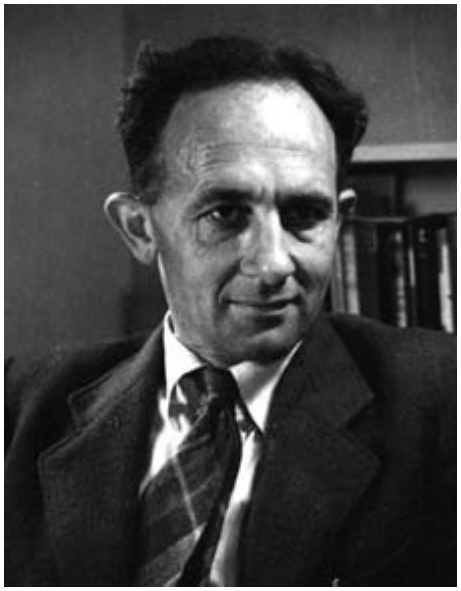

Arthur Norman Prior
(1914-1969)

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A LOGIC OF CREATION
A NEW TENSE LOGIC FOR EMERGING TRUTH

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PRIOR'S IDEA OF NON-STATABILITY AS A SOLUTION TO THE PROBLEM OF CONTINGENT INDIVIDUALS

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SUMMARY

In 1957, the founder of tense logic, A.N. Prior, proposed the modal system ***Q*** of which it is assumed that, for certain possible worlds, certain propositions simply do not occur because they relate to individuals which are absent from those worlds. Axiomatised by R. Bull, by K. Segerberg, and by Prior himself, and later translated into tensed terms as $\boldsymbol{QK_t}$, this logic of *non-statability* offers an interesting example of a system designed to solve the problem of non-permanent, or contingent, existents.

In the present paper the idea of *non-statability* is investigated in order to disclose its importance for the logic and philosophy of time. An alternative to $\boldsymbol{QK_t}$ is suggested which combines the logic $\boldsymbol{K_b}$ for future branching with certain features derived from Prior's interpretation of the systems of Peirce, Ockham, and Leibniz. It is argued that the tempo-modal system ***W***, by opening new perspectives towards the idea of an emerging or created truth, competes favourably with $\boldsymbol{QK_t}$.

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Mogens True Wegener

QUOTATIONS

The possible is necessarily general.
It is actuality, the force of existence, which bursts
the fluidity of the general and produces a discrete unit.
C.S. Peirce (CSP 4.172)

My view is that there are three modes of being ..
they are (i) the being of positive qualitative possibility,
(ii) the being of actual fact, and (iii) the being of law
that will govern the facts in the future.
C.S. Peirce (CSP 1.21)

There can be no truths, not even logical truths,
that are distinguishable about Caesar and Antony, until
there are such persons to be the subject of these truths.
A.N. Prior (PTT 77)

Nothing can be surer than that whereof we cannot speak,
thereof we must be silent - though it does not follow from this that
whereof we could not speak yesterday, thereof we must be silent today.
A.N. Prior (Philosophy 34, 11-17, 1959)

While the passage of time may eliminate possibilities
in the sense of alternative outcomes of actual states of affairs,
and cause that to be no longer alterable which once might have
been otherwise, with logical possibilities the opposite occurs.
For as new distinguishable individuals come into being,
there is a multiplication of the number of different subjects
to which our predications can be consistently attached, and so
a multiplication of distinguishable logical possibilities.
A.N. Prior (PTT 77)

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C O N T E N T S

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A. INTRODUCTION

It is our purpose to construct a new system ***W*** of *Tense Logic (**TL**)* which is indeterministic not only in the sense that it permits possibles to branch towards the future, but also in the sense that it, more radically than standard ***TL***, discards the idea of timeless truth by implying truth to emerge in time along with reality. Truth is nevertheless still assumed to be eternal in the sense that, once established, it can never be annulled or suspended, but is valid henceforth, i.e., in all future. We may see it as a virtue of the system ***W*** if it succeeds in reproducing the richest variety of linguistic forms by the simplest possible means of symbols and axioms. The final system will display features derived from sources as diverse as Aristotle, Diodoros, Anselm, Aquinas, Ockham, Leibniz, Kierkegaard, Peirce, and Prior.

K_t & K_b are two very simple ***TL***-systems of which soundness and completeness are provable relative to a Leibnizian *possible-worlds* semantics as renewed by Kripke. But with K_b time acquires a direction so that we can speak of *the arrow of time*, and for this reason alone it seems convenient to give priority to K_b, ahead of K_t. K_b is characterized by a successive loss of possibility. The actualization of only one among an infinity of possible futures means that most of the conceivable futures are successively eliminated. Hence, what was possible in the past may now be excluded. But, making use of Prior's concept of statability, we shall claim that this perpetual loss of possibility is compensated by a steady increase in the sum of statable truth. This lends support to the view that *the passage of time* is mind-independent.

We conclude that the sum of statable truth is steadily increasing, due to the fact that assertions which were not statable earlier become statable in the course of time. Being now statable, it is natural to assume that they will remain statable for all future, so that propositions feigning departed individuals to be still present are simply false. Granted this, we shall claim that what is true now will necessarily have been true. By contrast it is often uncertain whether what is now statable was always statable, so mostly we cannot know whether what is true now was always going to be true. Our system ***W*** thus makes a difference between past and future in the sense that a perpetual loss of possibility is compensated by a successive gain of statable truth. It is in this sense that we are entitled to speak of a *creation of truth*.

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1. THE URGE FOR TENSES

It may be argued that the verb is the central part of any proposition, meaning: any sentence to which a truth-value can be ascribed; but verbs are inflected by tenses. However, the translation of tensed propositions into standard logic by means of a timeless copula presents serious difficulties: "the verbs are absorbed by artificial noun constructs - there is no direct way of handling tensed verbs". *(R&U 2)* Some logicians, such as Strawson, have taken these difficulties to be evidence of an inherent limitation of standard logic, arguing that it is incapable of depicting adequately the statements of ordinary language. *(PFS 150f)* Others, primarily Quine, have argued that all statements containing tensed verbs are reducible to tenseless form by means of an extensional translatation making use of quantification over 'instants'. *(WVQ 170f & 191f)*

This puts us in a situation where, apparently, we must choose between accepting the inadequacy of our formal translations or assuming the existence of dubious entities. But we are not stuck in this ugly dilemma between bad philology and bad metaphysics. We are able to defend ourselves against the charge of misrepresenting the inflections of ordinary language without being compelled to assuume the real existence of instants. According to McArthur, the importance of *tense logic* is that it offers a third possibility by pointing to a way of escape between these equally unattractive alternatives. *(MA 1)* The point is that we do not have to accept the existence of temporal instants *á priori*. Instead we may advocate tense logic as the proper means to construct a chronology that is intuitively plausible and independent of both physics and metaphysics.

The aim and purpose of ***TL*** is to systematize reasoning with tensed propositions. In order to do so properly we must distinguish between two types of statements:

1) temporally definite statements - i.e., sentences with invariant truth-value

2) temporally indefinite statements - i.e., sentences with variable truth-value

Against the above distinction it has been objected that statements of the second kind are not proper propositions, but merely propositional functions that are not fully determined. This objection, however, can be dismissed as soon as we give attention to their context. Tense logic, or *the logic of change*, becomes indispensable when we decide to consider statements in their natural linguistic context which is always one of temporal change. What we call reality, the reality of experience, is obviously a reality in change and, just as reality itself is always a becoming and deceasing, an emerging and expiring, so our language, in order to represent this perpetual change faithfully, must needs reflect it in the successive origin and closure of the truth-value of its assertions.

The building material of ***TL*** consists for the major part of temporally indefinite statements, the definite statements being those which are omnitemporal, those which mark an absolute beginning or an absolute ceasing, and those which are unique in the sense that they are true *now*, but neither true in the past nor true in any future. With ***TL***, the verb, or copula, can no longer be interpreted as timeless but should be understood as referring to the present: it is *now* the case that so-and-so.

It is usual to speak of *the transparency of the now*: if anything is *now* the case, then it is *now* the case that it is *now* the case, and *vice versa*. Another peculiarity of the *now* is the *elasticity* of its duration, which is context-variable: what we call *now* may be the present second or the present century. In order to cope with these problems we shall use *instant-propositions* as our means of dating. *(PPF vi & PTT xi)*

2. TENSED OR TIMELESS TRUTH

Logic is the instrument (Aristotle: *organon*) for reasoning and rational discourse. It is its aim or purpose as an intellectual discipline to investigate the formal conditions for a correct transport of truth-value from some given premisses to a valid conclusion. But, due to its utilizing of *intensional operators*, ***TL*** cannot be reduced to a pure truth-functional semantics. This fact has motivated the application to tense logic of the socalled *possible worlds* semantics of Leibniz, as reconstructed by Kripke.

In the present paper, however, I want to underscore the importance of an axiomatic approach to ***TL*** in contrast to a semantic approach. My point is that only an axiomatic approach does justice to the dynamic features of time, whereas a semantic approach tends to obscure these traits. The latter approach, nevertheless, supplements the former by offering concrete, almost visual, models that enable us to check the syntactic axioms. So the *axiomatics* is fundamental, whereas the *semantics* is illuminating.

The reason supporting my standpoint is to be found in the classical opposition, due to McTaggart, between the *A-term analysis*, and the *B-term analysis*, of time. McTaggart ingeniously distinguished the absolutist *A-concepts of past / present / future* from the relationist *B-concepts of before / during / after*. A deep chasm has ever since separated the *A-theorists*, who insist to explain the *B-series* in terms of the *A-series*, from the *B-theorists*, who attempt to interpret the *A-series* in terms of the *B-series*. Today it is a commonplace in logic to distinguish "tensers" from "detensers"; but it was Prior, the founder of formal tense logic, who first gave weight to this distinction. According to Prior, all real existence is present, and only present existence is real, the past being no longer real and the future being not yet real, just as facts are true statements, and statements, if true, are true *now*, i.e., when said or read.

As it is, *A-theorists* or *tensers* (like Prior, e.g.) would attempt to reduce talk of instants to tensed propositions, whereas *B-theorists* or *detensers* (like Quine, e.g.) would attempt to reduce tenses to predicates of existing instants. A sort of half-way house in between is occupied by *neutralists* who prefer to treat these two positions on a par. Among the A-theorists we can further distinguish between *moderates* and *radicals*. Whereas the former would insist on using modal primitives together with the tenses, the latter would follow Prior in his attempt to define modalities by means of tenses. Taken together, these distinctions give rise to *four grades of tense-logical involvement*. *(PTT xi)*. In the present paper I intend to go all the way to the fourth grade.

Given a present fact, what are you able to infer regarding its past and future? It is a fact that you are now studying a paper from the logic meeting at Poel in 1995. From this fact you can infer not only that it will always have been the case that you were reading the present paper, but that it will inevitably have been the case. However, you cannot infer that it was always the case that you *would* once read *this* paper, merely that it was always possible that you *might* once read *a* paper. Our logic thus gives direction to *the arrow of time* by separating past from future: what is of the past is no longer possible, and what is of the future is not yet realized. But as possibilities are extinguished new facts emerge, created *ex nihilo*.

3. MODALITY OR QUANTIFICATION

Since Leibniz, modality has been explained by reference to *possible worlds*. In line with this account, what is *necessary* is what is true in all possible worlds, what is *possible* is what is true in at least one possible world, and the *actual* world is merely a privileged possible world, viz., that which we ostentatively call "our own". Due to Meredith, Prior, and Kripke, this view has attained great precision in our time.

Among detensers, tenses are interpreted as quantifications over those 'instants' at which tensed propositions are true. Clearly, there is much to be said in behalf of a far-reaching *parallellism* between the *extensional systems of quantification theory* and the *intensional systems of tempo-modal logic*. This parallellism has very often been marshalled as evidence for the position that the intensionalities of tempo-modal logic should be explained by means of extensional quantification. *(WTS 9f)* However, it is much less common to turn the parallels in the opposite direction**,** thus presenting quantification theory, or part of it, as a disguised form of modal logic.

Such move is nevertheless possible and, claims Prior, there is much more to be said for it than might at first be imagined. Prima facie, possibility and necessity are rather metaphysical notions, and in an intellectual climate dominated by positivism it is only natural that there should be attempts to explain them away; cf. the famous phrase: "flight from intentions", first coined by Quine. Nevertheless, according to Prior, ordinary predicate logic, or quantification theory, also has its own metaphysical presuppositions, in particular the assumption that the world consists of *things* about which this or that can be predicated. Those who would question this view might welcome the replacement of quantification theory by the machinery of tempo-modal logic. *(WTS 10f)*

The semantics of possible worlds may now assume one of several various forms, but in any case it amounts to a "tall story", and it is difficult to accept that anybody seriously believes it, despite persuasive claims to the opposite by, e.g., D. Lewis *(DL)*. Nevertheless, plenty of people apparently put confidence in a similar story about tenses, believing that tensed propositions are nothing but the predicates of existing 'instants'.

Contrary to this, C.S. Peirce displayed a persistent habit of treating quantification as a specific sort of modality, and quantification over individuals as a specific kind of quantification over states of affairs. He further suggested that individual terms are just general terms with a very peculiar feature: "Individuals are either identical or mutually exclusive .. (Of individuals), every predicate may be universally affirmed or denied". To Peirce, predicates were in fact nothing but "slightly damaged propositions". *(WTS 40f)* Thus, in his view, *the logic of propositions is prior to the logic of predicates*.

In any case, held Prior, we can construct a *modal theory* of world-propositions, or or a *tense-logical theory* of instant-propositions, or an *egocentric theory* of propositions about an individual, without assuming that such propositions satisfies the definition of a world, a time, or a mind. *(WTS 42)* Suppose that we equate a mind, an instant, or a world, with some always statable proposition which is true only of that mind, or at that instant, or in that world; and suppose that we equate being true of that mind, at that instant, or in that world, with being true iff conjoined to that proposition of mind, of time, of world. Then we can interpret the theory of *minds / times / worlds* as an extended tense logic, rather than as a special kind of applied standard predicate logic. *(WTS 112)* However, as stressed by Kit Fine, *we cannot avoid quantifying over propositions (WTS §5)*.

Prior now offered an alternative to Quine's account of ontological commitment. The entities which we countenance in our ontology do *not* depend, as Quine claimed that they do, upon which kinds of variables we are prepared to bind by quantifiers. They depend instead on which variables we are prepared to take seriously as individual variables in a first-order theory, i.e., as subjects subordinate to predicates.

If we want to handle instant-variables or person-variables as subjects of predicates, then we may be assumed to believe in the existence of instants, or of persons. However, if we treat either of these as propositional variables, i.e., as arguments of truth-functions and of modal functions, then we may be assumed to be sceptical about such metaphysics. In any case, using another of Quine's phrases, although in a sense quite opposite to his: ontological commitment varies inversely with modal involvement. *(PTT 142)*

Kit Fine has described the philosophical position of Prior by the following theses: *A) Modalism*: i.e., *only real objects exist*. *B) Actualism*: i.e., *only present objects exist*. *(WTS 116)* For modal actualists like Peirce and Prior, possible objects do not exist, the possible is just an openness of the future, only a conceptual mode, not something real. The modal actualist wants to eliminate talk of possible worlds and possible objects in favour of ordinary modal idioms in combination with quantification over actuals.

A similar deliberation is open for the tense-logical actualist. Consider, for instance, "possibly some individual is not actual". For the *possibilist*, this remark is an existential claim to the effect that some possible individual is not actual; hence there must be, or exist, some specific individual which is not actual. But for the *actualist*, the singularity is spurious; there is simply no instance in virtue of which the sentence might be true. The proposition quoted states an irreducible general possibility and, no matter how well the individual is described, it can possess no specific identity. *(WTS 118)*

4. THE CONTINGENCY OF EXISTENTS

Quine has claimed that non-existents cannot figure as values of bound variables. Prior, by contrast, insisted that this is the *only* way in which non-existents can figure. His position is that we cannot directly refer to what does not exist but is merely imagined to exist, or is merely going to exist; however, we can make quantified, but purely general statements about world denizens which are future, or feigned. *(PTT 143)* This point is relevant to the question whether quantification over propositions implies such entities to exist; *if* propositions do exist as entities, it is in a very abstract way.

Prior considered ancient, medieval, and modern, doubts about "coming to be", "being brought into being", and "being prevented from being" *(PPF viii,2 & 5-7,12-13)*, and he quoted Thomas Aquinas concerning a possible objection to the concept of *creatio ex nihilo* (*De Potentia Dei*, Q3, art.1, obj.17): "The Maker gives being to that which is made. If God makes a thing out of nothing, he gives being to that thing. Hence, either there is something that receives being, or there is nothing. If nothing, then nothing receives being by that action, and so nothing is made. If something, .. then God makes a thing from something already existing, and not from nothing."

Russell often claimed that it is non-sense to attach "exists" or "does not exist" to what he calls a logical proper name: what we can do is merely to attach "exists" or "does not exist" to a description. This was questioned by Moore and, in Prior's opinion, Moore at this point propounds a view that fits much better than does Russell's own view into Russell's general logical position. What Moore suggested was that "this exists" and "this does not exist" need not be senseless, but may be so used that, if they are not senseless, the former is necessarily true and the latter is necessarily false; for, if the function of 'this' is only to indicate the object the sentence is about, then, if no object is indicated, the sentence says nothing. To this, Prior remarked that, though Russell rejected "this exists" as ill-formed, the form 'x is identical to x', as used by Russell in *Principia Mathematica*, has the properties that are ascribed to "this exists" by Moore, and could therefore be used to define it. *(PPF 149)*

When variables for individual names and their proper predicates are introduced**,** it may well be argued that, before and after the individual x exists, there are no such propositions as ϕx, although there may be propositions saying that there has been or will be some individual with precisely the properties of x. This is the view of Moore. Prior, in fact, stressed the same point by arguing that, at the time in question, when no individual x is being present, the proposition ϕx is *'non-statable'*. This locution is not entirely fortunate because it suggests that the difficulty is just a question of reference. Prior therefore added that there are no facts to be stated about x if x does not exist. This, however, is not meant to imply that facts, or propositions, exist as real individuals. So, even though we quantify over propositions, their *esse* is solely *in intellectu*.

Formally, this course of argument makes it problematic to identify "hitherto *p*" with "not past not *p*", and "henceforth *p*" with "not future not *p*". Thus the classical rule of double negation seems suspended when the past or the future is concerned. Although we have "if α is thesis, then not past not α is thesis" and "if α is thesis, then not future not α is thesis", we neither have "if α is thesis, then α was always a thesis", nor do we have "if α is thesis, then α will always be a thesis", as these both presuppose the unconditional past and future statability of α, which is questionable. *(PTT 147)*

In order to provide a solution to these problems, Prior devised the system ***Q***. ***Q*** is an actualist modal logic. What distinguishes it from other logics is its account of sentences containing names for individuals which do not exist in a given world. Such sentences are said to be undefined, or without truth-value. This *gap convention* (K. Fine) can be split up into two parts: *(a)* that atomic sentences are undefined in case of empty reference, and *(b)* that gaps are preserved under logical operations.

It would be possible to accept the first part of the convention but not the second, e.g., by treating the gaps by the method of super-valuations, or some other method. However, such an approach would evidently conflict with the intentions of Prior who viewed an empty name in any sentence, whether atomic or not, as a source of gaps. When a reference is feigned, the sentence says nothing; it is just gibberish and lacks that identity which is the precondition of its being statable. *(WTS 148)*

If we use no individual name-variables at all, bound or free, and use no device for direct reference to individuals, it will suffice to use standard modal or tense logic, combined with quantification theory. This procedure compels us to distinguish between operators that form complex predicates from operators that form complex propositions. For instance, we may let *A* and *B* stand not for proper names, but for common names; then it is easy to see that the proposition "for some *A* it will be that the *A* is a *B*" is equivalent to the proposition "it will be that, for some *A*, the *A* is a *B*"; cf. Barcan. But neither of these is equivalent to "for some *A* the *A* is a thing that will be a *B*".

Even neglecting quantifiers, "it will be that the *A* is a *B*" is still not equivalent to "the *A* is a thing that will be a *B*", for the latter implies, what the former does not, that what will be a *B* now exists, since only what exists can properly be "the *A*". More exactly, the form "the *A* is a *B*", whatever *B* might be, implies "the *A* exists", i.e., "the *A* is an object", or "there is such a thing as the *A*"; but the form "it will be that the *A* is a *B*" implies only that "it will be that there is such a thing as the *A*". Furthermore, "it will be that the *A* is a *B*" implies that "what will be a *B* will be the *A* when it is a *B*", whereas "the *A* is a thing that will be a *B*" does not imply this, because it may have ceased to be the *A* by the time when it is a *B*. *(PPF 162f)*

There are many different solutions to the problem of non-permanent existents. We may omit individual names, using only the general names *A, B, C* and an undefined form ϵAB, to be read: "the only thing ever to be an *A* is a *B*". With such a name-logic, $\boldsymbol{K_t}$ appears reasonable. This led Prior to combine ***Q*** & $\boldsymbol{K_t}$ into $\boldsymbol{QK_t}$. *(PTT 160)*

5. INDIVIDUALS AND THEIR IDENTITY

Some of the statements that Leibniz uttered suggest that he thought of a *monad* as the conjunction of all the propositions which would ordinarily be said to be true of it. Wittgenstein, in a famous phrase, defined *the world* as "everything that is the case". In a similar vein, C.A. Meredith claimed that the only genuine individuals are worlds, i.e., propositions that express total world-states. A radical positivist would probably maintain that not only are instants not genuine individuals, but that in fact there are no real individuals. The positivist explanation of the apparent existence of individuals would therefore be that certain propositions can be treated as if they were individuals. Prior favoured the more moderate stance that *persons* at least are genuine individuals whereas, at first, he did not accept *instants* or *worlds* as genuine. *(PTT 141-2)*

As regards *personal identity*, Prior has some interesting comments to a little puzzle of N.L. Wilson's: "What would the world be like if Julius Caesar had all the properties of Mark Antony, and Mark Antony all the properties of Julius Caesar?" *(PTT 66f)* Wilson somewhat rashly claimed that "our attempt to describe a distinct possible world has produced just the same old world over again". Prior disagreed, being not convinced, since nobody perceives everything, that even a world which looked to everyone exactly as the actual one does would necessarily *be* the same.

Wilson then went on to consider a particularly perverse person who maintains that what has just been supposed is in fact the case; as regards this queer person Wilson opined that he is not guilty of factual error, but is just using the words 'Caesar' and 'Antony' with the sense that we usually attach to 'Antony' and 'Caesar'. Since Wilson included 'being *called* Julius Caesar' and 'being *called* Mark Antony', respectively, among the properties supposed to be interchanged, he was clearly right. It is evidently absurd to say: "It is not the person we call Julius Caesar that is called Julius Caesar, but he is rather a different person called Mark Antony".

Prior, nevertheless, sustained some doubt concerning the supposed interchange. There is, e.g., at least one property of Antony's which it makes no sense to suppose to be interchanged with the corresponding property of Caesar's, viz., the property of being Antony. Therefore, "properties which entail *being* Caesar or entail *being* Antony are obviously to be exempted from the exchange, if it is to be an exchange at all".

However, as Wilson suggested, one way in which his question might be stated is by asking whether there is a possible world, distinct from the actual one, in which Caesar has all of Antony's properties. Clearly, any such world would contain both Antony and Caesar; but it is hard to see how a merely possible world can contain individuals that are identifiable as "our" Caesar and "our" Antony. Prior's position was that *persons are genuine individuals*, and that it is because Caesar is not just a collection of properties that we cannot separate his identity from himself in order to attach it to a merely imaginary person in a merely imaginary world.

In this connection Prior hinted at a new way of speaking of 'possible worlds'. We can say that a 'possible world' is (1) one of the many possible future outcomes of the present world-state, or (2) one of the many possible future outcomes of some past world-state - or (3) some possible future course of events in sense (1) or (2) together with all its past, so that a possible world in sense (3) is a total world-course, comprising the past as its common history and the future as its possible programs. Such a world is, at least partially, a linear string branching off towards the future. Hence, if we wipe out enough of the actual past world-course of events we would presumably reach a remote state of affairs of which any imaginable world would be a possible outcome; at least this would be the case if going back far enough takes us back to the creative act of God, granted that this act properly belongs to the past.

So there may have been a world in which Julius Caesar was called 'Antony', since possible sequels to part of his life include, e.g., adoption by Antony's family. Can we go further yet and suppose Caesar to have had the whole of Antony's life? Here Prior remarks that it is always a useful exercise to ask: when was it possible? Thus, if Caesar could have had different parents: when could he have had them? Clearly, after his conception it was too late for him to have had different parents. Could he have had them before? Do the possible worlds in which Caesar exists include different sequels to what happened before he existed? The problem is that before Caesar existed there would seem to be no individual identifiable as Caesar, i.e., *that* Caesar who is known by all of us and whom we are presently discussing. At least in this context it seems as if Prior was prepared to give up his previously cited view in favour of rather treating past statability as different from future.

It has been suggested by A.J. Kenny, that the naming of departed individuals is easier than the naming of future individuals because of the indeterminacy of the future. For this reason persons who do exist, or who did once exist, seem to be individually identifiable in a way in which unborn beings not yet in existence are certainly not. The only case in which there can be facts about future individuals, just as there are facts about past ones, is that of a perfect determinism where we can legitimately speak of an absolute determination of the future reaching down to tiniest details. Solely on that condition could the future of an individual be as determined as its past. But is such a determinism possible? Only to hard-boiled believers! *(PPF 171f)*

To the present writer, at least, it seems that individuals behave differently relative to past and future, and I feel that this asymmetry should be incorporated into our logic. At this point I happen to agree with Fine who assumes that the domain of identifiable individuals is steadily increasing. *(WTS 153f)* Hence, although I accept the arguments of Prior for the limited statability of propositions concerning the past, I shall deviate from him by postulating the full future statability of all now statable propositions. In accordance with this position I shall not treat the proposition *'Sortes currit'* as being non-statable, rather I shall evaluate it as being false forever, i.e., in all future, its falsity being implied by the truth of the assertion *'Sortes mortuus est'*.

A possible objection to the unavoidable statability of all known propositions would stress the fact that not only particular nouns or verbs, but whole languages, sometimes run into oblivion: were not the forgotten utterances on tablets written in cuneiform, or in linear-B, at least temporarily 'unstatable' until they were translated? This objection, however, goes far astray by ignoring the difference between issues of *epistemology* and issues of *metaphysics*. My principle: *once statable forever statable*, does not specify a condition of knowing, but a condition of having truth-value.

To conclude, it seems as if Prior were willing to accept the saying of Berkeley: *"Nothing properly but persons i.e., conscious things do exist, all other things are not so much existences as manners of the existence of persons." (Commonplace Book 24)* If so, he would also be in line with the existential creed of Søren Kierkegaard.

6. PRIOR ON LEIBNIZIAN EGOCENTRIC

Following Leibniz, self-knowledge was the starting-point of his notion of reality: "Because I conceive that other beings have also the right to say 'I', or it may be said for them, it is by this means that I conceive what is called substance in general." Concerning truth, he said: "In consulting the notion I have of every true proposition I find that every predicate, whether necessary or contingent, past, present, or future, is already comprised in the notion of the subject." For this reason the *ego*, as a subject, is identical to the conjunction of its predicates in a compound *egocentric* proposition. A subject *is* reality, or *is* the world-course, as seen in a certain perspective. *(WTS 38)*

In accordance with his famous *pre-established harmony*, the actual world-course should be identified with the sum total of the multitude of its egocentric perspectives. Although the world is described differently by the different observers using their own egocentric languages, their various descriptions must be correlated in the sense that how it is described by one observer is consistent with how it is described by any other. The Leibnizian idea of the pre-established harmony is mirrored in his metaphysical idea of the *compossibility* of substances and reflected in the logical principle of the *maximal consistency* of a possible world, so distinctive of Kripke's semantics.

Leibniz did not accept a place for genuine relations among individuals. *(WTS 39)* In *egocentric (**E**)*, two-place predicates as "is less perfect than" vanish into modalizings of propositions, with the modalizing of a proposition in one individual *ego* requiring an appropriate corresponding modalizing in another individual *ego*. In ***E***, individuals are not allowed to be mentioned, but all statements in ***E*** are conceived as directly, or indirectly, relating to the tempo-spatial perspective of the subject. ***E*** contains no immediate devices for referring to other individual perspectives than that of the speaker. Now, can ***E*** be so enlarged as to contain such devices, without loosing its egocentric character?

Non-egocentric modes of individual reference can be constructed on the following "Leibnizian" principles: (i) individuals form a linear series in their order of perfection

(ii) each individual has something that is true only of him in case that he is the speaker. Philosophically, the most interesting proposition which is true of a certain individual is the conjunction of all truths related to it; but to our present purpose any proposition which is true of that *ego* only, i.e., any proposition true only when said by it, will do. In ***E***, anyone can say: "I am the true proposition, and all other are false". *(WTS 34)*

Prior could see no reason why there should not be a perfect subject or monad, i.e., one than which none is more perfect; cf. the famous "ontological" argument usually ascribed to Anselm although, as ontological, it ought rather be ascribed to Descartes. An egocentric logic which refers to the perfect monad, God, would contain this law: "For any proposition *p*, either not-inferior-to-*p*, if I am the perfect monad, or inferior-to-not-inferior-to-*p*, if someone superior to me is the perfect monad". *(WTS 39)*

E is thus a consistent *private language* admitting of effective "communication". That a consistent egocentric logic can be construed, in spite of Wittgenstein, suggests that idealism may be a more defensible philosophy than is usually believed. *(WTS 40)* Much in the philosophy of Leibniz assumes a new significance if we regard him as a thinker who might have regarded ***E*** as being basic to his metaphysics.

However, the principle (i) of *a linear series of perfection* seems inherently absurd and makes it harder to defend Leibniz against the accusation of determinism.

7. THE DEFINITION OF WORLD-STATES

Prior defined a 'world-proposition' as one which is necessarily maximal: being contingent, it implies any proposition or its negation. He remarked that C.A. Meredith proposed three axioms to characterize *the world*: *1. n; 2. Ln ⇒ p; 3. p ⇒ L(n ⇒ p);* i.e.: *1. the world exists; 2. the world is contingent; 3) the world necessarily implies all truth.* Instead of the constant *'n'*, R. Suszko suggested a primitive operator, *'W'*. *(PPF 78)*

In the same vein, Prior interpreted an *instant-proposition* according to tense logic as the conjunction of everything that could be said to be true at the instant in question or, alternatively, as a specific proposition that could be said to be true at that instant only. Accordingly, we might define 'being true at an instant' as being omnitemporally implied by that instant when understood as a proposition. Furthermore, an instant's 'being earlier' than another instant would be definable as the pastness of the former being co-present with the latter, i.e., as the latter omnitemporally implying the pastness of the former. The 'being later' of some instant relative to another could be defined analoguously. In this way it would become possible for us to treat the theory of the quasi-relation of earlier-later as a part of tense logic, rather than vice versa. *(PTT 138)*

To perform this reduction, we may dispose of some simple devices when the series of instants is linear, and each instant has something true at that instant solely. Prior utilized these two assumptions in order to state some illuminating examples: *(1) 'That p, is the case at the present only' = (2) '(It is the case that) p, but it has*

not been the case that p and will not be the case that p'. In a similar vein we have: *(3) 'That p, is the case at one instant only' = (4) 'At some time (p, and it has not been the case that p, and it will not be the case that p)' = (5) 'At some time (2)' = (6) 'Either (2), or it has been the case that (2), or it will be the case that (2)'*. We might then say that an 'instant' is a proposition of which *(6)* is true. *(WTS 32f)*

Directly connected with tense logical priority is the stance that time is absolute. Now time can be absolute in two ways: *(A)* it may be absolute in the sense that a universal simultaneity is definable independently of any particular reference frame, or, alternatively: *(B)* it may be absolute in the sense that we can speak of simultaneous events belonging to different possible worlds. For the tense-logical theorist, the present has objective significance, and an absolute cross-world simultaneity may be introduced by supposing that the same 'now' is co-present in all possible worlds. *(WTS 158f)*

Fine has claimed that, once a logician has combined modality with tenses, he is almost committed to the view that time is absolute in the second sense at least. *(WTS 160)* I consent to this. However, it is difficult to see how simultaneity can be absolute in the second sense above without being absolute in the first sense too. This reflects on so-called *Special Relativity (SR)* where simultaneity is related to frames. I wholly agree with Prior that: "We may say that the theory of relativity isn't about real space and time .. The time which enters into the so-called spacetime of relativity theory is just part of an artificial frame-work which scientists have constructed to link together observed facts in the simplest way possible". But *SR* is not the simplest of frame-works, cf. my *NSR*!

8. TENSES, MODALITY, DETERMINISM

We live in *an orderly world* that seems to be governed by eternal *physical laws* of a universal scope which apparently prescribe the *future* to be determined by the *present* in precisely the same way as the *present* has just now become determined by the *past*. Indeed, it is rather difficult to see how the world could be orderly at all if it were not ruled by laws ensuring that our notions of *cause* and *effect* are applied legitimately. Is there a place for *chance* in such world, or for the *freedom* of creative *spontaneity*?

Probably nobody would claim that the world is devoid of determination altogether, so the differences of opinion mainly concern the world's degree of lawlike determination. Thus a *determinist* would hold that the future is completely, or absolutely, determined by reasons or causes that are already hidden in the present whereas, by contradistinction, an *indeterminist* would insist that the predetermination of the future is never complete. This discloses a conspicious difference concerning the pretensions of the two positions: the onus of proof is infinitely heavier for determinism than it is for indeterminism!

A philosopher who does not believe in fate, destiny, or determinism, should be prepared to defend the position that, in the least, some future truth is now contingent. The problem is how this view should be construed in order to be clearly defensible.

Lucas, who has criticized Prior for ignoring the implicit reference to dates of tensed statements *(JRL 98)* has spoken of the 'defeasible' ascription of 'indefectible' truth to future events *(JRL 71)*. This description applies strikingly to the view of Peirce; but Lucas regrettably does not refer to the important work of Peirce. [In spite of this criticism, Lucas later generously referred to my paper (1st ed.) with appreciation! *(ACT 14)*]

Peirce, we know from the citations given above, accepted three 'modes of being', namely: *1) accomplished fact*, *2) future possibility* and *3) future necessity*. *(Ø&H 137)* For this reason, "that which characterizes .. an assertion of possibility is its emancipation from the principle of contradiction, whereas it remains subject to the principle of the excluded third", just as "that which characterizes .. an assertion of necessity is that it remains subject to the principle of contradiction, but throws off the yoke of excluded third", while "what characterizes and defines an assertion of simple existence or actuality is that it (obeys) both formulae" *(Ø&H 144, see also this book, ch.11 p.149, notes 7-8)*.

To the Ockhamist, Peircean tense-logic will appear to be incomplete; it seems to be a fragment of his own system where contingently true predictions are not statable since, to the Peircean, casual predictions of future contingents should be treated as false. To the Peircean, however, Ockhamist tense-logic treats what is still future in a way in which only what is inevitably future should be treated. But is hard to define a modality within Peircean tense-logic that makes all of the past, as well as some of the future, inevitable, but not predestined. *(PPF 130-2)* With our system ***W*** this problem is solved.

Following Kierkegaard, we shall identify possibility with indeterminate futurity, thereby accepting 'the arrow of time' from the outset; and, giving up the traditional definition of the necessary as that which is not possibly not the case, we shall keep possibility and necessity strictly apart, interpreting the latter as being omnitemporal.

Let us now define what is inevitable as that which is not possibly not the case, and let us further define what is conceivable as that which is not necessarily not the case. The necessary then entails the inevitable, just as the possible entails the conceivable.

Translating all this into modern terms by combining the system $\boldsymbol{K_t}$ as our logic of possibility with the system ***S5*** as our logic of necessity, we get a very expressive logic. Accepting only minds and their worlds as ultimate referents, and covering their states with abstract dates in terms of unrepeatable 'instants', we obtain the system ***W***.

9. PROVIDENCE OR FREEDOM OF WILL

Let us now consider the theological implications of the ideas behind our new system ***W*** of tempo-modal logic. According to the Christian tradition, God is omnipotent, omniscient, and benevolent. The logical relations between these properties of the divine trinity has always been of special import to theology. Intellectual non-believers construe these properties as being mutually inconsistent whereas intellectual believers claim that the divine nature is coherent. The poor alternative is to admit a creed in absurdity.

Christianity teaches us that the infinite power of God manifests itself in the act of creation whereby something, viz., the temporal world, is called forth out of nothing; further, that the infinite wisdom and mercy of God's providence shows itself in creating man as an *imago dei* with freedom of will, foreseeing the fall and our ensuing evil deeds as well as his own divine decision to save us by sending his son and spirit. So far, there is no contradiction in this tale. However, contradiction lurks if providence is construed as foreknowledge of the now unpreventable truth of all future events.

Even if we ignore the non-statability of assertions relating to future individuals, it is difficult to reconcile our intuitive notion of freedom as unpredictable spontaneity with the presupposition that the truth-value of all possible statement of future contingents is known from eternity by God at this very instant. In the words of Peirce *(Ø&H 139)*: "They suppose that a man is perfectly free to do or not to do some given act, and yet that God already knows whether he will or will not do it. This seems to most persons flatly self-contradictory, and so it is if we conceive God's knowledge to be among the things which exist at the present time. But it is a degraded conception to conceive God as subject to time which is rather one of his creatures."

When we consider the semantical difficulties produced by the fact that some truths which have now become statable in the course of time were previously not statable, it may seem as if the problem of God's providence has been wrongly posed. Might God not have his own private language, incommunicable to us not only in fact but in principle - a secret language in which everything is written down *ab aeterno*? The idea is logically possible, but to the present writer it seems to spurn reason.

Why should God's work of creation be predestined to repeat an eternal truth? Should God really be unable to create anything freely without a preconceived plan? Ockham, who believed truth to be immutable and known of eternity by God, though the divine way of knowing truth is inscrutable to us, never addressed this question. However, by nature, God must be a brilliant mathematician. Could we not think of him as an infallible intelligence reflecting everything in advance, as suggested by Leibniz? God does not need a brain, of course; but if he chose to make use of one, how large would it have to be? One less than the universe itself would hardly do the job!

The reason why God created a world whose future is only predictable in general terms might be that he wanted to convey spontaneity and freedom of will to man!

The Danish poet Grundtvig once uttered that: *"creation is a divine experiment"*. Maybe God does not know future contingents because he has chosen not to do so?

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10. AXIOMATICS FOR THE SYSTEM $\mathcal{W}$

PRELIMINARIES

1. *Atomic propositions are well formed formulae, wff.*
2. *The set $\mathcal{W}$ of atomic propositions π contains a subset of abstract propositions τ called 'instants' or 'dates', and one unique proposition ω called 'the world'.*
3. *Instant-propositions may be distinguished by their index, e.g. τ by τ_i*
4. *If $\alpha, \beta,$ and τ are wff, then $\neg\alpha, \alpha \Rightarrow \beta, N\alpha, H\alpha, \Pi\tau_i{:}\ \alpha,$ are wff:*
   - *for '$\neg\alpha$' read: 'not α' or 'it is not the case that α'*
   - *for '$\alpha \Rightarrow \beta$' read: 'if α (is the case), then β (is the case)'*
   - *for '$N\alpha$' read: 'henceforth α' or 'α will always obtain'*
   - *for '$H\alpha$' read: 'hitherto α' or 'α did always obtain'*
   - *for '$\Pi\tau{:}\ \alpha$' read: 'at all instants, or dates, $\tau{:}\ \alpha$'*
5. *No other formulae except those above and their combinations are wff*

DEFINITIONS & RULES

df $\vee$ $\alpha \vee \beta \equiv \neg\alpha \Rightarrow \beta$ *read: '(either) α or β' ≡ 'if not α, then β'*

df $\wedge$ $\alpha \wedge \beta \equiv \neg(\alpha \Rightarrow \neg\beta)$ *read: '(both) α and β' ≡ 'not: if α, then not β'*

df $\Leftrightarrow$ $(\alpha \Leftrightarrow \beta) \equiv ((\alpha \Rightarrow \beta) \wedge (\beta \Rightarrow \alpha))$ *'α iff β' ≡ 'if α then β, and if β then α'*

df P $P\alpha \equiv \neg H\neg\alpha$ *read: 'past α' ≡ 'not hitherto not α'*

df M $M\alpha \equiv \neg N\neg\alpha$ *read: 'maybe α' ≡ 'possibly α ≡ 'not henceforth not α'*

df L $L\alpha \equiv HN\alpha$ *read: 'forever α' ≡ 'necessarily α' ≡ 'in all past future α'*

df K $K\alpha \equiv \neg L\neg\alpha$ *read: 'once α' ≡ 'conceivably α' ≡ 'not necessarily not α'*

df Π $\Pi\tau{:}\ \alpha \equiv L(\tau \Rightarrow \alpha)$ *read: 'α at all instants τ' ≡ 'α holds at all instants τ'*

df Σ $\Sigma\tau{:}\ \alpha \equiv \neg\Pi\tau{:}\ \neg\alpha$ *read: 'α at an instant τ' ≡ 'not at all instants τ not α'*

df P_{τ_i} $P_{\tau_i}\alpha \equiv P(\tau_i \wedge \alpha)$ *read: 'α did occur at τ_i' ≡ 'past: τ_i and α'*

df M_{τ_i} $M_{\tau_i}\alpha \equiv M(\tau_i \wedge \alpha)$ *read: 'α may occur at τ_i' ≡ 'maybe: τ_i and α'*

df K_{τ_i} $K_{\tau_i}\alpha \equiv K(\tau_i \wedge \alpha)$ *read: 'α might occur at τ_i' ≡ 'conceivably: τ_i and α'*

df F_{τ_i} $F_{\tau_i}\alpha \equiv \{M\tau_i \wedge N(\tau_i \Rightarrow \alpha)\}$
read: 'inevitably α at τ_i' ≡ 'maybe τ_i and henceforth if τ_i then α'

df D_{τ_i} $D_{\tau_i}\alpha \equiv \{K\tau_i \wedge L(\tau_i \Rightarrow \alpha)\}$
read: 'necessarily α at τ_i' ≡ 'once τ_i and necessarily if τ_i then α'

df $<$ $\tau_i < \tau_j \equiv L(\tau_i \Rightarrow M\tau_j)$ *'τ_i before τ_j' ≡ 'necessarily: if τ_i then $M\tau_j$'*

RN $\vdash \alpha \rightarrow \vdash N\alpha$ *if α is a thesis then $N\alpha$ is also a thesis*

RH $\vdash \alpha \rightarrow \vdash H\alpha$ *if α is a thesis then $H\alpha$ is also a thesis*
with the proviso that $H(\pi \Rightarrow \pi)$ for all π in α (no value gaps)

MP $\vdash \alpha$ & $\vdash (\alpha \Rightarrow \beta) \rightarrow \vdash \beta$ *if α and $(\alpha \Rightarrow \beta)$ are theses, then β is a thesis*

$R\Pi 1$ $\vdash \phi(\tau) \Rightarrow \alpha \rightarrow \vdash \Pi\tau{:}\ \phi(\tau) \Rightarrow \alpha$ *if $\phi(\tau) \Rightarrow \alpha$ is a thesis, it is so for all τ*

$R\Pi 2$ $\vdash \alpha \Rightarrow \phi(\tau) \rightarrow \vdash \alpha \Rightarrow \Pi\tau{:}\ \phi(\tau)$
if $\alpha \Rightarrow \phi(\tau)$ is a thesis then also $\alpha \Rightarrow \Pi\tau{:}\ \phi(\tau)$
with the proviso that τ is not free in α

RS *a general rule allowing the substitution of equivalents*

AXIOMS FOR PC (The Propositional Calculus - Lukasiewicz)

$P1$ $(\neg\alpha \Rightarrow \alpha) \Rightarrow \alpha$ *read: 'if, if not α then α, then α'*

$P2$ $\alpha \Rightarrow (\neg\alpha \Rightarrow \beta)$ *read: 'if α, then, if not α then β'*

$P3$ $(\alpha \Rightarrow \beta) \Rightarrow ((\beta \Rightarrow \gamma) \Rightarrow (\alpha \Rightarrow \gamma))$
read: 'if, if α then β, then: if, if β then γ, then, if α then γ'

AXIOMS FOR THE SYSTEM K_b (Future Branching Possibility: Kripke, Prior)

$A1$ $\alpha \Rightarrow NP\alpha$ [$A1$ entails $MH\alpha \Rightarrow \alpha$]
read: 'if α, then inevitably past α'

$A2$ $\alpha \Rightarrow HM\alpha$ *if $H(\pi \Rightarrow \pi)$ for all π in α* [$A2$ entails $PN\alpha \Rightarrow \alpha$ with proviso]
read: 'if α, then hitherto maybe α, granted that all π in α were hitherto statable'

$A3$ $H(\alpha \Rightarrow \beta) \Rightarrow (H\alpha \Rightarrow H\beta)$ [$A3$ claims distributivity of H]
read: 'if hitherto: if α then β, then: if hitherto α then hitherto β'

$A4$ $N(\alpha \Rightarrow \beta) \Rightarrow (N\alpha \Rightarrow N\beta)$ [$A4$ claims distributivity of N]
read: 'if henceforth: if α then β, then: if henceforth α then henceforth β'

$A5$ $MP\alpha \Rightarrow (\alpha \vee M\alpha \vee P\alpha)$ [$A5$ claims linearity of the past]
read: 'iff maybe past α, then α or maybe α or past α'

$A6$ $N\alpha \Leftrightarrow NN\alpha$ [$A6$ claims transitivity&density of N]
read: 'iff henceforth α, then henceforth henceforth α'

$A7$ $H\alpha \Leftrightarrow HH\alpha$ [$A7$ is provable with unconditioned RH]
read: 'iff hitherto α, then hitherto hitherto α'

$A8$ $N\alpha \Rightarrow M\alpha$ [$A8$ says inevitability implies possibility]
read: 'if henceforth always α, then maybe α'

AXIOMS FOR THE SYSTEM S5 (Omni-Temporal Necessity - Leibniz, Lewis)

$L1$ $L\alpha \Rightarrow \alpha$ [$L1$ is derivable from *dfL*, PC1-3, $A2$, $A6$]
read: 'if forever α, then α'

$L2$ $L(\alpha \Rightarrow \beta) \Rightarrow (L\alpha \Rightarrow L\beta)$ [$L2$ is derivable from *dfL*, PC1-3, $A3$, $A4$]
read: 'if forever: α implies β, then forever α implies forever β'

$L3$ $KL\alpha \Rightarrow L\alpha$ [$L3$ is the basic characteristic of system ***S5***]
read: 'if only it might be that forever α, then forever α'

AXIOMS FOR INSTANT-PROPOSITIONS (Abstract Dates - Wegener)

$T1$ $\Pi\tau_i$: $(\tau_i < \tau_i) \Rightarrow \alpha$ *'instant-propositions are unrepeatable'*

$T2$ $\Pi\tau_i\Pi\tau_j$: $(\tau_i < \tau_j) \vee (\tau_j < \tau_i)$ *'the order of instant-propositions is linear'*
$T2$ & df $<$ entail the corollary: 'instant-propositions are necessarily statable'

AXIOMS FOR THE WORLD ('The Now' - Meredith)

$N1$ ω *'the world exists now'*

$N2$ $L\omega \Rightarrow \alpha$ *'the world is contingent'*

$N3$ $\alpha \Rightarrow L(\omega \Rightarrow \alpha)$ *'the world is universally true', i.e., 'the world necessarily comprises all that is true just now'*

11. SEMANTICS OF THE SYSTEM $\mathcal{W}$

Our system $\mathcal{W}$ can be expressed in an ever growing language $\mathcal{L}_{\mathcal{W}}$ consisting of a dense, partially ordered, and backwards linear, set $\mathcal{W}$ of individual states σ, an ordering relation $<$ and, for any $\sigma \in \mathcal{W}$, two sets of propositional atoms: $\mathcal{S}_\sigma$ (those statable at σ) and $\mathcal{T}_\sigma$ (those true at σ). $\mathcal{I}$ is a totally ordered set of always statable temporal instants τ covering all conceivable individual states. Instant-propositions are abstract and differ from state-propositions by being statable over all conceivable individual states. State-propositions are concrete and differ from ordinary propositions, simple as well as complex, by being maximal, i.e., no further proposition can be added to them, or conjoined with them, on pain of inconsistency. Future possibilities differ in that different possible states are correlated, or conjoined, to the same future instants.

1. $a)$ *For all* $\tau, \tau' \in \mathcal{I}$ *(subset of* $\mathcal{W}$*) we have:* $\tau<\tau'$ *or* $\tau'<\tau$ *or* $\tau=\tau'$.
   $b)$ *For all* $\sigma, \sigma', \sigma'' \in \mathcal{W}$*, if* $\sigma<\sigma'$*, there is some* σ'' *so that* $\sigma<\sigma''<\sigma'$.
   $c)$ *For all* $\sigma, \sigma', \sigma'' \in \mathcal{W}$*, if* $\sigma'<\sigma$ *and* $\sigma''<\sigma$*, then* $\sigma'<\sigma''$ *or* $\sigma''<\sigma'$ *or* $\sigma'=\sigma''$.
   $d)$ *For all* $\sigma, \sigma', \sigma'' \in \mathcal{W}$*, if* $\sigma<\sigma'$ *and* $\sigma'<\sigma''$*, then* $\sigma'<\sigma''$.

2. *In* $\mathcal{L}_{\mathcal{W}}$*, at any* $\sigma \in \mathcal{W}$*,* $\mathcal{S}_\sigma$ *(subset of* $\mathcal{W}$*) is the set of all statable atoms* π*, and* $\mathcal{T}_\sigma$ *(subset of* $\mathcal{S}_\sigma$*) is the set of all atoms* π *stating definite truths (facts).*
   $a)$ *Any given world-state* σ *is true in or at itself:* $\sigma \in \mathcal{T}_\sigma \subset \mathcal{S}_\sigma \subseteq \mathcal{W}$.
   $b)$ *A wff* α *was statable,* $S\alpha$*, at a past world-state* σ *- i.e.,* $\alpha \in \mathcal{S}_\sigma$ *- iff, for all* π *in* α*, either* π *or not-*π *was true at* σ*, i.e.,* $\pi \in \mathcal{T}_\sigma$ *or not-*$\pi \in \mathcal{T}_\sigma$.
   $c)$ *For any* $\sigma \in \mathcal{W}$*, and for any wff* $\alpha \in \mathcal{S}_\sigma$*, we define* $\mathcal{V}(\sigma, \alpha)$ *such that* $\mathcal{V}(\sigma, \alpha)$ *takes the value* 1 *(true) or the value* 0 *(false), but not both; if a* π *in* α *was not statable at* σ*,* $\mathcal{V}(\sigma, \alpha)$ *was not defined (had a gap).*
   $d)$ *Whenever a wff* α *has become statable it will be statable forever after, i.e., if* $\sigma<\sigma'$*, then* $\mathcal{V}(\sigma, S\alpha) = 1$ *entails* $\mathcal{V}(\sigma', S\alpha) = 1$ *for all* $\sigma' \in \mathcal{S}_\sigma$.
   $e)$ *Whenever* σ *is restricted to a linear (totally ordered) subset* $\mathcal{L} \subset \mathcal{W}$ *(a world-course), the bijection* $\zeta(\sigma)$ *yields a mapping of* $\mathcal{L}$ *onto* $\mathcal{I} \subset \mathcal{S}_\sigma$.

3. *The* $\mathcal{V}$*-functions of* $\pi, \neg\alpha, \alpha \Rightarrow \beta, S\alpha, N\alpha, H\alpha, L\alpha, K\alpha, M\alpha, P\alpha, W\alpha, \tau, \Pi\tau{:}\phi(\tau)$*:*

   $a)$ $\mathcal{V}(\sigma, \pi) = 1$ *iff* $\pi \in \mathcal{T}_\sigma \subset \mathcal{S}_\sigma \subseteq \mathcal{W}$
   for: π *read: '*π *is true (at* σ*)'*

   $b)$ $\mathcal{V}(\sigma, \neg\alpha) = 1$ *iff* $\pi \in \mathcal{S}_\sigma$ *for all* π *in* α*, and* $\alpha \notin \mathcal{T}_\sigma$
   for: $\neg\alpha$ *read: '*α *is false (at* σ*)' or 'not-*α *is true (at* σ*)'*

   $c)$ $\mathcal{V}(\sigma, \alpha \Rightarrow \beta) = 1$ *iff* $\mathcal{V}(\sigma, \beta) = 1$*, or* $\mathcal{V}(\sigma, \neg\alpha) = 1$*, or both*
   for: $\alpha \Rightarrow \beta$ *read: 'if* α *then* β *(at* σ*)' or '*α *implies* β *(at* σ*)'*

   $d)$ $\mathcal{V}(\sigma, L\alpha) = 1$ *iff* $\mathcal{V}(\sigma, S\alpha) = 1$ & $\mathcal{V}(\sigma', \alpha) = 1$ *for all* $\sigma' \in \mathcal{W}$
   for: $L\alpha$ *read: 'forever* α*' or 'necessarily* α*'*

   $e)$ $\mathcal{V}(\sigma, N\alpha) = 1$ *iff* $\mathcal{V}(\sigma, S\alpha) = 1$ & $\mathcal{V}(\sigma', \alpha) = 1$ *for all* $\sigma' \in \mathcal{S}_\sigma$ *where* $\sigma<\sigma'$
   for: $N\alpha$ *read: 'henceforth* α*' or 'in the future always* α*'*

   $f)$ $\mathcal{V}(\sigma, H\alpha) = 1$ *iff* $\mathcal{V}(\sigma, S\alpha) = 1$ & $\mathcal{V}(\sigma', \alpha) = 1$ *for all* $\sigma' \in \mathcal{S}_\sigma$ *where* $\sigma'<\sigma$
   for: $H\alpha$ *read: 'hitherto* α*' or 'in the past always* α*'*

$g)$ $\mathcal{V}(\sigma, K\alpha) = 1$ *iff* $\mathcal{V}(\sigma, S\alpha) = 1$ & $\mathcal{V}(\sigma', \alpha) = 1$ *for some* $\sigma' \in \mathcal{S}_\sigma$
for: $K\alpha$ *read: '*α *might occur' or 'conceivably* α*'*

$h)$ $\mathcal{V}(\sigma, M\alpha) = 1$ *iff* $\mathcal{V}(\sigma, S\alpha) = 1$ & $\mathcal{V}(\sigma', \alpha) = 1$ *for an* $\sigma' \in \mathcal{S}_\sigma$ *where* $\sigma < \sigma'$
for: $M\alpha$ *read: '*α *may occur' or 'possibly* α*'*

$i)$ $\mathcal{V}(\sigma, P\alpha) = 1$ *iff* $\mathcal{V}(\sigma, S\alpha) = 1$ & $\mathcal{V}(\sigma', \alpha) = 1$ *for an* $\sigma' \in \mathcal{S}_\sigma$ *where* $\sigma' < \sigma$
for: $P\alpha$ *read: '*α *did occur' or 'past* α*'*

$j)$ $\mathcal{V}(\sigma, W\alpha) = 1$ *iff* $\mathcal{V}(\sigma, \alpha) = 1$ & $\mathcal{V}(\sigma', \alpha) \neq 1$ *for all* $\sigma' \in \mathcal{S}_\sigma$ *where* $\sigma' \neq \sigma$
for: $W\alpha$ *read: '*α *is an individual (a mind, a world)'*

$k)$ $\mathcal{V}(\sigma, \tau) = 1$ *iff* $\sigma \in \mathcal{L}, \tau \in \mathcal{I}$ & $\mathcal{V}(\sigma, \zeta(\sigma) \Rightarrow \tau) = \mathcal{V}(\sigma, \tau \Rightarrow \zeta(\sigma)) = 1$
for: τ *(at* σ*)* *read: 'world-state* σ *is realized at the instant* τ*'*

$l)$ $\mathcal{V}(\sigma, \Sigma\tau\colon \phi(\tau)) = 1$ *iff* $\mathcal{V}(\sigma, \phi(\tau)) = 1$ *obtains at some* $\tau \in \mathcal{I}$
for: $\Sigma\tau\colon \phi(\tau)$ *read: 'some* τ *phi-es'*

$m)$ $\mathcal{V}(\sigma, \Pi\tau\colon \phi(\tau)) = 1$ *iff* $\mathcal{V}(\sigma, \phi(\tau)) = 1$ *obtains at all* $\tau \in \mathcal{I}$
for: $\Pi\tau\colon \phi(\tau)$ *read: 'all* τ *phi-es'*

In $\boldsymbol{\mathcal{L}_{\mathcal{W}}}$, some given statable wff α is called valid iff $\mathcal{V}(\sigma, \alpha') = 1$ for all $\sigma \in \mathcal{W}$, where α' is derivable from α by replacing its variables with atomic constants in $\mathcal{S}_\sigma$. It can be verified that all axioms of system $\boldsymbol{\mathcal{W}}$ are valid according to this definition.

12. MAP OF THE SYSTEM $\mathcal{W}$

Kripke modality (K$_b$)

$$MH\alpha \rightarrow \quad \leftarrow PN\alpha \text{ with proviso}$$
$$\downarrow \quad \leftarrow \alpha \rightarrow \quad \downarrow$$
$$NP\alpha \qquad H M\alpha \text{ with proviso}$$

Lewis modality (S4')

$$N\alpha \rightarrow NMN\alpha \rightarrow \begin{matrix} \rightarrow MN\alpha \rightarrow \\ \uparrow \qquad\qquad \downarrow \\ \downarrow \qquad\qquad \uparrow \\ \rightarrow NM\alpha \rightarrow \end{matrix} MNM\alpha \rightarrow M\alpha$$

Brouwer modality (B)

$$NH\alpha \rightarrow MPNH\alpha \rightarrow \alpha \quad \rightarrow \quad NHMP\alpha \rightarrow MP\alpha$$
with proviso

Leibniz modality (S5)

$$(L\alpha \leftrightarrow KL\alpha) \rightarrow \alpha \rightarrow (LK\alpha \leftrightarrow K\alpha)$$

Kierkegaard modality

$$L\neg\alpha \rightarrow \neg M\alpha$$

Ockham future

$$D_\tau\alpha \rightarrow F_\tau\alpha \rightarrow M_\tau\alpha$$

Peirce future

$$F_\tau\alpha \rightarrow \neg F_\tau\neg\alpha$$

Mogens True Wegener

O. CONCLUSION

It is remarkable that we can construct a logic combining the features of a great variety of modal systems for an ever growing language, the basic axioms being:

$A1$ $\alpha \Rightarrow NP\alpha$ *'if* α *then inevitably past* α*'*

$A2$ $\alpha \Rightarrow HM\alpha$ *if* $H(\alpha \Rightarrow \alpha)$ *'if* α *then hitherto possible* α*, granted* $H(\alpha \Rightarrow \alpha)$*'*

$A1$ is identical to the major premiss used by Diodoros in his famous master-argument, but is also reflected in the principle: *unum quodque quando est oportet esse*, of Leibniz. This axiom is not weakened by any proviso since we assume, contrary to Prior, that all propositions which are presently statable will henceforth, in all future, remain statable. $A2$, however, is a weakened version of the law $\alpha \Rightarrow HF\alpha$ that was criticized by Prior for involving the omnitemporal statability of all now statable propositions *(PPF vii, TT iii)*.

$\mathcal{W}$ is restricted by the fact that the notion of a "true future" is left inexpressible. Thus $\mathcal{W}$ takes more from Prior and Peirce than from Ockham. According to the latter, God knows all future contingents, although we don't know how. But opinions diverge: what believers in a true future consider as a defect, this writer counts as a virtue.

The issue is not the one whether we must be silent about what we cannot know, but whether it is sensible to suppose that the future was always already known by God. Of course, if the future were predestined from eternity, then, granted that there is a God, God would forever know the future; but human freedom would then be a delusion.

In any case it seems evident that it does make sense to speak of a created truth. Accepting with Peirce that *God knows whatever can be known*, and that this comprises what is not decided by blind chance or by the free will of man, we leave the issue.

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The present paper is an improved version of a joint paper written by the author in collaboration with Peter Øhrstrøm, the title of our previous paper being:

A New Tempo-Modal Logic for Emerging Truth

Faye & al.: ***Perspectives on Time***, Boston Studies, Kluwer 1996.

Please, notice the kind appreciation of $\mathcal{W}$ by J.R. Lucas in his 1999 article.
The axiomatics is here simplified, and the semantics is adjusted accordingly.
I am very grateful to Peter Øhrstrøm for his kindness and helpfulness during our lengthy discussions of the formalities of $\mathcal{W}$. I also thank Torben Bräuner.

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