THE WORLD–TIME PARALLEL

Is what could have happened but never did as real as what did happen? What did happen, but isn't happening now, happened at another time. Analogously, one can say that what could have happened happens in another possible world. Whatever their views about the reality of such things as possible worlds, philosophers need to take this analogy seriously. A. A. Rini and M. J. Cresswell exhibit, in an easy step-by-step manner, the logical structure of temporal and modal discourse, and show that every temporal construction has an exact parallel that requires a language that can refer to worlds, and vice versa. They make precise, in a way which can be articulated and tested, the claim that the parallel is at work behind even ordinary talk about time and modality. The book gives metaphysicians a sturdy framework for the investigation of time and modality – one that does not presuppose any particular metaphysical view.

ADRIANE RINI is a senior lecturer in philosophy at Massey University in New Zealand. She is the author of *Aristotle's Modal Proofs* (2011).

MAX CRESSWELL is a professor of Philosophy at the Victoria University of Wellington. He has published ten books, including *Entities and Indices* (1990), *Language in the World* (Cambridge, 1994) and, with G. E. Hughes, *A New Introduction to Modal Logic* (1996).

THE WORLD–TIME PARALLEL

Tense and Modality in Logic and Metaphysics

A. A. RINI AND M. J. CRESSWELL

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Preface

The emergence of possible-worlds semantics for modal logic in the late 1950s and early 1960s led to a recognition that the structure of modal and temporal logic can be treated in an exactly parallel way, with 'possible worlds' in the one case playing the same role as moments of time in the other. While this has been known now for many years there has been considerable reluctance among philosophers to ask why it should be so, and to embrace its consequences. Most of those who have written on the topic have had the aim of attempting to explain why the formal parallel has little philosophical significance. The present volume is, we believe, the first book-length work to address the phenomenon explicitly and present the case for its power.

Introduction

Today is sunny at Waitarere Beach. The sea is sparkling, the sky is blue, the air is calm and it feels good to be alive.

(1) But it wasn't sunny yesterday. Yesterday was grey, wet and windy, and we were depressed.
(2) But it didn't *have* to be sunny today. It might have been grey, wet and windy, and we would have been depressed.

What have (1) and (2) in common? Begin with (1). Suppose that today is Tuesday, meaning obviously some particular Tuesday. Then (1) is true on Tuesday because there was rain (and it was grey and windy and so on ...) on Monday. That seems like common sense. It also seems common sense that rain is something that can occur on one day – Monday – and fail to occur on another day – Tuesday. What then should be said about (2)? We shall assume in this book that sentences about what is necessary or about what is possible have literal truth values.[1] Our aim is to introduce you to a way of dealing with (2) which is exactly parallel with the way of dealing with (1) that we have just mentioned. This came about with the advent of the possible-worlds semantics for modal logic – the logic of necessity and possibility – in the early 1960s. Corresponding to the *times* Monday and Tuesday and so on, at which things happen, philosophers began to speak of the *possible worlds* in which they happen – so that (2) is true because in some possible but non-actual world there is rain today (at Waitarere), even though *in the actual world* it is sunny. Where is this world? Well, *where* is

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[1] Chapter 3 of Lycan 1994 is a sustained demonstration of the ubiquity of modal discourse – of sentences about what is or is not possible or necessary. Not all philosophers might agree on the importance of modality. Some feel that although modality might be a part of natural language it should be banished from austere scientific discourse. Smart 1987, p. 182, says "I want to keep modality (and possible worlds) out of physical theory". And some linguists have suggested that a sentence like (2) may not be true or false – but may be used merely to express an attitude.

yesterday's rain? *Now* it is nowhere, but yesterday it was *here* in Waitarere. Similarly the merely possible rain *would have been here*.

Because times and worlds are often in the domain of metaphysicians, metaphysical intuitions are aroused that make philosophers suspicious of the world–time parallel, or unsure of its real import. For a start, many philosophers don't like the assumption of other possible worlds. One of the earliest was Arthur Prior, who, in Prior 1957, had already advocated a temporal interpretation of the operators of modal logic. Prior saw that you could think of modality in the way in which it is common to think of tense. In Prior 1968c he comments on p. 191:

I wonder whether anybody wants to put forward anything like the following as a piece of serious metaphysics: There really are such objects as possible worlds, and what we loosely describe as propositions of modal logic are in fact predicates of which these objects are the subjects.

He follows this up on p. 192 with

[T]his seems a tall story, and as I have said, I doubt whether anyone seriously believes it. But plenty of people believe an exactly similar story about tenses, i.e. believe that tensed propositions are predicates of 'instants', and that there is – really is – an instant at which I unalterably 'am' drinking.

Only a very few years after Prior made these observations David Lewis explicitly referred to this passage, and proclaimed that he was one who did accept that other worlds were equally as real as other times.[2] Prior and Lewis represent extremes in this debate: Prior thinking that neither other times nor other worlds are 'real'; and Lewis thinking that *both* are real. What they share is a belief that the cases are parallel, and it is the parallel itself that the present book will be investigating.

But surely it might be said that it is *obvious* that worlds and times are different – that it is *obvious* that modal and temporal talk have a different ontological status. Consider the execution of Charles I in 1649. This actually happened. It is part of reality. Charles I *was* executed. Some years later Oliver Cromwell was offered the crown. He refused. Cromwell *might have* become king, but he *didn't*. King Oliver is *not* part of reality. Doesn't this show that the whole enterprise of examining the world–time parallel is flawed from the beginning?

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[2] In footnote 6 on p. 185 of Lewis 1970, Lewis says, "A. N. Prior states the indexical theory of actuality in [Prior 1968c] but, sadly, he goes on to say 'this seems a tall story, and ... I doubt whether anyone seriously believes it'."

Our first comment is this. It is no part of the claim that worlds and times are structurally parallel that temporal talk is *synonymous* with modal talk. Worlds and times are different. Tense is about times, and modality is about worlds. But tense and modality have parallel structures – that is, every temporal locution has a corresponding modal locution, and vice versa.

(3) Charles I was executed

does make a claim about what actually happened, while

(4) Oliver Cromwell might have become king

does not. Put in terms of times and worlds (3) is now true in the actual world because Charles I was executed (in the actual world) at some time t which precedes the present.[3] (4) is true because there is a possible but non-actual world in which Cromwell accepted the crown. (3) has a structure

(5) It was so that α

while (4) has a structure

(6) It might have been so that α.

The examples we have chosen here draw out the parallel between tense and modality by setting out a past tense sentence and a sentence about an unrealised possibility. The parallel between tense and modality is itself more general so that, instead of the structure of (5) and (6), we can describe the structure of (3) and (4) by exhibiting more general schemata:

(7) it is/was/will be that α
(8) it is/might have been that α.

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[3] It is customary in (at least philosophical) English to speak of truth 'at' a time, and truth 'in' a world. As far as this book is concerned 'true at' and 'true in' are no more than stylistic variants. Some philosophers have tried to make more of this distinction. For instance Adams 1981, pp. 20–24, restricts truth *in* a world to truths about things which exist in the world in question. This is because he thinks that propositions about things which do not exist in a particular world do not themselves exist in that world, and so cannot be true or false in that world. To the best of our knowledge no philosopher has made a distinction between existing *at* a time and existing *in* a time, but the analogous distinction could certainly be made. Prior for one (Prior 1957, p. 31) claims that there are no facts about things which no longer exist. Prior himself took this to demand a logic in which bivalence has been given up, and he began attempting to study such a logic in chapter 5 of Prior 1957. We are assuming a classical bivalent attitude to truth, and our use of 'true in a world' is Adams's 'true at a world'.

(7) invokes the *tense* trichotomy of past, present and future, while (8) invokes the *modal* dichotomy of actual and possible. On the face of it this might seem to make the project implausible, since it is lopsided. Explaining how this dichotomy and trichotomy are nevertheless parallel will be one of the tasks of this book. So let us go back to the original claim that (3) is a part of reality but that (4) is not. What might this mean? Well certainly

(9) It is true in reality that Charles I was executed.

But then

(10) It is true in reality that Cromwell might have become king

is equally so, as is

(11) Cromwell might have really become king.

What is not true is

(12) Cromwell became king

but all that that tells us is that something might have been true which never was true. That certainly *is* a truism, but it merely reflects the fact that worlds and times are different, and is of little help in assessing their comparative reality.

Have we been too swift? Charles I's execution is *actual*, Cromwell's becoming king is merely *possible*. Isn't that enough? Perhaps, but we here introduce the other way of marking the difference. In modality we talk of the actual and the possible. Sometimes we speak of the *merely* possible, as what is possible but not actual. The temporal contrast is between the present and the past and future. The first point is that talking of past, present and future cannot provide an analysis of tense. Although the execution of Charles I is not present – it is past – yet it *was* present. In fact anything that is past was once present. There is a famous argument due to J. M. E. McTaggart against the reality of time. One premise of this argument is that everything must be both past and present (and future as well), while another premise is that *nothing* can be both past and present. Whatever this curious argument does or does not show about the unreality of time, the first premise is only plausible in a tensed language, where it can be said that everything that *is* past *was* present.[4]

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[4] Chapter 33 of McTaggart 1927 argues that the alleged contradiction is essential to time itself, and therefore that time is unreal. Certainly no predicate like 'present' can analyse tense. So if tense needs

What does all this tell us about modality? It is this. The claim is supposed to be that the actual encompasses everything that is so – that there is nothing apart from what is actual. But that turns on what *is* means. Although only the actual perhaps *is* actual, there is much that is not actual but *might have been* actual. Cromwell might actually have become king. Although he didn't, it might have been actual that he did. One might respond that this is to conflate what *is* actual with what might have been actual. And this helps illustrate how the parallel plays out. For consider the claim that Charles I's execution is present. That claim is false. What is true is, presumably:

(13) Charles I's execution *was* present

and (13) seems to mean the same as

(14) Charles I's execution *is* past.

As was said in the discussion of (7) and (8), the modal phrase corresponding to 'was' is 'might have been'. In (13) the 'presentness' of Charles I's execution is qualified by 'was', and, for the same reason, in

(15) Cromwell's becoming king might have been actual

the 'actuality' of Cromwell's becoming king must be qualified by 'might have been'.

But perhaps there is this difference. Perhaps there is no such thing as Cromwell's becoming king, and so (15) is false, or maybe does not even make a claim, since there is nothing which might have been actual except what is actual. Someone who says this will be claiming that while (14) is an alternative way of expressing (3), yet (15) is not an alternative way of expressing (4). The reason is that Cromwell's becoming king only exists if Cromwell does become king, and since he never did there is nothing which might have been actual. If this is the argument look again at (14). For there *is* no such thing as Charles I's being executed – that is Charles I is not being executed. Of course there *was* such a thing, in that Charles I *was* executed. The defender of (14) can say that the talk of Charles I's execution does not entail that it is now taking place. All that it entails is that it did take place,

an *analysis* we are in for a vicious regress, just as Mellor 1981 claims on p. 94. As an analysis of tense the regress is vicious because, as Bigelow 1991, p. 5, says, it "presupposes what we are trying to explain". This is in fact McTaggart's own complaint at p. 21. Dyke 2002a argues (p. 141) that even if you can avoid the contradiction at the first level it is only by introducing one at the second level, and so on. She is right that if there *is* a contradiction at any level it won't be removed by going a level up.

or is taking place, or will take place. In fact it *did* take place. That is what
the truth of (3) amounts to. But that defence is available to the defender of
(15). For the claim is not that Cromwell's becoming king *is* taking place,
or that it was, or that it will be. It is merely that it *might* have taken place.
That is what the truth of (4) amounts to. And nothing has been said so far
to show what is wrong with that.

What do we mean by a 'structural parallel'? It might help to begin with
some explanation of what the parallel is not. Since we began writing this
book we have often received comments like the following:

So you are going to argue in favour of the world–time parallel. That's nice, but
it's hardly new. Most metaphysicians already recognise that there is a structural
parallel at the level of logic. But we claim that you can admit this parallel without
supposing it tells you anything of metaphysical significance. Yes there is a logical
parallel between what happens at other times and what happens in other worlds,
but there is all the metaphysical difference in the world between the reality of these
other worlds and the reality of other times. So we can accept your parallel and yet
feel it doesn't help us at all, and that we need take no notice of it.

Some people suppose that when we say there is a structural parallel we
mean simply that tense and modality can be formally modelled using the
resources of semantical indices – i.e., using possible worlds for modality,
and using times for tense. Others may want to know what is 'the correct'
tense logic or 'the correct' modal logic. And they suppose that a claim that
there is a logical parallel between time and modality must be wrong when
they make the further supposition that a system like S5 might be "right"
for modality, but is surely "wrong" for time with both a past and a future
operator. (See footnote 11, p.12, for more about this.) Our book is not
about logic in this sense. What we mean is this. If you are faced with an
argument in the philosophy of modality, there ought to be a corresponding
argument in the philosophy of time which has the same structure.

Suppose you have two metaphysical arguments, one, **T** say, about time,
and another parallel argument, **M** say, about modality. The metaphysicians
we have in mind agree that the logical parallel is exact. So imagine a step T_n
in argument **T**. Then there will be a corresponding step M_n in argument
M, and vice versa. Either T_n – and therefore M_n – is a premise, or it is
obtained from some earlier members of **T**. If the latter, then, given that
the *logical* parallel is exact, M_n will be obtainable from the earlier members
of **M** by the same logical rules according to which T_n was obtained from
the earlier members of **T**. Either these rules are good rules, or they are not,
but either way the success of the modal argument stands or falls with the

success of the temporal argument. If, on the other hand, T_n is a premise, it must be a premise for which no argument is given, since if an argument *is* given you can apply the same procedure to *that* argument. So it must be an unargued premise. Of course it is easy to provide such. If you postulate as unargued premises:

T_0: All times are ontologically real

and

M_0: Only the actual world is ontologically real

then indeed you will lose the parallel. But unfortunately you then have nothing better to offer the advocate of a different premise than an incredulous stare, and your opponent will simply stare right back at you. To put the point crudely we suggest that if logic is about argument, a metaphysician who gives the T_0/M_0 reply is suggesting that logical argument has no place in metaphysics.

We do not in this book claim that there are *never* reasons to treat temporal and modal arguments differently. But we *do* claim that whenever you meet one of these arguments you should very carefully examine the corresponding one. More importantly, as we try to illustrate, it is by no means a trivial matter to be clear about just *what* the corresponding argument is.

Part I of the book sets out what we call an 'indexical' semantics. That is a semantics in which a sentence is held to be true or false, not absolutely, but at a *semantical index*, or more accurately at a sequence of semantical indices. Of these we single out three, a time, a possible world and a 'person', where a person may be understood abstractly, as for instance in the sense of 'observer' used in relativity theory. It is important to say something here about our use of the word 'indexical'. While we believe that it is the use envisaged by early writers in the semantics of intensional logic,[5] it has acquired a number of different uses in recent years. For instance MacFarlane 2009, p. 232, suggests the following definition:

(1) An expression is *indexical* iff its *content* at a context depends on features of that context.
(2) An expression is *context-sensitive* iff its *extension* depends on features of that context.

[5] We make some historical remarks about indexicality on p. 24 below.

We do not, in this book, use 'content' as a technical term, but in Chapter 2 we do offer an account of various kinds of propositions as sets of indices – an untensed proposition is a set of worlds, a tensed proposition is a set of world–time pairs, and so on. An indexical semantics assigns such entities as the semantic content of sentences, and while the truth or falsity of such sentences changes from index to index, the proposition expressed by the sentence does not – since the sentence is true or false at an index iff that index is in the set assigned to the sentence. This means that we are using the adjective 'indexical' to mean what MacFarlane means by 'content-sensitive'.[6] Whether there is, in addition to this kind of indexicality, a need for indexicality in MacFarlane's sense is a question we do not deal with in this book, though we make a few remarks about the content of utterances in Chapter 12.

We end Part I by looking at the possibility that truth at an index can be given an analysis in terms of a primitive notion of actual present truth. This raises the following question: do we privilege the actual in a way in which we do not privilege the present? Critics of possible-worlds metaphysics may say that it cannot analyse 'plain truth' but only truth in a world. Some philosophers of time – the so-called presentists, such as Craig (2000a and 2000b) – say that others – the so-called eternalists, such as Mellor (1981 and 1998) – cannot analyse 'present truth' but only truth at a time. The upshot of our discussion suggests that it may not matter whether you take truth at an index as basic, or simple actual present truth. But more importantly it suggests that whatever you do about this you can do equally for tense and for modality.

To give precision to our discussion of the world–time parallel we give in Part II a formal definition of the syntax and semantics of first-order predicate languages with a selection of tense and modal operators, and look at how they can be used to formalise sentences involving time and modality. The languages introduced, together with their semantics, are perfectly standard, and have been around since the late 1960s. Their fullest development is in the work of Richard Montague, collected in Montague 1974. Formal modelling of natural-language sentences is now common in semantic studies and needs no justification, and in any case our use of

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[6] These remarks are in no way intended as any criticism of MacFarlane, who remarks on p. 232 that "we are free to use technical terms in whatever way is most useful", and in fact goes on to make some very insightful observations, many of which we agree with, pointing out confusions in certain current debates. One thing is clear. As a quick glance at the articles in two collections on these matters, Preyer and Peter 2005 and 2007, shows, different contributors appear to want to understand the terms of debate in very different ways.

it is restricted to the investigation of the world–time parallel, and makes
no claim to adequate formalisation of the many and varied phenomena
of tense and modality in natural language in any respect other than that
parallel. Any treatment in a formal langauge of matters like this is subject
to the complaint that it imposes an unwarranted precision and idealisa-
tion on an account of our linguistic practices. While such a complaint
would undoubtedly be justified if we were making a contribution to the
philosophy of language, the formal languages we use, however idealised,
are sufficient to establish that the resources of the tense and modal lan-
guages needed to express a number of ordinary natural-language sentences
have to be extended by mechanisms which give the power of quantifica-
tion over worlds and times. Here too the formal results have been available
for a number of years. We give an account of the technique of 'multiple
indexing' developed in the 1970s and 1980s. Although the technique is
well known it is typically applied either to times alone or to worlds alone.
Our treatment highlights the exactly parallel way in which the technique
applies to tense and modality.

In Part III of the book we reflect on the implications of what has been
shown in Parts I and II. Part III begins by presenting an attitude to ontology
which makes it depend on the structure of truths. Whether or not this is
a viable attitude, we argue that it applies to the modal case in exactly the
same way as it applies to the temporal case. Much in this part of the book
examines what various philosophers have said about modality, and looks at
what happens when you say the same things about time, or examines what
philosophers of time have said, and looks at what happens when you say
the same things about modality.

Part IV addresses questions about the nature of the various entities
involved in discussions of time and modality. For example, philosophers
often ask whether the same individual can exist in more than one possible
world. We investigate the analogous question about individuals existing at
more than one moment of time. Or you may be concerned about the *nature*
of possible worlds, or the nature of what exists in them. Are they abstract or
concrete? Is the real world ontologically different from the merely possible
worlds? You can ask these questions in just the same way as you can ask
about the status of times, as in the dispute between those who think that
only the present is real, and those who think that all times are equally real.

We do not ourselves wish to take sides in any metaphysical controversy;
and you will not find in this book a survey of the many views in the
philosophical literature on the ontological status of times, or worlds, or

anything else.[7] To be sure, there are occasions when we allude to such controversies, and if you feel that we have not taken sufficient account of the literature, do remember that contributing to these controversies is no part of our aim, except where it might bear on the parallel between time and modality. If we have an agenda it is simply this: given that many philosophers assume that there is a clear difference between worlds and times, it is we believe vital to ensure that arguments for or against the difference are real arguments and not bogus arguments. A large part of this book is intended to establish that many of the considerations which are put forward to show that modal talk and temporal talk are not parallel simply do not hold up. Only when this has been seen and appreciated do we feel that it is appropriate to ask what the *real* differences are. If we appear to be trying to advance the thesis that times and worlds are ontologically equivalent, bear in mind that none of our arguments support any positive metaphysical position. F. H. Bradley once said that metaphysics is the finding of bad reasons for what we believe upon instinct.[8] Maybe the instinct that worlds and times have a different ontological status is right, but we must first clear away the bad reasons.

The book is addressed to anyone with an interest in the semantics or metaphysics (or both) of time and modality. The precise articulation of the world–time parallel does require the resources of formal logic, and we make no apology for that. We have though tried to explain all the technical apparatus we assume, and have tried to make clear at every point just what the formal framework is intended to show. However, to enhance the readability of Part II we have put its more severely technical results into Appendices 1 and 2 on pp. 199–224, which need only be read by those who do not wish to take on trust the claims made in the main text.

[7] A valuable introduction to theories of possible worlds is found in Melia 2003.
[8] Bradley 1893, p. x.