent to do otherwise, perhaps with some other conditions.

epistemic freedom a type of freedom by which the freely acting agent does what s/he elects to do, perhaps with some other conditions

John Locke provides an illustrative example distinguishing between libertarian freedom and epistemic freedom:

> [S]uppose a man be carried, whilst fast asleep, into a room where is a person he longs to see and speak with; and be there locked fast in, beyond his power to get out: he awakes, and is glad to find himself in so desirable company, which he stays willingly in, i.e. prefers his stay to going away. I ask, is not this stay voluntary? I think nobody will doubt it: and yet, being locked fast in, it is evident he is not at liberty not to stay, he has not freedom to be gone. So that liberty is not an idea belonging to volition, or preferring; but to the person having the power of doing, or forbearing to do, according as the mind shall choose or direct.[2]

The man in Locke's example does not have libertarian freedom. It is not possible for him to leave the room. Since he cannot do otherwise than stay in the room, he lacks libertarian freedom. The happy prisoner, as Locke points out, stays in the room by his own volition. The man exercises his free will in the sense that he does what he wants to do. He has epistemic freedom, as it is defined above.

Libertarian freedom entails that some events—in particular, some agents' actions—are contingent. Recall from Section 2.4 that a future-contingent event is an event that, at some point before the would-be time of the event, the event can occur and it can fail to occur. It is

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[1]Compatibilist freedom is not compatibilist in the primary sense used in this essay, namely, the view that God's omniscience is compatible with freedom. Rather, compatibilist freedom is compatible with determinism.

[2][Locke(1690)], II.XXI.10
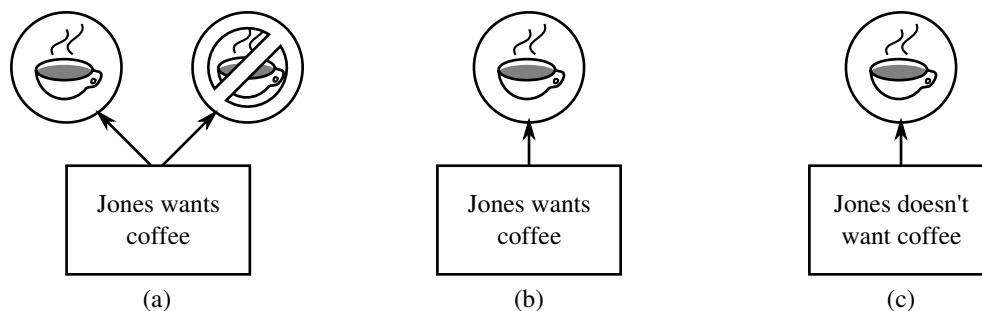
Figure 4.1.1: Libertarian and epistemic freedom. (a) Jones has libertarian and epistemic freedom. (b) Jones has epistemic freedom, but not libertarian freedom. (c) Jones has neither libertarian nor epistemic freedom.

necessary (although not sufficient) for libertarian freedom that there are future contingents, for a freely acting agent can elect to perform the given action and s/he can also decide to do otherwise. As such, libertarian freedom is at odds with fatalism.

To the contrary, epistemic freedom is independent of contingency and thus fatalism. An agent with free will can do what s/he wants to do. The agent's actions or volitions might be, on the one hand, free in the libertarian sense and they could be, on the other hand, determined or fated. Thus, although libertarian freedom might be sufficient for epistemic freedom (assuming that libertarian freedom requires that agents elect their own actions), libertarian freedom is not necessary for epistemic freedom.[3]

The following examples may help illuminate the relationships between contingency, libertarian freedom, and epistemic freedom. The various cases are illustrated in Figure 4.1.1.

Suppose that Jones has libertarian freedom with respect to drinking coffee tomorrow. She can drink coffee tomorrow and she can abstain from drinking coffee tomorrow; that is, whether or not she drinks coffee tomorrow is a contingent matter depending on what Jones elects to do. In this case, Jones has both libertarian and epistemic freedom. This situation is depicted in Figure 4.1.1 (a).

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[3]Epistemic freedom may be thought to include or constitute a belief on the part of the agent that s/he is free, or at least a lack of certain belief regarding what s/he will do. In this case, it would be important to know whether or not Locke's prisoner believes he is imprisoned. No argument will be given here for or against this view of epistemic freedom because the exact nature of freedom and its relationship to moral responsibility are beyond the scope of this project.

Next, consider a case in which Jones' coffee-drinking is determined independently by a third party. In this scenario, Jones does not have libertarian freedom because her coffee-drinking is not contingent. More information is required to determine whether or not Jones has epistemic freedom. Jones has epistemic freedom if she wants to drink coffee, as in Figure 4.1.1 (b). She can do what she wants to do in this case. As far as Jones is concerned, it is as if there were no interfering third party.[4] If the third party forces Jones to drink coffee against her will, she lacks epistemic freedom. This case is shown in Figure 4.1.1 (c).

4.2   The Importance of Freedom

Many scholars are concerned with fatalism on account of its challenge to accountability. Such worries are evident in the writing of many thinkers, like Prior. Libertarian freedom requires that there are future contingents and is therefore contrary to fatalism. If fatalism holds, then either moral responsibility is farcical or it does not require libertarian freedom in the sense defined here.

Compatibilists about freedom hold that libertarian freedom is not necessary for accountability, that responsibility and either fatalism or determinism are compatible. Accountability itself need not serve as the primary reason for why logical fatalism, at least, should be avoided. Even if the future is in fact determined or fated, it is epistemically indeterminate for agents in that they do not know which future will come to pass. Agents use a decision procedure to select one of various possible options. Decisions are made presupposing future-contingency on an epistemic level. Logical fatalism threatens to render this picture incoherent by forcing there to be only one possible option. If logical fatalism holds, then future-contingency is inconsistent on any level, metaphysical or epistemic. So even freedom/determinism compatibilists must be concerned about fatalism for reasons pertaining to morality; if not for accountability, then at least to ensure that there is a coherent decision-making process.

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[4]This explanation is given for the sake of convenient illustration, serving the purpose of this essay. The statement should not be mistaken for an adequate explication of epistemic freedom.

The preceding concerns may be instantiated in several important theories. Adequately representing libertarian freedom is crucial for decision theory, game theory, and mechanism design. These systems presuppose indeterministic models in which agents can select one of various courses of action. Such tools continue to prove their fruitfulness in individual decision-making, analysis of social welfare, and other applications. The coherence of these analyses should not be threatened simply by an inadequate representation of *will*.

4.3   Logical Fatalism

The problem of logical fatalism is one of many philosophical challenges dating back to antiquity. Aristotle formulated the issue in *On Interpretation* 1.9. Here is a similar, more compact rendition of the problem. Consider the following statements.

(4.1) Either there will be a sea battle tomorrow or there will not be a sea battle tomorrow.

(4.2) Tomorrow's sea battle is future-contingent. That is, it might happen and it might not.

Suppose that (4.1) is true. Without loss of generality[5], suppose that there will be a sea battle tomorrow. If there might not be a sea battle tomorrow, then it is false that there will be a sea battle tomorrow (because should there not be a sea battle tomorrow, it would be false that there will be one). Hence, it cannot be that the sea battle does not occur given that it will. It follows that there must be a sea battle tomorrow. It is therefore either necessary that the sea battle occur or necessary that it not occur. Thus, (4.2) is false.

Aspects of the preceding argument will be explicated and analyzed throughout this essay. One facet of the argument that can be clarified now is the type of modality involved in the

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[5]Without loss of generality, WLOG for short, is an expression commonly used in demonstration. When disjuncts are relevantly symmetric, there is little point in deriving analogous results from each because such derivation amounts to recreating essentially the same proof multiple times. It is enough to show that a conclusion follows without loss of generality from one disjunct. This subproof indicates that corresponding results follow from the other disjuncts using subproofs correlating to the one given.

argument and in (4.2). It was seen that all-things-considered (ATC) modality is what is relevant to future contingency.[6] Recall that ATC modality forms the tree structure underlying branching time systems. The argument for logical fatalism begins with instances of S-FLEM[7] like (4.1) and derives corresponding instances of ATC fatalism.

Below is a semi-formal version of the argument that will be discussed throughout this essay. This version lacks formalizations of temporal and modal operators, which are included in Chapter 8, but the formal structure is evident. Let s represent *There is sea battle.*

ARGLF   Argument for Logical Fatalism (Generalizable)

(ARGLF.1) will:s ∨ will:¬s [premise, an instance of S-FLEM]

(ARGLF.2) will:s [WLOG assumption from (ARGLF.1)]

(ARGLF.3) If ATC-possibly:¬s, then ¬will:s [premise]

(ARGLF.4) ¬ATC-possibly:¬s [by (ARGLF.2) and (ARGLF.3)]

(ARGLF.5) ATC-necessarily:s [by (ARGLF.4), given that ¬possibly:¬s is equivalent to necessarily:s]

(ARGLF.6) ATC-necessarily:s ∨ ATC-necessarily:¬s, and whichever is necessary corresponds to what will be. [by (ARGLF.1), (ARGLF.2), and (ARGLF.5)]

If ARGLF or something like it is correct, then everything that will happen must happen. Given that any given proposition either will be true or will not be true, as in (ARGLF.1), there are no future contingents. This position is *logical fatalism.*[8]

An important way in which ARGLF differs from some related arguments is that ARGLF has no extraneous present-past-future hopping. There are a couple of reasons why one might

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[6]See Chapter 2, especially Sections 2.3, 2.4, and 2.5.
[7]See Section 3.2 for more on S-FLEM.
[8]See Section 2.4 for specific definitions of future-contingency and logical fatalism.

use present-past-future hops.[9] First, the hops might bring out the role of the fixedness of the past. The fixedness of the past is to some extent incorporated in ATC modality.[10] Temporal standpoints also play a role in explicating the fixedness of the past because the fixed past is standpoint-relative. Second, and not independently, past-present-future hops can be used to substantiate (ArgLF.3). This is how Aristotle seemed to use such hops in *On Interpretation* 1.9.

(ArgLF.3), which draws a connection between *will* and ATC necessity, warrants some explanation and may even be the crux of ArgLF. A common intuition behind (ArgLF.3) is that should there fail to be a sea battle, then it cannot have been the case that there was going to be a sea battle. So it is impossible for the sea battle to not occur given that it will; hence, (ArgLF.3). One of the primary tasks of this essay is to shed light on the relationship (or lack thereof) between *will* and ATC necessity.

Aristotle and many others rejected logical fatalism. This type of response to logical fatalism goes by various names, including "Aristotelian", "Peircean", and "open futurist". The latter term, designated by the acronym OF, will be used here. Friends of OF, including (but hardly limited to) Prior and Belnap[11], reject (ArgLF.1), the statement that either there will be a sea battle or there will not be one, while affirming (ArgLF.3), the premise connecting *will* to ATC necessity. (ArgLF.1) is not an instance of the law of excluded middle (LEM) due to the presence of future temporal operators, nor does (ArgLF.1) follow from LEM. (ArgLF.1) is rather an instance of a stronger proposed truism, S-FLEM, for *Strong Future Law of Excluded Middle*.[12] OF is discussed further in Chapter 7.

S-FLEM does have some intuitive plausibility. Another influential response accepts S-FLEM while rejecting the derivation of (ArgLF.5) from (ArgLF.2) on the grounds that (ArgLF.3) is false. This true futurist (TF) solution, associated with medieval scholars like

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[9] For a recent example, see Merricks' Main Argument on p. 33 of [Merricks(2009)]. Pike's classic argument for theological fatalism, found in [Pike(1965)], also involves present-past-future hops. In this essay, see especially the analysis in Sections 6.3.3.

[10] See Section 2.3.1.

[11] See [Prior(1967), Belnap and Green(1994), Belnap(2005)].

[12] See Section 3.2.

William of Ockham and Richard of Lavenham, has a number of recent adherents, including Peter Øhrstrøm and Alvin Plantinga.[13] TF is the topic of Chapter 6.

A third response, supervaluationsim (Sup), avoids logical fatalism by rejecting (ArgLF.3), as does TF. Sup in fact takes TF as a foundation, building a more complex logic from TF. In this project, a new form of Sup will be developed based on OF.[14] This OF-based Sup opens the door for Sup to use the OF rejection of logical fatalism.

4.4   Theological Fatalism

Suppose that God exists and is omniscient. Since God is omniscient, he infallibly knows all and only truths. Assume that God has infallible foreknowledge of all that will occur, including knowledge of what people will choose to do in the future. God knows whether or not Jones will drink coffee tomorrow, for example. Without loss of generality, suppose that God knows that Jones will drink coffee. It follows that Jones will drink coffee tomorrow. The next phase of the argument is like the case for logical fatalism. From *Jones will drink coffee*, it is derived that *Jones cannot not drink coffee*, and hence *Jones must drink coffee*. In general, no future actions are contingent.

Following is a more official version of this argument for theological fatalism. Let j represent *Jones has a cup of coffee.*

ArgThF   Argument for Theological Fatalism (Generalizable)

(ArgThF.1) For any proposition, ϕ, if God believes that ϕ, then ϕ. [premise: infallibility]

(ArgThF.2) For any proposition, ϕ, either God believes that will:ϕ or God believes that will:$\neg\phi$. [premise: comprehensive foreknowledge]

(ArgThF.3) Either God believes that will:j or God believes that will:$\neg j$. [by (ArgThF.2)]

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[13]See [Øhrstrøm(1984), Plantinga(1986)]. Note that branching time semantics represent Øhrstrøm's position, but not Plantinga's.

[14]See Section 7.2.3 and Section .

(ArgThF.4) God believes that will:j. [WLOG assumption from (ArgThF.3)]

(ArgThF.5) will:j [by (ArgThF.1) and (ArgThF.4)]

(ArgThF.6) will:j ∨ will:¬j [by (ArgThF.3), (ArgThF.4), and (ArgThF.5)]

(ArgThF.7) ATC-necessarily:j ∨ ATC-necessarily:¬j, and whichever is necessary corresponds to what God believes will be. [by (ArgThF.6) and ArgLF]

Libertarian freedom requires that some future actions are such that the actors can do otherwise, and hence those actions are contingent. As with logical fatalism, it follows from theological fatalism that no one is free in the libertarian sense. Many contemporary theists, most notably Christians, Jews, and Muslims, insist that libertarian freedom is necessary for responsibility. Responsibility, in turn, is necessary for Judgment, especially in Islam. For Christians, that a person may be fated for salvation or damnation prior to existence strikes many as absurd or unfair. Fatalism may thus pose a substantial threat to mainstream theism. Many theists are freedom/foreknowledge incompatibilists, but there are important exceptions and compatibilism does not directly conflict with theism.

Fatalism need not challenge theism generally, but only some now-popular types of theism. Some Christian reformers, like Luther, reject libertarian freedom.[15] Reformers like Luther hold that belief in libertarian freedom is outright heretical, stemming from deep misunderstandings of the Divine. Sects like traditional Lutheranism, Calvinism, and Presbyterianism strive to account for predestination or providence, by which all events are determined by God's Will. As a comparatively weaker position, theological fatalism arguably poses no threat to belief systems already incorporating providentialism.

Another position that may render theism compatible with theological fatalism is freedom/determinism compatibilism. Freedom/determinism compatibilists hold that libertarian freedom is not necessary for moral accountability. Although theists may turn to such an alternative account of responsibility to reconcile fatalism (or determinism) with responsibility,

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[15]See especially [Luther(1525)].

logical fatalism is still a problem. As discussed in Section 4.2, there are other important reasons why freedom/determinism compatibilists need to address fatalism, considerations which hold just as well for theistic compatibilists. On an epistemic level, libertarian freedom plays a crucial role in decision-making processes, both formally and informally. Although freedom/determinism compatibilists may not rely on libertarian freedom for an account of responsibility, they must ensure that libertarian freedom remains intact on an epistemic level in order to retain formal accounts of decision-making processes.

ArgThF is closer to versions of the argument given by thinkers like Edwards and Prior.[16] Philosophers in the freedom/foreknowledge literature (with some exceptions, especially recently) tend to reject logical fatalism as true futurists (TF), denying (ArgLF.3). The inference from (ArgThF.6) to (ArgThF.7), which relies on (ArgLF.3), would be considered unreasonable by those scholars. Incompatibilists in that tradition provide different reasons for accepting the incompatibility thesis that God's comprehensive, infallible foreknowledge conflicts with libertarian freedom.[17] As far as theological fatalism is concerned, the approach taken here is to bring out concerns associated with ArgLF and show that both ArgLF and ArgThF ought to be taken seriously. The argument for the thesis that TF still engenders freedom/foreknowledge incompatibility is beyond this discussion.

There are three popular ways by which scholars reject theological fatalism: theistic eternalism (ThEtrn), Ockhamism, and open theism. ThEtrn is the position that God is somehow outside of time. The eternal God does not have foreknowledge *per se*, so (ArgThF.2) is false. Many thinkers have argued either that ThEtrn is incoherent or that it fails to avoid theological fatalism. Nevertheless, ThEtrn has been around for a long time, has important connections to other facets of Western theism, and continues to have worthy advocates. ThEtrn is the topic of Chapter 5.

Ockhamists may reject theological fatalism for other reasons. For this project, Ockhamism may be seen to have two main ingredients. The first is TF. TF is often called

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[16][Prior(1967)]

[17]See, for instance, [Pike(1965)] and, more recently, [Hasker(2001), Cowan(2003)].

"Ockhamism" in the future contingents literature, although the term is not used so liber-
ally in the freedom/foreknowledge literature. Some freedom/foreknowledge incompatibilists
adhere to TF but no incompatibilist is called an "Ockhamist" in that literature. TF is a
position by which S-FLEM is valid and a particular future will come to pass. The future is
specified by the thin red line in the future contingents literature and, equivalently, by com-
prehensive sets of soft facts in the freedom/foreknowledge literature. TF defeats ARGLF
and ARGTHF by rejecting the connection between *will* and possibility/necessity given in
(ARGLF.3). TF is the topic of Chapter 6 and a critique of TF's response to fatalism is
given in Section 6.4. This project primarily emphasizes the first tenet of Ockhamism.

The second facet of Ockhamism, the one emphasized in the freedom/foreknowledge lit-
erature, is the tenet that characterizations of God's past and present beliefs are themselves
soft facts. The softness of God's beliefs is required to track the true future. The second
tenet is required for the following commonly held thesis:

(4.3) For any proposition, ϕ, if ϕ, then God has always believed that ϕ.

(4.3), like (ARGTHF.2), is a way of specifying comprehensive foreknowledge. (ARGTHF.2)
is forwards-looking in the sense that it is about what God now believes about what will be.
(4.3) is backwards-looking since it emphasizes what God believed about what is now the case.
Standpoint inheritance clarifies what it is for God's beliefs to be soft and what accepting
comprehensive foreknowledge requires. This issues is discussed further in Section 6.3.4.

Another way to avoid theological fatalism is open theism (OT). OT amounts to a
rejection of the view that God has comprehensive foreknowledge of the future; that is,
(ARGTHF.2). OT may be associated with true futurism, although it is increasingly popular
to derive OT from open futurism. Open theism is the topic of Section 7.2.4.

Part II

True Futurism and Open Futurism

Chapter 5

Theistic Eternalism

Theistic eternalism (THETRN) is a cluster of views by which God is outside of time, eternal. THETRN has a long history in the Abrahamic religions and influences from classical thought. Western scholarly work near the end of the twentieth century has often emphasized Boethius's contributions, to a point at which THETRN has been called "Boethianism". Despite the focus on Boethius, similar views were popular among other medieval scholars, including Augustine, Anselm and Aquinas. The interested reader may find a number of survey articles discussing THETRN in the context of the freedom/foreknowledge problem; for instance, [Helm(2010), Zagzebski(2011b)].

Section 5.1 describes some basics about temporal and atemporal existence. Only temporal entities can hold properties with respect to times and only temporal entities can have certain temporally relational properties. These facts introduce challenges to accounts of atemporal entities. Such views must show how atemporal entities can have properties at all, and in particular how atemporal entities can have properties corresponding to temporally relational properties. Those issues are addressed by the end of Section 5.1.

Several varieties of THETRN have appeared over the centuries in which the view has been around. Three such accounts are given in Section 5.2. The section concludes with discussions of various criticisms that have heckled THETRN.

The punchline of the chapter is that THETRN entails true futurism, a fact brought out in Section 5.3. Ontologically, God's direct apprehension or knowledge of events specifies an actual timeline. Semantically, although the eternal God directly apprehends or knows about events as either present or atemporal, someone in time can truly say that God apprehends/knows the future. Thus, since God apprehends/knows all and only truths, true futurism follows from THETRN in both an ontological and a semantic sense.

5.1   Temporal and Atemporal Entities

This section provides a broad description of THETRN and how eternity differs from everlastingness. Section 5.1.1 points out that only temporal entities can have properties at times and only those entities can have temporally relational properties. Section 5.1.2 describes the senses in which atemporal beings can have properties at all, and properties that have something to do with time (including beliefs about what occurs when). Some details of how THETRN addresses theological fatalism are covered in Section 5.1.3.

5.1.1   Temporal Existence

Familiar objects like Jones and her cup of coffee are in a sense temporal entities. Temporal existence has both metaphysical implications and logical/linguistic facets. Two important characteristics of temporal entities are that only temporal entities can hold properties at times, and that only temporal entities can hold certain temporally relational properties. The discussion here draws from the accounts of temporality/atemporality proposed by Friedrich Schleiermacher and Nelson Pike.[1]

Many objects that exist can in some sense or other change over time, even coming in and out of existence. For instance, Jones can change by becoming hyper after drinking a

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[1]See [Schleiermacher(1968), Pike(1970)]. Schleiermacher and Pike emphasize temporal location and duration. See [Schleiermacher(1968)], p. 203–5 and [Pike(1970)], p. 6–8.

cup of coffee.[2] Jones and other temporal entities hold properties *with respect to time.* For any property, it makes sense to ask, When did Jones have that property, if ever? When was she hyper? Perhaps this afternoon, perhaps always, perhaps never. The ability to have properties with respect to times, whether or not those properties change, is characteristic of temporal entities.

Some properties and relations involve more complex temporality. Suppose that Smith believes that Jones will drink coffee tomorrow. Smith has a belief today, but the content of that belief relates to another time, namely, tomorrow. Smith has a temporally relational property, a characteristic involving a temporal relationship between the property holder and a time. Tomorrow is the day after today. Smith's belief relates the current time to tomorrow. Smith's having that belief is temporally relational because the time that the belief is about, tomorrow, is specified relative to the time at which Smith holds the belief. If Smith holds the belief on a Tuesday, the belief is about what Jones will do on Wednesday; if he[3] holds the belief on a Friday, the belief is about what Jones will do on Saturday; and so forth. Smith must have the belief on some day if the belief is to make any sense because having a belief like Smith's presupposes that Smith is in time. The tomorrow that the belief is about would be underspecified if no day were given for tomorrow to be after. Such examples show that only beings in time can have temporally relational properties or relations involving a *now* or current time.

In slightly more formal terms, philosophers tend to explicate temporal statements using either the A-theory, preferred in this analysis, or the B-theory, to use McTaggart's now-standard terminology.[4] Either approach may be used for this example. In A-theory terms, one would use a metric temporal operator to express the content of Smith's belief, yielding:

(5.1) will (in one day): Jones drinks coffee.

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[2]Endurantists and perdurantists explicate change in different ways, but those ontological differences are unimportant for this part of the discussion. (Cf. [Rogers(2007)]) The exposition is given in endurantist terms because that is the approach assumed in this project.

[3]Recall that for this project, Jones is female while Smith is male.

[4][McTaggart(1908)]

Using the B-theory, the belief looks something like:

(5.2) Jones drinks coffee one day later than whatever today is.

Both the A-theoretic temporal operator and the B-theoretic *later than* are relational. Thus, Smith's belief has relational content. The A-theoretic temporal operator, *will*, is inherently relational. In this case, the *later than* has as one of its relata an indexical term (like *now*) referring to the time at which Smith holds the belief. The relational content of Smith's belief cannot be eliminated without changing the belief's content. For instance, Smith's belief may be stated in absolute terms by specifying today's date, but that would be a different belief given that Smith does not require any information about the date to have the original belief. That Smith has such a belief is a temporally relational property. It only makes sense to ascribe this property to Smith because he is in time.

Not all temporally relational properties/relations require that all parties involved are in time.[5] The number 2 can be Jones's favorite number today even if 2 is not in time. Similarly, Jones can love God today even if God is outside of time. That Jones loves God today requires that Jones is in time, but it is not clear that God must also be in time. So atemporal entities may play some roles in temporal properties and relations, but not others.[6]

Thus, two important characteristics of temporal entities are:

(5.3) Only temporal entities can hold properties at or with respect to times.

(5.4) Only temporal entities can hold certain temporally relational properties.

Some beings may come into existence and later cease to exist, but finitude is not necessary for temporality. In principle, a temporal entity may have always existed or may henceforth always exist. Its duration or temporal extension, in other words, can be unbounded from below or above. A temporal being whose duration is unbounded in both directions is everlasting

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[5]If holding a temporally relational property requires existence in time, then atemporal entities cannot hold any temporally relational properties. See also the discussion in Section 5.2.2.

[6]This observation is related the the distinction between real and apparent change. See [Geach(1969)], p. 71 and [Kenny(1979)], p. 40–4.

or sempiternal.[7] God is everlasting provided that he exists in time.

Another characteristic that is often ascribed to God is immutability. His traits do not change over time. If God exists in time, he can be immutable in a weaker or stronger sense. In the first case, his temporally non-relational traits can remain static while his temporally relational properties can change as time passes. Today he might believe that Jones will drink coffee tomorrow while two days from now he would believe that Jones drank coffee yesterday.

A stronger sense of immutability requires that not even God's substantive temporally relational traits can change. That God is everlasting and immutable in the strong sense entails that he has few, if any, temporally relational properties. Suppose that Jones had a cup of coffee on Wednesday, but not on Thursday. *Jones had a cup of coffee yesterday* is true on Thursday, but not on Friday. If, on Thursday, God believes *Jones had a cup of coffee yesterday*, and God's temporally relational beliefs cannot change, then God would believe *Jones had a cup of coffee yesterday* on Friday. God would this have a false belief on Friday, which is impossible. So God must not have had such a belief in the first place.

The question of which type of immutability is correct depends on what it means for God's temporally relational characteristics to change substantively. The point to grasp for this analysis is that there is a sense of immutability, the stronger sense, that requires a non-relational account of God's properties. If he has knowledge about events or things that change in time, that knowledge must be temporally absolute instead of relational. This view of God and immutability takes him a step away from temporality and towards atemporality.

5.1.2 Atemporal Existence and Two Logical Challenges

An atemporal entity is something that exists outside of time. Something that is eternal is atemporal, perhaps with some additional traits. This section focuses on two important

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[7]One may elect to add life or other criteria to the necessary conditions of everlastingness. Such a criterion would ensure that abstracta like numbers, if they exist, would not be everlasting. In their explication of Boethius, Stump and Kretzmann include life and other criteria to eternality. See [Stump and Kretzmann(1981)].

logical characteristics[8] of atemporality. Atemporal beings can neither hold properties at times nor hold temporally relational properties. THEETRN must account for how atemporal entities like God can have properties at all, and how such entities can have characteristics pertaining to times (like beliefs about events that occur in time) without having temporally relational characteristics.

Spatial metaphors have often been helpful—although sometimes misleading—in explaining issues involving time. Like time, space is extended. Time also serves as a parameter in many formulas, just as space does. Space is therefore a good place to start learning about time, although one should keep in mind that there are some relevant differences.

Property attribution tends to be independent of spatial location. One can meaningfully attribute properties to Jones, as in:

(5.5) Jones is drinking coffee.

(5.6) Jones is hungry.

and so forth, regardless of where one makes such assertions or where Jones happens to be. She would not even need to be anywhere if not for the fact that, presumably, she is the sort of thing whose existence requires a spatial location (and perhaps being hungry and drinking coffee require having a spatial location). Space is likewise irrelevant to other properties and relations, except those reducible to forms explicitly bringing space into the picture. Examples of the latter type include:

(5.7) Jones is at home.

(5.8) Jones is studying at the café.

Temporality is akin to spatiality in some regards, although the two are not perfectly analogous. Human beings can roam about a spatial landscape, but not a temporal one. This arbitrariness of spatial location encourages, if not necessitates, separating spatial location

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[8]Here, logical characteristics are traits pertaining to adequate representation within a formal system.

from property attribution in the general case. Temporal location is not so arbitrary. Jones can pace back and forth across a room, but she cannot shift time from today to tomorrow and back to today again. It is thus no surprise that languages tend to offer more spatial versatility then temporal. Tokens of (5.5) and (5.6) assert something about Jones in the present time. A particular instance of (5.5) evaluated now indicates that Jones is drinking coffee now, not that she was, is or will be drinking coffee.

Whatever the extent to which property attribution is bound to time by standard usage, one might attempt to create an artificial temporally-independent mode of attribution, in analogy with the spatial case. However, there is a notable obstacle to such endeavors. Jones does not (wholly) exist at multiple spatial locations at once, enabling her to hold a specific set of properties at a given time, regardless of her spatial location. The temporal situation is different, for Jones can have different characteristics at different times. (5.5) is logically equivalent to:

(5.9) Wherever Jones is (if anywhere) she is drinking coffee.

Jones' spatial location is irrelevant to evaluating (5.9). Jones occupies at most one spatial location at the time of evaluation, so ignoring space does not run the risk of contradiction. Time cannot be removed from the attribution because Jones has different traits at different times, even with respect to a particular spatial location. She may go to the same café every day and sit in the exact same spot, but one day she drinks coffee and on another she drinks tea. Time could be the only difference between the coffee-drinking scenario and the tea-drinking scenario. Thus, time must be specified either as a parameter of the truth function or as part of the attribution.

Jones is a changeable entity. If Jones were immutable in the strong sense, then she would either have or not have any given property throughout her existence. Property attribution for strongly immutable entities is arbitrary with respect to time. As such, space and time are relevantly similar when it comes to property attribution for strongly immutable entities. The analogy holds just as well for atemporal entities since, like strongly immutable entities,

atemporal ones do not change over time. It is therefore possible to attribute properties and relations independently of time, but it only makes sense to use such attribution for beings that are either immutable with respect to the properties being attributed or not in time at all.

One might think that every temporally relational property or statement is logically equivalent to some temporally absolute property or statement. For example, suppose that today is Tuesday and Smith believes that Jones will have a cup of coffee tomorrow. The content of Smith's belief can be restated as:

(5.10) Jones (atemporally) drinks coffee on Wednesday.

Notice that the content of Smith's new belief does not tie him to a particular time. The restatement does change the content of Smith's belief, but the two versions are logically equivalent: they have the same truth value. Any meaningful temporally relational property or statement can be transformed in the same way, yielding a temporally absolute property or statement.

A lingering issue is that the transformation may not successfully eliminate all off the troublesome temporal content. Prior argues that specifying the times at which events occur requires a temporally relational verb.[9] For instance, (5.10) can only be explicated using something like:

(5.11) Jones (atemporally) drinks coffee and today is Wednesday.

The right conjunct fails to be atemporal, according to Prior. For the purpose of this discussion, it will be assumed that Prior is wrong and that temporally relational properties can be reduced to temporally absolute properties. Whether or not the transition works, true futurism still follows from THETRN, as discussed in Section 5.3.

The result that absolute temporal operators are needed to represent eternity has its adherents in the contemporary literature, most notably Paul Helm and Katherin Rogers.[10]

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[9][Prior(1957), Prior(1967)]

[10][Helm(1997), Helm(2010), Rogers(2000), Rogers(2007)]

These scholars argue that eternity is best represented using a B-series. Ignoring Prior's criticism mentioned above, an A-series (which is inherently relational) that is equipped with a metric and a (somewhat arbitrary) zero point can be transformed into a B-series.

The discussion in this section indicates that two basic logical challenges to representing atemporality can be met. Beings that are atemporal or immutable in the strong sense can be attributed properties atemporally. Although atemporal or strongly immutable entities cannot have temporally relational properties *per se*, every meaningful temporally relational property can be transformed into a logically equivalent temporally absolute property, assuming that Prior's challenge can be met.

5.1.3 Theistic Eternalism Against Fatalism

How THETRN handles logical and theological fatalism depends to some extent on the particular variety of THETRN in question. A discussion of thoroughgoing eternalism and perdurantism is beyond the scope of this project, although some allies of THETRN advocate such views.[11] Here, the emphasis is on forms of THETRN that acknowledge genuine temporal existence.

When friends of THETRN as such talk about fatalism, they are primarily (if not exclusively) worried about theological fatalism. If God is eternal, then he does not hold beliefs about events in time *before* (or after, or at the same time as) those events occur. The eternal God hence does not have *fore*knowledge, at least in some sense. (ARGTHF.2) is false, so ARGTHF is unsound.

Many scholars attempt to show that THETRN fails to avoid theological fatalism, after all. Some of these critiques are discussed further in Section 5.2. One type of argument challenges THETRN's coherence. If THETRN is incoherent, then of course it fails to address anything whatsoever, including theological fatalism. Two other responses are more directly relevant to THETRN's response to theological fatalism. One popular route is to rephrase

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[11]See Section 5.2.3.

an argument for theological fatalism in atemporal terms. This method brings the argument for theological fatalism to THETRN. Another tactic, the one emphasized here, is to bring THETRN to the argument for theological fatalism. This is done by showing that there is an important and relevant sense in which foreknowledge can be attributed to an eternal God. Details are given in Section 5.3.

5.2 Varieties and Criticisms of Theistic Eternalism

This section outlines three types of eternalism: duration (DURETRN), point (PTETRN), and perdurantist (PRDETRN). Some but not all of these views are mutually exclusive. DURETRN and PTETRN are incompatible. Both of those views tend to be given an endurantist reading. Nevertheless, those types of eternalism can be nurtured under perdurantism, as well. Some criticisms of particular views are mentioned along the way. The section concludes with a brief overview of general challenges to THETRN.

5.2.1 Duration Boethianism

In their landmark analysis, Eleonore Stump and Norman Kretzmann identified two passages in which Boethius described God's eternality.[12]

> What is said of God, [namely, that] he is always, indeed signifies a unity, as if he had been in all the past, is in all the present—however that might be—[and] will be in all the future. That can be said, according to the philosophers, of the heaven and of the imperishable bodies; but it cannot be said of God in the same way. For he is always in that for him *always* has to do with present time. And there is this great difference between the present of our affairs, which is *now*, and that of the divine: our now makes time and sempiternity, as if it were running along; but the divine now, remaining, and not moving, and standing still, makes eternity. If you add '*semper*' to 'eternity', you get sempiternity, and the perpetual running resulting from the flowing, tireless now. (*De trinitate*, Ch. 4, 20.64–22.77)

> That God is eternal, then, is the common judgment of all who live by reason. Let us therefore consider what eternity is, for this makes plain to us both the

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[12][Stump and Kretzmann(1981)]

divine nature and knowledge. Eternity, then, is the complete possession all at once of illimitable life. This becomes clearer by comparison with temporal things. For whatever lives in time proceeds as something present from the past into the future, and there is nothing placed in time that can embrace the whole extent of its life equally. Indeed, on the contrary, it does not yet grasp tomorrow but yesterday it has already lost; and even in the life of today you live no more fully than in a mobile, transitory moment. [...] Therefore, whatever includes and possesses the whole fullness of illimitable life at once and is such that nothing future is absent from it and nothing past has flowed away, this is rightly judged to be eternal, and of this it is necessary both that being in full possession of itself it be always present to itself and that it have the infinity of mobile time present [to it]. (*The Consolation of Philosophy*, Bk. V, Prose 6, 422.5–424.31)[13]

Using Boethius's description as a foundation, Stump and Kretzmann enumerated four criteria for eternality.

Life.   Numbers, truth, and corpses cannot be eternal.

Illimitibility. The life of an eternal being is either unbounded or unextendable. (Stump and Kretzmann argued that eternal life is unbounded rather than unextendable.)

Duration. The life of an eternal being has extension.

Complete possession of all its life at once. Every portion of an eternal being's life is immediately present to it.

That is how Stump and Kretzmann developed and explicated Boethius' view, which was also endorsed by Brian Leftow.[14] What characterizes this notion of eternity is that it is not point-like, but has duration and arguably extension. The duration of eternity, however, cannot be divided into substantively distinct parts. This type of THETRN will be called duration theistic eternalism (DURETRN) and the corresponding eternity, duration eternity.

Stump and Kretzmann described eternity as an unbounded line parallel to the universe's timeline.[15] In the former line, everything is present; in the latter, only a single point is

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[13]The translation given here is from [Boethius(1973)].

[14]For Stump and Kretzmann's view, see [Stump and Kretzmann(1981), Stump and Kretzmann(1987), Stump and Kretzmann(1991), Stump and Kretzmann(1992)]. For Leftow's work, see [Leftow(1991a), Leftow(1991b)].

[15][Stump and Kretzmann(1987)], p. 219

present, as indicated in Figure 5.2.1 (a). The analogy between eternal existence and a line is weak in some respects (as those authors admit), but the illustration brings out two important characteristics of Stump and Kretzmann's notion of eternity: duration and ever-presence. One may capture this eternity's indivisibility by specifying that the line is more like the intuitionistic continuum than a typical line. Every non-empty subset of the intuitionistic continuum is identical to the whole.
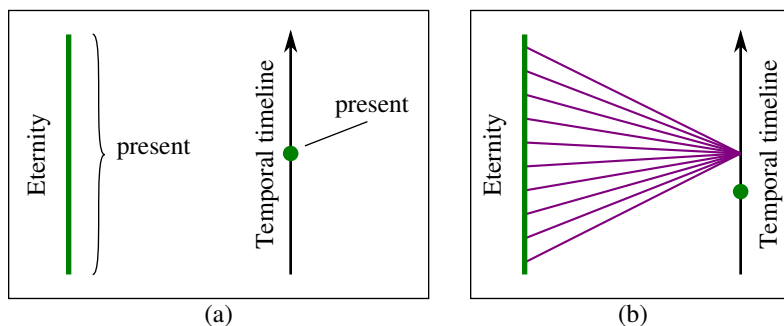
Figure 5.2.1: Duration theistic eternalism. (a) Eternity is likened to an infinite line parallel to the temporal timeline. Every point on the eternal line is present, while only one point on the temporal line is present. (b) Any point on the temporal line is simultaneous (or ET-simultaneous, as Stump and Kretzmann would say) with all eternal points. Likewise for all temporal points, be they past, present, or future from a given temporal perspective.

The logical characteristics of a duration-eternal being are in certain respects like that of an everlasting, immutable entity. As Rogers pointed out, if eternity has duration, then eternity can be made to correspond to the temporal timeline.[16] The correspondence may be arbitrary in two ways. First, there is no *a priori* reason to relate the present moment to one point of eternity over another. Second, there is no *a priori* way to relate eternity's scale to the actual timeline. The arbitrary character of the bijection is irrelevant since eternity is effectively immutable. The origin and scale of the correspondence do not make a difference because there are no differences for the eternal or immutable.

Despite some notable similarities, duration eternity is not quite a variety of temporal immutability. An important difference is that no more than one moment can be present to

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[16][Rogers(1994)]. Note that if the universe did not have a timeline to begin with, one will be designated by the correspondence.

a temporal entity, even an immutable one. On the contrary, every moment is present to an eternal entity. This is the relevant sense in which God is atemporal for DurEtrn.

Historically, ThEtrn has been fueled by the presumption that divisibility is an imperfection (and, similarly, change is bad). God, being perfect, is therefore indivisible. Yet it is difficult to see how eternity can have a kind of duration, even atemporal duration, without having extension. Extension is divisible. Thus, divine eternity cannot have duration, and DurEtrn is incoherent.

One way out for DurEtrn is to reject the premise that eternity is divisible. It may be that the duration of eternity does not really have extension, or that eternity has a type of extension that is not divisible. There is an independent example of such an entity: an abstract structure with extension but that cannot be separated into differentiable parts is the intuitionistic continuum. That there is such an abstractum may be enough to show that DurEtrn is at least structurally plausible. If divine eternity has a similar structure, then divine eternity can have duration or extension without being divisible, thus retaining the perfection of divine simplicity.

5.2.2   Point Theistic Eternalism

Contra Stump, Kretzmann, and Leftow, Rogers argued that DurEtrn is not the correct interpretation of Boethius.[17] According to Rogers, Boethius, Augustine and Aquinas held that eternity has no duration. Eternity is instead point-like, a view that will henceforth be called point theistic eternalism (PtEtrn). Rogers cited various analogies used by Boethius, Augustine, and Aquinas. Perhaps the most famous is Aquinas' comparison between, on one hand, eternity and its relation to moments in time; and, on the other hand, the center of a circle and its relation to points on the circumference.

> We may see an example of sorts in the case of a circle. Let us consider a deter-
> mined point on the circumference of a circle. Although it is indivisible, it does

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[17][Rogers(1994)]

not co-exist simultaneously with any other point as to position, since it is the order of position that produces the continuity of the circumference. On the other hand, the centre of the circle, which is no part of the circumference, is directly opposed to any given determinate point on the circumference. Hence, whatever is found in any part of some other time it be past or future. Something can be present to what is eternal only by being present to the whole of it, since the eternal does not have the duration of succession. The divine intellect, therefore, sees in the whole of its eternity, as being present to it, whatever takes place through the whole course of time.[18]

PTETRN is more challenging to formalize than DURETRN. As discussed in Section 5.2.1, DURETRN allows for a correspondence between eternity and the actual timeline. The bijection makes duration-eternity logically (although not in all other respects) similar to immutable everlastingness. There is no such correspondence in the case of PTETRN.

One concern about PTETRN was discussed by Pike.[19] Temporal beings should be able to say that God exists. Suppose that God exists at some actual moment. One might propose that if God exists at all, He exists necessarily; where the necessity in question is either logical (a matter of mere consistency) or metaphysical (broad logical necessity, as Plantinga calls it[20]). Whether or not God's existence is conditionally necessary in either of those senses, at least he cannot come into existence or cease to exist. Thus, God is conditionally necessary in any linear or branching chronological structure of moments—his existence is conditionally ATC-necessary. If he exists at all, he has always existed and will, inevitably, always exist. God's existence at one moment in a chronological structure or ATC tree entails that he exists at every moment within that structure. His existence at a single moment yields that His existence stretches out across time, giving His existence duration. Either PTETRN collapses into DURETRN or PTETRN entails atheism.

There are at least two options left for PTETRN. First, one might argue that God's existence does not have duration, regardless of appearances, when his existence is embedded within a chronological structure. That is, the embedding is somehow misleading on a level

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[18]*Summa Contra Gentiles* I, 66, 7. [Pagis(1997)]

[19][Pike(1970)], p. 10–4

[20][Plantinga(1974)]

beyond its representation within a formal system. The burden of proof is on PTETRN to explain how the embedding is misleading, describing how one should interpret the apparent duration of eternity without genuine duration.

Second, friends of PTETRN might construct a model in which God's existence is not stretched out in time. God might be outside of time in the sense that he does not exist at (or in the domain of) any moment, but in some other way or at some distinct node to which either all or no times are present. After all, a circle's center does not exist on the circle, a surveyor at a distant height does not inspect the landscape below from that landscape below, and so forth.[21] A problem with this approach is the difficulty in explaining God's existence and his various relations to temporal things in a way that is not *ad hoc*. Formally, whether or not something exists at a node (moment) depends on whether or not the object is represented in the domain at that node. If God does not exist in any moment, yet it is true at those moments that he exists, *God exists* cannot have a typical meaning. PTETRN must explain how *God exists* can be true at a moment although God is not represented within the domain of that moment.[22]

5.2.3 Perdurantist Theistic Eternalism

According to Rogers, Anselm's eternalism has some distinguishing characteristics.[23] Other medieval scholars, like Boethius, take an endurantist (three-dimensionalist) and maybe even presentist approach. Anselm's notion of eternity, by contrast, is perdurantist (four-dimensionalist, with eternity as a "fifth dimension"). Perdurantist theistic eternalism (PRDE-TRN) has gained some contemporary adherents, most notably Rogers.[24] Although a full discussion of endurantism/perdurantism is beyond the scope of this paper, some points are

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[21] The surveyor analogy is from Boethius' *De Consolatione Philosophaie*, Book V, Prose VI, lines 27–8.

[22] Some advocates of PTETRN attempt to avoid this criticism by relating time to space. For instance, Rogers (following Anselm) used this approach for A.4 (see Section 5.2.3) in [Rogers(2007)], p. 29. However, if nodes are parameterized with respect to spatial location, the problem simply reappears, now in terms of space instead of time: either God is spatially extended or he does not exist.

[23] [Rogers(2006), Rogers(2007)]

[24] Cf. [Helm(1997)].

worth mentioning.

One characteristic of perdurantism is that it describes time fundamentally using absolute time in terms of a B-series (that is, with *at*, *later than*, *earlier than*). Instead of using temporal operators (*was*, *will*, and so forth) as a basis for characterizing time, absolute time is the core of perdurantism. Time behaves just like another spatial dimension. The discussion in Section 5.1.2 shows that absolute time is crucial for any eternalism, perdurantist or not. Absolute time is primary whether or not any particular eternalist, like Boethius, acknowledges its importance in accounting for eternity. That PRDETRN emphasizes absolute time is something that this form of eternalism has in common with the others. At least, other kinds of THETRN must also use absolute time to maintain coherence.

A perdurantist takes all temporal objects as four-dimensional entities. Objects do not change over time or endure. Rather, they consist of various temporal parts, static sub-objects that are parameterized with respect to time. Jones, for instance, has a yesterday part, a today part, a tomorrow part and so forth, all of which are static entities. The account given here does not, at least without further reduction, adequately represent perdurantism with respect to all objects. In particular, ATC-necessity (necessity *per accidens*) is assumed to be a characteristically endurantist notion.[25]

Rogers was quite clear about the fact that PRDETRN entails that there is a unique actual timeline. That is, PRDETRN entails true futurism (TF). She also realized that designating a particular future creates a sort of necessity, which she called "consequent necessity". Rogers held that consequent necessity does not interfere with the sort of contingency required for libertarian freedom. The accessibility relation behind consequent necessity appears to be the TRL, the temporal relation of TF corresponding to soft facts; although friends of TF are typically at pains to keep from associating the TRL with any sort of necessity. Since

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[25]See Section 2.3 for more on ATC-modality. ATC-modality characterizes how some events, things, or propositions *become* necessary over time. If events, things, or propositions are four-dimensional, then they cannot *become* anything. That said, it may be possible to give a formal account of ATC-modality using static terms; if not for branching time, then certainly within a two-dimensional system like the one described in [MacFarlane(2012)]. The tricky part would be giving a philosophical account of ATC-accessibility.

PRDETRN is itself beyond the scope of this analysis and consequent necessity seems related to the TRL, Rogers' particular arguments will not be critiqued here. Some criticisms that are relevant to her analysis are given discussions of true futurism Section 6.4.[26]

PRDETRN may be the most promising variety of THETRN. Unlike DURETRN and PTETRN, PRDETRN is compatible with a thoroughgoing absolutist approach, including perdurantism, general eternalism, and the B-theory. Because PRDETRN takes such a different basis from the one used in this essay, PRDETRN cannot be given an adequate treatment here. One of the goals of this essay is in fact to push TF to absolutism and theism to either open theism or PRDETRN. It would be another project altogether to show that absolutism is inadequate.

5.2.4   Additional Criticisms

It may (and probably should) seem peculiar that there could be entities that are not merely changeless, but outside of time itself. Some exploration is required to discover whether or not eternalism is somehow incoherent. The literature is not lacking in debate. Some challenges to DURETRN and PTETRN are mentioned in Sections 5.2.1 and 5.2.2, respectively. More general criticisms of THETRN are briefly discussed here.

Two logico-linguistic challenges to THETRN are discussed in Section 5.1.2. Some scholars argue that THETRN is incoherent on other grounds.[27] According to THETRN, everything, all events and entities at all times, are immediately present to God. If God apprehends all things at once, then he apprehends them simultaneously. Hence Anthony Kenny's infamous remark about Aquinas's eternalism:

> But, on St. Thomas' view, my typing of this paper is simultaneous with the whole of eternity. Again, on his view, the great fire of Rome is simultaneous

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[26]Consequent necessity seems akin to the formal necessity generated by the TRL. The arguments in Section 6.4 indicate the necessity of the TRL is either philosophically baseless or has genuinely modal characteristics that interfere with future-contingency. The discussion in Section 6.4 presupposes dynamic or branching time; however, Rogers' position appears closer to thorough absolutism.

[27][Kenny(1969), Kenny(1979), Swinburne(1977)]

with the whole of eternity. Therefore, while I type these very words, Nero fiddles heartlessly on.[28]

And Geach:

> Misperception is involved if God is supposed to perceive what really is future not *as* future but as present: flat self-contradiction, if what God sees is *both* future *and* simultaneously (since in itself it is just as God sees it) also present.[29]

Two events are simultaneous if and only if they occur at the same time, and God apprehends all events simultaneously. Simultaneity is an equivalence relation[30]. Thus, all events occur at the same time. This conclusion is unacceptable. There is no sense in which Jones had breakfast at the same time at which she had lunch. Of all entities, a perfect, eternal observer should realize that.

There are various replies in the literature.[31] Any response must explain how two non-simultaneous events can be at once present to or directly apprehended by God while avoiding conflict. God observes events simultaneously, not *as* simultaneous.[32] Helm even argues that it does not make sense for anything to be *present* to an eternal God or *simultaneous* for him.[33] What is important, however, is that God does not apprehend the events at different times because there are no different times from the eternal perspective. For example, God may know that

(5.12) Jones is having breakfast

(5.13) Jones is having lunch

or directly apprehend Jones doing those things. How can God differentiate between contrary events that occur at distinct times?

One might disentangle events that occur at different times by encoding those events together with some identifying absolute temporal information. For instance,

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[28][Kenny(1969)], p. 264

[29][Geach(1977)], p. 57

[30]Equivalence relations are reflexive, symmetric, and transitive.

[31]For instance, [Stump and Kretzmann(1981), Helm(1997)].

[32]Kenny is aware of the distinction.

[33][Helm(1997)]

(5.14) Jones has breakfast *at 8 AM*

(5.15) Jones has lunch *at noon*[34]

God apprehends those events simultaneously (from the standpoint of eternity), or at least not at distinct times. He knows that Jones had breakfast (not lunch) at 8 AM and lunch (not breakfast) at noon. There is at least no contradiction in the content of His apprehension/knowledge.

There is still the matter of explaining how God apprehends events like that or how he comes about such knowledge. Consider:

(5.16) (Smith observes Jones eating breakfast) at 8 AM

(5.17) Smith observes (Jones eating breakfast at 8 AM)

Smith observes Jones eating breakfast. If Jones were to do the exact same thing at noon, then Smith would observe the exact same thing. *At 8 AM* is an adverb affecting when Smith makes the observation, not part of what Smith observes. (5.16) captures a familiar type of observation, but (5.17) does not. If *observes* is to be understood atemporally, adverbs of the form *at time t* cannot apply to the atemporal verb. So God's apprehension must be more like (5.17), not (5.16). (5.17), however, is unlike familiar cases and needs some explaining.

A related obstacle for THEETRN is that it is not clear how to explicate the relation between an atemporal being and temporal ones. For instance, how does God perform miracles or sustain life in different ways at distinct times if he is outside of time and everything is simultaneous for him? (Similar concerns apply to immutability.) Pike gave an often-cited argument:

> Let us suppose that yesterday a mountain, 17,000 feet high, came into existence on the flatlands of Illinois. One of the local theists explains this occurrence by reference to divine creative action. He claims that God produced (created, brought about) the mountain. Of course, if God is timeless, He could not have produced

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[34]One must also address Prior's claims that there is temporal information hidden within the *at* operator, and that an eternal being cannot know temporal information. See Section 5.1.2.

the mountain *yesterday.* This would require that God's creative-activity and thus the individual whose activity it is have position in time.[35]

Pike, elaborating on Schleiermacher,[36] maintained that there is a temporal relation between the creator and the created. Advocates of THEtrn rejecting Pike's position must explicate creation differently, allowing God to atemporally create something in time. The usual analysis of creative activity amounts to something like:

(5.18) (God created a mountain) yesterday

or the grammatically interchangeable:

(5.19) Yesterday, God created a mountain.

The specification of time applies to the main verb; designating the time at which God created the mountain. If God is outside of time, this explication of creation is inadequate because it is impossible that atemporal creation occurs in time. The adverb cannot apply to the main verb. Additionally, consider the statement without the adverb:

(5.20) God created a mountain.

Mountains are temporal objects. It always makes sense to ask questions like:

(5.21) When did God create the mountain?

(5.22) When did the mountain appear?

The answers may be given in the context in which tokens occur, or someone might need to ask questions like (5.21) and (5.22). Either way, those questions always have an answer. There is no answer if creative activity does not occur in time. Pike agreed that the temporal specification must play a role, but the usual role does not work for THEtrn. A different account of creative activity is needed.

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[35][Pike(1970)], pp. 104–5. Neither Pike nor Schleiermacher before him reject eternalism due to this type of argument. Their method is to reduce creation to preservation or sustenance. Contra Pike and Schleiermacher, preservation/sustenance may require a temporal relation if creation does.

[36][Schleiermacher(1968)]

A first attempt to reevaluate creative activity is to simply change the scope of the temporal specification, moving the adverb into the object so that the verb can be atemporal, as in:

(5.23) God created (a yesterday-mountain).

This solution is not generally acceptable. There is no such thing as a yesterday-mountain. Just as (5.16) is natural and (5.17) seems *ad hoc*, (5.18) and (5.19) are the familiar cases and it is not clear that (5.23) even makes sense.

A second attempt to handle Pike's argument adds another term to creative activity.[37] Logically, this analysis makes creative activity into a three-place relation, such as:

(5.24) creates(creator, object created, creation time)

This explication allows the creator to be atemporal. Here is an analogy to clarify this notion. Suppose there is a magical creation apparatus. To use the machine, one must input two pieces of information, the object to be created and the time at which the object will appear. Similarly, God creates objects by his Word, but he must specify both the object and when it is to appear. This analysis of creation can be generalized to other atemporal activity. However, some argument is required to show that the explication is not *ad hoc*. Familiar temporal creation (by mutable entities) occurs in time, but time is not a part of creative acts.[38]

Some scholars worry that atemporality limits God's knowledge. If God's knowledge cannot have temporal content, he cannot really understand what it is like to be in time. Prior said,

> Many reputable philosophers, e.g. St. Thomas Aquinas, have held that God's knowledge is in some way right outside of time, in which case presumably the verb 'knows' in our translation would have to be thought of as tenseless. I want to argue against this view, on the ground that its final effect is to restrict *what God*

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[37]Stump and Kretzmann used a similar approach in [Stump and Kretzmann(1981)], p. 448.

[38]Even when using a microwave to create unfrozen vegetables, one inputs a duration, not an absolute time.

knows to those truths, if any, which are themselves timeless. For example, God could not, on the view I am considering, know that the 1960 final examinations at Manchester are now over; for this isn't something that He or anyone could know timelessly, because it just isn't true timelessly. It's true now, but it wasn't true a year ago (I write this on August 29th, 1960) and so far as I can see all that can be said on this subject timelessly is that the finishing-date of the 1960 final examinations is an earlier one than August 29th, and this is *not* the thing we know when we know that those examinations are now over.[39]

As mentioned in Section 5.1.2, Prior rejected a general reduction of temporal statements/properties to fully atemporal correlates.[40] So even if God's knowledge has atemporal content that is logically equivalent to the relevant temporal statements, there is some missing content if one "takes time seriously". Prior's famous example is

(5.25) Thank goodness that's over!

The speaker is thankful that the event in question was present and is now past, no longer present. According to Prior, there is no way to explicate this shift using only absolute terms. One can at best describe how the event occurred at some earlier time than now, not that it is no longer present. Many scholars have come to disagree with Prior's view that the A-theory is irreducible to B-theoretic terms.[41] The issue will not be pursued further here because it is beyond the scope of this project. It is nevertheless worth noting that saving THEETRN from Prior's criticism seems to necessitate reducing the A-theory to the B-theory.

Conversely, atemporal renditions of temporal statements may require content that the temporal versions do not. For example, consider:

(5.26) The 1960 final examinations at Manchester are now over

To start, the following is not the sort of thing that can be known by an eternal God:

(5.27) The final examinations are (atemporally) occurring at some time earlier than now and are not now occurring.

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[39][Prior(1962)]

[40][Prior(1957), Prior(1967)]

[41]For a recent challenge to Prior's view, see [Sider(2003)].

God cannot know (5.27) because (5.27) takes the current time as a reference point, as indicated by the use of *now*. There is no current time for an eternal being. To eliminate all temporal relations, something like the following is required:

> (5.28) On August 29 of 1960, the 1960 final examinations at Manchester are (atemporally) over.

(5.28) is the sort of thing that can be known by God because (5.28) does not require a reference point in time. Officially, time is picked out using only the *at* operator; like in *at August 29 of 1960*. The specification of time given in (5.28) is not contained in the temporal version, (5.27). Atemporal statements that can be known by an eternal God that are about mutable temporal events require a time specification, but not all true statements have the content of a time specification. Thus, an eternal God cannot know all truths. At best, the content of his knowledge contains a complete description of the universe at all times, and even that requires that statements like (5.25) are reducible to strictly atemporal terms.

Some authors have criticized THEETRN on the grounds that it does not avoid theological fatalism. There are two ways to propose such an argument. One route is to rephrase an argument for theological fatalism in absolute terms. A second strategy is to argue that an argument for theological fatalism that is in temporal terms still applies to THEETRN. If beings in time can truly say that God knows what will happen, God's eternality makes no difference.

Linda Zagzebski emphasized the first avenue.[42] She reformulated an argument for theological fatalism using absolute instead of relative times. The content of the eternal God's knowledge or apprehension is in the relevant ways just as it is in the temporal case except expressed in terms of absolute times instead of relative times. Zagzebski switched the terms in the argument to match the atemporality of God's knowledge, creating a parallel argument.

This project emphasizes the second path.[43] Section 5.3 shows that TF follows from

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[42][Zagzebski(1991), Zagzebski(2011a)]
[43]Cf. [Helm(1997)]

THETRN. Section 6.4 argues that if TF is tenable at all, it is not the best option for avoiding fatalism given a dynamic view of time. Zagzebski's route may be a little bit more direct. An upshot is that the account given here does not require a separate argument to show that THETRN entails theological fatalism.

5.3 Theistic Eternalism and True Futurism

An important criticism of THETRN is that the view does not avoid theological fatalism. THETRN entails TF, and the latter yields fatalism. This section elaborates on the connection between THETRN and TF. In addition to TF as an ontological position, THETRN is committed to certain statements about future events and God's knowledge of those events. These statements, associated with TF generally, are what open the door to fatalism. That TF does not avoid fatalism is discussed in Section 6.4.

5.3.1 The True Future

THETRN designates an actual timeline. This fact can be derived in one of two ways, using God's direct apprehension of events or his propositional knowledge of events. In the first case, the eternal God directly apprehends all events as immediately present. He must somehow differentiate between actual events and non-actual ones. Insofar as he apprehends merely possible circumstances at all, he does not directly perceive, conceive, or will them to be in the same way as actual happenings; for otherwise those merely possible scenarios would be actual. As such, actual events are distinguished from merely possible ones. Assuming that there can be only one complete description of the world at a given time, THETRN picks out a timeline of actual events.

For the second case, suppose that God's knowledge has propositional content. Given his omniscience, comprehensive foreknowledge, and infallibility, the content of God's knowledge

constitutes a full description of the actual world at every moment in time.[44] He may also know everything about merely possible scenarios. As is the case for his apprehension, he must know what is actual as distinct from what is merely possible. He could not know *the* future, otherwise. His knowledge therefore designates a unique timeline of actual events.

Thus, THETRN entails TF. Although the eternal God does not apprehend events as past or future, his direct apprehension or knowledge designates an actual timeline. This variety true futurism will be called ontological true futurism (ONTF)[45] because of its ontological commitments. The actual timeline, represented by the TRL, is not just an epistemic or semantic mechanism.

5.3.2 Temporal Statements about God and the Future

THETRN entails ONTF, but it has not been clarified how THETRN should account for statements given from temporal perspectives. ONTF involves semantic commitments.[46] That there is an actual timeline indicates some kind of semantic true futurism (SMTF). However, THETRN is not committed to a particular account of propositions within a temporal framework involving past or future times. An advocate of THETRN could be a semantic absolutist, using one and only one TRL; or a semantic indexicalist, employing moment-specific TRL_m.

For THETRN, God apprehends or knows everything about both the past and the future, but as present or timeless rather than as past or future.[47] So a little bit of caution is required when interpreting statements given at moments in time about God's apprehension or knowledge. Consider, for instance:

(5.29) God knows that Jones will drink coffee.

The content of the eternal God's knowledge cannot be:

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[44]God's knowledge contains a full description of the actual world at every moment even if atemporality limits his knowledge in the ways mentioned in Section 5.2.4.

[45]See Section 6.2.3 for more on ONTF.

[46]See Section 6.2.3 for more on ONTF and its semantic commitments.

[47][Helm(1997)] contains more analysis on temporal statements about an eternal God.

(5.30) Jones will drink coffee,

as discussed in Section 5.1.2. Understanding the temporal operator as part of the content of God's knowledge is not the only way to interpret (5.29). Instead of indicating that the content of God's knowledge or apprehension is temporal, where his apprehension may not even be propositional, the statement reports that the *object* of God's apprehension/knowledge is Jones drinking coffee at some time that is future with respect to the standpoint (or context of utterance) of (5.29).

Consider a spatial analogy. Suppose that Jones is visiting a distant friend. The day that Jones was initially scheduled to return, she decides to stay for a few more days. Jones renders the following proposition true from her own standpoint:

(5.31) *I* am staying *here* for a few more days.

Jones then calls Smith and says, "I'm staying here for a few more days". From Smith's standpoint, it is true that:

(5.32) Jones told me that *she* is staying *there* for a few more days.

That (5.32) is true from Smith's standpoint does not imply that Jones's report to Smith or the proposition that Jones rendered true from her own standpoint, (5.31), are about a place other than where she is. (5.31) and (5.32) are not about a place that would be *there* rather than *here* from Jones's standpoint. Moreover, that (5.32) is true from Smith's standpoint does not imply that someone other than Jones is staying, a person that would be a *she* rather than an *I* from Jones's standpoint. Similarly, (5.29) does not imply that God's knowledge is of the future from his own standpoint, for it could be that Jones' act is future with respect to the time at which the proposition is assigned a truth value.

Three observations can be made at this point. First, THEETRN entails S-FLEM[48] everywhere along the actual timeline and that a particular future will be. Second, although the content of the eternal God's knowledge cannot involve past or future times from his

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[48]See Section 3.2 for an introduction to S-FLEM.

perspective, his apprehension or knowledge can be described using temporal language from a temporal perspective. Third, that there are such descriptions does not even require that God's apprehension or knowledge has propositional content, as long as the objects of his apprehension/knowledge can be described with propositions. These three observations yield that THETRN is a variety of TF, the topic of the next chapter.

Chapter 6

True Futurism

True futurism (TF) is one of the most popular responses to logical and theological fatalism. Even many freedom/foreknowledge incompatibilists adhere to the view.[1] So TF warrants a careful analysis along with criticisms. This project inspects TF under the dynamic framework althoughTF can be absolutist, too. One of the primary claims made here is that TF is incompatible with the dynamic framework.

This chapter describes TF in some detail. TF's history and rejection of fatalism are given in Section 6.1. Section 6.2 provides a useful taxonomy of various kinds of TF.

Section 6.3 discusses TF's linguistic facets. The validity of the strong future law of excluded middle (S-FLEM) is one of TF's selling points. TF is the simplest branching temporal logic (of those that anyone uses nowadays) by which S-FLEM is valid. There have been challenges to TF as a semantic view, some of which have never been met in the literature. Even the toughest of these problems dissipates when TF is enhanced with an account of temporal standpoints.

TF cannot avoid a number of philosophical problems, given in Section 6.4. On one hand, there is a set of arguments by which TF yields fatalism. On the other hand, TF succumbs to the general grounding problem, by which TF either is *ad hoc* or entails fatalism. Theistic

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[1]Two notable examples are Pike and Hasker. [Pike(1965), Hasker(2001)] (Note that Pike is not an incompatibilist when it comes to an eternal God.)

considerations add to the grounding problem. When God is involved, TF must explain how God knows soft facts in addition to soft facts themselves. Ultimately, these challenges are insurmountable within the framework of this analysis.

6.1 A Brief History of True Futurism and Ockhamism

This section provides a very brief account of TF's history, emphasizing it's contemporary development from Prior onwards. TF's current form was developed largely by Øhrstrøm, who furthered branching-time representations of TF. The section concludes with a discussion of how TF aims to dismantle both ARGLF and ARGTHF.

6.1.1 History

TF gained notoriety through some medieval scholarship, like that of William of Ockham and Richard of Lavenham, although the position can be traced back to antiquity. These thinkers hold that there is always a fact of the matter about what the future holds, yet there are future contingents. According to this view, there are some things that will be although they are not necessary. TF seeks to retain, on the one hand, that there are future contingents, or that agents are free in the libertarian sense; on the other hand, that any given proposition either will be true or will be false, or (sometimes) that God has infallible and comprehensive foreknowledge.

TF has found many adherents in the last several decades. Prior gave one of the first systematic accounts of the view.[2] Systems like Prior's are known as Priorian Ockhamist. Prior describes a system in which, for ϕ representing a proposition, necessarily:ϕ does not follow from will:ϕ. For example, suppose that Jones will have a cup of coffee tomorrow. Jones' coffee drinking might still be contingent: she could refrain, but she will not.
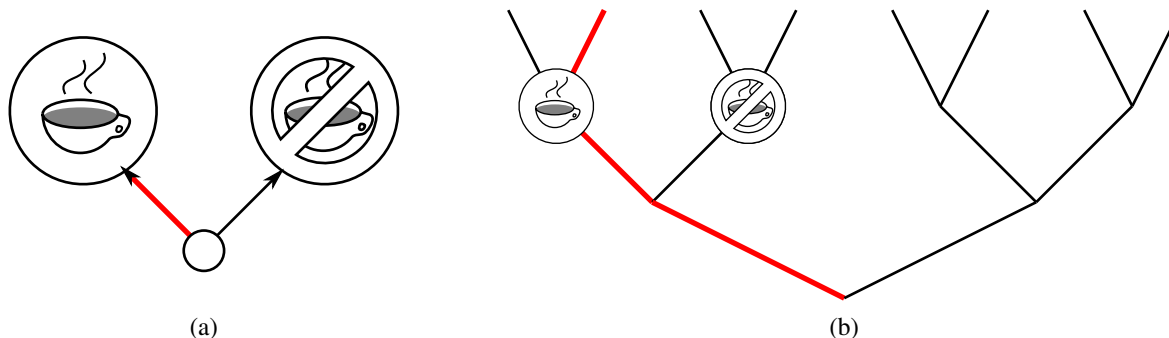
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[2][Prior(1967)]

Figure 6.1.1: Jones will contingently drink coffee, as designated by the TRL. (a) Jones will contingently drink coffee. The non-linear branching indicates that Jones' coffee-drinking is contingent. The bold red line indicates the TRL sitting atop the underlying ATC tree. The bigger picture in (b) shows the linearity of the TRL.

TF aside, Prior holds that if an event will come to pass, then there must be some present facts that make it so. Many thinkers since Prior, most notably Øhrstrøm, observe that Priorian Ockhamism[3] fails to capture a central tenet of Ockham's actual view.[4] In particular, Ockham's account leads to a semantics of time quite different from Prior's. Øhrstrøm and other true futurists propose a device called "the thin red line" (TRL). The TRL consists of one or more chains of moments. These chains are often called "chronicles" or "histories". What will be the case is designated by what occurs on the TRL and likewise with what was the case. Priorian Ockhamism represents only the divorce of time from modality without a genuinely Ockhamist temporal semantics. The TRL is designed to provide such a semantics.

Consider again the example of Jones and her beloved coffee. Figure 6.1.1 illustrates a branching-time version of the scenario. The non-linear branching of the tree makes it so that Jones might drink coffee and she might not, where possibility is understood as ATC-possibility. Thus, whether or not she drinks coffee is a contingent matter. The bold red line represents the TRL. In this case, the TRL is a single chain along the tree. The TRL designates what will occur: Jones will drink coffee.

Since Prior's exposition, thinkers have proposed several varieties of TF. Some of these

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[3]Ockhamism in this context does not necessarily include the view that characterizations of God's beliefs about the future are soft facts.

[4][Øhrstrøm(1984), Øhrstrøm(2009)]

types are discussed in Section 6.2, including distinctions that appear underdeveloped in the current literature. Formal versions are given in Chapter 8.

As they occur in the literature, the names of these various systems can be confusing. TF also goes by "Ockhamism" in the future contingents literature. In the freedom/foreknowledge literature, "Ockhamism" picks out a view related to but more specific than TF by which statements characterizing God's beliefs are soft facts. In some more recent work,[5] indexical systems are called "Molinist" although that term will not be used here. Specific varieties of TF are discussed in Section 6.2.

6.1.2 True Futurism Against Fatalism

In an influential article on Ockhamism, Plantinga makes the following bold claim.

> [N]o one, presumably, except for the most obdurate logical fatalist, will hold that [There is (i.e., is, was or will be) such a time as eighty years ago, and Paul will mow in 1999] is incompatible with Paul's being free to mow in 1999.[6][7]

An argument for logical fatalism, ARGLF, is outlined in Section 4.3. This ARGLF hinges on the thesis that will:ϕ entails ¬possibly:¬ϕ, put forth in the logically equivalent (ARGLF.3). Plantinga and other advocates of TF reject this premise of the argument.

TF maintains that the TRL is not a modal relation between moments in time. Indeed, the TRL does not correspond to a set of principles, setting it apart from familiar propositional modalities like the physical and metaphysical sorts.[8] Recall that ATC-modality captures future contingency. The TRL accounts for temporal operators like *will*. If the TRL is non-modal and only modal relations can be meaningfully associated with possibility and necessity, then temporal operators cannot be associated with possibility and necessity, including ATC-possibility and necessity. (ARGLF.3) is therefore false and ARGLF is unsound.

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[5]For instance, [Malpass and Wawer(2012)]

[6]That is, no one except perhaps Aristotle, Prior, Belnap, and a host of others who are not logical fatalists. Plantinga's decision to use "presumably" is a good one, for the claim is alarmingly presumptuous for such an otherwise careful thinker.

[7]See [Plantinga(1986)], p. 250.

[8]See Section 2.2 for more on propositional modalities.

Thus, TF rejects logical fatalism. The same maneuver, denying the modality of temporal operators, may be used to dismantle the argument for theological fatalism represented in Section 4.4 by ArgThF. It makes no difference to suppose that God or anyone else infallibly knows what the future holds. Such knowledge only shows that there is a particular true future. TF designates such a future regardless of God's foreknowledge. In terms of ArgThF, (ArgThF.7) does not hold because it relies on the soundness of ArgLF, which TF denies.

So far, so good; but advocates of TF have some explaining to do. If temporal operators are non-modal, what exactly do they amount to? If God exists and has complete, infallible foreknowlege, what is the source of that knowledge? TF must provide reasonable answers to such questions without opening the door to fatalism. These issues are given further treatment in Section 6.4.

6.2 Varieties of True Futurism

The future contingents literature is full of many varieties of TF. Only branching types are given here. The first division is between absolute and indexical TF, given in Section 6.2.1. While absolute TF uses a single, unparameterized TRL, indexical TF uses moment-specific TRLs that are defined for every moment. The core of TF, semantic TF, is described in Section 6.2.2. Semantic TF is a view about how to account for temporal language, asserting that the future will turn out one way over others as captured by soft facts or, equivalently, the TRL. Semantic TF is typically coupled with ontological TF, by which there is a real or actual timeline. Ontological TF is described in Section 6.2.3. Instead of ontological TF, semantic TF may be coupled with epistemic TF. According to epistemic TF, the TRL designates what a given agent thinks the future holds. Epistemic TF is the topic of Section 6.2.4. The view is defended against Malpass and Wawer's recent criticisms, although other considerations may rule it out as a viable alternative to ontological TF.
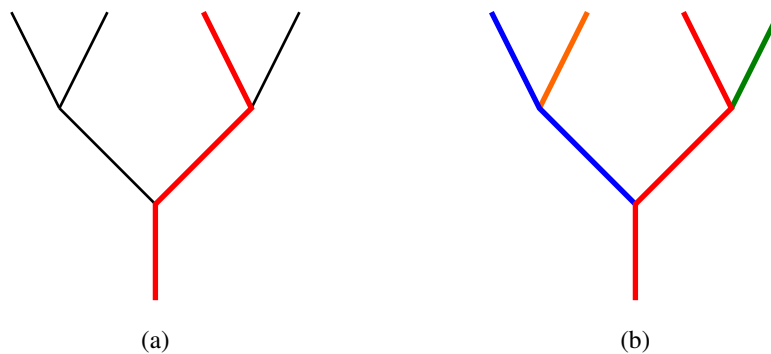
Figure 6.2.1: True futurism: absolute and indexical. (a) Absolute true futurism. There is a unique, unparameterized (absolute) TRL. This TRL marks *the* actual timeline. (b) Indexical true futurism. TRLs are parameterized with respect to moments as TRL_m. Note that the TRL_m have no starting point but some TRL_m overlap others (they effectively have a priority ranking).

6.2.1 Absolute and Indexical True Futurisms

In Øhrstrøm's first TF systems, the TRL is unique.[9] This view may be called "absolute true futurism" (ABSTF) because there is a single TRL that is unparameterized, and thus in a sense warrants the title, "absolute". See Figure 6.2.1 (a). ABSTF is fueled by ontologies by which there is one and only one actual world—or, in the case of moments, a unique timeline. The TRL represents this actual timeline.

One can describe the way temporal statements work in terms of diagrams as in Figure 6.2.1. The truth of future statements involving *will* and *will-always* is determined by following the TRL upwards, forwards in time. The TRL serves to distinguish the true future from merely possible ones. Whatever happens at moments along the red TRL in Figure 6.2.1 (a) designates what will be the case, such as Jones' coffee-drinking in Figure 6.1.1. The same rule holds when there are multiple TRLs, as in Figure 6.2.1 (b). From the blue line, the future is determined by following the blue line upwards, and likewise for the other lines. Unlike the contingent future, the past is backwards linear—that is, unique—in branching systems, eliminating the need for disambiguation. So TRLs make no difference to evaluations of past-time statements (those involving operators like *was* and *was-always*).

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[9][Øhrstrøm(1984)]

Most scholars agree that AᴃsTF is deficient, at least as a semantic thesis. As indicated in Figure 6.2.1 (a), AᴃsTF does not define a TRL for counterfactual moments. The TRL is the temporal relation, crucial for evaluating statements involving *will* and other temporal operators. The main problem is accounting for temporal statements at counterfactual nodes. There is no TRL through those moments, so either temporal statements are undefined or another account, like open futurism, must be used for temporal statements at counterfactual nodes. These criticisms of AᴃsTF are presented in more detail in Section 6.3.2. On account of these issues, AᴃsTF has few contemporary adherents.[10]

In light of arguably insurmountable criticism against AᴃsTF, scholars developed indexical true futurism (IᴅxTF). In IᴅxTF, TRLs are moment specific, designated TRL_m. Effectively, the TRL_m are prioritized so that they overlap, as shown in Figure 6.2.1 (b). The use of moment-specific TRL_m ensures that the temporal relation is defined at all moments, avoiding problems with AᴃsTF.

6.2.2   Semantic True Futurism

The heart of TF is semantic true futurism (SᴍTF). SᴍTF is a view about how to explicate the content of temporal language, which may be accompanied by one of various ontological or epistemological positions. SᴍTF employs the TRL to account for the meanings of propositions involving temporal relations. The TRL consists of one or more chains spanning time. As such, SᴍTF entails that for any ϕ representing a proposition, either it will be the case that ϕ or it will the case that $\neg\phi$. This principle is S-FLEM (not to be confused with W-FLEM or M-FLEM).[11] As an example, either it will be the case that Jones drinks coffee or it will be the case that Jones does not drink coffee. S-FLEM is also valid in supervaluationism, but it may turn out that neither disjunct is true. SᴍTF goes a step further by designating either will:ϕ or will:$\neg\phi$ as true. Thus, SᴍTF is a view that uses the TRL to affirm the following:

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[10]Semantic absolute true futurism was recently endorsed in [Malpass and Wawer(2012)].

[11]These future excluded middles are introduced in Section 3.2 and further disambiguated in Section 3.3.

(6.1) S-FLEM is valid (along the TRL):

$$\vDash \text{will:}\phi \lor \text{will:}\neg\phi$$

(6.2) At any moment, either will:ϕ or will:$\neg\phi$ is true

SMTF yields that S-FLEM is valid along the TRL. In general, S-FLEM is valid within and only within temporal structures in which moments are temporally connected in chains, including deterministic and fatalistic structures. Using the notation of Section 2.4, SMTF is TRL-fatalistic, although friends of TF would prefer to avoid associating their view with fatalism. Indeed, if the TRL is non-modal, then SMTF is fatalistic in a merely formal, innocuous sense.

At this point in the discussion, the focus has been on accounting for temporal language. Ontological and epistemological concerns are addressed in the next sections. Note that it is possible to employ IDXTF as a semantic thesis, then designate a special TRL, perhaps to distinguish real moments from merely possible ones, an absolutist reality from an semantic indexical actuality. One may think of this absolutely real TRL as the one with the highest precedence. More specifically, the only one in a given tree such that for any distinct moments m and m' on the TRL, TRL_m is identical to $\text{TRL}_{m'}$ (and both are just the special TRL).

6.2.3   Ontological True Futurism

SMTF is often (although not necessarily) associated with corresponding ontological commitments. Ontological true futurism (ONTF) is the view that, despite contingency, some course of events is privileged. In the terms used in the freedom/foreknowledge literature, ONTF is the view that there is a hard/soft fact distinction and that soft facts pick out a real or actual future.[12]

Eternalism is the view that the future exists or is real in some sense or other. Being

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[12]For a description of the hard/soft fact distinction, see Section 2.7.

real is one way in which a given course of events can be special. Despite the various uses of "eternalism" in the literature, general eternalism should not be confused with theistic eternalism (THETRN), discussed in Chapter 5.[13] General eternalism is one of several related absolutist views, along with perdurantism and the B-theory. Unlike THETRN, general eternalism does not commit one to the existence of God. Contra Boethius, THETRN turns out to be sufficient for general eternalism. It will be argued later in this chapter that TF is inadequate under the dynamic, branching view of time. If viable at all, TF requires general eternalism. Since THETRN entails TF, THETRN can only make sense with general eternalism. Additionally, several of the criticisms of THETRN mentioned in Chapter 5 presuppose the dynamic approach and can be avoided within a broader eternalist framework.

Recall that THETRN entails ONTF, as discussed in Section 5.3. Whether by his direct apprehension of all events as present or his propositional knowledge of them, the eternal God shows that there is a real timeline. Such a God does not apprehend or know what will occur as future; nevertheless, it is true from a temporal perspective that he apprehends/knows what has occurred, is occurring, and will occur.[14]

Not all advocates of ONTF are eternalists. Øhrstrøm, for instance, is not an eternalist; and in general advocates of branching time are not eternalists, true-futurist or not. The non-eternalist view of ONTF is that a particular future will come about. The actual future is not seen as atemporally real. This non-eternalist view is the primary focus of this chapter. The position is infeasible for reasons discussed later in the chapter.

ONTF may be understood absolutely or indexically. Taken absolutely, ONTF designates a unique timeline. The term "real" is sometimes used to pick out this one and only privileged timeline. Absolute ONTF should probably not be labeled as a type of realism, however, since realism in other modal contexts is the Lewisian view that all nodes (possible worlds) are

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[13]Both Boethius and Anselm endorsed THETRN. Compare Rogers' accounts of Boethius' view in [Rogers(1994)] and Anselm's view in [Rogers(2006), Rogers(2007)]. Anselm may have adhered to generic eternalism, but Boethius did not. So not all advocates of THETRN are general-eternalists. That said, Rogers argued that a more thoroughgoing absolutism like Anselm's yields a superior variety of THETRN.

[14]See also [Helm(1997)].

equally real. Lewisian realism is therefore quite opposed to absolute ONTF, but is instead similar to the indexical interpretation of ONTF by which actuality is node-dependent. That is, what counts as the actual timeline is moment-specific. The actual timeline of moment m is TRL_m.

ONTF is about ontology, not directly about how to represent time as it occurs in language. However, given that ONTF designates some actual timeline, SMTF is not far behind. The actual timelines of ONTF form the TRL, the temporal relation of SMTF. The converse implication, that SMTF entails ONTF, is false. One might have independent reasons to accept TF as an account of language. Such reasons could, for example, be linguistic or perhaps derived from the fruitfulness of a TF system in game theory, model checking, or some other endeavor. One might have other reasons for denying ONTF. In this case, the TRL carries no ontological commitment, but rather is just a linguistic or epistemic apparatus.

6.2.4   Epistemic True Futurism

John Burgess provided the following description of TF (in terms of branching time).

> We *picture* time as a tree. If x represents the present, its predecessors represent the past, and the x-branches our possible futures. The truth-value of a future tense statement depends on which x-branch *we think of* as representing the course of events which is actually going to turn out to happen.[15]

On this view, the TRL is designated by an internal process, as by stipulation, instead of what will actually be the case. This approach is epistemic true futurism (EPTF). EPTF provides an alternative counterpart to SMTF, aside from ONTF.

Some scholars maintain that SMTF only makes sense with ONTF. Alex Malpass and Jacek Wawer recently gave an argument to this effect. In their argument, an "Inner Baptist" is an advocate of EPTF.

> Samantha and Jonny are in a betting shop. Samantha picks a horse called 'Knobbly Knees' which is scheduled to run in the next race, and places a bet. As she

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[15][Burgess(1979)], p. 575, emphasis added.

makes the bet, she says to Jonny "Knobbly Knees will win," and while she does so she makes the 'internal supposition' to use a history in which he wins as the value of the history parameter. They sit and watch the race, only to see Knobbly Knees come last. Nevertheless, as a good Inner-Baptist, Sam maintains that she spoke the truth. "Who cares what actually happened? My prediction was associated internally with a winning history, so what I said was true." When she goes to collect her money, the bookie (quite rightly) refuses to pay. This is because bookies do care about what actually happened, and not about what she was thinking of at the time of the bet. It is what 'actually happens,' and not any type of inner association, that decides whether the bet would be paid out. Our first complaint then, is that it seems odd that bet payouts do not correspond to the (Inner Baptist's) truth of predictions. We think that if you make a true prediction, then a bet about the content of the prediction should (perhaps later on) also pay out. This intuitive idea about the relation between true predictions and successful bets seems to be just incorrectly handled by Inner-Baptism. In fact, making true predictions of future contingents is almost as easy as thinking that your prediction is true.[16]

In Malpass and Wawer's example, EPTF allows Sam to designate a TRL of her choice before the race. She specifies the TRL in which Knobbly Knees will win. Thus, *Knobbly Knees will win* is true. At this point, open futurists object that the statement is not true. ONTF agrees, adding that *Knobbly Knees will lose* is true. Truth may not be the right criterion to apply regarding EPTF. That concern can be put off for now. It will be discussed below.

As it turns out, Knobbly Knees loses. Sam is aware of the loss because she watched the race. After the race, it is false that it was the case that the horse will win. Malpass and Wawer claimed that EPTF sanctions the contrary: it was the case that Knobbly Knees will win. Thus, EPTF yields an unacceptable consequence.

Malpass and Wawer missed a great advantage of EPTF: agents' ability (or obligation) to revise the TRL. Revisions should be made based on temporal standpoints. An explicit implementation of temporal standpoints like standpoint inheritance is unnecessary for this purpose. Recall from Section 3.4 that traditional branching time systems effectively switch standpoints with every new point of evaluation although standpoints play no explicit role in the semantics of those theories.

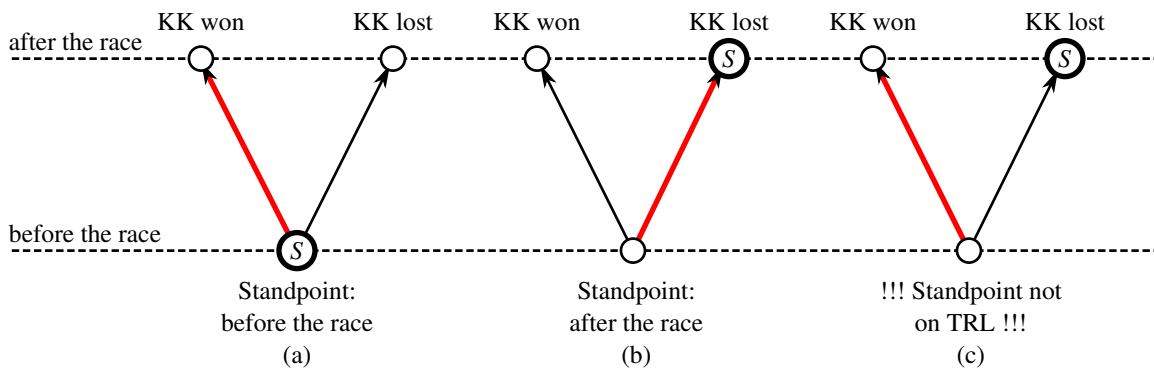[16][Malpass and Wawer(2012)], p. 7–8

Figure 6.2.2: The surprising failure of Knobbly Knees. TF structures representing (a) Sam's designation before the race, (b) what her designation should be after the race, and (c) the designation that Malpass and Wawer ascribed to her. The S nodes represent the standpoints or contexts of utterance, and the bold red lines represent the TRL.

The TRL at any moment (standpoint) should always contain that moment in the sense that, with respect that moment, it had always been the case that what holds at that moment will occur. This stipulation ensures that TRL chains select the correct past since TRL chains are backwards linear. The future, however, may be open to designation by the agent under EPTF. (Some future must be specified; otherwise, EPTF would not be true futurism at all.)

Consider the TRL designations presented in Figure 6.2.2. The left structure is attributed to Sam before the race, for she supposes that Knobbly Knees will win. As it turns out, Knobbly Knees loses. Given that the standpoint must be on the stipulated TRL, Sam should revise her beliefs. After revision, the TRL should point to the standpoint or context of utterance, the node in which Knobbly Knees has lost—not that in which the horse won. Sam maintains that the TRL points to the node at which Knobbly Knees won; and since the horse lost, the standpoint lies apart from the TRL. Malpass and Wawer charged that EPTF sanctions Sam's epistemic irresponsibility, but one need not presume any such thing. Advocates of EPTF need only maintain that the TRL should contain the standpoint or context of utterance.

There is a delicate issue of scope. Once standpoints enter the scene, it is important to be clear about which standpoint applies to which temporal operator. In the scenario given by Malpass and Wawer, all temporal operators should follow the outermost designation of

context. Consider:

(6.3) Knobbly Knees was going to win,

where the context is after the horse has lost. This statement may be truncated as:

(6.4) was: will: *KK wins*

The standpoint of the outermost temporal operator (namely, *was*) is that in which the horse has already lost. If the standpoint of the innermost operator is the past moment picked out by *was*, the node before the race, then the proposition is true just as Malpass and Wawer claimed. That is because from that earlier standpoint, Sam stipulated a TRL in which

(6.5) Knobbly Knees will win

(6.6) will: *KK wins*

is true. To get the truth value of (6.3) and (6.4) right, the inner *will* must use the same context as the outer *was*. (6.5) and (6.6) are subtely different when taken alone on the one hand and when embedded in (6.3) and (6.4) on the other hand.

The need for temporal standpoints is not limited to EpTF. The idea has independent support. A variety of branching temporal logics can use temporal standpoints to handle combinations of temporal operators. Temporal standpoints are discussed further in Section 3.4 and formally in Section 8.3. The theory of standpoint inheritance given in those sections is not necessary to handle Malpass and Wawer's example. It suffices for EpTF to stipulate that that agents ought to revise their beliefs to include the context of utterance.

Malpass and Wawer provided a second alleged counterexample to EpTF.

> Imagine that Jonny countered Sam's prediction by saying "Knobbly Knees will not win," and that he associated his utterance with a future in which the horse loses. Then, he and Sam will both have spoken the truth, even though they sound very much like they have contradicted each other. We find this situation counter-intuitive. Our complaint here is that it seems that only one of Sam or Jonny could have spoken the truth, and the other falsity.[17]

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[17][Malpass and Wawer(2012)], p. 8

This allegation conflates standards for EPTF with those for ONTF. It is not the truth of propositions that is internally baptized, nor does it generally make sense to ask about which proposition is objectively the right one. A fan of EPTF might reject ONTF. In this case, there is no objective truth of the matter regarding whether or not Knobbly Knees will win until the horse either wins or loses. EPTF associates the content of Sam's and Jonny's respective assertions with internal states. So it does not make sense to ask whose assertion is objectively true unless there is an objectively true picture in terms of which to evaluate the individual pictures of Sam and Jonny. Both of their assertions can be represented and associated with internal suppositions using separate models, and that may be all a friend of EPTF is interested in.

Although objective truth may not be an issue, there is still room for discussion about justification. Sam and Jonny make incompatible assertions and have corresponding incompatible models of the world. One might ask, *Who's assertion is justified?* or *Who's picture is justified?* One could even inquire about who is right by combining ONTF and EPTF.

Despite the virtues of EPTF, true futurists seem uninterested in the position. One reason may be that the future can be epistemically indeterminate and agents may withhold judgment about the future. Such epistemic considerations are often taken to support open futurism or supervaluationism against TF. Agents do not have to designate a particular future as the one that is going to happen—that sounds like a lot of pressure. Sometimes, agents do designate such a future, and perhaps an EPTF understanding would be helpful for those cases. Even granting that there may be such cases, EPTF does not seem to apply to most realistic situations.

6.3   True Futurism and Language

SMTF has seen mixed reviews. In SMTF's favor, many thinkers and other English speakers acknowledge S-FLEM's validy. SMTF is the simplest theory in which S-FLEM is

valid.[18] Section 6.3.1 discusses S-FLEM's validity, explaining S-FLEM's intuitive character as a particular type of LEM.

Most scholars hold that ABsTF is implausible. An important reason why is described in Section 6.3.2. ABsTF involves only a single TRL. There is no TRL at counterfactual moments. The TRL is the relation used to evaluate propositions involving temporal operators: *will*, *was*, and company. So ABsTF has problems evaluating temporal operators at counterfactual moments; and there is no appealing way around these issues.

That leaves IDxTF. Section 6.3.3 describes a criticism given by Belnap and Green against IDxTF. Standard IDxTF logics are incapable of resolving the problem. Temporal standpoints, however, allow IDxTF to get the correct result, as shown in Section 6.3.4. The resolution brings out the extent to which God's beliefs are standpoint-dependent, unlike normal beliefs. At least, either God's beliefs depend on standpoints or fatalism wins the day.

6.3.1 For S-FLEM's Plausibility

As far as accounting for natural language goes, two connected reasons favoring S-FLEM's validity are intuitive plausibility and actual use. Many scholars find S-FLEM intuitively plausible. The vote for S-FLEM may be close to unanimous for other English speakers. Just as English speakers agree with instances of LEM such as:

(6.7) Jones is either drinking coffee or not drinking coffee,

they find corresponding instances of S-FLEM equally obvious:

(6.8) Either Jones will drink coffee or she will not.

Thus, intuitive plausibility and actual use *prima facie* favor S-FLEM.

One reason why instances of S-FLEM look like truisms just as much as corresponding instances of LEM is that *will* and *not* appear to commute. For example:

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[18]S-FLEM is also valid under supervaluationism, but supervaluationism has some quirks that many thinkers are unwilling to accept. Supervaluationism is explained in Section 7.2.3.

(6.9) Jones will drink coffee.

This proposition may be formalized as:

(6.10) $c := Jones\ drinks\ coffee$

(6.11) will:c

English speakers reject (6.9) with a proposition like:

(6.12) Jones will not drink coffee.

This proposition may be symbolized as:

(6.13) will:$\neg c$

That (6.9) is rejected using (6.12) and conversely indicates that the two are logical opposites. That is:

(6.14) will:c and will:$\neg c$ are logical opposites.

Generalizing on this example yields the following result:

(6.15) For any proposition ϕ, $\neg$will:ϕ and will:$\neg\phi$ are logically equivalent.

This is the promised result that *will* and *not* commute. Given bivalence, it immediately follows that S-FLEM and M-FLEM are equivalent, and that both are special cases of LEM. For instance, (6.8) is equivalent to the following instance of M-FLEM:

(6.16) Either Jones will drink coffee or it is not the case that Jones will drink coffee.

W-FLEM also follows from LEM and is typically equivalent to M-FLEM. It is no wonder that English speakers find instances of S-FLEM just as plausible as instances of LEM.

A second argument for S-FLEM is *ex post* in flavor and is especially plausible when put in terms of predictions or bets. This argument aims to show that exactly one disjunct is true for a given instance of S-FLEM. Suppose that LEM is valid, at least pertaining to atoms. For instance,

(6.17) Jones is either drinking coffee or she is not.

(6.17) holds at all moments, including right now. Yesterday, Smith and Brown placed bets on Jones' coffee drinking. Smith bet that:

(6.18) Jones will drink coffee.

Brown bet that:

(6.19) Jones will not drink coffee.

Exactly one of Smith and Brown won the bet because (6.17) holds. As such, exactly one of (6.18) and (6.19) was true at the time when the bets were placed. Again, S-FLEM appears to follow from LEM.[19]

6.3.2 Temporal Operators at Counterfactual Moments

Early versions of TF, the absolute variety, involve a single TRL. This TRL is moment-independent and, more generally, has no parameters at all. It is *the* TRL. Ontologically, the TRL corresponds to the real timeline. ABSTF encounters severe difficulties. As a result, most advocates of TF now reject ABSTF in favor of its indexical counterpart.

Consider:

(6.20) Had Jones not drunk coffee, she would have a headache, although it would have been possible that she would not have a headache.[20]

(6.20) shifts the temporal standpoint from an actual moment to a counterfactual moment in which Jones did not drink coffee.[21] In Figure 6.3.1, the absolutely actual moment that

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[19]This argument is critiqued in Section 7.3.4

[20]Despite some differences in portrayal, this example is designed to emphasize the point made with the coin example in [Belnap and Green(1994)], p. 379.

[21]Although making the right point with the example does not require such pedanticism, (6.20) is perhaps best understood as shifting the temporal standpoint to a *class* of counterfactual moments in which Jones did not drink coffee. From those counterfactual moments, it should be evaluated whether or not Jones will have a headache.
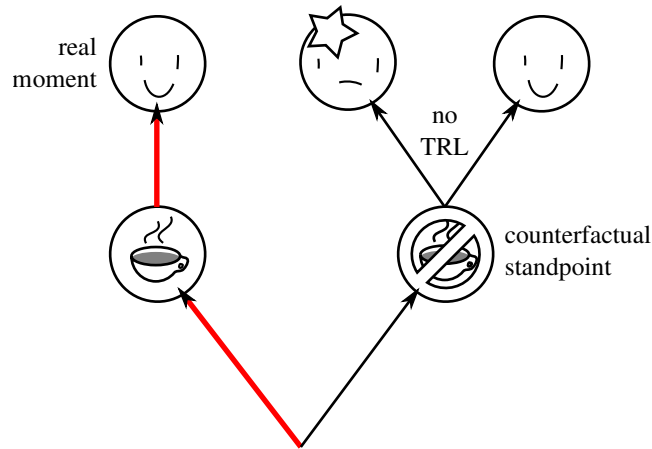
Figure 6.3.1: Absolute true futurism: Jones' counterfactual headache. Really, Jones had coffee and does not have a headache (left branch). No TRL is defined from the counterfactual standpoint, creating difficulty for evaluating temporal operators there.

serves as the starting point is on the upper-left, featuring a happy illustration of Jones. The counterfactual standpoint picked out by the antecedent of the conditional is the one in which Jones did not drink coffee. (6.20) requires evaluating whether or not the following is true from the counterfactual standpoint:

(6.21) Jones will have a headache.

In any sort of true futurism, temporal operators like *was* and *will* are defined along the TRL. The TRL does not run along counterfactual moments in absolute true futurism. As such, temporal operators cannot be properly evaluated: they are undefined, false, or vacuously true at counterfactuals. In the example above, (6.21) is false, vacuously true, or cannot be evaluated from the counterfactual moment at which Jones did not drink coffee. The truth value of (6.20) inherits this problem. In general, ABSTF does not account for counterfactuals involving temporal operators. Such examples constitute a significant class of propositions, rendering ABSTF just as significantly deficient in its capacity to account for relevant linguistic data.

Fans of ABSTF may accept the result, modify their theory, or abandon it. The first two options do not appear promising, although that has not stopped a few scholars from

taking them.[22] Those who accept the result must acknowledge that ABsTF is inadequate as a general account of temporality in English. Most contemporary scholars agree that alternative theories are more promising.

It is possible to define temporal operators with the TRL at actual moments and without the TRL at counterfactual moments. The only temporal theory that does not require a TRL is open futurism (OF). One could thus apply ABsTF at actual moments and OF at counterfactual nodes. This suggestion, however, is quite unappealing for at least two reasons.

First, the proposed mixed theory is disparate if not inconsistent in its account of natural language. The semantics applied to a given proposition may differ, being TF at some moments and OF at others. The semantics used is selected for non-linguistic reasons, but instead on account of presumably ontological considerations. One significant difference is that *will/not* commutativity and S-FLEM hold along the TRL, but not elsewhere. The only difference between moments where one account is employed over another is the reality of moments at which a temporal operator is evaluated, but that distinction is not a linguistic one. A unified semantic account is desirable, and it is important to ensure that analyses of propositions are not determined by extra-linguistic or irrelevant factors.

Second, the mixed theory concedes too much to OF. If OF provides a good account of temporal operators outside of the TRL; and if there is no linguistic difference between temporal propositions occurring at actual moments on the one hand and counterfactual moments on the other hand; then OF provides a good account of temporal operators, period. There is no need to use ABsTF at all.

Together, these two criticism of the mixed theory indicate that an advocate of the mixed theory should just adhere to OF. Advocates of TF are better off rejecting absoluteness. That is exactly what most of them do.

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[22]For example, [Malpass and Wawer(2012)].

6.3.3   Counterfactual Past-Future Combinations

Most contemporary advocates of TF follow the indexical theory (IDXTF) at least on a semantic level, their ontological and epistemological commitments aside.[23] IDXTF easily handles propositions like (6.20). Every moment m has a TRL_m.[24] As such, propositions calling for a switch in temporal standpoint, like counterfactual propositions, and propositions simply occurring at counterfactual moments can be evaluated uniformly using the TRL_m.

Whenever future contingents are involved, some moment m has at least two incompatible possible futures. TRL_m designates exactly one of those futures as the (indexically) actual future of m. Those possible futures not chosen by TRL_m have pasts that do not lead back to those counterfactual nodes. In general, the criticism is that IDXTF sanctions the following:

(6.22) Had some given counterfactual event occurred, then it would have been the case that the event was not going to occur.

Belnap and Green provided an example. A coin was flipped and came up heads. The following comes out true from a counterfactual standpoint in which the coin came up tails.

The coin came up tails, but this is not what was going to happen. The coin was going to come up heads. It's just that it didn't.[25]

To explain this example, let:

(6.23) $m_{tails} :=$ a counterfactual moment at which the coin came up tails,

(6.24) $m_{past} :=$ a past moment at which the result of the toss is contingent, although it will be heads, and

(6.25) $m_{heads} :=$ a moment in which the coin came up heads, and TRL_{past} points to m_{heads}.

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[23]A description of IDXTF is in [Øhrstrøm(2009)], p. 29. Recent literature on true futurism seems to take [Øhrstrøm(2009)] as providing the canonical description.

[24]Distinct moments can have the same TRL; that is, $\text{TRL}_{m_1} = \text{TRL}_{m_2}$ for $m_1 \neq m_2$.
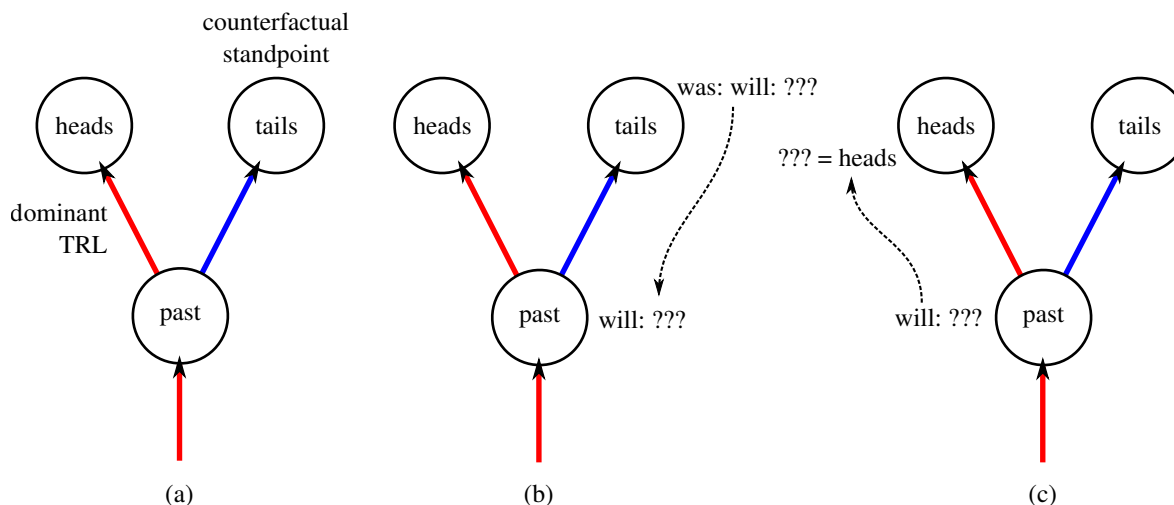
[25][Belnap and Green(1994)], p. 380

Figure 6.3.2: Indexical true futurism: The coin came up tails, but it was going to be heads. (a) clarifies the initial (counterfactual) standpoint and the dominant red $\text{TRL} = \text{TRL}_{past} = \text{TRL}_{heads}$. To evaluate what was going to be the case, as in (b), the outer *was* directs one backwards in time. In (c), the inner *will* follows the dominant TRL to m_{heads}, which is not the desired result.

The scenario is depicted in Figure 6.3.2 (a). The questionable statement in Belnap and Green's example is:

(6.26) The coin was going to come up heads.

(6.27) was: will: *heads*

Starting from the counterfactual node m_{tails}, Belnap and Green evaluated the outer temporal operator, *was*, shifting from m_{tails} to m_{past} as in Figure 6.3.2 (b). Doing so leaves:

(6.28) will: *heads*

This statement is evaluated from m_{past}. m_{past} points to m_{heads} because m_{tails} would not be counterfactual otherwise. Hence, Belnap and Green's result.

6.3.4   Standpoint Inheritance and God's Beliefs

A true futurist may object to Belnap and Green's example on the grounds that it does not adequately consider temporal standpoints.[26] Temporal operators (*was*, *will*, and so forth) are

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[26]Temporal standpoints are introduced in Section 3.4 and treated formally in Section Temporal Standpoints and Standpoint Inheritance.

standpoint-sensitive. In IDXTF, temporal operators are evaluated using the TRL_m. That m is a standpoint is equivalent to that temporal operators are to be evaluated using TRL_m.

Belnap and Green took m_{past} to be the appropriate standpoint of the inner temporal operator, *will*. Their interpretation is in accordance with standard practice in temporal logic, but is nevertheless mistaken. In (6.27), the temporal standpoint of both the outer *was* and the inner *will* is m_{tails}. That is because the inner operator, *will*, inherits the temporal standpoint of the outer operator, *was*. Recall the rule for standpoint inheritance given in Section 3.4:

> (6.29) Only change standpoint when absolutely necessary—when evaluation is only possible by shifting standpoint. Evaluation is impossible if what holds at the standpoint is inconsistent with what holds at the point of evaluation.

This type of shift is required for moving to the counterfactual m_{tails} from the factual m_{heads} in the first place, in the example setup. No such change in standpoint is required for evaluating the inner future operator. The standpoint for that *will* is m_{tails}, so the future operator should be evaluated using TRL_{tails}. Since TRL_{tails} contains m_{tails}, the inner *will* is directed back to m_{tails} as it should be, not m_{heads}. IDXTF thereby avoids the awkward result. Had the toss yielded tails, then it was going to be tails, after all.

Related to Belnap and Green's worries are various statements involving predictions and God's beliefs. Suppose the following hold:

> (6.30) Jones drank coffee.

> (6.31) Smith predicted that Jones would drink coffee.

Thus,

> (6.32) Smith correctly predicted that Jones would drink coffee.

> (6.33) God believed that Jones would drink coffee.

Considering the counterfactual scenario in which Jones did not drink coffee, the following should obtain:

(6.34) Had Jones not drunk coffee, then she was going to abstain from drinking coffee.

(6.35) Had Jones not drunk coffee, then Smith's prediction would have been incorrect.

(6.36) Had Jones not drunk coffee, then God would have believed that she was going to abstain from drinking coffee.

The example in Belnap and Green's criticism, given Section 6.3.3, pertains to (6.34). The same problem applies to (6.35), which relies on (6.34). It was shown above that IDxTF can handle such propositions using standpoint inheritance. Since (6.34) holds, (6.35) is also true.

(6.36) is the peculiar case. Ockhamists in the freedom/foreknowledge literature have repeatedly endorsed propositions like (6.36).[27] Had Jones not drunk coffee, then the following would obtain (entailed by (6.34)):

(6.37) God believes that Jones was going to abstain from drinking coffee.

(God believes: was: will: $\neg coffee$)

(6.36) requires that a subtly different statement obtains at the counterfactual standpoint:

(6.38) God *believed* that Jones would not drink coffee.

(was: God believes: will: $\neg coffee$)

The difference between (6.37) and (6.38) is that (6.37) is about what God now believes while (6.38) is about what he believ*ed*. The distinction is also indicated in the semi-symbolic representation in parentheses.

Statements like (6.38) may be generalized to:

(6.39) For any proposition, ϕ, if ϕ, then God has always believed that ϕ.

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[27]As in the infamous [Plantinga(1986)].

(6.39) is plausible expression of comprehensive foreknowledge. (6.39) is backwards-looking in that it emphasizes what God believed about what is now the case. By contrast, (ArgThF.2) focuses on what God now believes about what will be the case.

Omniscience does not entail (6.39). That God believes all and only truths does not by itself yield that any proposition, ϕ, can be substituted into just any instance of *God believes that ϕ*, no matter where ϕ occurs. Ockhamists want statements like (6.36) to come out true, so that kind of unlimited substitutability needs to hold, at least to the extent required by (6.39). It is the standpoint-dependence of God's beliefs that enable substitution as in (6.38). The softness of God's beliefs is especially pronounced when IdxTF is augmented with temporal standpoints. His beliefs adapt perfectly to the standpoint and are very supple as a result. Hence, the following noun phrase is underspecified if taken without qualification:

(6.40) That which God believed

An implicit qualification when no other is specified is *from this standpoint*. (6.40) is not incoherent if there is an implicit standpoint. The important observation here is that (6.40) requires qualification, explicit or implicit, because what God believed changes from one standpoint to another, indicated in the difference between (6.33) and (6.36). What Smith believed, on the other hand, is standpoint-independent. What changes based on standpoint is whether or not Smith was correct, as in from (6.32) to (6.35). God's beliefs are always correct. His beliefs are unique, suspiciously so, in that they are standpoint-dependent.

Typical agents believe what they do with respect to the standpoint at which they hold beliefs. Yesterday, Smith believed that Jones would drink coffee. Smith held that belief from yesterday's perspective. If God's beliefs were like normal beliefs, then his belief that Jones would drink coffee would also be from yesterday's perspective. To get (6.38) right in the counterfactual scenario in which Jones did not drink coffee, God's belief cannot be from today's perspective.

TF is left with a choice between three options. First, one might follow Ockhamists in the freedom/foreknowledge literature in maintaining the softness of God's beliefs. Doing so

requires that God's beliefs are as standpoint-dependent as the facts that those beliefs are about. That is the only way to ensure that God's beliefs track soft facts. As a result, God's beliefs are drastically unlike normal beliefs. The standpoint-dependence of God's beliefs needs some explaining. Without a viable explanation, this route seems *ad hoc* and is not compelling.

Another path is to claim that God's beliefs are like everyone else's. That is,

> (6.41) From any standpoint, God's beliefs at a moment are evaluated with that moment as the standpoint.

(6.41) ensures that (6.38) is false from the counterfactual standpoint at which Jones did not drink coffee. That is not a problem if God is out of the picture. Otherwise, this is a hard bullet for TF to bite on the usual understanding of omniscience. The following holds at the counterfactual standpoint:

> (6.42) Jones did not drink coffee although God believed that she would.
>
> (was: God believes: will: *coffee*)

(6.42) indicates that it is possible for God to hold false beliefs. He is fallible. Of course, God will in fact not hold any false beliefs. God could be wrong, but he never is.[28] Statements like (6.42) can only obtain at counterfactual moments. So theists could maintain that God's beliefs are like everyone else's, settling for God's correctness instead of infallibility.

Finally, one could propose that God's beliefs are like everyone else's and sacrifice the typical understanding of omniscience to retain infallibility. On this view, there are truths that God does not know. Given his infallibility, he cannot consistently know all truths in a world with future-contingents. Electing to create a world with future contingents, including free agents, amounts to creating a world in which God does not know all soft facts. So God

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[28]That God is never wrong requires that there is a dominant TRL in the IDXTF model. For this to happen, the ATC tree must have root moment or segment. That is, forking must have a chronological lower bound. The TRL of the root will dominate other TRLs.

does not have comprehensive foreknowledge, but only because he chooses not to in favor of contingency and freedom. This position is where TF and open theism overlap.[29]

6.4 True Futurism and Fatalism

Critics of TF maintain that it does not successfully avoid fatalism. These challenges come in various forms, two of which are emphasized here. First, there is a class of arguments by which TF entails fatalism. Some arguments along these lines stemming from interpreting *will* as *will-actually* are given in Section 6.4.1.

The second type of critique amounts to a general version of the grounding objection usually stated against Molinism. The general grounding problem may be specified as follows:

grounding objection TF is either fatalistic or *ad hoc*, arbitrarily designating futures

To avoid being *ad hoc*, TF must provide some meaningful account of the TRL or, equivalently, soft facts. The problem is that any attempt to ground the TRL attaches the TRL to modality in a way that entails fatalism. The challenge for TF is to provide an account of the TRL that is neither *ad hoc* nor yields fatalism. The grounding objection is described in terms of modalities in Section 6.4.2 and soft facts in Section 6.4.3.

Theistic considerations add another difficulty to the grounding problem. TF must explain how God comes to know soft facts in addition to soft facts themselves. This issue is discussed in Sections 6.4.3 and 6.4.4. The latter section emphasizes considerations specific to Molina's approach.

The grounding problem seems unavoidable within the dynamic framework used here. The discussion in Section 6.4.5 indicates that eternalism or a more thorough absolutism is a natural choice for TF. Eternalism grounds soft facts by given them something to describe. A different set of worries may come along with eternalism, but those concerns are not addressed here.

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[29]Open theism, including this variety, are discussed further in Section 7.2.4.

6.4.1   Will-Actually

Some advocates of TF maintain that the TRL represents the actual course of history.[30] In this case, *will* might be interpreted as *will-actually*. (For consistency in notation, *actually-will* is used instead of *will-actually*.) At least a couple of observations make it problematic to interpret *will* as *actually-will*.

Some clarification is in order before proceeding. The notion of actuality used here is not absolute, but indexical. There is no such thing as *the* actual moment simpliciter, as if there were a special moment, α, specified in each branching time model. Absolute actuality may be popular in some circles, but it is not ultimately viable for the those who "take time seriously". A full discussion of this issue is beyond this project since the dynamic view is assumed here, but here is a rough synopsis. If each model has a unique actual world, α, then there is an equivalence class of models representing a given tree structure such that the models differ only in their assignments of α (plus all and only differences that follow from that assignment). There is no flow inherent in the equivalence class, which is more like a deck of cards than a river. At best, time flow is extra metaphysical baggage that Priorians add to the way they interpret their models; at worse, the non-flowing nature of the equivalence class shows that time does not flow. Hence, it is necessary to reject absolute actuality to avoid compromising time flow. Indexical actuality is the only viable option. *Actually* works more like *I* and *now* in that those indexicals do not universally pick out a particular individual or time, respectively.

If *will* cannot feasibly be interpreted as *actually-will*, then what exactly does *will* amount to under TF? The arguments in this section are designed to show that under TF, *will* cannot amount to *actually-will*.

First, the TRL's formal modality enables one to use TRL-specific modal operators.[31] Just as *will* is interpreted as *actually-will*, the modal operators along the TRL may be called

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[30]For instance, [Malpass and Wawer(2012)], p. 8.

[31]Recall that a formal modality is a relation that can be depicted using an accessibility relation. See Section 2.2.

actually-possibly and *actually-necessarily.* Actual possibility and actual necessity are such that *actually-will* is equivalent to *not actually-possibly not.* That is,

(6.43) actually-will:ϕ is logically equivalent to $\neg$actually-possibly:$\neg\phi$

(6.43) holds on account of two facts that obtain in TF systems:

(6.44) $\neg$actually-will:ϕ is equivalent to actually-will:$\neg\phi$

(6.45) actually-will:ϕ is equivalent to actually-possibly:ϕ

Some preliminary clarification is in order before explaining (6.43) in more semantic detail. In logics for which the temporal relation is linear, like TF, *will* is like a *future-possibly* operator. There is in general no inconsistency in both ϕ and $\neg\phi$ being possible at once. This fact also holds for *will*, but for the wrong reasons. This scenario occurs when ϕ is true at some future moment and $\neg\phi$ is true at some different, earlier or later, future moment. The result is that statements like:

(6.46) Jones will drink coffee and she will not drink coffee

turn out true, although (6.46) looks absurd. There is an implicit assumption that the conjuncts of statements like (6.46) are about the same time.[32]   Under that supposition, (6.46) and its ilk are false because they violate the law of non-contradiction. Jones cannot both drink coffee and not drink coffee *at the same time.* Section 8.1.3 describes this issue and how it can be addressed formally. For now, it is enough to assume that token statements about what will occur are about particular future times. In what follows, suppose for clarity that (6.47)–(6.50) are corresponding tokens pertaining to tomorrow.

Returning to an explanation of (6.43), start with:

(6.47) actually-will:ϕ

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[32]See Section 3.2.

(6.47) holds at moment m just in case ϕ is true tomorrow on some (the one and only) TRL-accessible branch.[33] The negation of (6.47) is:

(6.48) ¬actually-will:ϕ

holds just in case ϕ is untrue tomorrow on all TRL-accessible branches. Additionally:

(6.49) actually-will:¬ϕ

is true if and only if ¬ϕ holds tomorrow on some TRL-accessible branches. Since there is only one such branch, (6.49) is equivalent to (6.48). That is the *will-not* commutativity result celebrated by TF. The truth conditions for (6.49) are the same as those for:

(6.50) actually-possibly:¬ϕ

(6.47) and (6.50) are logical opposites. Hence, (6.43).

Even taken alone, (6.43) is problematic for TF. *Prima facie,* the *actually-possibly* operator means something like *actualizably.* If something is genuinely possible, then it is actualizable. (6.43) shows that if ϕ will hold (at a given time), then ¬ϕ is not actualizable (at that same time) and hence not genuinely possible. (Recall that ATC-possibility, whatever exactly it amounts to, represents genuine possibility by definition.) To avoid this fatalistic conclusion, TF must select one of these options:

(6.51) Deny that *will* amounts to *actually-will*

(6.52) Deny that *actually-possibly* amounts to *actualizably*

(6.53) Deny that actualizability is required for genuine possibility

(6.51) requires TF to explain what exactly *will* means, if not *actually-will.* (6.53) does not seem viable unless interpreted as (6.53). (6.52) may therefore be the best option. It is left to TF to show how *actually-possibly* is relevantly distinct from *actualizably.*[34]

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[33]This definition, which uses *some* rather than *all*, is equivalent to the one given in [Øhrstrøm(2009)], p. 29. This equivalence holds because the TRL is linear and unbounded.

34

An apparent way out for TF is that *actually-possibly* equivocates on *possibly*. That *actually-will* amounts to *not-actually-possibly-not* takes possibility in a merely formal sense. It requires a non-formal, genuinely modal sense of possibility to get from *actually-possible* to *actualizable*. That response is not very convincing. It is the nature of *will* that requires the linearity of the TRL to avoid statements like *Jones will drink coffee and she will not* coming out true when about the same future time. Setting that concern aside and ignoring its source, *will*, suppose the TRL has a fork on which Jones drinks coffee on one branch and she does not on the other. (There may still be other ATC branches that are not TRL-accessible, so the TRL is not identical to the ATC tree.) Then *Jones actually-possibly drinks coffee* and *Jones actually-possibly doesn't drink coffee* are true. Here, *actually-possibly* does not seem merely formal, but indicates that Jones' coffee-drinking and her non-coffee-drinking are *actualizable*.

A second consideration leads to similar worries but does not require interpreting *actually-possibly* as it stands. One might instead drop *actually* and obtain a relevant sense of *possibly*. What enables this move is that *actually* tends to be redundant when it comes to truth value.[35] For example:

(6.54) It is raining.

(6.55) It is actually raining.

(6.56) Actually, it is raining.

Speakers may utter (6.54)–(6.56) under different circumstances, perhaps using *actually* for emphasis or to highlight a literal interpretation. Taken as propositions and focusing on truth value, however, (6.54)–(6.56) are logically equivalent. At least, (6.55) and (6.56) entail (6.54). Analogous results hold for the following:

(6.57) It might be raining.

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[35]See [Brogaard(2008)].

(6.58) It might actually be raining.

(6.59) It actually might be raining.

(6.60) Actually, it might be raining.

There is a problem for TF for those who hold that *actually* is redundant.[36] Combined with (6.43), the eliminability of *actually* resuscitates the argument for logical fatalism. The TRL's formal modality connects temporal operators to modal operators. The redundancy of *actually* shows that those modal operators are not merely formal, but relevant to fatalism. The supposed disparity between temporal operators and relevant modalities is baseless.

ArgLF-Act   Argument for Logical Fatalism using *Actually-Will* (Generalizable)

(ArgLF-Act.1) Either Jones actually-will have coffee or she actually-will not. [premise, an instance of S-FLEM]

(ArgLF-Act.2) Jones actually-will have coffee. [WLOG assumption from (ArgLF-Act.1)]

(ArgLF-Act.3) If Jones actually-will have coffee, that Jones does not have coffee is not actually-possible. [premise[37]]

(ArgLF-Act.4) That Jones does not have coffee is not actually-possible. [by (ArgLF-Act.2) and (ArgLF-Act.3)]

(ArgLF-Act.5) *Actually* is redundant. [premise]

(ArgLF-Act.6) That Jones does not have coffee is not possible. [by (ArgLF-Act.4) and (ArgLF-Act.5)]

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[36]The argument given below, ArgLF-Act, might be reformulated for other notions of *actually*. A full discussion of *actually* and other indexicals like *now* is beyond this project. Note that the arguments against TF given elsewhere in this chapter do not hinge on the redundancy of *actually*.

[37]The discussion above explains how TF yields this result. Of course, the result holds in formal settings, both in the TF systems given in Chapter 8 and in canonical renditions like [Øhrstrøm(2009)].

(ARGLF-ACT.7) That Jones has coffee is necessary. [by (ARGLF-ACT.6), given that ¬possibly:¬ϕ
is equivalent to necessarily:ϕ]

(ARGLF-ACT.8) It is either necessary that Jones has coffee or necessary that she does not,
and whichever is necessary corresponds to what will be. [by (ARGLF-ACT.1),
(ARGLF-ACT.2), and (ARGLF-ACT.7)]

ARGLF-ACT differs substantively from ARGLF only with respect to the two proposals
discussed above. (ARGLF-ACT.3) is unavoidable in true-futurist logics. Whatever the TRL
amounts to, *will* is equivalent to *not-possibly-not* along that relation. That fact is not
problematic in itself. *Possibly* in this case is formally modal, as is the corresponding necessity.
As discussed in Section 2.2, formal modality does not in itself have any bearing on other
senses of modality, like the kinds that might infringe upon contingency. Permissibility, for
instance, is formally modal although what is impermissible or obligatory does not affect
contingency.

(ARGLF-ACT.5) makes the TRL modally threatening to contingency. Contingency in-
volves a particular sort of possibility, all-things-considered (ATC) possibility, that is at least
as stringent as physical possibility. The redundancy of *actually* indicates that the term does
not modify the kind of possibility/necessity involved. Something is actually logically possible
if and only if it is logically possible, actually physically possible if and only if it is physically
possible, and so forth. In the arguments for logical fatalism, possibility is understood to be
of the type relevant to contingency. Since actual-possibility reduces to possibility simpliciter,
actual-possibility is of the same type in this context.

The concern may also be expressed by taking the possibility tree metaphorically as a
forking path. Considering the tree sans TRL, contingencies generate forks in the path such
that each branch might be actualized from their respective temporally antecedent moments.
For example, Jones may elect to follow the coffee-drinking path tomorrow or the coffee-
deprived path. Introducing the TRL fixes the actualized paths. Perhaps the TRL specifies
that the coffee-drinking path is actual and not its counterpart. The TRL is static with

respect to a given model. From the perspective of any given moment in a particular model, the TRL cannot be altered. It is not within Jones' power to follow/actualize the coffee-deprived path, thereby changing the path of the TRL. In general, positing an actual future restricts which futures can be followed/actualized.

One might attempt to counter as follows. The TRL was defined separately from the underlying tree structure representing ATC possibility. A *prima facie* reasonable hypothesis is that ATC possibility is just physical possibility. The TRL does not amount to physical possibility. The former is generally stricter than (is extensionally a proper subset of) the latter and there are notable modal differences between the TRL and physical possibility.[38] Unlike physical possibility and hence ATC possibility, the TRL is not modal in any sense that threatens contingency.

By assumption, the TRL is not intensionally the same thing as physical possibility. It is also agreeable that physical possibility is a good candidate for ATC possibility. The issue, however, is that ARGLF-ACT shows that introducing the TRL makes a difference. The presence of the TRL changes ATC possibility so that, whatever else warrants consideration, the TRL is also relevant. With the TRL around, ATC possibility cannot just be physical possibility. ATC possibility is extensionally identical to the TRL.

ARGLF-ACT concludes that the TRL is genuinely modal. The TRL is not propositional. On the one hand, if not all genuine modalities are propositional (perhaps some are ontological), then the TRL is genuinely modal in a non-propositional sense. Linear genuine modality yields fatalism, in which case TF is fatalistic. On the other hand, if all genuine modalities are propositional, then the TRL is not genuinely modal because the TRL is not propositional. So TF is incoherent—both genuinely modal and not. TF must dismantle ARGLF-ACT or choose between fatalism and absurdity.

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[38]Section 6.4.2 discusses the ways in which the TRL and is not modal.

6.4.2 The Modality of the Thin Red Line

Advocates of TF claim that *will* is not modal, at least not in any way that affects future contingency. There are, however, senses in which *will* is modal and the TRL can be associated with possibility and necessity. Many scholars have criticized TF, claiming that either the TRL is modal in an interesting sense, in which case true futurism leads to fatalism, or TF is baseless. (This is a general version of the grounding problem faced by Molinists.) For instance, Belnap and Green condemned ABsTF and IDxTF:

> Let us note also that each of these forms of actualism about the future involves commitments to facts that do not supervene upon any physical, chemical, biological or psychological states of affairs. The fact, if it is one, that at a given indeterministic moment m there is some history such that it is the one that will occur, is not a state of affairs that supervenes upon what is true of particles, tissues or organisms that exist at m. Those of us who do not postulate a Thin Red Line have no need of such a mysterious realm of fact. (We hope you join us in regarding as spurious a reassurance having the form, "but it's only a logical fact." That's bad logic.) [39]

Section 2.2 enumerates four senses in which something can be modal. These types of modality are grammatical, formal, propositional, and ontological. Section 3.1 notes that *will* is grammatically modal, placing *will* into the same grammatical category as *can* and *should*.

Like *can* and *should*, *will* is representable using modal operators. The TRL can be depicted with an accessibility relation. As such, the TRL is a formal accessibility relation and *will* is formally modal. Being formally modal is not sufficient for having any relation to genuine possibility and necessity.

The dangerous types of modality, the kinds from which TF wants to steer clear because of their relevance to contingency, are propositional and ontological modality. Recall from Section 2.2 that a propositional modality is one that can be captured using a set of principles expressed as propositions. The structure and path of an ontological modality is dictated by some mechanism, physical or otherwise.

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[39][Belnap and Green(1994)], p. 381.

The TRL is not propositionally modal. This fact may be part of Belnap and Green's criticism against TF. The TRL cannot be depicted by a set of laws. There is no rule or formula specifying the TRL's path. Granted, one can learn the TRL's path by inspecting God's beliefs if he has maximally specific, infallible foreknowledge. As emphasized by many commentators, however, God knows what will happen *because* it will happen, not the other way around. God's beliefs about the future do not in any sense cause a particular future to occur. The future does not take God's beliefs as its source, but conversely: that a given future will be is the source of God's beliefs. A rule like

(6.61) An event will occur if and only if God believes that it will occur,

while logically true, is ultimately circular as an explanation of what will occur (although the rule is not circular as an explanation of God's beliefs).

Belnap and Green observed that there is no material state of affairs determining what will be the case in situations of genuine future contingency. Indeed, there is no mechanism of any sort, no principle in the ontological sense, selecting one timeline over another as designating the actual future. So the TRL is not ontologically modal, either. (As noted above, God's beliefs should not be understood as the future's source.) Nevertheless, the TRL follows a specific path, choosing exactly one future over many.

What, then, is the TRL? Øhrstrøm, a foremost adherent of TF in the future contingents literature, asked a series of relevant questions:

> But what makes the specified branch privileged? Is it merely that it represents what is going to happen? Is there anything in the present situation [...] which makes one branch ontologically special as opposed to the other branches?[40]

Fans of TF tend towards ONTF, but this leaves them in a quandary. Either there are principles or mechanisms specifying the true future or there are not. If there are principles or mechanisms specifying the true future, the TRL would be propositionally or ontologically modal, respectively. TF would be unable to maintain the supposed divorce of time from

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[40][Øhrstrøm(2009)], p. 26. Øhrstrøm does not commit to particular answers.

modality. Without any principles or mechanisms to specify what the future is, it is not clear what direct evidence there could be for ONTF. Such ontology an is *ad hoc*, if not outright baseless; unless there is are independent reasons for accepting ONTF. There must be a reason why one future will be and others will not.

One way of endorsing ONTF is through SMTF. If SMTF is the best account of temporal language and if consistency demands that someone who holds SMTF should hold ONTF, then ONTF is a viable position, other factors being equal. This route seems popular in the future contingents literature, but there are obstacles. First, insofar as S-FLEM is intuitively plausible, SMTF must contend with supervaluationism. Second, S-FLEM may not be as unobjectionable as it seems, given the upcoming considerations in Section 7.3.1 and Section 7.3.4. So endorsement for SMTF may not be enough to support TF against other worries.

6.4.3 Grounding Soft Facts

Another point worth mentioning has to do with the ontological modality of the TRL. Ockhamists in the freedom/foreknowledge literature insist that God's beliefs about the future depend on what happens in the future. As Todd pointed out, scholars in that tradition have not successfully analyzed that dependence relation and there is little reason to think that a good analysis is forthcoming.[41] Ockhamists in the freedom/foreknowledge literature tend to classify propositions specifying God's beliefs about the future as soft facts.

For this discussion, it suffices that God believes all and only truths, in which case God's beliefs depend on certain soft facts. This perspective helpfully distinguishes between two separate issues:

(6.62) the dependence of soft facts on contingent futures, and

(6.63) the dependence of some of God's beliefs on present soft facts.

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[41][Todd(2012)]

The first dependence relation is relevant to both logical and theological fatalism, while the second dependence relation pertains only to the latter. Problems arise in both departments.

TF needs to account for the dependence of soft facts on contingent futures. This dependence relation runs against the flow of time. *Ex hypothesi*, soft facts are facts prior to that upon which at least some of their facthood depends. Backwards dependence (with respect to time) seems anomalous, perhaps even inexplicable. TF is challenged to find independent examples of relevantly similar dependence relations. The dependence relation must be explicated so as to make sense of why soft facts depend on some possible futures rather than others. That is, one must account for both why a particular course of events counts as the true future and others do not, and how the dependence relation works.

It is often fine for beliefs to depend on present facts. For example, Jones might believe that she is sipping coffee since she is. Granted, this simple example involves the dependence of Jones' belief on a hard fact, not a soft fact. There is no future content essential to the fact that Jones is sipping coffee. Soft facts, which have essential future content, can neither cause nor justify beliefs in the same way as hard facts. The events specified by corresponding hard facts are or were observable but soft facts lack such a basis. Future events that are the source of soft facts cannot be observed by agents in time. Take a paradigmatic soft fact,

(6.64) Smith correctly asserted that Jones will drink coffee

Assume once again that whether or not Jones drinks coffee is a contingent matter. Jones, who has yet to decide whether or not she will drink coffee, does not know whether or not Smith's assertion is correct. That is, Jones does not know the truth value (using a true-futurist understanding) of:

(6.65) Jones will drink coffee.

Jones can, however, know that

(6.66) Smith asserted that Jones will drink coffee.

(6.64) is equivalent to the conjunction of (6.65) and (6.66). (6.66) is known to be true as a hard fact. The truth value of (6.65), on the other hand, cannot be known in any familiar way until Jones decides once and for all. Since the truth value of (6.64) depends on not only (6.66) but also (6.65), the truth value of (6.64) cannot be known in a familiar way, either. So if God infallibly believes soft facts, he must come about that knowledge in an unfamiliar way. To make sense of God's mysterious foreknowledge acquisition is to answer what Alfred Fredosso and Christopher Kosciuk call the "source question".[42] One such answer, Molinism, is discussed below in Section 6.4.4.

Theistic eternalists do not need to rely on soft facts to account for God's beliefs about the future. Given that all events—past, present, and future—are present to God, he can form beliefs about them similarly to the way that Jones forms beliefs about her own coffee-sipping or other happenings she observes around her. Events corresponding to soft facts are observable by an eternal God.

6.4.4 Molinism and the Grounding Objection

Molinism has its roots in Luis de Molina's work.[43] Molina claims that God has such intimate knowledge of his creation that he knows what would happen in any given circumstance. He even knows how free agents will freely act.

To clarify middle knowledge and its role, it may be helpful to look at other aspects of Molina's view about God's knowledge. Molina separates God's knowledge into three "moments". These stages have a logical or conceptual order, although the stages are not temporally ordered. The first stage is a precondition of the second, which in turn is a precondition of the third.

The first stage of God's knowledge is his natural knowledge, depicted in Figure 6.4.1 (a). He knows all logical and metaphysical truths. He may not know which physical laws he will instantiate, but he knows what the options are and how each would play out. Such vast

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[42][Kosciuk(2010)], p. 4. See also [Freddoso(1988)].
[43][Molina(1988)].

natural knowledge
(a)
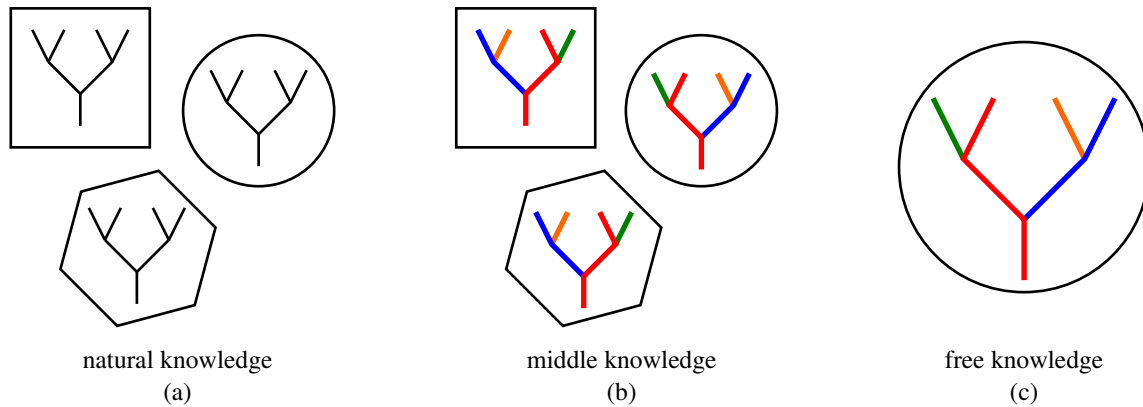
middle knowledge
(b)

free knowledge
(c)

Figure 6.4.1: Molinism: natural, middle, and free knowledge. (a) By God's natural knowledge, he knows all of the possible universes (ATC trees) that he can create; and he knows all of the possible scenarios that can occur in those universes. The various trees are specified by different creation/interaction options. (b) God's middle knowledge yields what will occur in each possible scenario. Middle knowledge specifies the TRL or, equivalently, all soft facts. (c) God knows which possible universe he will create by his free knowledge.

natural knowledge is enough for an infinite intellect to know all possible situations. In terms of a branching temporal system, he comprehends all possible ATC trees in the first stage, but not the TRL. An underlying possibility tree is of course a precondition of the TRL.

The second stage constitutes middle knowledge. Here is Molina's description.

> [I]n virtue of the most profound and inscrutable comprehension of each faculty of free choice, He saw in His own essence what each such faculty would do with its innate freedom were it to be placed in this or that or, indeed, in infinitely many orders of things—even though it would really be able, if it so willed, to do the opposite.[44]

The result of God's middle knowledge is illustrated in Figure 6.4.1 (b). Drawing from Platonism, Molina views creaturely essences as partial or diluted instantiations of the divine essence. Since God understands his own essence perfectly, he is intimately familiar with each of its possible imperfect derivatives. Thus, he knows how free agents will act in any given situation. God, by way of his middle knowledge, knows the path of the TRL in every possible circumstance after the moment of creation.

For instance, suppose that it is contingent whether or not Jones will drink coffee tomor-

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[44][Molina(1988)], p. 168

row. God knows Jones quite well, even better than she knows herself. He knows that she loves coffee and that there will be no circumstances tomorrow to dissuade her from drinking her favorite Guatemalan light roast in the morning. Thus, knowing Jones and the relevant factors of the circumstances, God knows that Jones will freely decide have a cup of coffee, although she is capable of doing otherwise. God can see himself in Jones' shoes, so to speak, to forecast what she will do.

The third stage accounts for God's free knowledge. See Figure 6.4.1 (c). He knows which of all possible universes he will create, which creatures (free and otherwise) will occupy that world, and how he will be involved in that world's happenings. He will create a world in which Jones exists, young Jones would grow to like coffee, a particular Guatemalan light roast will be her favorite, and the circumstances will be ripe for her to choose to enjoy a cup of it tomorrow.

The grounding objection is often considered the most serious threat to Molinism. This criticism is stated in various ways. Steven Cowan, for instance, portrayed the issue as tension between Molinism's commitment to libertarian freedom and true counterfactuals of freedom.[45] The grounding objection in its broadest form applies to all kinds of TF. A general statement of the grounding objection is that TF is either fatalistic or *ad hoc*.

According to Molinists, God's middle knowledge includes his intimate knowledge of free agents. God knows with absolute certainty what Jones will do any circumstance by his middle knowledge and his natural knowledge of possible circumstances in which Jones may find herself. On the one hand, Molinism makes it seem that free agents like Jones are constituted so as to yield absolutely certain output in every circumstance they could possibly be in. Molinism portrays so-called free agents more like deterministic automata than genuinely free agents. On the other hand, one might contend that free agents are not determined. It just so happens that there are soft facts about them. In this case, the criticism is that agents are not completely predictable and thus middle knowledge has no basis.

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[45][Cowan(2003)], p. 93

Notice that the determinism horn of the grounding objection does not require that agents are *physically* determined. Even if agents' characters are relatively independent of the physical world, agents must still be mechanistic on a mental level. There must be causes at work even if those causes are not physical. Middle knowledge is baseless or deteriorates into natural knowledge.

Molinists sometimes try to skirt the issue by rejecting this mechanistic view of free agents. There are facts about the contingent future, soft facts, and middle knowledge just amounts to knowing all of the soft facts about every possible circumstance. Koscuik, for instance, used soft facts as examples to show that there can be a fact of the matter even when contingencies are involved.[46] The problem with this approach is that it presupposes an explanation of soft facts (or, equivalently, the TRL). The general grounding problem for TF, discussed in Sections 6.4.2 and 6.4.3, was seen to be non-trivial. Molinism cannot just take soft facts for granted. Following Freddoso, Koscuik maintained that Molinism serves as an explanation of the source of God's knowledge about soft facts.[47] If Molinism is to avoid the general grounding problem, Molinism should also explain soft facts themselves.

Freddoso and Kosciuk claim that middle knowledge includes, for example, knowledge specifying the indeterministic behavior of subatomic particles.[48] When such a particle exhibits indeterministic behavior, God does not know by his natural knowledge alone what will occur in some circumstances involving the particle. Unlike free agents, there is no person (like Jones) to know intimately enough to specify how an indeterministic particle will behave. Given that the particle's behavior is indeterministic, a Molinist would propose that there is a soft fact of the matter about how the particle will behave. By his middle knowledge, God comes to know the soft fact by understanding the fact's source. That by which the soft fact is true is the same as the source of God's knowledge of that soft fact. In this case, God knows how the particle will behave since he knows it intimately as part of his own essence.

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[46][Kosciuk(2010)], p. 175/+.

[47][Freddoso(1988), Kosciuk(2010)]

[48][Freddoso(1988)], p. 29; [Kosciuk(2010)], pp. 147–148.

Anything about the particle that makes its behavior epistemically determinate would make that behavior physically determined. Thus, the following entail one another:

(6.67) God knows how the particle will behave.

(6.68) There is a fact of the matter about how the particle will behave.

(6.69) The particle's behavior is determined.

TF is challenged to explain how (6.68) could be true while (6.69) is false. That is an instance of the general grounding problem. Since the basis of God's knowledge about soft facts is the source of their truth, an explanation of how soft facts are grounded would solve the Molinist grounding problem. Freddoso and Kosciuk shifted the argument away from agents to indeterministic particles, emphasizing soft facts generally. Their response to the Molinist grounding problem presupposed a solution to the general grounding problem. That move begs the question since the two problems are ultimately the same.

6.4.5   True Futurism and General Eternalism

The preceding discussions of the grounding problem, both for Molinism in particular and for TF generally, pose significant challenges to TF. There is no basis for assigning the TRL and soft facts in terms of the dynamic framework used here. Some advocates of TF seem aware of this fact. Øhrstrøm, for instance, acknowledged the arbitrariness of the TRL.[49]

Ockhamists in the freedom/foreknowledge literature do not appear to share Øhrstrøm's concerns. They have frequently endorsed the notion that soft facts, not to mention the content of God's beliefs, describe something. Even incompatibilists like Pike, Hasker, and Cowan voiced their support for the view that facts about the contingent future will hold, soft facts, although these scholars reject the Ockhamist view that statements characterizing God's beliefs are soft.[50]

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[49][Øhrstrøm(2009)]

[50][Pike(1965), Hasker(2001), Cowan(2003)]. Granted, Pike was a theistic eternalist at the end of the day, so maybe he is not the best example. [Pike(1970)]

According to OnTF, the TRL stems only from a description of what will occur as specified by soft facts. That would be more sensible if the future were real, in which case there would be something for soft facts to describe. This attempt to ground soft facts connects TF to (general) eternalism. Øhrstrøm's careful discussions of TF indicate that he understands the relationship and is wary of its consequences.

If the future is real, it must be so atemporally. What has happened, is happening, and will happen is captured by a set of atemporal facts. There does not seem to be a need for fundamentally temporal facts anymore. So eternalism opens the door to the B-theory. On the B-theory, time loses its dynamic character and is instead more like another spatial dimension. Without time flow and with static representations of all facts, one might wonder about the reality of change under its standard, endurantist portrayal. It requires further argument to demonstrate that the B-theory and especially perdurantism follow from eternalism, but the slope appears slippery.[51] Thus, an eternalist grounding for soft facts and the TRL may lead to thoroughgoing absolutism.

In conclusion, TF is not the best option in the framework used for this analysis. Eternalism seems like the only way for TF to avoid the grounding problem. Eternalism, however, may take TF down a very different path than the one cleared by Øhrstrøm and others.

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[51]The important relationships between eternalism, the B-theory, and perdurantism were discussed by Sider in [Sider(2003)].

Chapter 7

Open Futurism, Supervaluationism, and Open Theism

Open futurism (OF) and related views have been around to heckle TF and eternalism at least since antiquity. This chapter describes OF and company, including supervaluationism and open theism. Section 7.1 gives a synopsis of OF's recent history, explains the core of OF semantics, and describes OF's responses to both logical and theological fatalism. Section 7.2 provides additional details about bivalent OF, non-bivalent OF, supervaluationism, and open theism.

Section 7.3 justifies and enhances OF's position on linguistic use and theoretical analysis thereof. Except for supervaluationism, OF rejects S-FLEM's validity. A host of arguments are given (admittedly favoring bivalent OF) to show that S-FLEM is not as intuitive as it might seem. Section 7.3 concludes with a discussion of predictions and temporal standpoints. Traditional versions of OF do not handle predictions well, but this problem is alleviated with standpoint inheritance. Standpoint inheritance also has a number of other advantages.

7.1 The Basics of Open Futurism

This section introduces OF. Section 7.1.1 provides a brief history emphasizing OF's contemporary philosophical development. Section 7.1.2 contains an important description of OF semantics. There is a common misconception that at least bivalent OF conflates *will* and *will-inevitably*. Granted, those terms are logically equivalent in bivalent OF. That logical equivalence, however, stems from notably different semantics for those terms. Additionally, *will* and *will-inevitably* always differ in truth value in non-bivalent OF and systems that incorporate temporal standpoints, bivalent or not.

Section 7.1.3 describes epistemological and ontological commitments associated with OF. If either epistemological or ontological indeterminism hold, corresponding renditions of several other views follow. In particular, OF is closely related to presentism (or the growing-block theory), time flow, the A-theory, and endurantism.

A discussion of OF's response to fatalism is given in Section 7.1.4. Regarding logical fatalism, OF avoids fatalism by rejecting the validity of S-FLEM. Open theists hold that if God has comprehensive foreknowledge, then S-FLEM is valid and fatalism holds. One may dismantle arguments for theological fatalism by rejecting that God has comprehensive foreknowledge.

7.1.1 History

OF is a set of views characterized as Heraclitean, Aristotelian, or Peircean. Storrs McCall used "Heraclitean" to describe the thesis that time flows,[1] a notion that is required by OF. Time flow is a popular notion in the future contingents literature and is hardly limited to OF. Prior quite passionately endorsed the proposal, contra Jack Smart.[2] A more recent debate on the issue occurs between McCall and Graham Nerlich; and Theodore Sider provides additional illuminating discussion.[3] Time flow was discussed in Section 2.5.

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[1][McCall(1998)]

[2][Prior(1996), Smart(1949)]

[3][McCall(1994), Nerlich(1998), McCall(1998), Sider(2003)]

Aristotle considered logical fatalism in *On Interpretation* 9. Historically, many scholars—among them, notable schoolboys like Lavenham[4]—thought that Aristotle proposed rejecting S-FLEM. The standard contemporary view agrees that Aristotle rejected S-FLEM although this interpretation is not without exception.[5]

Prior endorsed different formulations of OF at various points in his career. On the non-bivalent account, propositions about the contingent future are neither true nor false. In his earlier writings, Prior supported a non-bivalent OF he associated with Peter de Rivo's view.[6] The position is not limited to Prior and was taken up by Geach other others, as well.[7] Three-valued temporal logics continue to enjoy further developments.[8]

Prior endorsed a bivalent variety of OF in his later work.[9] Prior characterized this view as Peircean. Bivalent OF accommodates some intuitively plausible statements, like LEM and bivalence, while sacrificing *will/not* commutativity.

Richmond Thomason proposed that Bas van Fraassen's supervaluationist semantics yields interesting results for temporal logics.[10] Supervaluationism falls somewhere between TF and OF. Like TF, supervaluationism acknowledges S-FLEM's validity and uses TRLs in its semantics, at least traditionally. Like OF, supervaluationism rejects strong future bivalence, that either will:ϕ is true or will:$\neg\phi$ is true. In other words, supervaluationism does not identify a particular future as the true future.

Some theistic views reminiscent of OF fall under the heading of open theism. Open theism is the view that God does not have comprehensive foreknowledge because freedom and foreknowledge are incompatible. One type of open theism, advocated by William Hasker and others, accommodates TF but not freedom/foreknowledge compatibility.[11] A second variety of open theism stems from OF. Insofar as there are no facts about what the contingent

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[4][Øhrstrøm(1983), Tuggy(1999)]

[5]See [Øhrstrøm(1981)] for commentary.

[6]Prior characterized his view as such in [Prior(1967)], p. 128. See also [Prior(1953)].

[7][Geach(1977)]

[8]For instance, [Akama et al.(2007)Akama, Nagata, and Yamada, Akama et al.(2008)Akama, Nagata, and Yamada]

[9][Prior(1967)]

[10][Thomason(1970)]

[11][Hasker(2001)]

future holds, God cannot have comprehensive foreknowledge simply because there is no such knowledge to be had. A number of scholars have recently advocated this combination of open futurism with theism, including Benjamin Arbour, Gregory Boyd, Alan Rhoda, and Dale Tuggy.[12]

7.1.2   Wait and See Semantics

The semantics of OF can be somewhat elusive. OF provides an interesting case in which formal systems may not adequately characterize the philosophical views they are supposed to represent. That is, a full understanding of the semantics is not evident from a cursory inspection of traditional OF logics.

OF uses a *wait and see* approach to evaluate statements about the future. This analysis applies to statements like the following:

(7.1) Jones will have coffee.

(7.2) Smith guesses that Jones will have coffee.

(7.3) Smith predicts that Jones will have coffee.

and so forth.[13] The general rule is that statements about the future have at least one foot in the future, so to speak. OF need not differ from TF in that statements about the future depend on how the future turns out.

OF maintains that where future contingents are involved, there is no way to identify a specific possible future to evaluate. One might evaluate all possible futures, but none of those possibilities has precedence over the others. This notion is reflected by the fact that OF does not introduce a mechanism like the TRL, a device used to specify a privileged future. The ATC tree is as far as the temporal relation goes. So when it comes to future contingents, what will happen is indeterminate until the contingencies are resolved. That

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[12][Arbour(2013), Boyd(2003), Rhoda et al.(2006)Rhoda, Boyd, and Belt, Rhoda(2003), Tuggy(2007)]

[13]There may be a difference between guesses and predictions, as discussed by Lucas in [Lucas(1989)], p. 65. Such differences do not bear on this discussion.
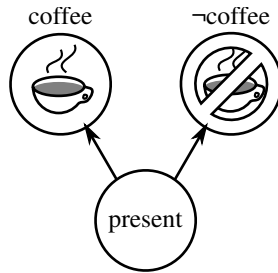
Figure 7.1.1: Open futurist semantics: Jones' coffee-drinking. OF does not specify a privileged future. So to determine what will happen from the present moment, the best one can do is check all possible futures. From the standpoint of the present node, it is neither the case that Jones will drink coffee nor that she will not. One must wait and see how the contingency is resolved.

resolution occurs when the standpoint moves to a later node at which one of the previously contingent options can be uniquely designated. Visually, the standpoint must be past the fork to determine what will occur. Figure 7.1.1 illustrates and describes this aspect of OF semantics in terms of Jones' contingent coffee-drinking.

Even if there is no particular future to evaluate, there are special propositions about the future that do have a truth value. There are two ways to view such statements. The first perspective emphasizes the fact that *will* follows from *will-inevitably.* If there is a truth maker for the future statement, then the statement is true. For example, if the laws of physics determine that it will be sunny tomorrow, then *it will be sunny tomorrow* is true. When an event is inevitable or ATC-necessary, the event will occur. There is no need to wait and see if it will be sunny because tomorrow's sunniness is not contingent.

A second way to view the matter is to wait and see—check the future. According to OF, there is no such thing as *the* future when contingency is at play, so one must check all possible futures. Even if there is not a particular designated future, there may be certain statements that turn out true no matter which possible future comes about. Thus, *will* appears to be treated once again as *will-inevitably*, although there are some important differences, mentioned shortly.

These two ways of understanding the special case in which there are true statements about the future are illuminating. The first proposal, which focuses on present truth makers

rather than what will occur, appears to conflict with the notion that evaluating future statements involves looking at the future. What the first proposal characterizes is not *will* in the general case, but something like *will-inevitably*. Nevertheless, if something will inevitably be the case, then it will be the case: *will-inevitably* entails plain *will*. The reason for the entailment is characterized by the second proposal. No matter which future turns up, it will bear witness to that which is inevitable. ATC possibility trees are effectively linear with respect to inevitable propositions. It is as if a particular future were designated (by present truth makers); but when contingents are involved not all aspects of the future are determinate, only those that are not contingent. For instance, suppose that Jones' coffee-drinking is contingent but the sun will inevitably rise tomorrow. Considering only that the sun will rise, the future is linear. The ATC tree forks when Jones' coffee-drinking enters the scene, but Jones' choice does not affect the sun's behavior.

In simple cases, such as when p is a literal, will:p holds if and only if will-inevitably:p does, making it look as if OF maintains that *will* and *will-inevitably* amount to the same thing. In bivalent branching time systems that do not account for temporal standpoints, *will* and *will-inevitably* always have the same truth value. Despite some appearances, even bivalent OF does not confuse *will* and *will-inevitably*. The terms are logically equivalent yet they do not have the same meaning. *Will-inevitably* focuses on present causes and *will* employs *wait and see* semantics. In non-bivalent systems and systems that account for temporal standpoints, *will* and *will-inevitably* differ in truth value. The distinction is brought out by the presence of future contingents.

Will-inevitably yields truth based on whether or not the future is present in its causes, so to speak. *Will*, on the other hand, involves inspecting the future by waiting to see what happens. Insofar as what will be is now indeterminable, corresponding statements involving *will* lack a determinate truth value under non-bivalent OF. Statements involving *will-inevitably* are just false. Bivalence and the lack thereof are discussed further in Sections 7.2.1 and 7.2.2, respectively.

Will not only requires inspecting the future, but also exhibits standpoint inheritance with similar temporal operators. *Will-inevitably* involves evaluating whether or not an event is present in its causes; that is, determined. When temporal standpoints are properly taken into account, the contrast between *will* and *will-inevitably* yields a difference in truth value for important statements with temporal operators. The significance of temporal standpoints for OF is discussed more in Section 7.3.3 through Section 7.3.5.

7.1.3 Epistemology and Ontology

Most scholars agree that OF and supervaluationism are compelling when interpreted epistemically. The future is not observable, so the only way to tell what will occur is to search for existing evidence. Such evidence is available only when the future is present in its causes. Those causes are observable (in principle) although the future is never is. Thus, statements about the future are only justifiable when their present causes make them inevitable (or likely).

Many adherents of OF understand their view ontologically, as well. This is not to say that they are indeterminists—they may or may not be—but they hold that OF is the best way to represent an indeterministic system. Indeterminism requires several related tenets, according to OF: presentism (or the growing-block theory), time flow, the A-theory, and perhaps also endurantism. OF views any designation of the future as an infringement on genuine contingency. No particular future will occur, no particular future or future objects exist atemporally or otherwise, and there is no timeline already spread out like a tapestry.

All true futurists hold that a particular future will occur, and OF rejects that view. Some true futurists, like Øhrstrøm and Trenton Merricks, have agreed with OF up to that point.[14] Eternalists, perdurantists, and B-theorists have less in common with OF. This disparity has led to rather separate approaches to future contingents and related issues, making dialog challenging on account of the lack of the common ground.

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[14][Øhrstrøm(1983), Merricks(2009)]

7.1.4   Against Fatalism

Given that the only cases in which simple propositions about the future are true are those scenarios in which *will* meets *will-inevitably*, instances of S-FLEM yield inevitability. Recall Jones' future-contingent coffee-drinking.

> (7.4) will:*coffee* ∨ will:¬*coffee*

is true if and only if

> (7.5) will-inevitably:*coffee* ∨ will-inevitably:¬*coffee*

holds. Depending on which disjunct of (7.5) holds, it is either unavoidable that Jones will drink coffee or unavoidable that she will not. Thus, it is not surprising that OF focuses its attention on S-FLEM to dismantle arguments for logical fatalism. In terms of the version of the argument given in this essay, OF avoids logical fatalism by rejecting (ArgLF.1) in ArgLF. According to OF, S-FLEM is not valid, and in particular S-FLEM does not hold for future contingents, so ArgLF is unsound.

OF endorses incompatibilism when it comes to theological fatalism. That is, OF maintains that libertarian freedom is incompatible with infallible, maximally specific foreknowledge. Such foreknowledge yields instances of S-FLEM, as shown in ArgThF. By ArgLF, S-FLEM is incompatible with contingency which, in turn, is necessary for libertarian freedom.

Detractors tend to interpret OF's incompatibility thesis as an unwarranted restriction of God's omniscience, if not an outright assault on his divinity.[15] An omniscient God, according to them, knows every detail about what the future holds. OF—in this case, open theism— does not propose a limitation or attack on omniscience. Omniscience is just believing all and only truths. Opponents who think that, in order for God to be properly omniscient, he must know everything about the future just beg the question against OF by assuming that there is always something to know. If it is neither true that Jones will have coffee nor that

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[15][Ware(2000)] is a case in point.

she will not, then to believe one way or the other is to believe that which is not true. An omniscient being cannot believe that which is not true. Open theism is discussed further in Section 7.2.4.

7.2   Varieties of Open Futurism

Several types of OF and related views have been mentioned throughout this essay: bivalent OF, non-bivalent OF, supervaluationism, and open theism. These positions are discussed in more detail in this section. Bivalent OF retains classical validities like LEM at the cost of *will/not* commutativity. Non-bivalent OF respects *will/not* commutativity, but not LEM. Supervaluationism manages to keep *will/not* commutativity, LEM, and even S-FLEM without designating a privileged future. However, supervaluationism compromises bivalence and symmetry between object- and meta- language. This section concludes with a discussion of open theism, its motivations and variations.

7.2.1   Bivalent Open Futurism

The simplest OF system is bivalent (BIVOF). That is, every statement is either true or false in BIVOF. Prior endorsed this approach, which he called Peircean, in his later work.[16] Familiar validities are respected by BIVOF, such as LEM and non-contradiction. The system and its characteristics are described more formally in Section 8.2.1. The price of this relatively simple approach which keeps familiar results is that *will* and *will-inevitably* have the same truth conditions in traditional systems that do not account for standpoints.

Notice that *will-inevitably* does not commute with *not*. That holds for any contemporary temporal logic, not just BIVOF. The following are not equivalent:

(7.6) It is not the case that Jones will inevitably drink coffee.

$\neg$(will-inevitably:*coffee*)

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[16][Prior(1967)]

(7.7) Jones will inevitably not drink coffee. (will-inevitably:¬*coffee*)

Perhaps Jones' future coffee-drinking is contingent, as in Figure 7.1.1. In this case, (7.6) is true while (7.7) is false, demonstrating the inequivalence. Since *will* and *will-inevitably* have the same truth conditions in BivOF,

(7.8) It is not the case that Jones will drink coffee

(7.9) Jones will not drink coffee

are not equivalent in BivOF. In other words, *will/not* commutativity is invalid in BivOF. If Jones' coffee-drinking is contingent, then (7.8) is true while (7.9) is false.

M-FLEM and W-FLEM are valid in BivOF. Thus, statements like the following hold:

(7.10) It either is or is not the case that Jones will drink coffee. (M-FLEM)

(7.11) Jones will either drink coffee or not drink coffee. (W-FLEM)

S-FLEM, however, is not valid. The following may not hold:

(7.12) Jones will drink coffee or she will not.

Likewise, strong future bivalence does not hold. Both of the following may be false:

(7.13) Jones will drink coffee.

(7.14) Jones will not drink coffee.

Since BivOF denies the validity of *will/not* commutativity and S-FLEM, supporters of BivOF may try to dismantle intuitions favoring those rules. Such arguments are inspected in Section 7.3.1 and Section 7.3.4.

7.2.2   Non-Bivalent Open Futurism

A slightly more complicated OF view allows partial truth functions or, similarly, a third truth value. Prior endorsed this kind of position in some of his earlier writings and others have recently furthered his developments.[17] That said, Prior later came to reject this approach

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[17][Prior(1953), Akama et al.(2007)Akama, Nagata, and Yamada, Akama et al.(2008)Akama, Nagata, and Yamada]

in favor of BivOF.[18] Even if non-bivalent open futurism (NBivOF) is ultimately not worth it, the view is interesting and exhibits potential for additional development.

Recall that BivOF does not accommodate *will/not* commutativity. If this is too much to bear, it is possible to obtain *will/not* commutativity at the cost of LEM and bivalence. In NBivOF, *will* is true if and only if *will-inevitably* is, and *not-will* is true if and only if *will-inevitably-not* is true.[19] Thus, *will-not* and *not-will* have the same truth conditions (as long as corresponding statements are about the same time). In cases of future-contingency, both *will* and *not-will* have no truth value or are assigned a third value representing indeterminacy.

Will and *will-inevitably* turn out to have different truth conditions. The distinction is apparent when future contingents come into play. Suppose once again that Jones' future coffee-drinking is contingent. Then the following are plain false:

(7.15) Jones will inevitably drink coffee.

(7.16) Jones will inevitably not drink coffee.

The negations of (7.15) and (7.16) are true. Statements corresponding to (7.15) and (7.16) that involve *will* instead of *will-inevitably* have no truth value. In particular, the following have no truth value.

(7.17) Jones will drink coffee.

(7.18) Jones will not drink coffee.

(7.19) It is not the case that Jones will drink coffee.

(7.20) It is not the case that Jones will not drink coffee.

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[18][Prior(1967)]

[19]To handle non-metric operators, it is necessary to stipulate that *not-will* can only be true if *will-inevitably* does not hold. This requirement avoids a truth glut in situations like one in which Jones will inevitably drink coffee tomorrow and she will inevitably not drink coffee two days hence. The truth conditions are given formally in Section 8.2.5. As long as corresponding instances of *not-will* and *will-not* are about the same time, *will-not* commutativity holds.

As such, NBɪvOF respects the distinction between *will* and *will-inevitably* although one might accuse BɪvOF of ignoring that difference. Some thinkers, like Tuggy, proposed that separating *will* and *will-inevitably* is important enough to rule out BɪvOF in favor of NBɪvOF.[20] Standpoint inheritance, however, ensures that *will* and *will-inevitably* have different truth conditions in BɪvOF as well as NBɪvOF.

7.2.3 Supervaluationism

Supervaluationism is a type of system developed by van Fraassen.[21] Thomason proposed a supervaluationist temporal logic (Sᴜᴘ) which continues to enjoy discussion.[22] Sᴜᴘ is an attempt to capture the virtues of both TF and OF.

When considering a theory like Sᴜᴘ, one must be careful to differentiate between operators in the object language and their metatheoretic correlates. Material implication differs from semantic consequence, LEM differs from bivalence, and so forth.

Here is a rough description of how Sᴜᴘ semantics works. Figure 7.2.1 illustrates the semantics using the example of Jones' coffee-drinking. Sᴜᴘ differentiates between two kinds of truth functions. The first type of truth function pertains to incidental truth in particular models, here called "inner models", which are IᴅxTF models. This variety of truth is the familiar kind defined for semantic IᴅxTF, a system described in Section 6.2.1.

The second and primary type of truth function is defined using the first. To help with clarity, ᴛʀᴜᴇ/ꜰᴀʟsᴇ is used for truth determined by the second function and true/false for the first. There is an equivalence class of inner models corresponding to a given branching structure of moments and a particular assignment of true/false to propositional literals. Members of the equivalence class have the same ATC structure and differ only in TRL assignment. The equivalence classes may be called "outer models". The second truth function maps a sentence to ᴛʀᴜᴇ/ꜰᴀʟsᴇ if and only if it is corrospondingly true/false in every inner

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[20][Tuggy(2007)], pp. 35/+.
[21][van Fraassen(1968)]
[22][Thomason(1970), MacFarlane(2003), MacFarlane(2008)]

outer model
will:coffee or will:¬coffee

inner models

will:coffee
will:coffee or will:¬coffee

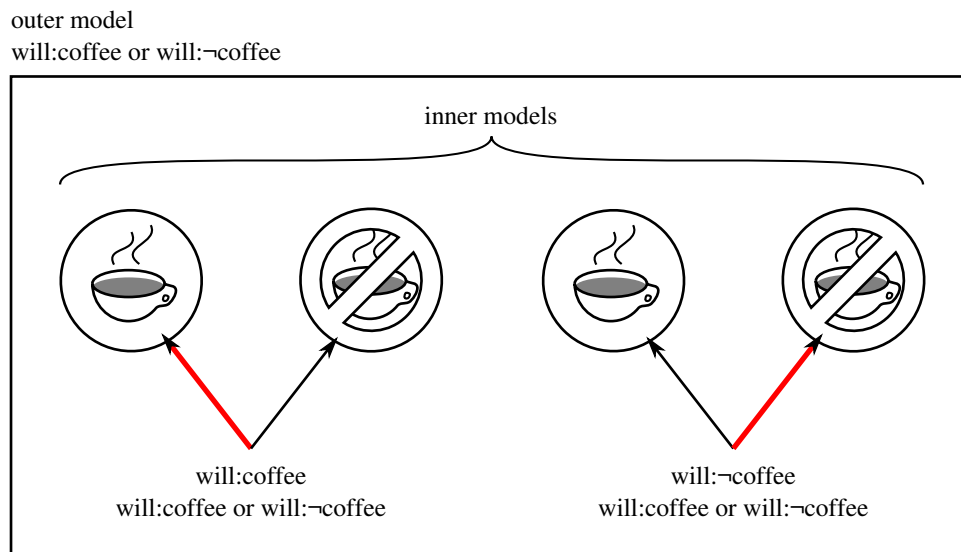will:¬coffee
will:coffee or will:¬coffee

Figure 7.2.1: Supervaluationism: Jones' coffee-drinking (indexical true futurist basis). Both inner models respect S-FLEM, so S-FLEM holds in the outer model. The inner models differ on whether Jones will drink coffee or she will not, so no particular course of action is assigned to Jones in the outer model—strong future bivalence fails.

model; otherwise, the sentence is neither TRUE nor FALSE. Validity is defined in the typical way using TRUTH/FALSENESS.

S-FLEM is valid under SUP. On Thomason's account, inner models amount to IDxTF models. S-FLEM is valid in IDxTF and thus SUP, too. S-FLEM's metatheoric comrade, strong future bivalence, fails in SUP. If the inner models in question involve a future contingent, if they are non-linear, or if there is more than one element in the equivalence class (all three of those conditions amount to the same thing), then there is a ϕ such that will:ϕ holds in some inner models while will:$\neg\phi$ holds in others. Due to the stipulation that TRUTH/FALSENESS requires truth/falseness for every member of the equivalence class, neither will:ϕ nor will:$\neg\phi$ is TRUE.

While SUP is designed to combine the advantages of both TF and OF, one may object that some of their flaws are also inherited. TF's allies may object that the primary type of truth, the second type described above, generally fails to pick out true futures. That is, strong future bivalence does not hold in SUP. So although S-FLEM is valid under SUP, an important aspect of TF is left by the wayside. TF may thus view SUP as ultimately a

ternary kind of OF that just manages to include S-FLEM.

While Sup could use TF arguments against fatalism, other routes are available. One option is to block the elimination of S-FLEM disjuncts, the move from (ArgLF.1) to (ArgLF.2). After all, S-FLEM is valid but when future contingents are involved, neither disjunct is true.

OF fans may not be happy with Sup, at least given Thomason's semantics. Underlying the second type of truth is the first type, applied to inner models of IdxTF. OF may object to the fact that the TRL still plays a role, for the TRL is questionable in its own right. Someone with OF inclinations who finds Sup attractive might find another way to generate a Sup semantics. Here is one suggestion. From the perspective of OF, Sup emphasizes that which shall be resolved. The past and present are resolved from the present standpoint. The contingent future is unresolved. Sup looks at future standpoints to see what will later be resolved. A Sup semantics can be given as follows:

(7.21) A proposition is true just in case it will inevitably be resolved as true, sooner or later.

(7.22) A proposition is false just in case it will inevitably be resolved as false, sooner or later.

Future-contingent propositions will inevitably be resolved, but not the same way in all possible futures. In one possible future, it will be resolved that Jones drinks coffee tomorrow; in another, she does not. Hence, Sup assigns no truth value to future-contingents. Bivalence fails. No matter how things turn out, Jones coffee-drinking will be resolved one way or another. LEM is valid, as is *will/not* commutativity, S-FLEM, M-FLEM, and W-FLEM.

Standpoint inheritance allows Sup to be formalized using this notion of resolution from future standpoints. In OF, the temporal relation, ATC accessibility, is tree-like. ATC accessibility is backwards linear although it is not forwards linear. From a given temporal standpoint, propositions with temporal operators relegating the context of evaluation to the

standpoint's past involve the linear part of ATC accessibility from the standpoint. This linear portion represents that which is resolved. In SUP, TRUTH/FASENESS may be defined in terms of what will inevitably hold from future standpoints. For instance, it will inevitably be the case that either Jones was going to have coffee or she was not. The matter may be put in terms of predictions. Given that Smith predicted that Jones will have coffee and Brown predicted that she will not, it will inevitably be the case that either Smith or Brown was correct. This method uses temporal standpoints and the backwards linearity of ATC trees to capture resolution, eliminating the need for a TRL. The technique is implemented formally in Section 8.3.5.

SUP introduces new concerns, as well. One worry pertains not to the fact that SUP is ternary, but rather that SUP accepts certain theses at the object level while rejecting their metatheoretic correlates. Not all non-classical systems take this disparate approach. For example, intuitionists hold that the non-classical interpretation of operators extends to the metalanguage. In the case of SUP, the division between theses on the object and meta- levels may lead to an absurdity when combined with the thesis that SUP adequately represents certain portions of natural language.

In SUP, LEM is valid yet bivalence fails. S-FLEM is valid although strong future bivalence does not hold. SUP is supposed to do good job of representing certain aspects of natural language, like standard operators and temporal language. Perhaps SUP succeeds in this goal—at least that may be assumed for the sake of argument. So the validity of LEM and S-FLEM reflect actual usage. To keep this argument simple, consider just LEM. In SUP, it is generally (for any model of the system and any values assigned to the parameters of the truth function) accepted that:

(7.23) For any proposition ϕ, $\ulcorner \phi \vee \neg\phi \urcorner$ is true.

At the same time, the following is not accepted:

(7.24) For any proposition ϕ, either $\ulcorner \phi \urcorner$ is true or $\ulcorner \phi \urcorner$ is false.

Metatheory is a special part of natural language, and it was supposed that SUP does a good job of representing natural language. Granting that ⌜ϕ⌝ and ⌜$\neg\phi$⌝ can be replaced by any corresponding specific propositions from natural language and that *or* may be interchanged with ⌜$\vee$⌝ in natural-to-object language mappings, SUP appears to come across an absurdity.

Despite these concerns, SUP temporal logic remains an interesting combination of TF and OF, an attempt to retain S-FLEM without fixing a particular true future. As such, it has significant appeal given that the view accounts for some basic linguistic intuitions.

7.2.4 Open Theism

Many theists are under the impression that arguments for theological fatalism like ARGThF are somehow anti-theistic.[23] ARGThF does not aim to show that God does not exist, that he is not omniscient, or some other obviously anti-theistic conclusion. It is therefore important to see what bearing theological fatalism really does have upon theism. Many reputable theists hold that some argument for theological fatalism successfully demonstrates that infallible, comprehensive foreknowledge is incompatible with human freedom.

There are many arguments for theological fatalism. Practically every student of the subject has a favorite rendition. Some of these arguments, like the version presented here, associate theological fatalism with logical fatalism. Others take theological fatalism to be a separate problem, perhaps distinguished by the accidental necessity of God's past beliefs or his essential omniscience.[24] One way or another, those who find the argument convincing maintain that the following are incompatible:

(7.25) Infallible, comprehensive foreknowledge (necessarily certain knowledge of the future's every detail)

(7.26) Libertarian freedom (the sort that involves the ability to do otherwise)

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[23]For instance, [Plantinga(1975)]
[24]For instance, [Hasker(2001), Pike(1965)]

Some theists reject libertarian freedom. Traditional providentialists like Luther and Calvin held that it is outright heretical, symptomatic of misunderstanding the divine in important ways, to maintain that agents other than God are free in the libertarian sense.[25] Regarding theological fatalism, if comprehensive foreknowledge is incompatible with libertarian freedom, then providence certainly is. Thus, providentialists have nothing to gain (regarding theological fatalism) by rejecting the foreknowledge end of the incompatibility.

Some theists deny that God has comprehensive foreknowledge, foreknowledge of the future's every detail. This position open theism (OT). OT may be seen as the theistic analog to OF. According to OT, God does not know every detail about the future. That he does not have such knowledge is not due to a lack of omniscience, but rather because it would be absurd for him to have it. The nature of this absurdity depends on just how one understands OT.

OF combined with theism yields OT, but OT does not entail OF. Scholars like Hasker, Lucas, Richard Swinburne, and Peter van Inwagen separate logical and theological fatalism.[26] Hasker stated the matter boldly:

> The argument for logical fatalism claims, in effect, that *all* propositions that are true at a given time are accidentally necessary at that time—a claim that is quite implausible and is fairly easily refuted.[27]

It is a shame to dismiss logical fatalism so quickly, but at least it enables one to spend time addressing other important issues.

OT is just the view that God does not have comprehensive foreknowledge. For instance, if Jones is free to drink coffee tomorrow, then:

(7.27) God does not believe that Jones will drink coffee tomorrow, and God does not believe that Jones will not drink coffee.

For Hasker and company, one of the following is still true.[28]

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[25][Luther(1525)]

[26][Hasker(2001), Lucas(1970), Swinburne(1994), van Inwagen(2008)].

[27][Hasker(2001)], p. 100

[28]See esp. [Hasker(1989), Hasker(2001)].

(7.28) Jones will drink coffee.

(7.29) Jones will not drink coffee.

Thus, there are true propositions that God does not know. He could know (7.28) or (7.29), but he elects to not know either or them, as Lucas indicated.[29] God might thus refrain because he cannot know either of the following:

(7.30) Jones will *freely* drink coffee.

(7.31) Jones will *freely* not drink coffee.

On this view, there are facts that God cannot know since knowing them yields inconsistency. One of (7.28) and (7.29) is true, as is the corresponding one of (7.30) and (7.31); but (7.30) and (7.31) have some peculiar characteristics. If God were to believe one of those propositions, that proposition would be false because freedom and divine foreknowledge are incompatible. Since God knows that Jones is free, he cannot believe either (7.28) or (7.29), for otherwise he would believe (7.30) or (7.31), which is absurd. As a result, for God to have comprehensive foreknowledge while permitting human freedom is akin to creating a rock so heavy that he cannot lift it.

Some friends of OT, like Arbour, Boyd, Rhoda, and Tuggy, arrived at OT through OF.[30] This is not to say that these thinkers advocated the same notion of OF. Boyd, for instance, recommended BivOF while Tuggy endorsed NBivOF.[31] Scholars in the future contingents literature tend to associate logical and theological fatalism, but this approach has been less popular with the freedom/foreknowledge crowd. Nevertheless, recent work by thinkers like those just mentioned is likely to strengthen this position in the freedom/foreknowledge literature.

On this type of OT, there are no true propositions that God does not believe. Thus, God knows all and only true propositions, period. There is no allegedly *ad hoc* caveat that

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[29][Lucas(1970), Lucas(1989)]. For a reply, see [Kenny(1979)].
[30][Arbour(2013), Boyd(2010), Rhoda et al.(2006)Rhoda, Boyd, and Belt, Tuggy(2007)]
[31][Boyd(2003)], p. 5; [Tuggy(2007)], §5

God knows all and only those true propositions that he can consistently know, as Hasker claimed.[32] Even if Hasker's definition is not *ad hoc*, it still generates a significant class of propositions about the future that God cannot know. Such propositions include soft facts involving free actions, and perhaps soft facts more generally. According to OF, however, there are no soft facts. If Jones' actions are genuinely free or if there are future contingents, then there is no particular outcome that is designated beforehand, no fact of the matter, for anyone to know. Neither (7.28) nor (7.29) is true. God only knows truths, so he knows neither (7.28) nor (7.29)—not because there are truths that he does not know, but because there are no such facts to be known.

Boyd proposed an interesting rendition of OT which he called "neo-Molinism". Roughly, Boyd's position combines BivOF with Molinism. Traditional Molinists hold that God knows what would happen in every possible circumstance. In situations involving future contingency, like Jones' coffee-drinking, there is no fact to know about what Jones *would* do in one scenario or another. Rather, Jones *might* drink coffee and she *might* not. Therefore, according to Boyd, God knows what Jones might do instead of what she would do, for God knows all and only truths.

As far as theism is concerned, the approach taken in this essay is closer to that of Boyd, Tuggy, and other advocates of OT who base their view on OF. TF is untenable independently of theism. Thus, the only viable theistic position is an OT that accommodates OF (or Sup). Such OT does not infringe upon God's omniscience, but merely follows from his infallibility given OF.

7.3   Open Futurism and Language

Linguistically, the primary concern with OF is that it does not accommodate S-FLEM's validity. BivOF rejects the validity of *will/not* commutativity, as well. Section 6.3.1 argued that S-FLEM ultimately stems from LEM. Section 7.3.1 aims to show that S-FLEM is not as

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[32]See [Hasker(1989)] for this definition and [Tuggy(2007)] for criticisms.

intuitively plausible as it may seem. There are also theoretical reasons for rejecting *will/not* commutativity and S-FLEM.

OF has difficulty accounting for predictions and guesses, not to mention wait-and-see semantics more broadly. These problems are described in Section 7.3.2. OF has not received much scholarly criticism about its handling of predictions, presumably because OF's primary contender, TF, experiences similar difficulties. It was seen in Section 6.3.4 that TF can address its problems using standpoint inheritance. OF can do likewise, as shown in Section 7.3.3. Standpoint inheritance grants other benefits to OF, too. A notable advantage is that standpoint inheritance shows how a powerful type argument for S-FLEM fails, instead supporting a weaker principle that is compatible with OF. Section 7.3.5 adds some clarification of how standpoint inheritance works (and does not work) with God's beliefs.

7.3.1   Against S-FLEM's Plausibility

Sup aside, OF rejects S-FLEM's validity. The principle is not easy to debunk given its *prima facie* obviousness. One can show that S-FLEM is not quite as evident as it at first seems, but doing so is not enough to demonstrate that S-FLEM should be rejected. Such arguments may be combined with others showing that S-FLEM, under TF or Sup, involves unsavory commitments. This section introduces arguments of the first type, aiming to jostle S-FLEM's foundation. Four arguments are discussed, three descriptive/explanatory and one normative. Note that these arguments tend to favor BivOF. A stronger argument against S-FLEM's validity uses temporal standpoints and is presented in Section 7.3.4.

The first argument is an attempt to explain the apparent validity of S-FLEM in terms that do not ultimately indicate S-FLEM's validity. The argument points out that most English speakers may confuse S-FLEM with M-FLEM (or W-FLEM, which is equivalent to M-FLEM in most systems) on the ground that *will/not* commutativity stems from error. Consider and example.

(7.32)   The incumbent will win the election.

(7.33) $w :=$ *The incumbent wins the election.*

(7.34) will:w

Someone might reject (7.32) with:

(7.35) No, the incumbent might lose.

(7.36) possibly:$\neg w$

Possibility is understood as ATC possibility. Conversely, (7.32) might be used to reject (7.35). This example supports the BivOF thesis that will:ϕ and possibly:$\neg\phi$ are logical opposites. By associating temporal operators with possibility and necessity, the example directly challenges TF.

The example taken alone is not enough to establish that *will/not* commutativity fails. A brief tangent is in order to get the latter result. The thesis that possibly:$\neg\phi$ is opposed to will:ϕ does not exclude the proposal that will:ϕ and will:$\neg\phi$ are also opposed. It may be that will:$\neg\phi$ and possibly:$\neg\phi$ are equivalent. Given some rules of classical logic, this last equivalence amounts to the equivalence of will:ϕ and possibly:ϕ, again in terms of ATC possibility. In the nascent stages of temporal logic's development, temporal logic was developed from modal logic in a way that related *will* to *possibly*. Scholars considered the proposal that, in branching or similar systems, will:ϕ holds just in case there is some future in which ϕ is true; that is, will:ϕ is analogous to possibly:ϕ.

When the temporal relation is tree-like, as in OF (but not TF since the temporal relation, the TRL, is linear), will:ϕ cannot be equivalent to possibly:ϕ To see why, consider any future contingent, such as the now-familiar coffee-drinking of Jones. Jones might drink coffee tomorrow and she might not. If will:ϕ holds whenever ϕ is true in some possible future, then Jones will drink coffee and she will not. All parties agree that this result is unacceptable. Whether will:ϕ and will:$\neg\phi$ are opposites, as in TF, or maybe will:ϕ is opposed to possibly:$\neg\phi$, as in OF; will:$\neg\phi$ is not logically equivalent to possibly:$\neg\phi$ if the temporal relation is tree-like.

So BIVOF maintains that possibly:¬ϕ, not will:¬ϕ, is a logical opposite of will:ϕ. To rebut, TF may claim that the speaker of (7.35) engages in a parlor trick by negating (7.32) with (7.35). (7.35) serves only to make the possibility of losing salient. Many English speakers, at least those untrained in philosophy, tend to confuse a possibility's psychological salience with high probability or actual occurrence.

Here is an example illustrating TF's counterpoint. Jones and Smith have an appointment to meet at a specific coffee shop and at a designated time. Jones arrives on time but Smith is late. Jones, sitting at a table and waiting for Smith, begins to wonder why Smith is late. Perhaps he was hit by a car. Maybe he's in the hospital. *Et cetera.* Considering the details of these concerns, Jones becomes worried. Fortunately, her training in logic enables her to identify that there is a low probability that any such thing happened to Smith. He is only ten minutes late, after all. Recognizing the phenomenon may not completely alleviate Jones' unhappy psychological state, but at least she would avoid confusing her worry with high probability or actual occurrence. Many English speakers do not have Jones' fortunate training. They often conflate the salience of upsetting or joyous possibilities with high probability or actual occurrence. Thus, will:ϕ and possibly:¬ϕ are not genuine opposites.

The next descriptive argument also targets *will/not* commutativity, indirectly challenging S-FLEM. OF contends that will:ϕ holds at a given moment just in case ϕ is true somewhere on *every* future branch from that moment (perhaps with some restrictions about when ϕ must hold in order to count). Note the universal quantification in this portrayal of *will*. Unfortunately, as instructors of introductory logic courses know all too well, typical English speakers are notorious for rejecting positive/negative universals with negative/positive universals, respectively, instead of the appropriate existentials. For instance, consider the following propositions.

(7.37) All zombies eat flesh.

(7.38) No zombies eat flesh.

(7.39) Some zombies do not eat flesh.

Many typical English speakers claim that the negation of (7.37) is (7.38) rather than (7.39). According to OF, *will* involves an even more subtle universal quantification. OF may claim that English speakers make the same mistake when they conflate will:¬ϕ with ¬will:ϕ. On the OF account of *will*, the errors are indeed the same—mistaking the contrary of a proposition for its contradictory.

These descriptive arguments are not likely to convince a logician who favors S-FLEM and the commutativity of *will* and *not*. Logicians tend to have specific ideas of the systems they endorse and presumably know how to negate statements properly. Regarding the first two arguments, even if typical English speakers commit the errors in question, that hardly addresses logicians' arguments supporting S-FLEM and *will/not* commutativity. The problem is that logicians do not tend to give such arguments, instead claiming that *will/not* commutativity and S-FLEM are obvious. An argument that may support S-FLEM is the *ex post* argument given at the end of Section 6.3.1. This argument is challenged in Section 7.3.4.

Another argument pertains not to confusion on behalf of English speakers, but peculiarities of English grammar. Consider the difference between *cannot* and *can not*.

(7.40) Jones cannot have coffee.

(7.41) Jones can not have coffee.

These propositions may be respectfully symbolized as:

(7.42) ¬possibly:c

(7.43) possibly:¬c

Instead of being a straightforward compound word, *cannot* moves the negation outside of the scope of *possibly*. That is, *cannot* amounts to *not-can*. Recall that *will* is grammatically modal, just like *can*.[33] Perhaps there is a similar ambiguity in the case of *will*. Although

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[33]See Section 3.1.

"willnot" is not a word, the contraction *won't* is analogous to *can't*, and the latter is equivalent to *cannot*. It may be that *won't* amounts to *not-will* rather than *will-not*, just as *can't* should be represented as *not-can* instead of *can-not*. Notice that the claim is not that *will* is like *can*, but that it might be. One could just as easily say that *won't* is like *shouldn't* rather than *can't*. *Shouldn't* amounts to *should-not* as opposed to *not-should*. The point is twofold. First, it would be presumptuous to assume that *will* is like one other grammatical modality rather than another without independent support. *Can* is not well-behaved when combined with *not*. It would not be surprising if other grammatical modalities, like *will*, are similarly obnoxious.

Although they do not serve to debunk S-FLEM and *will/not* commutativity, the descriptive arguments given above may serve lesser purposes. On one hand, the arguments help OF explain its view that S-FLEM and *will/not* commutativity are implausible, despite appearances to the contrary. On the other hand, although not strong enough to show that S-FLEM and *will/not* commutativity should be rejected, the arguments cast some doubt on those principles' intuitiveness. The arguments might be used to bolster others for OF.

Another type of argument against S-FLEM and *will/not* commutativity is normative. Many such arguments aim to challenge particular theories supporting S-FLEM—TF and SUP. Those arguments are discussed elsewhere. There is at least one normative argument for the thesis that *will* and *not* do not commute, independently of particular theories supporting S-FLEM.

Will is grammatically modal. Consider other grammatical modalities without direct temporal import, for they may serve as independent test cases. *Should* and *can* are helpful paradigm cases, the former being normative and the latter being modal in the propositional or ontological sense.

(7.44) Jones should drink coffee.

(7.45) Jones can drink coffee.

Neither *should* nor *can* commute with *not*. Focusing on the *should*, the following are not equivalent:

(7.46) It is not the case that Jones should drink coffee. (¬should:*c*)

(7.47) Jones should not drink coffee. (should:¬*c*)

The form corresponding to S-FLEM does not hold for *should*:

(7.48) should:ϕ ∨ should:¬ϕ

Nevertheless, the form corresponding to M-FLEM holds for *should*:

(7.49) should:ϕ ∨ ¬should:ϕ

The situation is analogous for *can*. Thus, *not* fails to commute with grammatical modalities like *should* and *can*. In the interest of securing a general and unified analysis of grammatical modalities, *will* should not be represented as commuting with *not*, either, other things being equal.

Again, this argument is normative, not descriptive. The goal is not to describe actual use of *will* or explain away *will/not* commutativity as a mistake. For theoretical reasons, *will* should not be represented as commuting with *not* even if almost every English speaker uses the language otherwise. So if two leading representations of time and temporal language are otherwise equally good, but one theory involves *will/not* commutativity and the other does not, the second should be chosen over the first for the sake of having a unified analysis of grammatical modalities.

7.3.2 Predictions

Suppose that Jones' future coffee-drinking is contingent and Smith asserts that Jones will drink coffee. Depending on the particular rendition of OF employed, the following are either false or have no truth value.

(7.50) Jones will drink coffee.

(7.51) Smith's assertion that Jones will drink coffee is correct.

Further assume that time has passed and Jones did in fact drink coffee. The following seem correct.

(7.52) Jones was going to drink coffee. (was:will:c)

(7.53) Smith correctly asserted that Jones would drink coffee.

(7.53) especially seems true. If Smith had bet that Jones would drink coffee, he would have won the bet. To account for (7.53), traditional OF can use statements like:

(7.54) Jones drank coffee and Smith asserted that she would drink coffee.

(7.54), however, does not admit that Smith's assertion was correct. His assertion's content was validated in terms of the wait-and-see approach. (7.53) requires (7.52). To account for predictions (and guesses), then, OF must show how propositions like (7.52) can be true even though (7.50) was untrue from an earlier perspective.

Before moving on, note that (7.52) follows from a more general principle:

(7.55) When anything is the case, it has always been the case that it will be the case.

That is how Prior put it in 1954.[34] He was proposing a reasonable assumption behind Diodorus' Master Argument. The systems that Prior himself endorsed do not support (7.55), but something like (7.55) appears necessary to account for (7.53). Even if (7.52) can be explained away when taken alone, (7.53) is a thorn in the side of OF.

This issue with handling predictions and guesses is symptomatic of a deeper problem. Traditional OF fails to accurately represent for wait-and-see semantics. The reason why Smith's assertion was correct and Jones was going to drink coffee is that the passage of time validated Jones' coffee-drinking. From a standpoint before Jones drank coffee, OF

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[34][Prior(1955)], p. 210

maintains that there is no legitimate way to privilege the coffee-drinking future from the alternative. From a later standpoint in which Jones drank coffee, it is clear which past's future to evaluate: this one, the standpoint. Traditional OF semantics cannot represent this important difference in standpoint.

7.3.3 Temporal Standpoints for Open Futurism

(7.50) and (7.52) differ in standpoint. The standpoint of (7.50) is prior to Jones' coffee-drinking while the standpoint of (7.52) is later. This variation in standpoint is relevant given OF's wait-and-see approach to the semantics of *will*. When the standpoint is earlier than Jones' coffee drinking, there is no particular future that will occur. Thus, (7.50) should not turn out true. If the standpoint is after Jones' coffee drinking, then there is a way to pick out the future insofar as is necessary to determine that (7.52) is true. From the later standpoint, but not the earlier, the waiting and seeing has already been done.

There are several ways to manipulate temporal standpoints in English. Here, a simplified mechanism is employed to handle the aforementioned observations, ultimately incorporating (7.55). The technique accounts for cases like (7.53), provides a systematic way to treat temporal operators, and retains a lot of old results. This method can be called *standpoint inheritance*. An introduction to standpoint inheritance was given in Section 3.4 and a formal account is provided in Section 8.3. A less technical exposition specific to OF is given here.

A preliminary requirement of standpoint inheritance is that the underlying system accounts for the fact that possibility/accessibility changes depending on where one is in the ATC tree. It may have been possible for Jones to skip coffee yesterday, but that is no longer possible now that her coffee-drinking is said and done. Opportunities are lost to time, so to speak, as they become necessary *per accidens* or ATC-necessary. Formally, differences in standpoint can be represented using moment-specific subtrees of the more general ATC tree, as in Figure 3.4.3. These trees should capture the notion of what is possible from a given moment. Intuitively, a moment's tree consists of all ATC-accessible paths leading to and
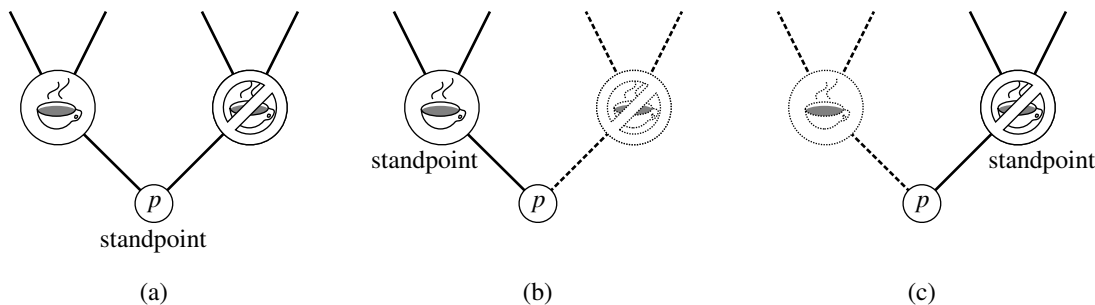
Figure 7.3.1: Open futurism with temporal standpoints. Different standpoints have different ATC subtrees. (a) depicts a standpoint before Jones decides whether or not to drink coffee. (b) illustrates a standpoint during or after Jones'-coffee drinking. The standpoint in (c) is a moment at which Jones does not drink coffee.

from that moment.

Notice that different standpoints sometimes have different accessibility relations corresponding to different subtrees. The truth values of modal/temporal statements are based on accessibility structure. This is how changes in standpoint affect modal/temporal statements in the context of branching time logics.

Standpoint inheritance has two primary tenets. The first divides modal/temporal operators into two classes. Standpoint-sensitive operators are completely restricted to a standpoint, which they pass on to all internal propositions. The purely temporal operators *will*, *was*, *will-always*, and *was-always* are standpoint-sensitive. Other operators are not restricted by standpoints, but may pass standpoints on. Such operators include *will-inevitably*, *was-inevitably*, and various kinds of *necessarily* and *possibly*. The second tenet proposes that standpoints should not be changed unless absolutely necessary. Thus, standpoint inheritance for OF is roughly captured by the following:

(7.56) *Will*, *was*, *will-always*, and *was-always* are the only standpoint-sensitive operators.

(7.57) Only switch standpoints when doing so is necessary to make sense of an evaluation.

Regarding Jones' contingent coffee-drinking, various standpoints are illustrated in Fig-

ure 7.3.1. From a standpoint in which Jones drank coffee, as in Figure 7.3.1 (b), one cannot sensibly evaluate a circumstance in which Jones did not drink coffee. The conflict in presuppositions yields absurdity. Visually, the contradiction in assumptions is illustrated by the fact that the standpoint in which Jones did not drink coffee is not on the subtree of the standpoint in which Jones drank coffee. The presupposition that Jones drank coffee must be dropped, which requires shifting standpoints. One must switch standpoints to a counterfactual scenario in which Jones did not drink coffee, as in Figure 7.3.1 (c). The counterfactual standpoint is sometimes designated using expressions like:

(7.58) Had Jones not drunk coffee...

(7.59) If Jones had not drunk coffee...

and so forth. A standpoint is inadequate when inspecting a situation that is not on the standpoint's subtree. Operators that are not standpoint-sensitive may require such evaluations. In other words, *will-inevitably*, *was-inevitably*, *necessarily*, and *possibly* may require shifting standpoint to a moment that is counterfactual with respect to the current standpoint. Operators that are standpoint-sensitive are restricted to a given standpoint or subtree, so those operators cannot by themselves generate changes in standpoint.

Standpoint inheritance does not affect the evaluation of (7.50) from the earlier standpoint. That statement remains untrue on an OF reading. From that earlier standpoint, the future is still unsettled, as in as in Figure 7.3.1 (a).

(7.52) is true under standpoint inheritance. That scenario is illustrated in as in Figure 7.3.1 (b). The initial standpoint, that of the outer operator, *was*, is the circumstance after Jones has had coffee. That initial standpoint is inherited by the inner temporal operator, *will*. From that standpoint, it is no longer possible for Jones to not drink coffee. Time has already verified her coffee-drinking.

That (7.52) turns out true does not render the following true.

(7.60) It was the case that Jones will inevitably have coffee. (was:will-inevitably:*coffee*)

Will-inevitably is not standpoint-sensitive. Therefore, *will-inevitably* is not restricted to the initial standpoint. (7.60) is false just as:

(7.61) Jones will inevitably drink coffee

is false when (7.61) is evaluated from the earlier standpoint, shown in Figure 7.3.1 (a), before the Jones' coffee-drinking became necessary *per accidens*. For the same reason, (7.60) is false when evaluated from the later standpoint.

Standpoint inheritance enables the simplification of many expressions involving temporal operators. Any string of consecutive *was*'s and *will*'s can be reduced to at most two. Under OF without standpoint inheritance, the reduction does not work for all combinations of those operators.[35] The reduction is discussed further in Section 8.3.4.

Thus, standpoint inheritance enriches OF in at least four ways. First, it allows the theory to account for predictions and guesses. Second, standpoint inheritance does a better job of representing the wait-and-see approach endorsed by OF. Third, it further emphasizes the semantic differences between *will* and *will-inevitably*. For BivOF, that may be the only distinction in truth value between those operators, making it all the more important to emphasize. Traditional BivOF semantics hides the distinction between between *will* and *will-inevitably*, making *will* appear identical to *will-inevitably*. Fourth, many expressions can be simplified under standpoint inheritance. Any string of consecutive *was*'s and *will*'s is reducible to at most two.

Two objections to standpoint inheritance might be that it is *ad hoc* and that it is too complicated. Regarding the first objection, standpoint inheritance is generalizable to and useful for all major branching time systems. The theory of standpoint inheritance for OF described above is the same as standpoint inheritance for TF, given the difference in tem-

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[35]Without standpoint inheritance, the reduction works only for non-metric temporal operators, and even then only because of density. Some operator may involve shifting an arbitrarily small distance, which is sketchy as a representation of natural language. Additionally, the reduction fails for metric operators without standpoint inheritance, which are closer than relational operators to English use provided context-determined restrictions on distances. With standpoint inheritance, the reduction is possible for both non-metric and metric operators.

poral relation between OF and TF. Standpoint inheritance is useful for all branching time systems and a general formal account is provided in Section 8.3.2. In addition to the theory's generality, standpoint inheritance is well-motivated by use of natural language. For OF, some of the most pointed cases are like those given above: the requirement of accounting for predictions, the distinction between (7.50) and (7.52), the plausibility of (7.55), and the distinction between (7.52) and (7.60). Standpoint inheritance addresses those issues for OF, but within a general framework that helps other branching time systems handle their own challenges.

Standpoint inheritance does introduce an extra explicit factor, the standpoint, that must be considered. In that sense, a system with standpoint inheritance is more complicated than one without. That is not much of a criticism, though. It is important for systems to be simple and elegant, but only insofar as a proper analysis can accommodate. Standpoint inheritance is well-motivated by examples and intuitions that should be addressed. The theory is simple and elegant insofar as it handles those problems within a very general framework. Additionally, standpoint inheritance grants additional simplifications, including the reduction of all *will/was* strings to at most two, not afforded by the traditional theories. Besides, as Prior noted, traditional theories without an explicit standpoint parameter still change standpoint implicitly.[36] The difference is that traditional systems change standpoint with every new point of evaluation while logics with standpoint inheritance only change standpoint when absolutely necessary. The relatively conservative approach endorsed by standpoint inheritance requires making the standpoint explicit.

7.3.4   *Ex Post* S-FLEM

Section 6.3.1 contained several arguments for S-FLEM and *will/not* commutativity. The last argument given in that section was an *ex post* argument. Supposing that LEM holds for literals,

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[36][Prior(1967)], p. 13

(7.62) Jones is either drinking coffee or she is not.

Yesterday, Smith and Brown placed bets on whether or not Jones would have coffee. Smith and Brown's respective bets are that:

(7.63) Jones will drink coffee.

(7.64) Jones will not have coffee.

Since exactly one disjunct of (7.62) obtains, exactly one of Smith and Brown won the bet. Thus, exactly one of (7.63) and (7.64) was true. (7.63) and (7.64) are corresponding S-FLEM disjuncts, so that instance of S-FLEM was true yesterday (not to mention the corresponding instance of strong future bivalence, contra SUP). This generalizable result appears to show that S-FLEM should be valid, but in fact such a general conclusion does not follow.

Any standpoint's subtree has only a branchless trunk leading back from that standpoint. This fact is illustrated well in Figure 3.4.3. The linguistic result of this structure is that whatever was the case, is now the case, or will be the case at a given standpoint is such that it was always going to be the case—from that standpoint. So whatever was, is, or will be is such that it was going to be, and thus either it was going to be or it was going to not be. With some symbols:

(7.65) $(\text{was:}\phi) \vee \phi \vee (\text{will:}\phi) \vDash \text{was:}(\text{will:}\phi \vee \text{will:}\neg\phi)$

This principle may be called *ex post* S-FLEM (ExP-S-FLEM). If one of the disjuncts on the left hand side holds, then ϕ's truth-makers either did or do now obtain. Hence the name, *ex post*.

The *ex post* argument for S-FLEM only shows an instance of ExP-S-FLEM. The argument fails to demonstrate a generalizable instance of S-FLEM. The conclusion is compatible with the thesis that from yesterday's standpoint, before Jones had resolved to drink coffee today, neither Smith nor Brown had won the bet. That is, the target instance of S-FLEM is not true.

A standpoint's future may still fork if there are contingencies that are future with respect to the standpoint. As such, S-FLEM is not valid. The past (including the present), however, is branchless. This linearity grants ExP-S-FLEM. Advocates of S-FLEM are challenged to find support for S-FLEM that does not really support ExP-S-FLEM or some other principle in the neighborhood, like W-FLEM or M-FLEM.

Ultimately, S-FLEM is too strong for the evidence granted by the *ex post* argument, which does not require a linear future. Standpoint inheritance accounts for the *ex post* scenario exactly without the extra baggage of a linear future. Given this observation, standpoint inheritance commandeers the *ex post* argument as its own evidence. The *ex post* argument supports standpoint inheritance with OF, not S-FLEM or TF. TF may have lost its greatest advocate.

7.3.5 What God did not Believe

A final point requires clarification. Suppose that Jones' coffee-drinking was contingent and that she drank coffee. Using standpoint inheritance as discussed in Section 7.3.3, (7.52) is true. God believes all and only truths, so:

(7.66) God believes that Jones was going to drink coffee. (God believes: was: will: *coffee*)

What does not follow is that:

(7.67) God *believed* that Jones would drink coffee. (was: God believes: will: *coffee*)

(7.67) involves replacing a sub-proposition of (7.52) with a statement that God believes that sub-proposition. This type of substitution is illegitimate, as (7.67) shows. Standpoint inheritance does not sanction (7.67). God held no such belief since Jones' coffee-drinking was contingent.

What would enable the unwanted substitution is allowing God's beliefs to be standpoint-dependent. The beliefs of agents in time are not standpoint-dependent. God is no exception. (7.66) is true because (7.52) is true. God is aware that the passage of time has verified Jones'

coffee-drinking. The latter holds because the *will* in the sub-proposition, (7.50), inherits the standpoint of the outer *was*. Again, that standpoint is the relatively future moment in which she drank coffee. God does not evaluate (7.50) from that standpoint, but from the standpoint at which he holds the belief. From that past standpoint, (7.50) is untrue, so God did not believe it. (7.67) is therefore false.

Part III

Formalities and Conclusions

Chapter 8

Formalities

Much has been said thus far about various temporal logics and standpoint inheritance. This chapter introduces a logic called MMBT (for "Multi-Modal Branching Time") that serves as a general framework through which to represent the views discussed in preceding chapters. Section 8.1 provides a generic setup for MMBT, which is like a prime matter from which particular systems can be individuated. To keep things simple, MMBT is left with a propositional basis. Section 8.2 gives the main logics discussed throughout this project (without standpoint inheritance): bivalent and non-bivalent open futurism, absolute and indexical true futurism, and supervaluationism. Finally, Section 8.3 modifies MMBT with standpoint inheritance and discusses some results mentioned in other chapters.

8.1   Generic Setup

The goal of this section is to specify a generic multi-modal system incorporating branching time structures, MMBT. For simplicity, MMBT is developed in terms of propositions, not properties and relations. Models and validity are defined in Section 8.1.1 and accessibility relations (including ATC accessibility) in Section 8.1.2. Truth conditions for operators are given in Section 8.1.3. In addition to the usual sentential operators, generalized modal and temporal operators are also defined. Such operators are later used with certain accessi-

bility relations to represent specific varieties of open futurism (OF) and true futurism (TF). Standpoint inheritance is not introduced until Section 8.3.

8.1.1 Models and Validity

Define the simplest sort of model as an ordered quadruple,

(8.1) $\langle M, \tau, \mathscr{R}, \nu \rangle,$

where M is a set of moments, τ is a time function, $\mathscr{R}$ is a set of accessibility relations, and ν (*nu*, not *vee*) is a truth function. This quadruple will do for now. Later, models require functions to pick out moment-specific accessibility relations.

Intuitively, moments are temporally sensitive possible worlds, or snapshots of possible worlds. For this purpose, not much hinges on how exactly one thinks of moments. They may be points or sets of propositions characterizing states of affairs. Note that this set of propositions is maximally specific if and only if bivalence holds.[1]

The continuum, $\mathbb{R}$, is used as a set of times. Officially, times might not be real numbers; but it is plausible to stipulate that the set of times is isomorphic to $\mathbb{R}$. For simplicity, then, $\mathbb{R}$ is used as the set of times.

Since moments are temporally sensitive, each moment has exactly one time such that it is that time at the moment. The set of times must have enough structure to allow the development of all-things-considered (ATC) accessibility and metric temporal operators. $\mathbb{R}$, ordered as usual, lends itself to this task quite nicely.

The time function, τ, assigns a time (real number) to each moment.

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[1]If moments are identified with sets of propositions, care must be taken to specify propositions that are sufficient to individuate nodes without unnecessarily restricting possibilities. For instance, if moments are consistent, maximally specific sets of literals, then there cannot be distinct, indiscernible moments (ignoring modal/temporal statements true at those nodes); and if moments are consistent, maximally specific sets of all propositions without qualification, then non-bivalent systems are ruled out (assuming that the set of propositions identifying a moment are those propositions that are true at that moment). So the best option is to identify moments with sets of propositions characterizing states of affairs; that is, those propositions mapped to true at respective moments. These sets of propositions are maximally specific if and only if bivalence holds.

(8.2) $\tau : M \longrightarrow \mathbb{R}$.

It is assumed that τ is a total function. That is, every moment has exactly one time. The time of a moment will be designated τ_m. τ is convenient to have around for describing metric operations.

The system is multi-modal, so instead of being limited to just one accessibility relation, there may be several. Thus,

(8.3) $\mathscr{R} \subseteq \mathscr{P}(M \times M)$.

The accessibility relations in $\mathscr{R}$ may include logical accessibility, physical accessibility, or whatever else one wishes. Of course, ATC accessibility and the thin red line (TRL) are relevant here.

The truth function, ν, maps propositions to truth values with respect to moments. ν is defined by

(8.4) $\nu : M \times \Phi \longrightarrow \{1, 0\}$.

Φ is an implicationally complete[2] set of propositions for the language used here, which is roughly the propositional calculus augmented with modal and temporal operators, as described below in Section 8.1.3. The values 1 and 0 represent TRUE and FALSE, respectively. No third truth value is used here, although ν shall be partial for non-bivalent systems. For $m \in M$ and $\phi \in \Phi$, $\nu_m(\phi)$ is used henceforth in place of $\nu(m, \phi)$.

Since ν is partial, it is appropriate to differentiate between two types of validity. Let $\Sigma \subseteq \Phi$ and $\phi \in \Phi$.

(8.5) $\Sigma \vDash \phi$ iff there is no model with a moment m such that for each $\psi \in \Sigma$, $\nu_m(\psi) = 1$ but $\nu_m(\phi) \neq 1$

If Σ is satisfied and ϕ has no truth value, then $\Sigma \nvDash \phi$. For logical truths, $\vDash \phi$ as long as ϕ is never untrue. $\vDash$ may be too restrictive under some circumstances. A weaker notion may be appropriate:

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[2]That is, implicationally complete in the sense used on p. 147 of [Boolos et al.(2007)Boolos, Burgess, and Jeffrey].

(8.6) $\Sigma \napprox \phi$ iff there is no model with a moment m such that for each $\psi \in \Sigma$, $\nu_m(\psi) = 1$ and $\nu_m(\phi) = 0$

In the case of $\napprox$, Σ may be satisfied while ϕ has no truth value. As far as logical truths go, $\napprox \phi$ just in case ϕ is never false.

The terms associated with validity used here are as follows:

(8.7) **validity:** $\Sigma \vDash \phi$

(8.8) **semi-validity:** $\Sigma \napprox \phi$

(8.9) **invalidity:** $\Sigma \nnapprox \phi$

Note that invalidity is not the opposite of validity. Rather, both validity and invalidity pick out extrema that are intended to approximate their classical counterparts.

8.1.2   Accessibility Relations

Although one can designate any number of accessibility relations in this system, only a few are useful here. For good measure, logical accessibility may be defined as

(8.10) **logical accessibility:** a relation $R_L = M \times M$.

A very important relation is the tree structure generated by ATC accessibility. ATC accessibility may be characterized as follows.

(8.11) **all-things-considered (ATC) accessibility:** a relation $<_{ATC}$ that is a continuous, unbounded ordering of one or more trees of moments[3] such that every moment is part of some tree and $m <_{ATC} m'$ only if $\tau_m <_{\mathbb{R}} \tau_{m'}$. (For readability, $<$ is used instead of $<_{ATC}$ unless disambiguation is necessary.)

The criteria provided ensure that $<$ has some desirable properties:

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[3]Moments are nodes and trees are backwards-linear partial orderings. Recall that partial orderings are irreflexive and transitive. For this purpose, trees need not have root nodes.

(8.12) <-related moments are ordered chronologically.

(8.13) There are no gaps due to continuity, enabled by the fact that the set of times is continuous.

(8.14) < forms trees. That is, < is backwards linear, irreflexive, and transitive.[4]

(8.15) Trees are unbounded—they have no beginning and no end.

(8.16) That $\mathbb{R}$ represents the set of times makes it easy to establish rulers for metric temporal operators.

< is used by every system here, but other relations are best defined when particular views are discussed. One can look forward to the TRL, moment-specific TRLs, and moment-specific ATC sub-trees.

8.1.3 Truth Conditions

This section provides truth conditions for propositions, connectives, and various important operators. These truth conditions are designed to be general, applicable to the particular theories developed in later sections.

A full property calculus is not developed here since quantification is not used. Some special propositions, here called timestamps, prove to be useful in defining some operations.[5]

timestamp a proposition denoted σ_t representing *the time is t*, for time t.

Propositional connectives are defined in the standard way, although extra specificity is given to ensure that these definitions still work if ν is partial and the system is non-bivalent. Let m be a moment and both ϕ and ψ, propositions.

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[4]Transitivity does not interfere with statements like *It is not yet possible to create a machine that passes the Turing test, but it might become possible in the future*. That is, no one can create such a machine with the current technology, but there is a possible later technological state under which someone could create such a machine. The instances of *possible* indicate an extra-things-considered modality, as in Section 2.5, that looks like ATC-modality plus a set of propositions specifying technological capacities.

[5]Cf. Prior's U operator as in [Prior(1957)]. U is an *at* operator so that $Ut\phi$ represents *ϕ holds at t*. Timestamps are designed to represent the temporal content of the *at* operator.

$$(8.17)\quad \nu_m(\neg\phi) = \begin{cases} 1 & \text{iff } \nu_m(\phi) = 0 \\ 0 & \text{iff } \nu_m(\phi) = 1 \end{cases}$$

$$(8.18)\quad \nu_m(\phi \wedge \psi) = \begin{cases} 1 & \text{iff } \nu_m(\phi) = \nu_m(\psi) = 1 \\ 0 & \text{iff } \nu_m(\phi) = 0 \text{ or } \nu_m(\psi) = 0 \end{cases}$$

$$(8.19)\quad \nu_m(\phi \vee \psi) := \neg(\neg\phi \wedge \neg\psi)$$

$$(8.20)\quad \phi \supset \psi := \neg\phi \vee \psi$$

$$(8.21)\quad \phi \equiv \psi := (\phi \wedge \psi) \vee (\neg\phi \wedge \neg\psi)$$

Below are some familiar tables depicting the truth-functional connectives. "i" is used for the case in which ν_m is undefined.

$\neg$	
1	0
ϕ i	i
0	1

$\wedge$	ψ 1	i	0
1	1	i	0
ϕ i	i	i	0
0	0	0	0

$\vee$	ψ 1	i	0
1	1	1	1
ϕ i	1	i	i
0	1	i	0

$\supset$	ψ 1	i	0
1	1	i	0
ϕ i	1	i	i
0	1	1	1

$\equiv$	ψ 1	i	0
1	1	i	0
ϕ i	i	i	i
0	0	i	1

Even in those cases in which the system is non-bivalent, it may be desirable to impose a limited bivalence. The following stipulation serves this purpose.

$$(8.22)\quad \nu_m(A) \in \{0,1\} \text{ for all moments } m \text{ and atomic propositions } A.$$

There is nothing unusual about modal operators here except that their truth conditions depend on which accessibility relations the operators respectively designate. Recall that accessibility relations may vary greatly in what they represent, like logical possibility and permissibility, so modal operators are only associated with modality in the formal sense defined in Section 2.2. Let m be a moment, ϕ a proposition, and R_x an accessibility relation.

$$(8.23) \quad \nu_m(\square_x \phi) = \begin{cases} 1 & \text{iff for every } m' \in M \text{ such that } mR_x m', \nu_{m'}(\phi) = 1 \\ 0 & \text{iff for some } m' \in M \text{ such that } mR_x m', \nu_{m'}(\phi) = 0 \end{cases}$$

$$(8.24) \quad \diamond_x := \neg \, \square_x \, \neg$$

If R_L represents logical accessibility, then $\square_L$ and $\diamond_L$ pertain to logical necessity and possibility, respectively; given that R_{ATC} represents ATC accessibility, $\square_{ATC}$ and $\diamond_{ATC}$ represent ATC necessity and possibility, respectively; and so forth.

It is also possible to designate operators using inverse relations, like past as opposed to future. Operations along an inverse relation, R_x^{-1}, are designated by $\square_{-x}$, $\diamond_{-x}$, *et cetera.*

Non-metric temporal operators represent *it will be the case that* and *it was the case that.* Instead of the usual F and P, $\triangle$ and $\triangledown$ are used for generalized future and past temporal operators, respectively. Like $\square$ and $\diamond$, $\triangle$ and $\triangledown$ are indexed with respect to accessibility relations. The triangle notation, although not standard, is relatively intuitive and more appropriate for multi-modal systems like this one. Analogs to temporal operators exist for all accessibility relations. There are many $\triangle_x$, but only one F. Indeed, it is controversial which $\triangle_x$ (if any) is the real future operator, and perhaps even more controversial which $\triangle_x$ should be the real future operator.

For the sake of illustration, the following will not do as a definition of a generalized temporal operator:[6]

$$(8.25) \quad \text{IMPLAUSIBLE!} \quad \nu_m(\triangle_x \phi) = \begin{cases} 1 & \text{iff for every path } P_x \text{ on } R_x \text{ starting at } m, \text{ some } m' \text{ on } P_x \\ & \text{is such that } mR_x m' \text{ and } \nu_{m'}(\phi) = 1 \\ 0 & \text{iff for some path } P_x \text{ on } R_x \text{ starting at } m, \text{ some } m' \text{ on } P_x \\ & \text{is such that } mR_x m' \text{ and } \nu_{m'}(\phi) = 0 \end{cases}$$

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[6]Recall that a path is just a linearly ordered set of nodes (which may contain repeats). Paths may be converted into a set of edges. For this project (in which only transitive relations are used), it suffices that if m' occurs later on a path P than m, then the edge $\langle m, m' \rangle$ is on P. P is said to be on a relation R just in case every edge in P is in R. A node is on a path iff the node is a vertex of one of the path's edges.
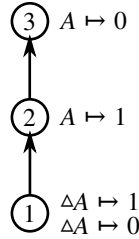
Figure 8.1.1: Counterexample to a bad definition of *will*. In the model illustrated, $\nu_1(\triangle A) = 1$ and $\nu_1(\triangle A) = 0$ under the implausible definition (8.25).

Truth gaps are allowed since ν may be partial. (8.25), however, yields truth gluts—circumstances in which ν maps some proposition to both 1 and 0 for a given moment. Consider a model with moments m_1, m_2, and m_3; accessibility relation R such that m_1Rm_2 and m_2Rm_3; and truth function ν such that $\nu_2(A) = 1$ and $\nu_3(A) = 0$. The result is that $\nu_1(\triangle A) = 1$ and $\nu_1(\triangle A) = 0$. This model is depicted in Figure 8.1.1. Some other definitions for non-metric $\triangle$ are similarly problematic.

A time parameter may be built into the truth function ν to avoid inconsistency, but that will not be done here.[7] One way to characterize the issue is that non-metric temporal operators do not provide ways of specifying how far in the past or future a given event will occur. Metric temporal operators can represent specific temporal differences. For instance, *two days from now, there will be a sea battle* and *five minutes ago, Jones ate a sandwich*. Such statements specify a difference in time between the current node and a set of target nodes above (future) or below (past) the current node.

Some non-metric temporal operators may be obnoxious, but generic *-inevitably* operators avoid truth gluts. It will later be important to distinguish between temporal operators and their *-inevitably* counterparts. $\triangle$ and $\triangledown$ are used for (generic) *will* and *was*, respectively. $\triangle\!\!\!\!\diagup$ and $\underline{\triangledown}$ are used for (generic) *will-inevitably* and *was-inevitably*, respectively. $\triangle$ and $\triangledown$ will later be defined using $\triangle\!\!\!\!\diagup$ and $\underline{\triangledown}$.

Let m be a moment, ϕ a proposition, and R_x be an accessibility relation. In what follows, paths P_x on R_x are assumed to be simple and forwards-maximal. A simple path does not

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[7]An example in which a time parameter is build into the truth function is given in [Øhrstrøm(2009)], p. 29. Note that the truth function takes both a time parameter and a chronicle (TRL) parameter.

contain cycles (repeat nodes). A forwards-maximal path continues unless it reaches a node m such that there is no m' for which mR_xm'.

$$(8.26) \quad \nu_m(\triangle_x\phi) = \begin{cases} 1 & \text{iff for every path } P_x \text{ on } R_x \text{ starting at } m, \text{ some } m' \text{ on } P_x \\ & \text{is such that } \nu_{m'}(\phi) = 1 \\ 0 & \text{iff for some path } P_x \text{ on } R_x \text{ starting at } m, \text{ every } m' \text{ on } P_x \\ & \text{is such that } \nu_{m'}(\phi) = 0 \end{cases}$$

$$(8.27) \quad \triangledown_x := \triangle_{-x}$$

Under this definition, $\nu_m(\triangle_x\phi) = 1$ if R_x does not contain or terminates at m. If not every moment is represented on R_x, it might be desirable to specify that $\nu_m(\triangle_x\phi)$ is false or undefined when R_x does not contain or terminates at m. Troublesome scenarios are not a problem in this analysis. The situation only crops up for ABsTF, discussed in Section 8.2.2.

It can be shown that:

$$(8.28) \quad \text{consistent: } \{\triangle_x\phi, \triangle_x\neg\phi\}$$

(8.28) is to be expected since the operator $\triangle$ is non-metric. As an example demonstrating (8.28), let m_1, m_2, and m_3 be nodes in a model such that $\nu_2(A) = 1$ and $\nu_3(A) = 0$. It follows that $\nu_1(\triangle A) = \nu_1(\triangle\neg A) = 1$. See Figure 8.1.2 (a).

Additionally,

$$(8.29) \quad \neg\triangle_x\phi \nvDash \triangle_x\neg\phi$$

$$(8.30) \quad \nvDash \triangle_x\phi \vee \triangle_x\neg\phi$$

Here is a model illustrating the invalidities given in (8.29) and (8.30). Let m_1, m_2, and m_3 be moments; R an accessibility relation such that m_1Rm_2 and m_1Rm_3; and ν a truth function such that $\nu_2(A) = 1$ while $\nu_3(A) = 0$. $\nu_1(\neg\triangle A) = 1$ but $\nu_1(\triangle A) = \nu_1(\triangle\neg A) = 0$. So $\nu_1(\triangle A \vee \triangle\neg A) = 0$. This model is shown in Figure 8.1.2 (b).
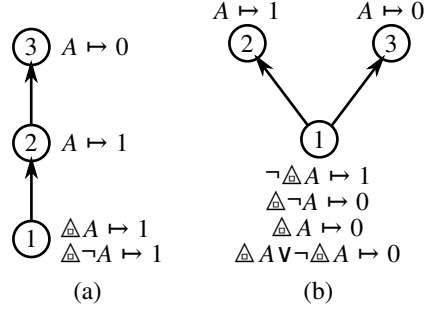
$$
\begin{array}{cc}
\begin{array}{ll}
\text{(3)} & A \mapsto 0 \\
\uparrow & \\
\text{(2)} & A \mapsto 1 \\
\uparrow & \\
\text{(1)} & \triangle A \mapsto 1 \\
& \triangle \neg A \mapsto 1
\end{array}
&
\begin{array}{l}
A \mapsto 1 \qquad A \mapsto 0 \\
\text{(2)} \qquad\qquad \text{(3)} \\
\nwarrow \qquad \nearrow \\
\text{(1)} \\
\neg \triangle A \mapsto 1 \\
\triangle \neg A \mapsto 0 \\
\triangle A \mapsto 0 \\
\triangle A \vee \neg \triangle A \mapsto 0
\end{array} \\
\text{(a)} & \text{(b)}
\end{array}
$$

Figure 8.1.2: Models demonstrating facts about generalized *will-inevitably*. (a) shows that $\triangle A$ and $\triangle \neg A$ are consistent. (b) shows that $\triangle$ does not commute with $\neg$ and that S-FLEM does not generally hold for $\triangle$.

It is good that (8.29) and (8.30) do not hold. MMBT needs to be able to represent various forms of OF as well as TF and SUP. Without (8.29) and (8.30), MMBT could not accommodate OF.

Although S-FLEM is invalid, $\triangle$ is defined so that LEM, M-FLEM, and W-FLEM are valid for this operator. That is:

$$(8.31) \quad \vDash \phi \vee \neg\phi$$

$$(8.32) \quad \vDash \triangle_x \phi \vee \neg \triangle_x \phi$$

$$(8.33) \quad \vDash \triangle_x (\phi \vee \neg\phi)$$

Given the definition of $\triangle$, M-FLEM and W-FLEM follow from LEM. There are a few reasons why LEM is valid. First, all of the operators defined so far are such that the criteria for truth and falsity are mutually exclusive. So the only way to obtain a truth glut is from a truth glut. (A truth glut would entail an instance of $\phi \wedge \neg\phi$, entailing an instance of $\phi \vee \neg\phi$ mapping to 0, in which case LEM would be invalid based on the definition of invalidity given in Section 8.1.1.) Second, it was stipulated that ν is defined for all atoms. Third, the truth conditions for the current set of operators ensure that ν only yields truth gaps from truth gaps. The first fact is enough to for LEM to be semi-valid (given that ν is a function). The three facts combined yield that LEM is valid, not just semi-valid.

LEM, M-FLEM and W-FLEM are merely semi-valid in NBIVOF. Semi-validity comes

with the introduction of operators that are consistent, but allow for truth gaps even if ν is defined for all of their sub-propositions. Past and future operators will be defined for NB<small>IV</small>OF so as to yield gaps when future contingents are involved. These truth gaps will propagate to M-FLEM and W-FLEM, and thus LEM.

Generic *will-inevitably* and *was-inevitably* are the only non-metric temporal operators defined so far, and they will remain as such. One might define *will* and *was* with *will-inevitably* and *was-inevitably*, respectively. (Doing so does not hurt TF in any way.) Metric operators will be considered shortly. For now, the important point is that there are some non-metric temporal operators. Consider just non-metric versions of $\triangle$ and $\triangledown$; letting $\triangle := \triangle\!\!\!\!A$ and $\triangledown := \triangledown\!\!\!\!\triangledown$ for the sake of discussion until specific views are implemented.

Two other common temporal operators are G and H. G represents the *it will always be the case that*, while H corresponds to *it has always been the case that*. In MMBT, G and H generalize to $\square_x$ and $\square_{-x}$, respectively.

Non-metric temporal operators as given here are too weak to adequately represent temporal language. It seems outright absurd that

(8.34) Jones will drink coffee and she will not.

(8.34) is an instance of (8.28). Figure 8.1.2 (a) provides a model illustrating (8.34) provided that $A :=$ *Jones drinks coffee.*

The fact that non-metric operators leave time underspecified does not accord with standard English usage. English speakers typically assume that the conjuncts of (8.34) are about the same time, and surely Jones cannot both drink coffee and not drink coffee at once. Non-metric temporal operators do not specify when they about. Perhaps Jones will drink coffee tomorrow and not two days hence.

In English, one can typically rely on conversational implicature to indicate that the disjuncts of M-FLEM and S-FLEM are about the same time.[8] Conversational implicature does not clarify the formal representations of English sentences, so those formal representations

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[8]See Section 3.2.

would require explicit qualification on every use. To skirt that annoyance, metric operators will be used to represent English sentences. Metric operators make it convenient to show when the disjuncts of M-FLEM and S-FLEM are about the same time and when those disjuncts are about different times. Note that the analyses in the rest of this chapter do not hinge on the absence of non-metric operators. One is free to use non-metric operators as long as it is understood how they do (and do not) correspond to English correlates.

Non-metric operators need only a relation between nodes. Metric operators require a system of measurement. As such, metric operators do not make sense for relations without a metric. ATC and TRL accessibilities are both constrained by the temporal metric, given that times are isomorphic to the continuum. The subscript μ is used to designate an arbitrary accessibility relation with a metric, R_μ. Distance in metric operations is designated by superscripts (with positive values), such as $\triangle_\mu^t$ and $\triangledown_\mu^t$, corresponding to the Priorian $F(t)$ and $P(t)$, respectively.

Metric temporal operators can be defined using their non-metric correlates together with timestamps. Timestamps are special atoms representing propositions of the form *It is date/time x*. The timestamp σ_x is true at m if and only if $x = \tau_m$. One can think of a timestamp as a statement giving a very specific report of the date/time on a calendar/clock.

To define metric temporal operators using timestamps, the idea is to explicate propositions like *Jones will drink coffee tomorrow* as *It will be the case that Jones drink coffee and it is date/time x*. Here, x is whatever time it is when the original sentence is uttered, τ_m, plus a day; so $x = \tau_m + 1$ day in the example. More generally, *it is x-o'clock* can be represented using timestamps as something like $\sigma_{\tau_m \pm t}$. For $t \in \mathbb{R}^+$,

$$(8.35) \quad \nu_m\big(\triangle_\mu^t \phi\big) := \nu_m\big(\triangle_\mu(\phi \wedge \sigma_{\tau_m+t})\big)$$

As desired,

$$(8.36) \quad \triangledown_\mu^t \phi = \triangledown_\mu\big(\phi \wedge \sigma_{\tau_m-t}\big)$$

The operators $\triangle_\mu^t$ and $\triangledown_\mu^t$ are suitable for *will* and *was* for each of the systems considered

here (although some modification is necessary in the case of NBıvOF).

$$(8.37) \quad \triangle_\mu^t := \triangleq_\mu^t$$

$$(8.38) \quad \triangledown_\mu^t \phi := \triangledown_\mu^t$$

Like their non-metric correlates, W-FLEM and M-FLEM are valid for metric operators, while S-FLEM and *will/not* commutativity are invalid.

It may appear suspicious to associate *will* and *was* with their *-inevitably* counterparts. So far, MMBT is very general. Particular systems will be faithfully represented by specifying additional information, such as about R_μ. TF uses that tactic. *Will-/was-inevitably* are explicated along ATC accessibility but *will/was* are presented in terms of TRLs.

Time-specific necessity and possibility may be defined similarly.

$$(8.39) \quad \square_\mu^t \phi := \square_\mu(\sigma_{\tau_m + t} \supset \phi)$$

$$(8.40) \quad \lozenge_\mu^t := \neg \square_\mu^t \neg$$

As expected,

$$(8.41) \quad \lozenge_\mu^t \phi \dashv\vDash \lozenge_\mu(\phi \wedge \sigma_{\tau_m + t}).$$

It is assumed that temporal operators in natural language should translate to metric operators in this system rather than non-metric operators. This rule ensures that (8.34) and similar statements are false. Granted, it is not always clear what t should be and intervals may be more appropriate rather than particular times. Regarding the over-specificity of metric operators, one might consider examples like

(8.42) Jones will have coffee tomorrow,

noting that it does not matter exactly when Jones has coffee. The statement turns out true as long as Jones has coffee *sometime* tomorrow. To address this issue, one could specify a range of times in which Jones' coffee drinking or lack thereof determine the truth value of the

statement. In the case of the example, the interval would span tomorrow. The complication is unnecessary for this project, however, and nothing important to this analysis hinges on the simplifying move to use specific times rather than intervals. Furthermore, a context function may be used to specify the value of t, although this presentation does not go into so much detail. It is henceforth assumed that t is given by context. The system may of course be expanded to more directly account for intervals as well as operators like *since* and *until*.

Suppose that R_μ is transitive. A result that was important in preceding chapters is:[9]

$$(8.43) \quad \triangle_\mu^t = \square_\mu^t = \neg \diamond_\mu^t \neg$$

(8.43) requires that both operators pertain to the same accessibility relation. One cannot equate $\triangle_{TRL}^t$ to either $\square_{ATC}^t$ or $\neg \diamond_{ATC}^t \neg$. $\triangle_{TRL}^t = \square_{TRL}^t = \neg \diamond_{TRL}^t \neg$, but $\square_{TRL}^t$ and $\diamond_{TRL}^t$ have nothing to do with contingency unless the TRL is relevantly modal, not just formally modal. Recall that permissibility is an example of a formally modal relation that does not impose on contingency.

8.2 Particular Branching Time Systems

This section briefly outlines specific traditional branching time logics using MMBT. Recall that MMBT has the usual sentential connectives, plus generalized modal and temporal operators of both the non-metric and metric varieties. The modal operators are $\square$ and $\diamond$. The temporal operators are $\triangle$ and $\triangledown$.

The differences in these logics pertain to *will/was* ($\triangle/\triangledown$). As such, the strategy used to develop particular traditional systems from MMBT is to provide definitions for $\triangle/\triangledown$. Only metric versions of $\triangle/\triangledown$ are given for the reasons discussed in Section 8.1.3. In transitioning from natural language, it is assumed that a temporal difference, $t \in \mathbb{R}^+$, is specified explicitly or implicitly.

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[9]See especially Section 6.4.1.

8.2.1 Bivalent Open Futurism

BivOF is characterized by making the following stipulations:

(8.44) *Will* is represented by $\triangle^{t}_{ATC}$; that is, $\triangle^{t} \coloneqq \triangle^{t}_{ATC}$.

(8.45) A proposition ϕ's future contingency is represented by $\diamond^{t}_{ATC}\phi \wedge \diamond^{t}_{ATC}\neg\phi$.

For readability, modifications on temporal/modal operators are left out for the remainder of this section. Metric operators are used although time is not written. The relation is $<$ unless otherwise noted and it is assumed that there is a specific $t \in \mathbb{R}^{+}$ given by context.

Since $<$ is transitive, (8.43) entails:

(8.46) $\triangle\phi \models\!\!\dashv \Box\phi \models\!\!\dashv \neg\diamond\neg\phi$.

As such,

(8.47) $\triangle\phi \vee \triangle\neg\phi \models\!\!\dashv \Box\phi \vee \Box\neg\phi$.

That is, S-FLEM amounts to ATC-fatalism. Whatever will be is necessary under BivOF. ArgLF is valid. It readily follows that:

(8.48) $\diamond\phi \wedge \diamond\neg\phi \models\!\!\dashv \neg(\triangle\phi \vee \triangle\neg\phi)$

That is, when and only when ϕ is future-contingent, corresponding instances of S-FLEM fail.

8.2.2 Absolute True Futurism

AbsTF requires a single TRL, which may be interpreted as something like an actual timeline. The TRL is represented by an accessibility relation, $TRL \subseteq <$ such that TRL is a maximal chain[10]. AbsTF is specified by:[11]

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[10]Recall that a chain is a totally ordered subset of a partial ordering and that a maximal chain is not a proper subset of another chain. The TRL is a linear portion of an ATC tree.

[11]See also [Øhrstrøm(1983), Malpass and Wawer(2012)] for formal accounts of AbsTF.

(8.49) *Will* is represented by $\overline{\triangle}^t_{TRL}$; that is, $\triangle^t := \overline{\triangle}^t_{TRL}$.

(8.50) *Will-inevitably* is represented by $\overline{\triangle}^t_{ATC}$.

(8.51) A proposition ϕ's future-contingency is represented by $\diamond^t_{ATC}\phi \wedge \diamond^t_{ATC}\neg\phi$.

For clarity, t is left out for the remainder of this section. The subscripts *TRL* and *ATC* remain because both relations are important and they have different characteristics.

The linearity of the TRL grants *will/not* commutativity for moments on the TRL, and S-FLEM also holds in those cases. If m is on *TRL*, then

(8.52) $\nu_m(\triangle\neg\phi) = \nu_m(\neg\triangle\phi)$

(8.53) $\nu_m(\triangle\phi \vee \triangle\neg\phi) = 1$

With respect to a given accessibility relation, S-FLEM is still contrary to merely formal contingency. So the following hold.

(8.54) $\overline{\triangle}_{TRL}\phi \vee \overline{\triangle}_{TRL}\neg\phi \dashv\vDash \neg(\diamond_{TRL}\phi \wedge \diamond_{TRL}\neg\phi)$

(8.55) $\overline{\triangle}_{ATC}\phi \vee \overline{\triangle}_{ATC}\neg\phi \dashv\vDash \neg(\diamond_{ATC}\phi \wedge \diamond_{ATC}\neg\phi)$

For TF, $<$ is relevant to genuine future contingency, not *TRL*. The presence of future-contingents entails that $<$ is non-linear, unlike *TRL*. By distinguishing the relations used to account for future-contingency, on the one hand, and the future operator, on the other hand; TF maintains *will/not* commutativity and S-FLEM without interfering with future contingency.

In ABSTF, *Will/not* commutativity and S-FLEM and do not function properly outside of the TRL. If m is not on the TRL, then $\overline{\triangle}_{TRL}\phi$ is vacuously true even if ϕ *will-inevitably*, which uses $<$ and not *TRL*, is false. That vacuity stems from the fact there are no *TRL*-paths for counterfactual moments under ABSTF. As such, $\overline{\triangle}_{TRL}\phi$ turns out true because "for every *TRL*-path" in (8.26) is satisfied vacuously. Since $\overline{\triangle}_{TRL}\phi$ is true for all ϕ, S-FLEM instances are always true. In fact, both disjuncts of S-FLEM instances are true. For moments m outside of the TRL,

(8.56) $\nu_m(\triangle\phi) = \nu_m(\triangle\neg\phi) = 1$

(8.57) $\nu_m(\neg\triangle\phi) = 0 \neq \nu_m(\triangle\neg\phi)$

For instance,

(8.58) *Jones will have coffee* and *Jones will not have coffee* are both true.

(8.59) ∴ *It's false that Jones will have coffee* is false while *Jones will not have coffee* is true.

Additionally, since $\triangle\phi$ always holds off of the TRL, even if $\triangle_{ATC}\neg\phi$ is true,

(8.60) $\triangle\phi \not\Vdash \diamond_{ATC}\phi$

That is, $\triangle\phi$ might be true even when ϕ is impossible. There is no way to fix this problem for ABsTF. One could easily redefine $\triangle_{TRL}$ so that $\triangle\phi$ is always false (by stipulating that there is a path from the moment at which truth is assigned), in which case S-FLEM would always be false off of the TRL and *will/not* commutativity would still fail. Other options for ABsTF, none of which are appealing, are discussed in Section 6.3.2.

8.2.3 Indexical True Futurism

In IDxTF, every moment m has a TRL_m. Each TRL_m can be represented by an accessibility relation, denoted TRL_m or $TRL(m)$, whatever is most convenient. One can include a (total) function $TRL : M \longrightarrow \mathscr{R}$ in the definition of a model instead of many accessibility relations, $TRL_m \in \mathscr{R}$. The function TRL is subject to the following constraints:[12]

(8.61) TRL_m is a maximal chain for all $m \in M$.

(8.62) m is on TRL_m.

(8.63) If $m <_{ATC} m'$ and m' is on TRL_m, then $TRL_m = TRL_{m'}$.

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[12]See also [Øhrstrøm(2009)], pp. 27–29; and [Braüner et al.(2000)Braüner, Hasle, and Øhrstrøm] for expositions.

Given this notion of TRL_m, traditional IDXTF may be characterized by the following:

(8.64) When evaluated at moment m, *will* is represented by $\triangle^t_{TRL_m}$; that is, $\triangle^t :=$ $\triangle^t_{TRL_m}$.

(8.65) *Will-inevitably* is represented by $\triangle^t_{ATC}$.

(8.66) A proposition ϕ's future-contingency is represented by $\diamond^t_{ATC}\phi \wedge \diamond^t_{ATC}\neg\phi$.

Again, metric operators are used although t is left out for readability. The notation also hides the moment-dependence of the future operator, clarifying some formulas.

IDXTF has all of the characteristics of ABsTF without the problems outside of the TRL. Both *will/not* commutativity and S-FLEM are generally valid:

(8.67) $\triangle\neg\phi \dashv\vDash \neg\triangle\phi$

(8.68) $\vDash \triangle\neg\phi \equiv \neg\triangle\phi$

(8.69) $\vDash \triangle\phi \vee \triangle\neg\phi$

IDXTF is therefore able to handle propositions about the future uniformly, even at relatively counterfactual moments, unlike ABsTF.

8.2.4 Supervaluationism

SUP can be developed by building off of IDXTF. The technique used here is similar to the one used by Thomason.[13] Define:

(8.70) $\mathbf{TRL}_m :=$ the set of all possible TRL_m (meeting the criteria of TRL_m for IDXTF).

There is a possible TRL_m for each $<$-path from m. There is a different IDXTF model for each possible TRL structure. These models only differ in TRL structure and, correspondingly, ν.

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[13][Thomason(1970)], esp. p. 274

The models are identical in other respects. One can define a Sup truth function N (capital *nu*) as follows.[14]

(8.71) $N_m(\phi) = 1$ if and only if for all $TRL_m \in \mathbf{TRL}_m$, $\nu_m(\phi) = 1$; and $N_m(\phi) = 0$ if and only if for all $TRL_m \in \mathbf{TRL}_m$, $\nu_m(\phi) = 0$.

This rendition of Sup has all of the same tenets as IdxTF except that N is used instead of ν.

(8.72) When evaluated at moment m, *will* is represented by $\triangle^t_{TRL_m}$; that is, $\triangle^t :=$ $\triangle^t_{TRL_m}$.

(8.73) *Will-inevitably* is represented by $\triangle^t_{ATC}$.

(8.74) A proposition ϕ's future contingency is represented by $\diamond^t_{ATC}\phi \wedge \diamond^t_{ATC}\neg\phi$.

(8.75) N is the primary evaluation function, not ν. (That is, if one wants to know the truth value of a proposition, look to N instead of ν. ν is just an intermediate step.)

Sup has all validities that hold in IdxTF. If a proposition is valid in IdxTF, then it is true at all moments under all possible TRL assignments. As such, N renders these propositions valid, too. It can be shown that LEM, W-FLEM, M-FLEM, *will-not* commutativity, and S-FLEM are valid.

Bivalence, however, fails. Suppose that Jones' might and might not drink coffee tomorrow. Then there are two possible TRLs, one by which she will drink coffee tomorrow ($\triangle^{1\ \text{day}} C$) and one by which she will not ($\triangle^{1\ \text{day}} \neg C$). It is neither true under all possible TRL assignments that $\triangle^{1\ \text{day}} C$ nor that in all possible TRL assignments that $\triangle^{1\ \text{day}} \neg C$. Thus, neither $\triangle^{1\ \text{day}} C$ nor $\triangle^{1\ \text{day}} \neg C$ is true by N.

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[14]It is not necessary to define a new truth function. One could also modify the truth conditions for each connective and operator to account for all possible arbitrary assignments—in this case, all possible TRL mappings. Revising all of the truth conditions would be cumbersome. It is easier for this purpose to just define a new truth function so as to build off of what has already been established.

8.2.5 Non-Bivalent Open Futurism

OF does not represent temporal operators using a fundamentally different relation than ATC accessibility, like the TRL. As such, OF must employ other mechanisms to bring out any differences between *will* and *will-inevitably*. One technique serving this end involves defining temporal operators $\triangle$ and $\triangledown$ for which bivalence fails:

$$(8.76) \quad \nu_m(\triangle_x\phi) = \begin{cases} 1 & \text{iff } \nu_m(\boxtriangle_x\phi) = 1 \\ 0 & \text{iff } \nu_m(\boxtriangle_x\neg\phi) = 1 \text{ and } \nu_m(\boxtriangle_x\phi) \neq 1 \end{cases}$$

$$(8.77) \quad \triangledown_x := \triangle_{-x}$$

Equipped with (8.76) and (8.77), a NBIVOF system is captured by the following.

(8.78) The truth function, ν, maps each atom to 1 or 0.

(8.79) *Will* is represented by $\triangle^t_{ATC}$.

(8.80) *Will-inevitably* is represented by $\boxtriangle^t_{ATC}$.

(8.81) A proposition ϕ's future contingency is represented by $\diamond^t_{ATC}\phi \wedge \diamond^t_{ATC}\neg\phi$.

As usual, subscripts and superscripts are left out for the remainder of this section, unless such notation is necessary for clarification.

It can be shown that LEM and is valid for propositions not involving $\triangle$.[15] In general, however, LEM is just semi-valid in NBIVOF.

(8.82) $\not\approx \phi \vee \neg\phi$

LEM instances are not true when and only when future contingents are involved. For example, suppose it is contingent that Jones will drink coffee tomorrow ($\triangle^{1\,\text{day}}C$). She turns out to drink coffee on some ATC-path from today, and she does not drink coffee on another

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[15]In the general case where $\triangle$ and $\triangledown$ pertain to other metric accessibility relations, LEM and bivalence may fail for propositions that have $\triangle$ or $\triangledown$. The properties of R_{ATC}—most importantly, backwards linearity—ensure that LEM and bivalence hold when only $\triangledown$ is involved.

ATC-path from today. Thus, she does not turn out to drink coffee on all ATC-paths from today, so $\nu_{\text{today}}(\triangle^{1 \text{ day}} C) \neq 1$; nor does she turn out to not drink coffee on all ATC-paths from today, so $\nu_{\text{today}}(\triangle^{1 \text{ day}} C) \neq 0$. The statements $\triangle^{1 \text{ day}} C$ has no truth value, just as it is indeterminate that Jones will drink coffee. Additionally, $\neg \triangle^{1 \text{ day}} C$ has no truth value. So the corresponding instance of M-FLEM, $\triangle^{1 \text{ day}} C \vee \neg \triangle^{1 \text{ day}} C$, has no truth value. Hence, M-FLEM is only semi-valid.

$$(8.83) \quad \napprox \ \triangle \phi \vee \neg \triangle \phi$$

Instances of M-FLEM are instances of LEM, showing why LEM is also only semivalid. Just as LEM and M-FLEM are merely semi-valid, W-FLEM is also only semi-valid.

$$(8.84) \quad \napprox \ \triangle (\phi \vee \neg \phi)$$

W-FLEM is not valid since $\nu_m(\triangle(\phi \vee \neg\phi))$ is undefined if ϕ cannot be evaluated at the requisite points. That situation only occurs when ϕ involves some future operator for which truth cannot be evaluated. For instance, $\nu_{\text{today}}(\triangle^{1 \text{ day}}(C \vee \neg C)) = 1$, but if $\phi := \triangle^{1 \text{ day}} C \vee \neg \triangle^{1 \text{ day}} C$, then $\nu_{\text{yesterday}}(\triangle^{1 \text{ day}}(\phi \vee \neg\phi))$ is undefined.

Familiar results involving *will-inevitably* still hold. $\nu_{\text{today}}(\boxed{\triangle}^{1 \text{ day}} C) = \nu_{\text{today}}(\boxed{\triangle}^{1 \text{ day}} \neg C) = 0$ in the preceding scenario. In NBivOF, *will-inevitably* and *will* differ in truth value when future contingents enter the scene.

When $<$ is taken as the accessibility relation, *will-not* commutativity is valid.[16] In other words,

$$(8.85) \quad \neg \triangle \phi \; \dashvDash \; \triangle \neg \phi,$$

although the following is only semi-valid:

$$(8.86) \quad \napprox \ \neg \triangle \phi \equiv \triangle \neg \phi$$

since $\equiv$ is not assigned a truth value if its relata are not assigned truth values. (This result could be changed by altering the truth conditions of $\equiv$ so that it turns out true when both relata are indeterminate.)

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[16]It is important that the accessibility relation does not have dead ends.

Just as bivalence fails in cases of future contingency, neither S-FLEM and M-FLEM are not valid. In the example of Jones and her coffee mentioned above, both $\nu_{\text{today}}(\triangle^{1 \text{ day}} C \vee \triangle^{1 \text{ day}} \neg C)$ and $\nu_{\text{today}}(\triangle^{1 \text{ day}} C \vee \neg \triangle^{1 \text{ day}} C)$, are undefined. Since *will/not* commutativity is valid, corresponding instances of S-FLEM and M-FLEM are logically equivalent.

(8.87) $\not\models \triangle\phi \vee \triangle\neg\phi$ although $\approx \triangle\phi \vee \triangle\neg\phi$

(8.88) $\not\models \triangle\phi \vee \neg \triangle\phi$ although $\approx \triangle\phi \vee \neg \triangle\phi$

Given that S-FLEM and M-FLEM are equivalent, that an instance of S-FLEM is outright false entails that a corresponding instance of M-FLEM is false. M-FLEM is a special case of LEM. So if an instance of S-FLEM were false, an instance of LEM would be false, and that is undesirable. Thus, S-FLEM/M-FLEM should not be invalid, but at least semi-valid. NBɪᴠOF achieves this result.

8.3   Temporal Standpoints and Standpoint Inheritance

Standpoint inheritance is incorporated into MMBT in this section. Section 8.3.1 rehearses the importance of standpoint inheritance. More in-depth coverage is given in Sections 3.4, 6.3.3, and 7.3.2. Section 8.3.2 describes a general theory of standpoint inheritance for MMBT that can be used for TF and OF alike. The general theory shows that standpoint inheritance is not tailored to a particular view, but to branching time systems more broadly. More details about standpoint inheritance for TF and OF are given in Sections 8.3.3 and 8.3.4, respectively. Finally, Section 8.3.5 delivers the promised result that traditional Sᴜᴘ can be defined using BɪᴠOF with temporal standpoints, eliminating Sᴜᴘ's apparent dependence on a TRL.

8.3.1 The Importance of Temporal Standpoints

All of the theories presented so far have encountered difficulties with combinations of temporal operators. Suppose, for instance, that Jones drank coffee yesterday, but could have done otherwise.

(8.89) If Jones had not drunk coffee, then God would have known that Jones would not drink coffee.

(8.90) If Jones had not drunk coffee, then it would have been the case that Jones would not drink coffee.

Since God knows only truths, (8.89) implies (8.90).

These statements should turn out true on an Ockhamist account.[17] Ockhamists in the freedom/foreknowledge literature, however, never managed to propose a convincing explication of the hard/soft fact distinction.[18] Meanwhile, advocates of TF have yet to answer Belnap and Green's criticism that statements like (8.90) and hence (8.89) turn out false under TF.[19]

OF and SUP do not as obviously get the wrong answer for (8.89) and (8.90). BIVOF yields that (8.89) and (8.90) are both false due to the contingency of Jones action, while NBIVOF and SUP yield that (8.89) and (8.90) have no truth value. One could argue that this is the correct response, according to those views; but perhaps OF and SUP would only satisfy their compatriots. Consider, for example, a case in which Smith predicted that Jones would drink coffee. Given that Jones drank coffee,

(8.91) Smith correctly asserted that Jones would drink coffee

should turn out true. For that reason,

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[17]In [Plantinga(1986)], p. 251, Plantinga indicates that Ockhamists hold such statements to be true.

[18][Todd(2012)]. Also, see Section 2.7

[19][Belnap and Green(1994)], p. 380. See [Øhrstrøm(2009)] for a recent portrayal of Ockhamism. Øhrstrøm's TF system does not address Belnap and Green's criticism. Belnap and Green's criticism is discussed in Section 6.3.3.

(8.92) Jones was going to drink coffee

seems true, as well. OF and SUP need to account for these statements.[20]

Reichenbach distinguished between three kinds of nodes relevant to evaluating statements.[21] First is the moment at which a temporal statement is assigned a truth value (Reichenbach's S). Second is the moment at which the proposition affected by a temporal operator is evaluated (Reichenbach's E). Potential moments of evaluation from m (with respect to a given accessibility relation) are those moments accessible from m. Third is a point of reference (Reichenbach's R) that may differ from the other two moments.[22] The systems proposed thus far only explicitly account for moments of the first two types. The third, here called "temporal standpoints" (following Lucas), can affect factors like accessibility relations. For instance,

(8.93) From yesterday's standpoint, Jones may and may not drink coffee.

(8.94) From today's standpoint (one in which Jones drank coffee), that Jones drank coffee is now unalterable—necessary *per accidens*.

(8.95) From a counterfactual-today standpoint (one in which Jones did not drink coffee), that Jones did not drink coffee is now unalterable.

Standpoints affect the structure of moment-specific accessibility relations. A moment-relative temporal accessibility relation is already available for IDxTF. Such relations might also be utilized for SUP. OF still needs a moment-specific temporal relation. Since ATC accessibility serves as the temporal relation in OF, ATC trees must be divided into node-specific parts.

A simplified technique is here used to account for temporal standpoints: standpoint inheritance. The details of standpoint inheritance in general and for TF and OF in particular systems are provided in the following sections.

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[20]The issue is given in slightly more detail in Section 7.3.2.

[21][Reichenbach(1947)]

[22]See Section 3.4 for more on Reichenbach's analysis.

8.3.2 A General Theory of Standpoint Inheritance

This section gives a general of standpoint inheritance. Specific examples are reserved for later sections in where there are particular temporal relations to work with.

First, some definitions are in order to clarify talk of standpoints. In terms of the systems given here, Reichenbach's S, R, and E are designated as follows.

truth-assessment point a moment m at which $\nu_m(\phi)$ is being assessed

standpoint a moment s used to designate moment-specific accessibility relations; or the moment-specific relation designated by s

evaluation point a moment m' is an evaluation point with respect to moment m and accessibility relation R just in case mRm'; a moment m' is an evaluation point with respect to moment m and modal/temporal operator $\bigcirc_R$ if and only if mRm'

Additional definitions pertaining to standpoints:

standpoint relation a relation or type of relation, S, designating standpoint-specific accessibility relations S_s. It is assumed that there is only one standpoint relation.

relative counterfactual a moment m is relatively counterfactual with respect to standpoint s iff m is not on S_s

Some operators appear to handle standpoints differently than others. The following term helps to differentiate between two types of operators.

standpoint-sensitive operator an operator that uses the standpoint relation to determine points of evaluation

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With those terms in mind, a general theory of standpoint inheritance may be stated informally as follows.

(8.96) Some operators are standpoint-sensitive while others are not.

(8.97) One should only change standpoint when the point of evaluation is counter-
factual with respect to the standpoint.

Implementing this theory in more detail requires a mechanism to keep track of standpoints. To this end, a standpoint parameter may be added to the truth function. For proposition ϕ and moments m and s,

(8.98) $\nu_{m|s}(\phi)$ may be read as "the truth of ϕ at m from s" or "the truth of ϕ at m given s".

It is assumed that the truth function is total with respect to atomic propositions:

(8.99) For all $m, s \in M$ and atom A, $\nu_{m|s}(A) \in \{0, 1\}$.

Standpoints are unnecessary for evaluating atomic propositions:

(8.100) For all $m, s \in M$ and atoms A, $\nu_{m|s}(A) = \nu_{m|m}(A)$.

Truth-functional operators require no substantial modification:

$$(8.101) \quad \nu_{m|s}(\neg\phi) = \begin{cases} 1 & \text{iff } \nu_{m|s}(\phi) = 0 \\ 0 & \text{iff } \nu_{m|s}(\phi) = 1 \end{cases}$$

$$(8.102) \quad \nu_{m|s}(\phi \wedge \psi) = \begin{cases} 1 & \text{iff } \nu_{m|s}(\phi) = \nu_{m|s}(\psi) = 1 \\ 0 & \text{iff } \nu_{m|s}(\phi) = 0 \text{ or } \nu_{m|s}(\psi) = 0 \end{cases}$$

The other truth-functional operators can be defined in terms of $\neg$ and $\wedge$, as usual.

To assess modal and temporal operators, standpoint inheritance uses a standpoint rela-
tion, which is a moment-specific accessibility relation. IDxTF is equipped with a suitable type of relation for standpoint-sensitive temporal operators, the type TRL, for which there are specific relations TRL_m. TRL is a function from moments to maximal chains. The notation TRL_s is used to indicate that s is a standpoint. A more general technique for individuating standpoint-specific relations from any relation S is as follows:

(8.103) $S_s := \bigcup\{P|P$ is an S-path containing $s\}$

One specific instance of this technique will be important for this project. Standpoint-specific subtrees of $<$, ATC accessibility, can be defined as:

(8.104) $<_s := \bigcup\{P|P$ is a $<$-path containing $s\}$

The idea to create subtrees is not new. Lucas, for example, has employed subtrees.[24] Intuitively, the subtree $<_s$ is the portion of $<$ that contains all paths to and from s. The subtrees $<_s$ are important for both OF and TF. OF uses $<_s$ as the temporal relation. TF requires $<_s$ to ensure that *will-inevitably* and *was-inevitably* pass on the correct standpoint.

All of the systems employed use only temporal standpoints. There are no other types of standpoints. The temporal relation S (TRL for TF and $<$ for OF) designates the standpoint-specific S_s (TRL_s for TF and $<_s$ for OF). There is exactly one standpoint relation per system. The theory presented here would require further generalization to accommodate multiple kinds of standpoints.

Some operators are standpoint-sensitive. For this purpose, the only standpoint-sensitive operators are temporal operators representing *will, was, will-always,* and *was-always*. The two operators required to define all others are $\square$ and $\triangle$. Standpoint sensitive versions of those operators may be defined as follows. Let S be the standpoint relation and assume that paths are simple and forwards-maximal.

Standpoint-sensitive operators:

(8.105) $\nu_{m|s}(\square_S\phi) = \begin{cases} 1 & \text{iff for every } m' \in M \text{ such that } mS_sm',\ \nu_{m'|s}(\phi) = 1 \\ 0 & \text{iff for some } m' \in M \text{ such that } mS_sm',\ \nu_{m'|s}(\phi) = 0 \end{cases}$

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[24][Lucas(1989)]

$$(8.106) \quad \nu_{m|s}(\triangle_S \phi) = \begin{cases} 1 & \text{iff for every path } P_s \text{ on } S_s \text{ starting at } m, P_s \text{ contains} \\ & \text{some } m' \neq m \text{ such that } \nu_{m'|s}(\phi) = 1 \\ 0 & \text{iff for some path } P_s \text{ on } S_s \text{ starting at } m, \text{ every } m' \neq m \\ & \text{on } P_s \text{ is such that } \nu_{m'|s}(\phi) = 0 \end{cases}$$

Consider an example. An illustration is given in Figure 8.3.1. There are three nodes, m_1, m_2, and m_3 and a relation S, where $m_1 S m_2$ and $m_1 S m_3$. S is the standpoint relation. Particular standpoint-specific subsets of S are derived using (8.103), by which the S_i are S-paths containing m_i. That yields $S_1 = S$ since both elements of S involve m_1. $m_1 S_2 m_2$ since only that path contains m_2. S_2 is depicted in Figure 8.3.1 (b). For the same reasons, $m_1 S_3 m_3$. In this model, $\nu_{2|2}(A) = 1$ and $\nu_{3|3}(A) = 0$.

This simple abstract example is more like OF than TF. Examples directly relevant to TF and OF are given in later sections.

Let $\triangle$ represent the standpoint-sensitive $\triangle_S$. It can be shown that $\nu_{1|1}(\triangle A) = 0$. The relevant standpoint-specific relation is S_1, shown in Figure 8.3.1 (a). $m_1 S_1 m_3$ is a maximal path starting at m_1. Every $m' \neq m_1$ on that path (just m_3) is such that $\nu_{m'|1}(A) = 1$. In particular, $\nu_{3|1}(A) = \nu_{3|3}(A) = 0$.

$\nu_{2|2}(\triangledown \triangle A) = 1$. In this case, the standpoint-specific relation is S_2, illustrated in Figure 8.3.1 (b). Since S_2 amounts to just $m_1 S_2 m_2$, there is only one path backwards along S_2 from m_2 and that path contains only one node preceding m_2, namely m_1. So $\nu_{2|2}(\triangledown \triangle A) = 1$ iff $\nu_{1|2}(\triangle A) = 1$. The operative standpoint-specific relation in this case is still S_2. There is only one path forwards along S_2 from m_1 and the only other node on that path is m_2. As such, $\nu_{1|2}(\triangle A) = 1$ iff $\nu_{2|2}(A) = 1$.

Standpoint-sensitive operators are very much like the modal and temporal operators defined in Section 8.1.3. There are two important things to notice. The first is that standpoint-sensitve operators use the standpoint-specific relations S_s, which s may or may not be identical to m. The second is that standpoint-sensitive operators pass their standpoints to their
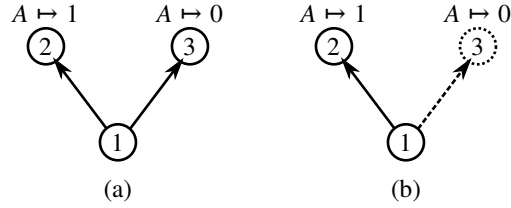
Figure 8.3.1:   A general model depicting standpoint inheritance. (a) illustrates the given relation S independently of standpoints, which in this case is the same as S_1. S_2 is shown in (b).

sub-propositions. This fact ensures that statements like:

(8.107) Jones was going to have coffee. $(\triangledown \vartriangle C)$

use the initial standpoint for both temporal operators. As such,

(8.108) $C \vDash \triangledown \vartriangle C$

That is, whatever is was going to be. It can be shown more generally that whatever was, is, or will be was going to be; and that whatever was, is, or will be was either going to be or going to not be. (The latter principle is ExP-S-FLEM, discussed in Section 7.3.4.)

(8.109) $\triangledown \phi \vee \phi \vee \vartriangle \phi \vDash \triangledown \vartriangle \phi$

(8.110) $\triangledown \phi \vee \phi \vee \vartriangle \phi \vDash \triangledown (\vartriangle \phi \vee \vartriangle \neg \phi)$

It is crucial to differentiate between standpoint-sensitive operators and other operators. This may be done using notation or context. Regarding notation, $\square$ and $\diamond$ are not a problem since, in this exposition, little will be done with *will-always* and *was-always*. $\square$ and $\diamond$ are used in their non-standpoint-sensitive, modal senses only. *Will* and *was* are represented by $\vartriangle$ and $\triangledown$, distinguishing them from the non-standpoint-sensitive $\boxed{\vartriangle}$ and $\boxed{\triangledown}$ used for *will/was-inevitably*, respectively.

Non-standpoint-sensitive operators do not use standpoints to determine points of evaluation. It is tempting to define non-standpoint-sensitive operators independently of standpoints, but this route yields some undesirable results. In particular:

(8.111) Bad result from proposed definition: inequivalent: $\{\triangledown \triangle \phi, \overline{\triangledown} \triangle \phi\}$

The reason why the two statements are not equivalent is that $\triangledown$ passes its standpoint on while $\overline{\triangledown}$ does not. The backwards-linearity of $<$ should yield that $\triangledown$ and $\overline{\triangledown}$ are interchangeable. By analogy, if physical determinism were to hold (that is, $<$ is linear), then whatever will occur is inevitable. It is already granted that whatever is inevitable will occur, so $\triangle$ and $\overline{\triangle}$ would be equivalent if $<$ were linear. Thus, $\triangledown$ and $\overline{\triangledown}$ should be equivalent since $<$ is backwards-linear.[25] To ensure this result, non-standpoint-sensitive operators must sometimes pass on their standpoints.

Standpoints are only relevant to non-standpoint-sensitive operators because those operators pass standpoints on to sub-propositions that may be standpoint-sensitive. Unlike standpoint-sensitive operators, non-standpoint-sensitive operators are not limited by standpoints to designate nodes at which to perform evaluations. It is necessary to change standpoints in order to sensibly evaluate at a node that is unrelated to the standpoint by the standpoint relation. For instance, the scenario depicted in Figure 6.3.1:

(8.112) Before Jones drank coffee, it was the case that Jones will inevitably not have a headache.

The initial standpoint is one in which Jones drank coffee. The inner operator, *will-inevitably*, has a point of evaluation at which Jones did not drink coffee. That node is counterfactual with respect to the initial standpoint. To evaluate at the counterfactual node, one must switch standpoints, asking what would have happened if Jones had not drunk coffee.

The foundational non-standpoint-sensitive operators may be defined as follows.[26] Let R be an accessibility relation such that $S_s \subseteq R$ for each moment s. Assume that paths are simple and forwards-maximal.

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[25] Additionally, the inequivalence of $\triangledown$ and $\overline{\triangledown}$ could be used to resuscitate Belnap and Green's criticism against IDXTF, discussed in Section 6.3.3, if not make the problem worse. *The coin was-inevitably going to come up heads* would hold at the tails scenario although *The coin was going to come up tails* would also hold.

[26] The upcoming definitions presuppose transitivity.

Non-standpoint-sensitive operators:

$$(8.113) \quad \nu_{m|s}(\square_R \phi) = \begin{cases} 1 & \text{iff for every } m' \in M \text{ such that } mRm', \\ & \text{if } mS_s m', \nu_{m'|s}(\phi) = 1; \text{ otherwise, } \nu_{m'|m'}(\phi) = 1 \\ 0 & \text{iff for some } m' \in M \text{ such that } mRm', \text{ either} \\ & (mS_s m' \text{ while } \nu_{m'|s}(\phi) = 0) \text{ or } \nu_{m'|m'}(\phi) = 0 \end{cases}$$

$$(8.114) \quad \nu_{m|s}(\triangle_R \phi) = \begin{cases} 1 & \text{iff for every path } P \text{ on } R \text{ starting at } m, \text{ for some } m' \ne m \\ & \text{on } P, \text{ if } m' \text{ is on some } P_s \text{ on } S_s, \text{ then } \nu_{m'|s}(\phi) = 1; \\ & \text{otherwise, } \nu_{m'|m'}(\phi) = 1 \\ 0 & \text{iff for some path } P \text{ on } R \text{ starting at } m, \text{ for every } m' \ne m \\ & \text{on } P, \text{ if } m' \text{ is on some path } P_s \text{ on } S_s, \text{ then } \nu_{m'|s}(\phi) = 0; \\ & \text{otherwise, } \nu_{m'|m'}(\phi) = 0 \end{cases}$$

The only difference between the standpoint-sensitive and non-standpoint-sensitive operators are those clauses involving $\nu_{m'|m'}$ in the definitions for non-standpoint-sensitive operators. Those operators' points of evaluations are not restricted by the standpoint to S_s. Points of evaluation not on S_s are deemed counterfactual with respect to s, so the standpoint is reset to the new point of evaluation, m'.

As an example, return to the model shown in Figure 8.3.1. For clarity, let $\triangle$ represent the non-standpoint sensitive $\triangle_S$. In that model, $\nu_{2|2}(\triangledown \triangle A) = 0$, as follows. The truth conditions for $\triangledown$ require checking nodes behind m_2 along S_2. There is only one such node, m_1, so $\nu_{2|2}(\triangledown \triangle A) = 0$ iff $\nu_{1|2}(\triangle A) = 0$. For the sake of illustrating the definitions, it is worthwhile to check all S-paths (note that S is not standpoint-specific) from m_1 although only the right path is needed. Consider the left path. The relevant evaluation is $\nu_{1|2}(\triangle A)$, the standpoint being m_2. Furthermore, S_2 includes the entire left path, so the standpoint m_2 is retained. It is necessary to check all $m' \ne m_1$ on the left path to see if $\nu_{m'|2}(A) = 0$. In this simple example, m_2 is the only such m'; but if there were others, the standpoint would

still be m_2. The case is different along the right path. That path is $m_1 S m_3$. It is shown using the right path that there is a path along S from m_1 by which $\nu_{1|2}(\triangle A) = 0$. The only node on the right path, m_3, is counterfactual with respect to m_2 because m_3 is not along S_2. See Figure 8.3.1 (b). Since m_3 is not along S_2, the truth conditions for $\triangle$ demand switching standpoints to m', which in this case is just m_3. $\nu_{3|3}(A) = 0$, so $\nu_{1|2}(\triangle A) = 0$; thus, $\nu_{2|2}(\triangledown \triangle A) = 0$.

8.3.3 Standpoint Inheritance for True Futurism

Standpoint inheritance is here applied to (branching) IDXTF. The standpoint affects only the temporal relation, which in this case is TRL. As such, that s is taken as the standpoint amounts to TRL_s being the operative temporal relation. One more bit of terminology needs to be clarified here. A node m is counterfactual with respect to s just in case m is not on TRL_s.

The method of implementing standpoint inheritance for IDXTF is quite simple. Roughly,

(8.115) All and only standpoint-sensitive operators are those that use TRL, namely, those representing *will, was, will-always,* and *was-always.*

(8.116) Only switch standpoints when the point of evaluation becomes counterfactual.

Observe that only operators that do not use the temporal relation are capable of accessing relatively counterfactual nodes when the standpoint is held fixed. Suppose the standpoint is held at s. Any member of a consecutive string of temporal operators—those corresponding to *will, was, will-always,* and *was-always*—only specify points of evaluation on TRL_s. That limitation is due to the fact that TRL_s is designated as the accessibility relation for those operators, which is what holding the standpoint at s amounts to.

In symbols, those temporal operators are $\triangle_{TRL_s} = \triangle_{TRL_s}$, $\triangledown_{TRL_s} = \triangledown_{TRL_s}$ (i.e. $\triangle_{-TRL_s}$), $\square_{TRL_s}$, and $\square_{-TRL_s}$. Note that the TRL's linearity yields that $\diamond_{TRL_m} = \triangle_{TRL_m}$ and $\diamond_{-TRL_m} = \triangledown_{TRL_m}$, so there is no need to account for those $\diamond$ operators directly. Only operators that use

accessibility relations other than TRL_s, the non-standpoint-sensitive operators, can access nodes counterfactual with respect to s, those moments not on TRL_s. Such operators include *will-inevitably, was-inevitably,* and various forms of *necessarily* and *possibly.* In symbols, $\triangle_<$, $\triangledown_<$, $\Box_<$, $\Diamond_<$, $\Box_L$, $\Diamond_L$, *et cetera,* and corresponding $\Box$ and $\Diamond$ operators along inverse relations. The mechanics of these operators are specific instances of the general analysis provided in Section 8.3.2.

Standpoint inheritance avoids Belnap and Green's criticism, discussed in Sections 6.3.3 and 6.3.4. The criticism has not been addressed using traditional branching time logics, but standpoint inheritance fixes the issue. Without standpoint inheritance, TRLs at counterfactual nodes are hijacked, so to speak, by a dominant TRL somewhere in the past. Standpoint inheritance blocks such hijacking by ensuring that the inner operator, $\triangle$, retains the standpoint of the outer $\triangledown$. This technique corresponds to actual usage by avoiding standpoint shifts as long as it makes sense to do so.

Standpoint inheritance yields:

(8.117) When anything is the case, it has always been the case that it will be the case.[27] $(\phi \vDash \Box_{-TRL} \triangle \phi)$

(8.118) $\phi \vDash \triangledown \triangle \phi$

(8.119) $\phi \vDash \triangledown^t \triangle^t \phi$ for any $t > 0$

Without standpoint inheritance, (8.117)–(8.119) do not hold in any of the systems here (except ABSTF, which was seen to be deficient). Belnap and Green showed that IDXTF gives the wrong answer for (8.118) and (8.119) at counterfactual nodes. More generally,

(8.120) consistent: $\{\phi, \triangledown \triangle \neg\phi\}$

(8.121) consistent: $\{\phi, \triangledown^t \triangle^t \neg\phi\}$

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[27][Prior(1955)], p. 210.
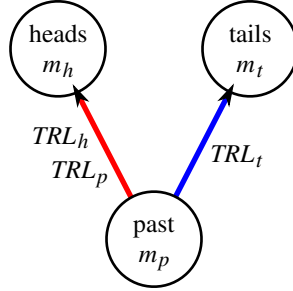
Figure 8.3.2: Indexical true futurism: Coin toss revisited. The red TRL (heads) dominates the blue TRL (tails), indicating that the actual timeline contains the heads moment, not the tails moment.

hold for some ϕ and $t > 0$ at some nodes in any model that has future contingents.[28] Standpoint inheritance avoids this unwelcome result by satisfying (8.118) and (8.119).

Example TF1:

For the sake of illustration, recall Belnap and Green's coin toss example, illustrated in Figure 8.3.2.

Let m_h, m_t, and m_p be the heads moment, tails moment, and past moment, respectively; and let TRL_h, TRL_t, and TRL_p be the corresponding TRLs. Suppose that $TRL_p = TRL_h \neq TRL_t$, but TRL_t contains m_p, as indicated in Figure 8.3.2. Define $H :=$ *The result is heads* and $T :=$ *The result is tails* where T is equivalent to $\neg H$. Assume $\nu_{h|h}(H) = 1$ and $\nu_{t|t}(T) = 1$ (standpoints are irrelevant to literals like H and T).

Consider $\nu_{t|t}(\triangledown \triangle T)$, the truth value of *The coin was going to come up tails* at/from the tails node. $\nu_{t|t}(\triangledown \triangle T) = 1$ since for every (the only) path backwards along TRL_t, some moment m along that path is such that $\nu_{m|t}(\triangle T) = 1$. (For the non-metric $\triangle$, every moment m preceding m_t along TRL_t makes $\nu_{m|t}(\triangle T) = 1$. For the the metric $\triangle^x$, at least one moment m preceding m_t along TRL_t makes $\nu_{m|t}(\triangle^x T) = 1$. That moment is m_p for $x = \tau_t - \tau_p$.) $\nu_{m|t}(\triangle T) = 1$ because for every (the only) path forwards along TRL_t from m contains a moment m' (namely, m_t) such that $\nu_{m'|t}(T) = 1$.

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[28]In particular, the problem occurs at nodes that are not on a special TRL, which may be called the real TRL. The real TRL is a unique TRL_m such that if $m' < m$, then $TRL_{m'} = TRL_m$. Not all IDxTF models have real TRL. There is such a TRL if and only if the ATC tree has a root node or a trunk; that is, the tree has a least m or is linear behind some m. There are nodes that are not on the real TRL if and only if there are future-contingents.

Standpoint inheritance retains the following.

(8.122) $\phi \approx \triangledown \triangle \phi$

(8.123) $\triangledown = \overline{\triangledown}$

Example TF2:

Here is an illustration of (8.122) using the coin example above. Consider $\nu_{h|h}(\triangledown^x \triangle^x H)$ for $x = \tau_h - \tau_p$. (Metric operators are used for convenience. Showing that the non-metric $\triangle H$ is false requires showing that H is false at *every* node on some branch, which is an unnecessary hassle for this example. There is no need to address what happens if the coin is tossed again in an hour, for instance. One could achieve the same effect by ignoring all nodes except m_h, m_t, and m_p.) $\nu_{h|h}(\triangledown^x \triangle^x H) = 0$ because the only node preceding m_h along TRL_h at which the time is $\tau_h - x$ is m_p and $\nu_{p|h}(\triangle^x H) = 0$. $\nu_{p|h}(\triangle^x H) = 0$ since $\triangle$ uses $<$ and there are two nodes at which the time is $\tau_p + x$ forwards along $<$ from m_p, namely, m_h and m_t. m_h is along TRL_h so the standpoint is kept at H (although it makes no difference for evaluating the atom H). The relevant evaluation is $\nu_{h|h}(H) = 1$. m_t is not along TRL_h. As such, the standpoint switches to m_t and the relevant evaluation is $\nu_{t|t}(H) = 0$. Thus, along the tails path, the coin does not come up heads at the requisite time, ensuring $\nu_{p|h}(\triangle^x H) = 0$.

Two examples were just given. The first emphasizes standpoint retention for temporal operators. The second example illustrates the fact that $\triangle$ is not bound by the standpoint. The next example shows how standpoint retention and switching work together.

Example TF3:

Consider again the coin toss scenario. It will be shown that:

(8.124) $\nu_{p|p}\left(\triangle^x\left((H \supset \triangledown \triangle H) \wedge (T \supset \triangledown \triangle T)\right)\right) = 1$

Again, the metric $\triangle^x$ is used for convenience as in the second example. $x = \tau_h - \tau_p$, as above. $\triangle$ uses $<$ and there are two paths forwards along $<$ from m_p, the heads path and the tails path. The only node along the heads (tails) path at which the time is $\tau_p + x$ is m_h

(m_t). m_h is along TRL_p, so the first relevant evaluation is $\nu_{h|p}\left((H \supset \triangledown \triangle H) \wedge (T \supset \triangledown \triangle T)\right)$; but $TRL_p = TRL_h$, so it is all the same if $\nu_{h|h}\left((H \supset \triangledown \triangle H) \wedge (T \supset \triangledown \triangle T)\right)$ is evaluated, instead. (The otherwise useless standpoint switch makes the two evaluations symmetric, allowing for a WLOG argument shortly.) m_t is not along TRL_p, so the second evaluation is $\nu_{t|t}\left((H \supset \triangledown \triangle H) \wedge (T \supset \triangledown \triangle T)\right)$. The two evaluations are symmetric, so consider only the first WLOG. The right conjunct of $\nu_{h|h}(T \supset \triangledown \triangle T) = 1$ since $\nu_{h|h}(T) = 0$. Given that $\nu_{h|h}(H) = 1$, $\nu_{h|h}(H \supset \triangledown \triangle H)$ depends on $\nu_{h|h}(\triangledown \triangle H)$. $\nu_{h|h}(\triangledown \triangle H) = 1$ following the argument in Example TF1. As such, $\nu_{h|h}\left((H \supset \triangledown \triangle H) \wedge (T \supset \triangledown \triangle T)\right) = 1$ since both conjuncts are true. Similarly, $\nu_{t|t}\left((H \supset \triangledown \triangle H) \wedge (T \supset \triangledown \triangle T)\right) = 1$. It follows that $\nu_{p|p}\left(\triangle^x\left((H \supset \triangledown \triangle H) \wedge (T \supset \triangledown \triangle T)\right)\right) = 1$.

8.3.4 Standpoint Inheritance for Open Futurism

Standpoint inheritance may be applied to BivOF and NBivOF. OF is not by default equipped with any moment-sensitive accessibility relations. Moment-specific subtrees of $<$ are defined using (8.104), as described above. That s is a temporal standpoint amounts to $<_s$ being the operative temporal relation.

A node m is counterfactual with respect to standpoint s if and only if m is not on $<_s$. Unlike the case for TF, that m is not counterfactual with respect to s does not imply that m is factual with respect to s. If m and m' are distinct, contemporaneous nodes such that $s < m$ and $s < m'$, then m and m' are incompatible, alternate possible futures from s. Thus, neither m nor m' are counterfactual with respect to s. Neither moment is factual with respect to s because OF never prioritizes one possible future of a standpoint over another.[29]

Standpoint inheritance for OF is roughly captured by these familiar tenets:

(8.125) All and only standpoint-sensitive operators are those representing *will, was, will-always*, and *was-always*.

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[29]This notion of counterfactuality is intended to clarify the discussion, but does not accord with all English usage.
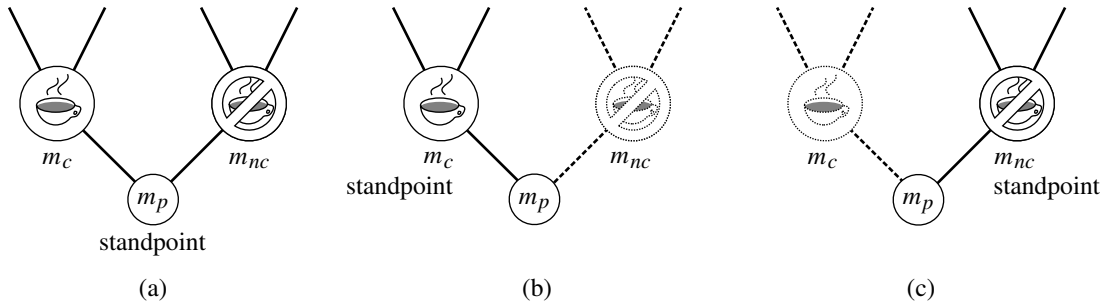
Figure 8.3.3: Open futurism: Jones drinking coffee revisited. Jones drinks coffee at m_c, but not at m_{nc}. Her coffee-drinking is future-contingent at m_p. In (a), the standpoint is m_p and the corresponding ATC subtree is $<_p$. That subtree includes all of the nodes shown in the figure. As such, (a) also shows $<$ independently of standpoint (ignoring nodes outside of the diagram). In (b), the standpoint is m_c and the corresponding subtree is $<_c$. $<_c$ does not include the non-coffee branch containing m_{nc}. In (c), the standpoint is m_{nc} and the subtree, $<_{nc}$. That subtree does not include the coffee branch containing m_c.

(8.126) Only switch standpoints when the point of evaluation becomes counterfactual.

Standpoint inheritance for OF is the same as that for TF, except for the difference in temporal/standpoint relations.

OF with standpoint inheritance, and not without, satisfies (8.118) and (8.119). This goal is accomplished respecting (8.122), (8.123), and S-FLEM's invalidity. OF can therefore account for predictions without compromising those other important tenets.

Example OF1:

Here is an example of (8.118) that is the same for both BɪᴠOF and NBɪᴠOF. See Figure 8.3.3 for an illustration of the familiar scenario of Jones' future-contingent coffee-drinking, now including subscripts. Let m_c be a node at which Jones drinks coffee and m_{nc} be a node at which she does not ("nc" stands for "no coffee"). m_p is a past node at which Jones' coffee-drinking is contingent.

Consider $\nu_{c|c}(\triangledown \triangle C)$, the truth value of *Jones was going to drink coffee* at/from m_c, the node at which Jones drinks coffee. The ATC subtree corresponding to m_c, $<_c$, is depicted in Figure 8.3.3 (b). $\nu_{c|c}(\triangledown \triangle C) = 1$ since there is a moment prior to m_c on $<_c$, namely m_p, such that $\nu_{p|c}(\triangle C) = 1$. $\nu_{p|c}(\triangle C) = 1$ because every path forwards from m_p contains a moment at which Jones drinks coffee. In particular, every such path contains m_c and $\nu_{c|c}(C) = 1$.

Example OF2:

This second example shows that $\nu_{c|c}(\triangledown^t \triangle^t C) = 0$ for $t = \tau_c - \tau_p = \tau_{nc} - \tau_p$ in the coffee scenario. The example works for both BivOF and NBivOF. As in Example TF2, metric operators are used for convenience to skirt unnecessary considerations like whether or not Jones drinks coffee next Thursday on the no-coffee branch. $\nu_{c|c}(\triangledown^t \triangle^t C) = 0$ since the only node backwards from m_c at which the time is $\tau_c - t$ is m_p and $\nu_{p|c}(\triangle^t C) = 0$. Recall that $\triangle$ uses $<$ and is not limited by standpoint. Ignoring the standpoint, the $<$ is depicted in Figure 8.3.3 (a). Each $<$-path from m_p contains exactly one of two nodes at which the time is $\tau_p + t$, namely, m_c and m_{nc}. Evaluating at m_c does not require a standpoint switch because m_c is on $<_c$ as in Figure 8.3.3 (b), so the relevant evaluation is $\nu_{c|c}(C) = 1$. m_{nc} is not on $<_c$, so evaluating at m_{nc} requires switching standpoint from m_c to m_{nc}. The relevant evaluation is therefore $\nu_{nc|nc}(C) = 0$. There is at least one $<$-path from m_p along which Jones does not drink coffee at the relevant time.

Another advantage to standpoint inheritance is that it greatly simplifies many expressions. All strings of non-metric and metric $\triangle/\triangledown$ can be reduced to a string with at most two of those operators.

The eight possible strings of three operators are $\triangle\triangle\triangle$, $\triangle\triangle\triangledown$, $\triangle\triangledown\triangle$, $\triangle\triangledown\triangledown$, $\triangledown\triangle\triangle$, $\triangledown\triangle\triangledown$, $\triangledown\triangledown\triangle$, and $\triangledown\triangledown\triangledown$. Density yields that:

(8.127) $\quad \triangle\triangle\phi \dashv\vDash \triangle\phi$

(8.128) $\quad \triangledown\triangledown\phi \dashv\vDash \triangledown\phi$

By those two equivalences, six of the eight length-three strings reduce to length two. The remaining strings are $\triangle\triangledown\triangle$ and $\triangledown\triangle\triangledown$. The following hold, regardless of standpoint inheritance.

(8.129) $\quad \triangle\triangledown\triangle\phi \dashv\vDash \triangledown\triangle\phi$

(8.130) $\quad \triangledown\triangle\triangledown\phi \dashv\vDash \triangle\triangledown\phi$

Standpoint inheritance yields that all operators in $\triangle/\triangledown$ strings use the same standpoint s, corresponding to the subtree $<_s$. Standpoint inheritance grants (8.129) and (8.130) intuitively. Without standpoint inheritance, (8.129) and (8.130) may require a temporal operator applying over an arbitrarily small interval. That is somewhat inelegant, but the reduction works nonetheless.

The case is different for metric operators. Let $t, u > 0$. Regardless of standpoint inheritance, the following equivalences hold.

(8.131) $\quad \triangle^t \triangle^u \phi =\!\models \triangle^{t+u} \phi$

(8.132) $\quad \triangledown^t \triangledown^u \phi =\!\models \triangledown^{t+u} \phi$

The next equivalences are only supported by standpoint inheritance. Let $t, u, v, x, y > 0$.

(8.133) $\quad \triangle^t \triangledown^u \triangle^v \phi =\!\models \triangledown^x \triangle^y \phi$

(8.134) $\quad \triangledown^t \triangle^u \triangledown^v \phi =\!\models \triangle^x \triangledown^y \phi$

The equivalences hold for $x = u$ and $y = t + v$. Without standpoint inheritance, it is impossible to specify a relationship between, on the one hand, t, u, v; and x, y on the other. For any proposed expression, it is possible to construct a countermodels of the following sorts:

(8.135) $\quad \triangle^t \triangledown^u \triangle^v \phi \nvDash \triangledown^x \triangle^y \phi$

(8.136) $\quad \triangle^x \triangledown^y \phi \nvDash \triangledown^t \triangle^u \triangledown^v \phi$

Such countermodels always exist because the first operator on the left is $\triangle$, but the first operator on the right is $\triangledown$. One can always ensure that the past operator dips below a confounding branch that changes the result. This is accomplished by placing such a branch below the standpoint closer than $\min(x, t)$. There are no confounding branches below the initial standpoint given standpoint inheritance. The standpoint's subtree only begins to fork at the standpoint.

8.3.5   Supervaluationism based on Open Futurism

There is nothing inherently true-futurist about SUP. SUP does not choose a privileged future. The only thing that SUP has in common with TF is that *will/not* commutativity and S-FLEM are both valid under those theories. It is incidental that semantics for SUP involve a TRL under Thomason's portrayal.[30] This section provides an alternative semantics for SUP built from OF with standpoint inheritance.

The idea behind SUP more broadly is that some things are underspecified.[31] Those types of things that can be underspecified are associated with all of their possible resolutions. There is something to designate only insofar as possible specifications are in agreement. In the case of temporal logic, what is underspecified is how the future will turn out. TRLs represent possible specifications of the future. The SUP truth function N yields truth or falsity to the extent that what will happen is resolved.

Using TRLs might not seem sensible to a friend of OF. In OF, the future is resolved as time passes. Whatever will happen tomorrow, for instance, will be resolved two days from now. Structurally, this resolution amounts to ATC subtree pruning over time; in terms of statements, ExP-S-FLEM holds in all OF systems with standpoint inheritance. A TRL that represents a particular contingent future is arbitrary if not empty from today's standpoint. A TRL might be legitimate if there were a standpoint to look back from, a standpoint from which everything is past. What will happen tomorrow will be resolved two days from now, but there is no time at which everything will be resolved, assuming time is unbounded and there is no point at which the future is determined. Creating something like a TRL from the perspective of OF requires a time beyond all other times. Put another way, the ATC tree must have maximal elements. OF does not presuppose a time after all others. Even though the TRL is arbitrary or senseless from the perspective of OF, ATC subtree pruning yields intermediate resolutions that are sufficient to provide a SUP semantics. There need not be

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[30][Thomason(1970)]
[31][van Fraassen(1966)]

a time at which everything is resolved as long as each aspect of the future will be resolved at some time.

$$(8.137) \quad N_m(\phi) = \begin{cases} 1 & \text{iff every } <\text{-path } P \text{ starting at } m \text{ contains a moment} \\ & s_0 \text{ on } P \text{ such that for all } s > s_0, \nu_{m|s}(\phi) = 1 \\ 0 & \text{iff every } <\text{-path } P \text{ starting at } m \text{ contains a moment} \\ & s_0 \text{ on } P \text{ such that for all } s > s_0, \nu_{m|s}(\phi) = 0 \end{cases}$$

The node s_0 is a point at which ϕ's truth at m is resolved. When a fact is resolved, it no longer changes. No amount of waiting and seeing can affect something that is resolved. (8.137) is designed to capture this notion of resolution. If it can be determined in advance how ϕ will be resolved, then N, assigns the truth value accordingly. Otherwise, ϕ does not get a truth value at m.

When employing the definition in (8.137), it does not matter whether BIVOF or NBIVOF is taken as the basis. That is because BIVOF and NBIVOF only disagree on the handling of unresolved propositions. SUP draws from its foundational logic only insofar as resolution is concerned.

(8.137) yields a SUP logic with all of the essential features of Thomason's original presentation. LEM, S-FLEM, and *will/not* commutativity are all valid. When ϕ is future-contingent at m, not all paths agree on whether or not ϕ will be true. As such, $N_m(\triangle\phi)$ is undefined.

Chapter 9

Conclusions and Further Research

The arguments of the preceding chapters indicate that TF is not the best view to hold in a dynamic framework. If TF works at all, it is under absolutism (eternalism, the B-theory, and company). At the end of the day, BivOF is the position of choice for avoiding fatalism within a branching time framework. Standpoint inheritance, a theory proposed to enhance all branching time views alike, was seen to have a number of advantages. These results endorse freedom/foreknowledge incompatibilism while avoiding theological fatalism. This chapter reviews those conclusions and proposes some avenues for further research.

9.1 True Futurism and Ockhamism

TF is the only theory to accommodate S-FLEM, *will/not* commutativity, and bivalence. As a logic that is relatively simple and keeps basic intuitions, TF seems ideal. The criticisms proposed by Belnap and Green were addressed using IDxTF combined with standpoint inheritance. In those respects, TF is in good standing.

The introduction of standpoint inheritance clarifies what it is for statements characterizing God's beliefs to be soft facts. Ockhamists hold that God's past and present beliefs are soft when they are about soft facts, although the tenet is not part of TF more generally. To retain their occasional softness, God's beliefs must be standpoint-dependent. The be-

liefs of other agents are not standpoint-dependent and it is not clear how an agent in time can have standpoint-dependent beliefs. Ockhamists must explain how God's beliefs can be standpoint-dependent to justify the view his beliefs are soft. Lacking such an explanation, it is *ad hoc* to propose that God's beliefs are so drastically unlike other beliefs. If God's beliefs are not standpoint-dependent and are instead like the beliefs of other agents, then he is fallible although in fact never wrong. At least, given a model in which there is a dominant TRL, God is never wrong along that TRL. God holds some false beliefs at counterfactual moments. A final option for TF is to maintain that God's beliefs are like those of other agents, but he lacks comprehensive foreknowledge. This position is a type of open theism akin to Hasker's.[1]

Another challenge for TF is to justify S-FLEM, strong future bivalence, and *will/not* commutativity. Several arguments were given indicating that those principles cannot be taken for granted. The supposed validities might stem from confusion, as the first few arguments in Section 7.3.1 indicate. The last argument in that section points out that other grammatical modalities, like *can* and *not*, do not commute with *not*. A unified theory would treat *will* like other grammatical modalities. These arguments do not conclusively show that *will* does not commute with *not*, in which case S-FLEM would fail, but that the burden of proof is on TF to give solid arguments for S-FLEM and commutativity. A candidate argument for S-FLEM and strong future bivalence is the *ex post* argument. The discussion in Section 7.3.4 shows that the *ex post* argument does not really support S-FLEM or strong future bivalence at all, but instead endorses the weaker ExP-S-FLEM. ExP-S-FLEM holds in OF systems equipped with standpoint inheritance. As such, TF isn't as intuitively plausible as it may seem at first glance. TF is challenged to find independently plausible evidence for S-FLEM that does not just endorse W-FLEM, M-FLEM, or ExP-S-FLEM.

Two arguments were given against TF to show that interpreting *will* as *actually-will* does not help. Both arguments draw from the fact that *will* is formally modal and thus

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[1][Hasker(2001)]

actually-will is logically equivalent to *not actually-possibly not*. The first argument proposes that *actually-possibly* should be interpreted as *actualizably*. Actualizability is necessary for contingency if not outright identical to ATC possibility. The second argument adds that *actually* is truth-functionally redundant. So *not actually-possibly not* amounts to *not possibly not*, which is just *necessarily* in some relevantly modal sense. To rebut these arguments, TF must show how *will* ought to be understood so as to secure its non-modality. *Actually-will* does not get the job done. TF cannot avoid fatalism without such an explication.

The arguments involving *actually-will* just mentioned directly conclude that TF yields fatalism. A related concern is the general grounding problem, by which TF is either *ad hoc* or entails fatalism. The temporal relation of TF, the TRL, can be specified with a comprehensive set of soft facts (given all of the hard facts). Conversely, the TRL designates a comprehensive set of soft facts. The general grounding problem challenges TF to explain either why the TRL selects one future over others or, equivalently, why the set of soft facts is constituted as it is. For instance, why will Jones drink coffee tomorrow instead of do otherwise? Any such explanation, so goes the criticism, yields fatalism. Grounding soft facts and the TRL requires a chronologically backwards dependence relation, for soft facts depend on future events. Chronologically backwards dependence is at best anomalous, especially in the context of dynamic time.

The grounding problem has another facet when God is involved. In particular, it is not clear how God or anyone else in time can come to infallibly know soft facts. Any conclusive evidence for a soft fact's truth would make the corresponding event determined. Molinism gives a popular candidate explanation for God's knowledge of soft facts and the TRL. The underlying ATC tree is known by God through his natural knowledge. Soft facts and the TRL are specified via God's middle knowledge (as far as agents go, in terms of counterfactuals of freedom). Everything stems from God's essence and God perfectly understands his own essence. So he knows what free agents and indeterministic subatomic particles would do in every possible situation. Commentators tried to justify middle knowledge of free agents'

behavior using soft facts. Soft facts, however, cannot be taken for granted. Molinists need to explain soft facts in the first place. Molinism does not serve as an explanation of TF, but instead presupposes TF.

The only viable alternative for TF is general eternalism, which would be combined with THEETRN if God is in the picture. Eternalism removes the mystery of the backwards dependence of soft facts on corresponding events. Truth itself is atemporal. Soft facts are (atemporally) true because the events that they are about are (atemporally) occurring. If God is atemporal, then he has epistemic access to events at all times, unlike temporally restricted agents who have much more limited evidence. General eternalism is part of a more thorough absolutism, involving the B-theory and perdurantism. By turning to eternalism, TF may be exiled from all aspects of the dynamic framework.

9.2   Open Futurism

OF does not have the same initial plausibility as TF, but considerations like those mentioned above have led some thinkers to accept OF. OF provides a way out of both logical and theological fatalism while yielding unified linguistic and philosophical analyses of temporal language. The evidence considered in this project leans towards BivOF, which was Prior's favored position, at least in his later writings.[2] Contra Prior, it was seen that OF requires standpoint inheritance.

All forms of OF emphasize a wait-and-see semantics for *will*, but look only at presently determining factors for *will-inevitably*. The distinction between *will* and *will-inevitably* was formally evident in traditional NBivOF and is brought out formally in BivOF by standpoint inheritance (the difference was there to begin with, but somewhat hidden by the formal system). Thus, neither BivOF not NBivOF can be charged with conflating *will* and *will-inevitably*.

Traditional OF cannot represent predictions and guesses that come out true. This is-

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[2][Prior(1967)]. Cf. [Prior(1957)].

sue stems from a deeper problem, a failure to capture the wait-and-see semantics of *will*. Standpoint inheritance provides a framework to naturally handle predictions and faithfully represent wait-and-see semantics. In addition to granting a superior characterization of true predictions and clarifying the difference between *will* and *will-inevitably* for BIvOF, standpoint inheritance allows OF to reduce all strings of consecutive *will*'s and *was*'s to at most two such operators.

Arguments against *will/not* commutativity and S-FLEM show that BIvOF is the best option. NBIvOF retains commutativity while sacrificing bivalence and LEM. SUP keeps LEM, S-FLEM, and commutativity; but not bivalence. As a result, SUP develops a chasm between object- and meta-theory that is at best awkward, if not incoherent. The sacrifices required by NBIvOF and SUP are unnecessary if commutativity and S-FLEM lack foundation to begin with, as proposed in Sections 7.3.1 and 7.3.4. Among varieties of OF, the only obstacle for traditional BIvOF was the apparent conflation *will* and *will-inevitably*. BIvOF with standpoint inheritance avoids the confusion, which was based on other confusions from the start.

9.3   Standpoint Inheritance

Traditional branching time logics effectively switch standpoint with every new point of evaluation. Every modal or temporal operator switches standpoint. Standpoint inheritance suggests a more conservative approach, motivated by counterexamples to traditional logics and corresponding to the empirical claim that speakers do not change standpoint unless they have to. Temporal operators do not affect standpoint at all. For modal operators, instead of switching standpoint with every new point of evaluation, a new standpoint comes into play only when a moment is incompatible with the current standpoint. Formally, this scenario is detected using standpoint-specific accessibility relations. For this project, the relevant accessibility relations are TRLs and ATC trees. If a moment is not on the standpoint's own

relation, then the moment is incompatible with the standpoint.

All major theories using branching time semantics need to incorporate temporal standpoints. Belnap and Green showed that traditional TF gets incorrect results at counterfactual scenarios. AᴮsTF cannot handle temporal statements at counterfactual moments at all. Here is an example demonstrating the point made by Belnap and Green against IᴅxTF. Given that Jones drank coffee, the following holds at a counterfactual moment at which Jones did not drink coffee:

(9.1) Jones did not drink coffee although she was going to. $(\neg c \wedge \triangledown \triangle c)$

(9.1) and its kin indicate the most prominent linguistic obstacle for IᴅxTF. Standpoint inheritance eliminates offensive propositions like (9.1) for IᴅxTF.

Standpoint inheritance also sheds light on the hard/soft fact distinction. The standpoint-dependence of propositions allows IᴅxTF to get correct results, avoiding statements like (9.1). Suppose that Jones' coffee-drinking is contingent. Thus:

(9.2) Jones will drink coffee

characterizes a soft fact. The softness of (9.2) is demonstrated by the fact that (9.2)'s truth value depends on future standpoint. In order for statements characterizing God's beliefs to be soft, those propositions must be standpoint-dependent. That is, God's beliefs must themselves be standpoint-dependent. Ockhamists are therefore committed to the view that God's beliefs are standpoint-dependent, for they advocate statements like:

(9.3) Since Jones drank coffee, God believed that she was going to drink coffee.

(9.4) If Jones had not drunk coffee, God would have believed that she was going to not drink coffee.

In the context of branching time, (9.4) requires that God's beliefs are standpoint-dependent, unlike the beliefs of other agents. Standpoint dependence clarifies this observation.

OF needs to account for temporal standpoints in order to account for predictions and faithfully represent wait-and-see semantics. If (9.2) was contingent, then it was untrue. Assume that:

(9.5) Smith predicted that Jones would drink coffee.

Smith's prediction was correct. Under standpoint inheritance, (9.2) remains untrue from earlier standpoints from which Jones' coffee-drinking is contingent. From later standpoints in which Jones drank coffee, her coffee-drinking and the veracity of Smith's prediction has been affirmed with the passage of time. (9.2) is true and Smith's prediction was correct from those later standpoints.

Under standpoint inheritance, temporal operators are restricted by standpoint. Like all operators, temporal operators pass their standpoints on to subsequent operators. These facts together yield that a string of *was*'s and *will*'s uses the same standpoint throughout. As such, any string of *was*'s and *will*'s can be reduced to at most two of those operators. Unlike the traditional view, this result holds for metric operators and discreet (non-dense) arrangements of moments.

SUP is traditionally formulated using IDXTF as a basis. With standpoint inheritance, SUP can be depicted in terms of OF, instead. This is an advantage for anyone who wants to avoid the TRL instead using OF's wait-and-see semantics characterize SUP.

9.4   Research Avenues

There are a number of ways in which this project could be extended. One obvious loose end is absolutism. Adequate treatments of eternalism, the B-theory, and related views are beyond this essay. A goal of this project is to enhance the dynamic approach, improving A-theoretic systems in ways that challenge their static counterparts. Another task is to show that the dynamic view is the best option for representing freedom and contingency. This might be accomplished by demonstrating that accidental possibility, which is required for

freedom and contingency, only makes sense within dynamic, branching systems.

This essay is relatively non-technical. It is not a logical treatise. For the sake of being explicit, a system (MMBT) was given in Chapter 8 through which specific views were portrayed and standpoint inheritance was implemented. MMBT could use a lot of development. Here are a few obvious improvements:

(9.6) Axiomatizations

(9.7) More operators: since, until, now, and so forth

(9.8) Property (predicate) calculus

(9.9) Additional meta-theorems

One might also add probabilities to MMBT. As mentioned in Section 3.1, *will* has a probabilistic sense. A related advancement would be to add a non-relevance conditional. Linguists have made a lot of headway in researching conditionals. Non-relevance conditionals might be implemented using the restrictor analysis, Fintel's analysis, or Gillies' analysis.[3] Probabilities and conditionals are interesting in their own right, but one could incorporate both. That may seem gratuitous, but a system equipped with probabilities, conditionals, and modality could shed light in a few intricate puzzles, like the problem of old evidence.

9.5   Looking Back

The main goal of this project is to address theological and logical fatalism. These goals have been accomplished within the dynamic framework given here. OF, and in particular BivOF, is the best option along with the associated type of OT. Along the way, standpoint inheritance was proposed as a way to enhance branching time logics. Standpoint inheritance allows branching systems to account for some linguistic difficulties. The theory clarifies not

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[3]See, for instance, [Fintel and Iatridou(2002), Gillies(2009)]. [Fintel(2009)] contains a useful summary.

only the hard/soft fact distinction, but also what is required for characterizations of God's beliefs to be soft.

Despite the achievements of this endeavor, there is still more to be done. Absolutist frameworks were beyond the scope of this analysis. There is also a lot more to be said about standpoint inheritance and how branching logics with standpoint inheritance compare to their static counterparts. It is hoped that the successes of this project will lead to excellent developments that hitherto were only possible.

Appendix A

Notations, Truncations, and Acronyms

The notations used in this essay are designed to conserve space without becoming overwhelming. It is a problem when most readers have to memorize lots of acronyms, especially when many of those acronyms are not even used outside of a particular document. Here, acronyms are used sparingly, with some truncation for clarity and with links to this section for quick reference.

A.1 Major Arguments

ARGLF   argument for logical fatalism (generalizable)

ARGTHF   argument for theological fatalism (generalizable)

ARGLF-ACT   argument for logical fatalism using *actually-will* (generalizable)

A.2 Open Futurism and Company

OF   open futurism

BIVOF   bivalent open futurism

NBɪᴠOF   non-bivalent open futurism

Sᴜᴘ   supervaluationism

OT   open theism

OF-OT   open futurist open theism

TF-OT   true futurist open theism

A.3   True Futurism

TF   true futurism

AʙsTF   absolute true futurism

IᴅxTF   indexical true futurism

SᴍTF   semantic true futurism

OɴTF   ontological true futurism

EᴘTF   epistemic true futurism

A.4   Theistic Eternalism

TʜEᴛʀɴ   theistic eternalism

DᴜʀEᴛʀɴ   duration theistic eternalism

PᴛEᴛʀɴ   point theistic eternalism

PRDETRN   perdurantist theistic eternalism

A.5   Logical Principles

LEM   law of excluded middle, $\vDash \phi \vee \neg\phi$

S-FLEM   strong future law of excluded middle, $\vDash \triangle\phi \vee \triangle\neg\phi$ ($\triangle$ = will)

ExP-S-FLEM   strong future law of excluded middle, $\vDash \triangle\phi \vee \triangle\neg\phi$ ($\triangle$ = will)

M-FLEM   medium future law of excluded middle, $\vDash \triangle\phi \vee \neg\triangle\phi$ ($\triangle$ = will)

W-FLEM   weak future law of excluded middle, $\vDash \triangle(\phi \vee \neg\phi)$ ($\triangle$ = will)

A.6   Symbols

Many of the operators used here are more general than those used in other contexts. Most operators given here (e.g. $\boxtriangle$) can apply to any accessibility relation. Indeed, except in the case of NBIVOF, $\triangle$ is defined as $\boxtriangle$ along whatever is taken to be the temporal relation, the relation used to explicate *will* and company. For clarity, other popular symbols are given in accordance with the primary use of operators in this essay. It should be understood that the operators here are typically not equivalent to those other operators, but more general. All operators can be used with any suitable accessibility relation, R, specified by a subscript, e.g. $\Box_{TRL}$.

Symbol   Other popular symbols. English.

$\triangle$ F. It will be the case that. (Works along the temporal relation)

$\triangledown$ P. It was the case that. (Works along the temporal relation)

$\triangle^t$ F(t). It will be the case t units (days/seconds/...) hence that

$\triangledown^t$ P(t). It was the case t units (days/seconds/...) ago that

$\square_T$ G. It will always the case that. (T is the temporal relation)

$\square_{-T}$ H. It was always the case that. (T is the temporal relation)

$\diamond_R$ M/$\diamond$. Possibly. (Meaning depends on accessibility relation R.)

$\square_R$ L/$\square$. Necessarily. (Meaning depends on accessibility relation R.)

A.7 Other

ATC all-things-considered

MMBT Multi-Modal Branching Time. MMBT is the generic system described in Section 8.1.

StPt standpoint inheritance

TRL thin red line

TRL$_m$ thin red line specific to moment m, as used in indexical true futurism

BIBLIOGRAPHY

[Adams(1967)] Adams, Marilyn McCord (Oct 1967): Is the Existence of God a Hard Fact? *The Philosophical Review*, 76(4):492–503. 45, 46

[Akama et al.(2007)Akama, Nagata, and Yamada] Akama, Seiki; Yasunori Nagata; and Chikatoshi Yamada (Jun 2007): A Three-Valued Temporal Logic for Future Contingents. *Logique et Analyse*, 50(198):99–111. 161, 168

[Akama et al.(2008)Akama, Nagata, and Yamada] Akama, Seiki; Yasunori Nagata; and Chikatoshi Yamada (Mar 2008): Three-Valued Temporal Logic Q_t and Future Contingents. *Sudia Logica*, 88(2):215–231. 161, 168

[Arbour(2013)] Arbour, Benjamin H (2013): Future Freedom and the Fixety of Truth: Closing the Road to Limited Foreknowledge Open Theism. *International Journal for Philosophy of Religion*, pp. 1–19. 3, 162, 176

[Belnap(1992)] Belnap, Nuel (Sep 1992): Branching Space-Time. *Synthese*, 92(3):385–434. 40, 52

[Belnap(2005)] Belnap, Nuel (2005): Branching Histories Approach to Indeterminism and Free Will. In: *Truth and Probability: Essays in Honour of Hugues Leblanc*, ed. Francois Brown, Bryson;Lepage, pp. 197–211. 83

[Belnap and Green(1994)] Belnap, Nuel and Mitchell Green (1994): Indeterminism and the Thin Red Line. *Philosophical Perspectives*, 8:365–388. 6, 83, 132, 135, 149, 216

[Boethius(1973)] Boethius (1973): *Boethius: The Theological Tractates and The Consolation of Philosophy*. Loeb Classical Library. 99

[Boolos et al.(2007)Boolos, Burgess, and Jeffrey] Boolos, George S; John P Burgess; and Richard C Jeffrey (2007): *Computability and Logic*. Cambridge, 5th edn. 196

[Boyd(2003)] Boyd, Gregory A (2003): Neo-Molinism and the Infinite Intelligence of God. *Philosophia Christi*, 5:187–204. 3, 162, 176

[Boyd(2010)] Boyd, Gregory A (2010): Two Ancient (and Modern) Motivations for Ascribing Exhaustively Definite Foreknowledge to God: A Historic Overview and Critical Assessment. *Religious Studies*, 46(1):41–59. 3, 176

[Braüner et al.(2000)Braüner, Hasle, and Øhrstrøm] Braüner, Torben; Per Hasle; and Peter Øhrstrøm (2000): *Determinism and the Origins of Temporal Logic*, Kluwer Academic Publishers, pp. 185–206. 210

[Brogaard(2008)] Brogaard, Berit (2008): Sea Battle Semantics. *Philosophical Quarterly*, 58(231):326–335. 145

[Burgess(1979)] Burgess, John P (Dec 1979): Logic and Time. *The Journal of Symbolic Logic*, 44(4):566–582. 125

[Copeland(1996)] Copeland, Jack (1996): *Logic and Reality: Essays on the Legacy of Arthur Prior*. Clarendon Press. 3, 37

[Cowan(2003)] Cowan, Steven B (Mar 2003): The Grounding Objection to Middle Knowledge Revisited. *Religious Studies*, 39(1):93–102. 86, 155, 157

[Fintel(2009)] Fintel, Kai Von (2009): Conditionals. pp. 1–34. 242

[Fintel and Iatridou(2002)] Fintel, Kai Von and Sabine Iatridou (2002): If and When If-Clauses Can Restrict Quantifiers. (June):1–14. 242

[Fischer(1983)] Fischer, John Martin (Jan 1983): Freedom and Foreknowledge. *The Philosophical Review*, 92(1):67–79. 46

[Freddoso(1988)] Freddoso, Alfred J (1988): *Introduction*. 153, 156

[Geach(1969)] Geach, Peter T (1969): *God and the Soul*. Routledge and Paul. 92

[Geach(1977)] Geach, Peter T (1977): *Providence and Evil*. Cambridge. 106, 161

[Gillies(2009)] Gillies, Anthony S. (2009): On Truth-Conditions for If (but Not Quite Only If). *Philosophical Review*, 118(3):325–349. 242

[Hasker(1989)] Hasker, William (1989): *God, Time, and Knowledge*. Cornell University Press. 175, 177

[Hasker(2001)] Hasker, William (Dec 2001): The Foreknowledge Conundrum. *International Journal for Philosophy of Religion*, 50(1):97–114. 86, 116, 157, 161, 174, 175, 236

[Hasle(2012)] Hasle, Per (2012): The Problem of Predestination: As a Prelude to A. N. Prior's Tense Logic. *Synthese*, 188(3):331–347. 2

[Hasle and Øhrstrøm(2004)] Hasle, Per and Peter Øhrstrøm (2004): The Flow of Time into Logic—and Computer Science. *Bulletin of the European Association for Theoretical Computer Science*, 82:191–226. 59

[Helm(1997)] Helm, Paul (1997): *Eternal God: A Study of God without Time*. Oxford University Press, revised edn. 96, 103, 106, 111, 113, 124

[Helm(2010)] Helm, Paul (2010): Eternity. Spring 2010 edn. 89, 96

[Kenny(1969)] Kenny, Anthony J P (1969): *Divine Foreknowledge and Human Freedom*, University of Notre Dame Press. 105, 106

[Kenny(1979)] Kenny, Anthony J P (1979): *The God of the Philosophers*. Clarendon Press. 92, 105, 176

[Kosciuk(2010)] Kosciuk, Christopher J (2010): *Human Freedom in a World Full of Providence: An Ockhamist-Molinist Account of the Compatibility of Divine Foreknowledge and Creaturely Free Will*. Ph.D. thesis, University of Massachusetts - Amherst. 153, 156

[Leftow(1991a)] Leftow, Brian (1991a): *Time and Eternity*. Cornell University Press. 99

[Leftow(1991b)] Leftow, Brian (Sep 1991b): Timelessness and Foreknowledge. *Philosophical Studies*, 63(3):309–325. 99

[Locke(1690)] Locke, John (1690): *An Essay Concerning Human Understanding*. Locked room: II.XXI.10. 78

[Lucas(1970)] Lucas, John Randolph (1970): *The Freedom of the Will*. Oxford University Press. 175, 176

[Lucas(1989)] Lucas, John Randolph (1989): *The Future: An Essay on God, Temporality, and Truth.* Blackwell. 58, 67, 162, 176, 220

[Luther(1525)] Luther, Martin (1525): *De Servo Arbitrio (On the Enslaved Will, or The Bondage of the Will).* 85, 175

[MacFarlane(2003)] MacFarlane, John (Jul 2003): Future Contingents and Relative Truth. *Philosophical Quarterly,* 53(212):322–336. 170

[MacFarlane(2008)] MacFarlane, John (2008): Truth in the Garden of Forking Paths. In: *Relative Truth,* ed. M Garcia-Carpintero, M;Kölbel, Oxford University Press, pp. 81–102. 67, 170

[MacFarlane(2012)] MacFarlane, John (2012): *Relativism,* New York: Routledge, pp. 132–142. 27, 67, 104

[Malpass and Wawer(2012)] Malpass, Alex and Jacek Wawer (2012): A Future for the Thin Red Line. *Synthese.* 11, 119, 122, 126, 128, 134, 142, 208

[McCall(1976)] McCall, Storrs (Sep 1976): Objective Time Flow. *Philosophy of Science,* 43(3):337–362. 40

[McCall(1994)] McCall, Storrs (1994): *A Model of the Universe: Space-Time, Probability, and Decision.* Oxford, Clarendon Press. 40, 52, 160

[McCall(1998)] McCall, Storrs (Jun 1998): Time Flow Does Not Require a Second Time Dimension. *Australian Journal of Philosophy,* 76(2):317–322. 39, 40, 160

[McTaggart(1908)] McTaggart, J M E (1908): The Unreality of Time. *Mind,* 17:456–473. 51, 91

[Merricks(2009)] Merricks, Trenton (2009): Truth and Freedom. *Philosophical Review,* 118(1):29–57. 83, 165

[Molina(1988)] Molina, Luis de (1988): *On Divine Foreknowledge.* Cornell University Press. 153, 154

[Müller and Strobach(2012)] Müller, Thomas and Niko Strobach (2012): A Letter on the Present State of Affairs: Prior, Indeterminism and Relativity 40 Years Later. *Synthese*, 188(3):469–485. 52

[Nerlich(1998)] Nerlich, Graham (1998): Falling Branches and the Flow of Time. *Australian Journal of Philosophy*, 76(2):309–316. 39, 40, 160

[Pagis(1997)] Pagis, Anton Charles (1997): *Basic Writings of Saint Thomas Aquinas: Man and the Conduct of Life*, vol. 2. Hackett. 102

[Pike(1965)] Pike, Nelson (Jan 1965): Divine Omniscience and Voluntary Action. *The Philosophical Review*, 74(1):27–46. 49, 83, 86, 116, 157, 174

[Pike(1970)] Pike, Nelson (1970): *God and Timelessness*. Routledge and K Paul. 90, 102, 108, 157

[Plantinga(1974)] Plantinga, Alvin I (1974): *The Nature of Necessity*. Clarendon Press. 102

[Plantinga(1975)] Plantinga, Alvin I (1975): *God, Freedom, and Evil*. Allen and Unwin. 174

[Plantinga(1986)] Plantinga, Alvin I (Jul 1986): On Ockham's Way Out. *Faith and Philosophy*, 3(3):235–269. 84, 119, 138, 216

[Prior(1953)] Prior, Arthur N (Oct 1953): Three-Valued Logic and Future Contingents. *Philosophical Quarterly*, 3(13):317–326. 161, 168

[Prior(1955)] Prior, Arthur N (Jul 1955): Diodoran Modalities. *The Philosophical Quarterly*, 5(20):205–213. 184, 226

[Prior(1957)] Prior, Arthur N (1957): *Time and Modality*. Clarendon Press. 39, 51, 96, 110, 198, 238

[Prior(1962)] Prior, Arthur N (Apr 1962): The Formalities of Omniscience. *Philosophy*, 37:114–129. 47, 110

[Prior(1967)] Prior, Arthur N (1967): *Past, Present and Future*. Clarendon Press. 4, 5, 39, 40, 43, 47, 51, 66, 83, 86, 96, 110, 117, 161, 167, 169, 189, 238

[Prior(1996)] Prior, Arthur N (1996): *Some Free Thinking about Time*, Clarendon Press, pp. 47–51. 51, 160

[Reichenbach(1947)] Reichenbach, Hans (1947): *Elements of Symbolic Logic*. Macmillan. 65, 217

[Rhoda(2003)] Rhoda, Alan R (2003): *Beyond the Chess Master Analogy: Game Theory and Divine Providence*, Wipf and Stock. 3, 162

[Rhoda et al.(2006)Rhoda, Boyd, and Belt] Rhoda, Alan R; Gregory A Boyd; and Thomas G Belt (Oct 2006): Open Theism, Omniscience, and the Nature of the Future. *Faith and Philosophy: Journal of the Society of Christian Philosophers*, 23(4):432–459. 3, 5, 162, 176

[Rogers(1994)] Rogers, Katherin A (Mar 1994): Eternity Has No Duration. *Religious Studies*, 30(1):1–16. 100, 101, 124

[Rogers(2000)] Rogers, Katherin A (2000): *Perfect Being Theology*. Edinburgh University Press. 96

[Rogers(2006)] Rogers, Katherin A (2006): Anselm on Eternity as the Fifth Dimension. *The Saint Anselm Journal*, 3(2):1–8. 103, 124

[Rogers(2007)] Rogers, Katherin A (2007): The Necessity of the Present and Anselm's Eternalist Response to the Problem of Theological Fatalism. *Religious Studies*, 43(1):25–47. 91, 96, 103, 124

[Rowe(2007)] Rowe, William (2007): *Philosophy of Religion: An Introduction*. Wadsworth, 4th edn. 3

[Schleiermacher(1968)] Schleiermacher, Friedrich (1968): *The Christian Faith—English Translation of the Second German Edition*. T and T Clark Edingburgh. 90, 108

[Sider(2003)] Sider, Theodore (2003): *Four-Dimensionalism: An Ontology of Persistence and Time*. Oxford University Press. 39, 110, 158, 160

[Smart(1949)] Smart, Jack (Oct 1949): The River of Time. *Mind*, 58:483–494. 39, 40, 160

[Smart(1963)] Smart, Jack (1963): *Philosophy and Scientific Realism.* Routledge & Kegan Paul. 50

[Stump and Kretzmann(1981)] Stump, Eleonore and Norman Kretzmann (Aug 1981): Eternity. *The Journal of Philosophy*, 78(8):429–458. 93, 98, 99, 106, 109

[Stump and Kretzmann(1987)] Stump, Eleonore and Norman Kretzmann (Apr 1987): Atemporal Duration: A Reply to Fitzgerald. *The Journal of Philosophy*, 84(4):214–219. 99

[Stump and Kretzmann(1991)] Stump, Eleonore and Norman Kretzmann (1991): Prophecy, Past Truth, and Eternity. *Philosophical Perspectives*, 5:395–424. 99

[Stump and Kretzmann(1992)] Stump, Eleonore and Norman Kretzmann (Oct 1992): Eternity, Awareness, and Action. *Faith and Philosophy: Journal of the Society of Christian Philosophers*, 9(4):463–482. 99

[Swinburne(1977)] Swinburne, Richard (1977): *The Coherence of Theism.* Oxford University Press. 105

[Swinburne(1994)] Swinburne, Richard (1994): *The Christian God.* Clarendon Press. 175

[Thomason(1970)] Thomason, Richmond H (1970): Indeterminist Time and Truth-Value Gaps. *Theoria*, 36:264–281. 66, 161, 170, 211, 233

[Todd(2012)] Todd, Patrick (2012): Soft Facts and Ontological Dependence. *Philosophical Studies.* 3, 45, 46, 151, 216

[Tuggy(1999)] Tuggy, Dale (1999): A Short Text of Lavenham. In: *Time, Creation and World-Order*, ed. M Wegener, pp. 260–264. 161

[Tuggy(2007)] Tuggy, Dale (Jan 2007): Three Roads to Open Theism. *Faith and Philosophy: Journal of the Society of Christian Philosophers*, 24(1):28–51. 3, 5, 162, 170, 176, 177

[van Fraassen(1968)] van Fraassen, Bas (1968): Presupposition, Implication, and Self-Reference. *Journal of Philosophy*, 65:136–152. 170

[van Fraassen(1966)] van Fraassen, Bas C (Sep 1966): Singular Terms, Truth-Value Gaps, and Free Logic. *The Journal of Philosophy*, 63(17):481–495. 233

[van Inwagen(2008)] van Inwagen, Peter (2008): *What Does An Omniscient Being Know About the Future?*, Oxford University Press, vol. 1, pp. 216–230. 175

[Ware(2000)] Ware, Bruce (2000): *God's Lesser Glory: The Diminished God of Open Theism.* Crossway. 166

[Zagzebski(1991)] Zagzebski, Linda Trinkaus (1991): *The Dilemma of Freedom and Foreknowledge.* Oxford University Press. 111

[Zagzebski(2011a)] Zagzebski, Linda Trinkaus (2011a): *Eternity and Fatalism*, Ashgate Press. 111

[Zagzebski(2011b)] Zagzebski, Linda Trinkaus (2011b): Foreknowledge and Free Will. 2011th edn. 89

[Øhrstrøm(1981)] Øhrstrøm, Peter (1981): Problems Regarding the Future Operator in an Indeterministic Tense Logic. *Danish Yearbook of Philosophy*, 18:81–95. 3, 47, 161

[Øhrstrøm(1983)] Øhrstrøm, Peter (1983): Richard Lavenham on Future Contingents. *Cahiers de l'Institut du Moyen-Âge Grec et Latin*, 44:180–186. 3, 47, 161, 165, 208

[Øhrstrøm(1984)] Øhrstrøm, Peter (Jul 1984): Anselm, Ockham and Leibniz on Divine Foreknowledge and Human Freedom. *Erkenntnis*, 21(2):209–222. 3, 47, 84, 118, 121

[Øhrstrøm(2009)] Øhrstrøm, Peter (2009): In Defence of the Thin Red Line: A Case for Ockhamism. *Humana Mente*, 8:17–32. 3, 11, 47, 118, 135, 144, 146, 150, 157, 201, 210, 216

[Øhrstrøm and Hasle(2011)] Øhrstrøm, Peter and Per Hasle (2011): Future Contingents. In: *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta. Summer 2011 edn. 3

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ABSTRACT

FUTURE CONTINGENTS, FREEDOM, AND FOREKNOWLEDGE

by

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This essay is a contribution to the new trend and old tradition of analyzing theological fatalism in light of its relationship to logical fatalism. All results pertain to branching temporal systems that use the A-theory and assume presentism. The project focuses on two kinds of views about branching time. One position is true futurism, which designates what will occur regardless of contingency. The opposing view is open futurism, by which no possible course of events is privileged over others; that is, there are no soft facts.

A contextualist theory of temporal standpoints, standpoint inheritance, is designed to enhance Priorian temporal logics. The proposal helps all branching time systems, not only those with an open future. Even though an account of temporal standpoints goes a long way towards aiding various analyses from a linguistic standpoint, theories that designate a true future ultimately succumb to philosophical difficulties. Under open futurism, standpoint inheritance commandeers the best semantic evidence for true futurism. Standpoint inheritance accounts for the evidence, but the evidence does not support true futurism's stronger claims. Furthermore, attempts to explain why one timeline is privileged as the actual future lead to fatalism. Open futurism and a related kind of open theism are the only viable alternatives under dynamic, branching time. If true futurism is feasible at all, it is so only with a static or eternalist basis.

Standpoint inheritance is very general. It is applied to every system discussed in this analysis to handle damning linguistic shortcomings of traditional logics. Standpoint inheritance yields several other fruitful results, too. The theory helps clarify what it is for characterizations of God's beliefs to be soft and how his beliefs must differ from normal beliefs to retain softness. For open futurism, all strings of consecutive *will*'s and *was*'s can be reduced to at most two such operators under standpoint inheritance, but not under traditional theories. The open futurist distinction between *will* and *will-inevitably* is clarified, too. Standpoint inheritance allows for a supervaluationist semantics using open futurism as its basis instead of the usual true futurism. The theory of standpoint inheritance enhances dynamic, branching accounts of time to better compete with their static correlates.

AUTOBIOGRAPHICAL STATEMENT

Mohammed Abouzahr has lived mostly in and near Detroit, Michigan. He finished his undergraduate degree at Eastern Michigan University with dual emphases in mathematics and philosophy. At Wayne State University, Mohammed attended graduate school and studied both computer science and philosophy, ultimately completing a Ph.D. in philosophy. His areas of specialization are logic, philosophy of religion, and epistemology. He also enjoys studying modern philosophy, ethics, complexity theory, and number theory.

In addition to research and teaching, Mohammed is devoted to improving and balancing many other aspects of his life. He strives for good health and nutrition, enjoys fun projects with his son and family, aims to master his favorite recipes, and is passionate about learning new things. Although the content of some of his activities may not be philosophical, Mohammed believes that the philosophical method can make any endeavor more fruitful.

Putting his diverse background to use, Mohammed has contributed to various philosophical groups. He has been a member and the webmaster of philosophy clubs at both Eastern Michigan University and Wayne State University. He has developed modules about the philosophical method, including lectures on research techniques, information sorting, project development, and teaching practices. With such modules as through his other work, Mohammed aims to show others how to use philosophy to improve themselves and the world around them.