

# TIME AND DEVELOPMENT IN KRIPKE'S "NAMING AND NECESSITY"

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ABSTRACT: In this article, I want to focus on time and development in Kripke's "Naming and Necessity" by considering two topics: (1) the evolution of scientific knowledge; (2) the evolution of biographies. In connection with (1) I suggest the introduction of a sentence operator for epistemic possibility and argue that some of Kripke's strong metaphysical statements are finely counterbalanced by rather "Popperian" epistemological considerations. In connection with (2) I consider the idea of exploiting necessity of origin for a crossworld identity criterion.

Keywords: time, "Naming and Necessity", scientific progress, necessity of origin, trans-world identity.

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### *1. Introduction*

*Time and development* are not explicitly treated in "Naming and Necessity". Nevertheless, much of what Kripke deals with has a temporal dimension and therefore quite a few of his famous examples have a temporal ring about them. It is worth to have a look at them with emphasis on time and development. I want to do so by considering two quite independent topics. The first is the evolution of scientific knowledge and the second is the evolution of biographies. In connection with the first topic I would like to point towards a "Popperian" trait in Kripke's thought which, I think, has

not always been very clearly noticed. In connection with the second topic I would like to examine the temporal ring of Kripke's examples in connection with the thesis of necessity of origin. In this context I will suggest that necessity of origin can be used as an identity criterion in modal theories if possible worlds are regarded as temporally structured and objects are regarded as evolving a history in time.

## 2. *Temporal horizons of knowledge*

Empedocles, like all his colleagues in ancient Greece, thought that water is an element. Whatever water is, we know today that it is not an element. So the question arises: Was Empedocles ever possibly right?<sup>1</sup>

A view according to Kripke's ideas in "Naming and Necessity" is that indeed in a way Empedocles wasn't ever possibly right. Since water *is* not an element, there *is* no possible world in which Empedocles was right. Things could never have turned out to *be* the way Empedocles thought, since things *aren't* the way he thought. We don't know which way things will turn out to *be*, but it's not really open which way they will turn out to *be*, since they can only turn out to *be* the way they *are*. Nothing can turn out to *be* the way it *isn't*. We may not know whether *p* or  $\neg p$  will turn out to *be* true, but if anything turns out to *be* true at all, then it's not undetermined now whether *p* or  $\neg p$  will turn out to *be* true. If anything turns out to *be* true at all, then if *p* *is* true, only *p* can turn out to *be* true and  $\neg p$  can't (and vice versa). It is already determined which of two contradictory statements has at all the capacity to turn out to *be* true, i.e. the one of them which *is* true.<sup>2</sup>

One might, however, ask: if Empedocles was necessarily wrong, was his theory, then, ever ever a serious epistemic option to be considered? Could it ever have been a candidate for scientific truth? In this case, I think that the answer should be "yes", and that (perhaps contrary to a first impression) this is quite compatible with Kripke's view. Empedocles didn't know that water *isn't* an element. Hence at his time the question whether it *is* or not was still open to scientific investigation. (Of course, the correct answer was already determined, since water already then was not an element, since it *isn't*). There was nothing to prevent Empedocles from basing a theory on the assumption that water *is* an element. Today, the situation is different with respect to what is known about water in the relevant scientific community. Empedocles' theory is no option for us today, since we know that water *isn't* an element. It would still be an option for a member of a scientific community on a remote island if this community does not know

yet that water *isn't* an element. One might say that the fact that water *isn't* an element was not included in Empedocles' horizon and that therefore it was still a serious option to him that water *was* an element.

One might think of precisely rendering this intuition by introducing an operator  $\Delta$  on temporally definite ("classical") propositions, which has the meaning of "it is an epistemic option that". Formulas of a logic containing this sign would have to be evaluated with respect to two contexts: a time (for example  $t, t_1, t_2, \dots$ ) and a subject of belief at that time (for example  $s, s_1, s_2, \dots$ ). Single persons as well as communities may be regarded as subjects of belief.

In order to formulate the semantics of  $\Delta$  we should introduce the notion of a horizon of knowledge of  $s$  at  $t$ . The *horizon of  $s$  at  $t$*  be the set of those propositions *known* by  $s$  at  $t$ . In order for  $p$  to be known by  $s$  at  $t$ , (traditionally)  $p$  has to be true and to be rationally believed by  $s$  at  $t$  (whatever that may mean in detail).<sup>3</sup> The horizon of  $s$  at  $t$  may be notated as  $H_{s,t}$ .

Let the semantics of  $\Delta$  be:

$\Delta p$  is true for  $s$  at  $t$  iff  $\neg p \notin H_{s,t}$ .

Truth-values of formulas containing this operator could vary with time and subject of belief.<sup>4</sup> It is interesting to contrast its application with the application of the usual  $\diamond$  operator of modal logic, which has the well-known semantics:

$\diamond p$  is true in a possible world  $w$  iff there is a possible world  $w'$  (accessible from  $w$ ) such that  $p$  is true in  $w'$ .<sup>5</sup>

Using the  $\Delta$  operator we can let  $t$  stand for the year 430BC,  $s$  for Empedocles and  $p$  for the proposition that water *is* an element. Let us suppose that water *is* not an element, i.e. that  $\neg p$  is true. We obtain that

$\Delta p$  is true for  $s$  at  $t$  and therefore  $\neg \Delta p$  is false for  $s$  at  $t$ .

The reason is that  $\neg p$  is not included in Empedocles' horizon of knowledge at  $t$ . We also obtain

$\Delta \neg p$  is true for  $s$  at  $t$ ,

since  $p$  is not included in Empedocles' horizon of knowledge at  $t$ . It cannot be, because in order to be included in his horizon of *knowledge* at  $t$ ,  $p$  would have to be true, which it isn't.

Nonetheless, with respect to the actual world we obtain, according to Kripke's view, that

$\diamond p$  is false and therefore  $\neg \diamond p$  is true.

The reason is that, since water *isn't* an element it could not possibly *be* one. (The reason for this, in turn, is that water is a natural kind term. It is clear that Kripke does not say that all truths whatsoever are necessary truths.)

The discovery of the ambiguity, which can be dissolved by using different logics with different operators for epistemic and for ontological possibility, is at the very core of "Naming and Necessity".

One might therefore think about applying the  $\Delta$  operator to Kripke's famous examples

- (1) "The Queen is the daughter of the Trumans"<sup>6</sup>,
- (2) "Gold is blue"<sup>7</sup> or
- (3) "Cats are little demons"<sup>8</sup>
- (4) "Gold has the atomic number 79"<sup>9</sup>

with (1) to (4) for  $p$ ,  $t$  for 1997 and  $s$  for us.

If one takes the (rather skeptical) view that in each of the cases neither  $p$  nor  $\neg p$  are safely included in our present horizon of knowledge, then both  $\neg p$  and  $p$  are epistemic options, i.e. both  $\Delta \neg p$  and  $\Delta p$  hold. If one assumes the truth of (1) to (4), nonetheless  $\neg \diamond \neg p$  is true in each of the cases, and  $\diamond \neg p$  is false.

But don't we *know* that gold is not blue? And is not part of what Kripke wants to claim by giving the examples (1) to (4) something like:

"It is *conceivable* that  $p$ ,  
*even if* we know that  $\neg p$  is true,  
 and *even if*  $\neg p$  is true  
 (since knowing that  $\neg p$  is true implies that  $\neg p$  is true),  
 and, hence, *even if*  $\neg \diamond p$  is true  
 (since then, as  $p$  contains a natural kind term,  $\neg p$  &  $\neg \diamond p$  is true)." ?

If this is what Kripke wants to say, and if epistemic possibility is to be equated with "being conceivable", then, it seems, epistemic possibility

must count as an irreducible concept. One should, in that case, not hope to exhaustively render it by using the notion of a horizon of knowledge. If that is so, the  $\Delta$  operator can only render a fragment of the use of the concept of epistemic possibility. It would extend to exactly those cases of conceivability which are epistemic options in the sense explained above. Whatever conceivability exactly is, if being conceivable isn't simply being an epistemic option, clearly epistemic options are cases of conceivability and, as seen above, they are rather interesting cases of conceivability.

I am, however, inclined to adopt a rather more "skeptical" reading of "Naming and Necessity". I admit that I am not quite sure what Kripke's intended reading was. I am not absolutely sure whether he would go so far as to claim that strictly speaking we do not *know* (1) to (3) to be false. However, my impression is that he might go so far, since he explicitly does so with (4).<sup>10</sup> If this is so, then epistemic possibility may in fact be a concept reducible in terms of horizons of knowledge.

Why I think so is perhaps best explained by starting from the fact that horizons may change with time. It depends on the theory of science one has whether they do so and, if so, in which way they might change. For example, a *hard-core sceptic* will say that all horizons of all subjects of belief at all times are always empty. He has the extreme opinion that we never knew anything, don't know anything and will never know anything.<sup>11</sup> He does not think that temporal horizons ever change.

An *epistemic optimist* will be convinced that at least some horizons are non-empty and will make no restrictions as to what kind of proposition may be included in horizons of knowledge.<sup>12</sup> On his view, horizons of knowledge do change. To him, scientific progress is widening one's horizon. Scientific progress consists in some proposition being included in a scientific community's horizon of knowledge at a time  $t$  which had not been contained in it at some earlier time  $t'$ . If this has happened, some proposition  $p$  has turned out to be true by  $t'$  for this community at  $t'$ , and  $\neg p$  is no more option ( $\neg\Delta\neg p$ ). This proposition had not yet turned out to be true at  $t$ , and at  $t$   $\neg p$  was still an option ( $\Delta\neg p$ ).

In the middle between the two extreme theorists is the *Popperian sceptic*. His position is more complicated than the extreme ones. In contrast to the hard-core sceptic, he will deny that all horizons are empty. In contrast to the epistemic optimist, however, he will, as far as scientific statements are concerned, allow only negative statements (such as "water *is not* an element") to be included in any horizon of knowledge.<sup>13</sup> Our present horizon of knowledge contains the proposition that water *is not* an element (this

assumption has been falsified). However, it does not contain the proposition that water *is* a molecule, since this is only a well-tested assumption but by no means known for sure. If  $p$  is a positive theoretical statement such as "Gold *has* the atomic number 79" it is at any future  $t$  an option to us that  $p$  may be false ( $\Delta\neg p$ ). Perhaps one day we realize that  $p$  was part of a wrong theory, Then  $p$  is no more option to us ( $\neg\Delta p$ ) because  $\neg p$  is then included in our horizon of knowledge and  $p$  has by then turned out to be false.

Kripke comes very close to the Popperian view in "Naming and Necessity":

Gold apparently has the atomic number 79. (...) Certainly we could find out that we were mistaken. The whole theory of protons, of atomic numbers, the whole theory of molecular structure and of atomic structure, on which such views are based, could all turn out to be false. (...) So in that sense, gold could turn out not to have atomic number 79.<sup>14</sup>

This is important to realize, since it helps to clarify an important point of Kripke's theory. Kripke famously holds it possible that theoretical identifications are necessarily true, i.e. that we may "very well discover essence empirically".<sup>15</sup> Taken in isolation, this is a very strong claim and may be thought to be counter-intuitively strong. It might give rise to the impression that, if Kripke's theory is correct, we can do a little empirical science and then with full conviction begin to state all sorts of necessary truths. This impression is, however, mistaken. Kripke's ontological essentialism is finely counter-balanced by quite "Popperian" epistemological traits of his thought. Kripke is always very careful to make clear the conditional form of his theoretical identifications: *If* gold does have the atomic number 79, then necessarily gold has the atomic number 79. What does this mean for ability to state necessary truths? We might be right that gold has the atomic number 79. If that is so and if we say so we are stating a necessary truth. However, if we happen to be sensible Popperian sceptics, we can never do so *with full conviction*. We might be lucky to state a necessary truth as we might be so lucky to state a true theoretical identification. But we can never be sure to be so lucky. We might be stating necessary truths, which sounds like a very big deal; but even if we are stating a necessary truth we can never *know* that we are stating a necessary truth, and that's pretty modest again. We may very well have discovered essence empirically, but we can never be sure that we have.

### 3. *It might all have developed in a different way*

#### 3.1. *Necessity of origin*

One of the topics of "Naming and Necessity" which are most clearly to do with time and development is Kripke's thesis of necessity of origin:<sup>16</sup>

(...) could the Queen -could this woman herself- have been born of different parents from whom she actually came? Could she, let's say, have been the daughter instead of Mr. and Mrs. Truman? (...) Let's suppose that really did come from these parents. (...) can we imagine a situation in which it would have happened that this very woman came out of Mr. and Mrs. Truman? (...) Perhaps in some possible world Mr. and Mrs. Truman even had a child who actually became the Queen of England (...). This would still not be a situation in which *this very woman* whom we call 'Elisabeth II' was the child of Mr. and Mrs. Truman (...) How could a person originating from different parents, from a totally different sperm and egg, be *this very woman*? (...) It seems to me that anything coming from a different origin would not be this object.<sup>17</sup>

Although what Kripke says about necessity could be rendered by means of a non-temporal modal logic, it is clear that time and development are involved when it comes to discussing origins. We might regard possible worlds as possible courses of history. In them, the "biographies" of objects are something very intimately connected with the objects themselves. For example, an object's future is destroyed if the object is destroyed, but not its biography, i.e. its past. And from the same starting point, an object may develop in very different ways. In the passage on necessity of origin Kripke comes very close to this view:

One is given, let's say, a previous history of the world up to a certain time, and from that time it diverges considerably from the actual course. This seems to be possible. And so it seems to be possible that even though she [Elisabeth II] were born of these parents she never became queen.<sup>18</sup>

Similarly, in a passage in lecture 1, Kripke reflects upon Aristotle pursuing a career very different from the one he did pursue.<sup>19</sup>

Kripke does not think that the thesis of necessity of origin can be argued. He says it is a matter of getting convinced of it and that he does not expect everybody to agree with it. I do not want to discuss possible reasons for this view here, although many interesting suggestions have been made for counter-examples.<sup>20</sup> I must admit that I still find the thesis of necessity of origin very plausible, so I would like to apply it rather than criticise it here. I would like to suggest a way of exploiting it for the solu-

tion of another problem. The problem is often called the problem of crossworld identity. I do not think this problem is quite as small as Kripke thinks, but that it might be solved by using necessity of origin as a criterion for cross-world identity.

### 3.2. *Temporal possibility*

In order to reflect the idea of "a previous history of the world up to a certain time, (...) from [which] time it diverges considerably from the actual course" we could introduce a combined modal and temporal logic by using an accessibility relation between possible worlds with a temporal parameter ( $A_t$ ):  $w$  is accessible from  $w'$  at  $t'$  ( $wA_{t'}w'$ ) iff  $w$  and  $w'$  are identical up to (and including)  $t$ .<sup>21</sup> This time,  $p$ 's stand for temporal propositions or for temporally indefinite statements.<sup>22</sup>

This logic could contain tense operators as well as modal operators. Following GAMUT, I would suggest such a logic to contain the following semantics:

$V_{w,t}(F\alpha)=I$  iff there is a  $t'$  with  $t < t'$  such that  $V_{w,t'}(\alpha)=I$ .

$V_{w,t}(P\alpha)=I$  iff there is a  $t'$  with  $t' < t$  such that  $V_{w,t'}(\alpha)=I$ .

$V_{w,t}(\diamond\alpha)=I$  iff there is a  $w'$  with  $w'A_t w$  such that  $V_{w',t}(\alpha)=I$ .

The notion of possibility involved here is not the same as contingency, but something rather more down to earth in the sense of realizability. While in non-temporal modal logic possibility and contingency coincide, the  $\diamond$  in temporal modal logic does not render contingency. Contingency is rather expressed by  $P\diamond Fp$  than by  $\diamond p$ . In accordance with this, the operator  $\square$ , if defined in the usual way as  $\neg\diamond\neg$ , expresses inevitability of things done. This intuitively justifies the result that  $p$  implies  $op$  (since, if  $p$  is true at  $t$ , only those  $w'$  satisfy  $wA_t w'$  in which  $p$  is true at  $t$ , because those in which  $\neg p$  is true at  $t$  are not identical with  $w$  up to *and including*  $t$ ).<sup>23</sup> Clearly, although  $p$  implies  $op$ ,  $p$  may nevertheless be a contingent truth. If  $p$  is "necessarily true" in the sense of being non-contingently true, this means that  $\neg p$  was never realizable. This is expressed by  $\neg P\diamond F\neg p$ .

So the idea that  $p$  might have been the case would be expressed by  $P\diamond Fp$ , the idea that it might not have been the case that  $p$  by  $P\diamond\neg Fp$ , the idea that it might have been the case that not- $p$  by  $P\diamond F\neg p$ , the idea that it could never have been the case that  $p$  by  $\neg P\diamond Fp$ , and the idea that it could



never have been the case that not- $p$  (i.e. that  $p$  was always inevitable) by  $\neg P\Diamond F\neg p$ .

The means of expression of this logic are comparatively fine-grained, at least if compared with a non-temporal modal logic. Therefore I think, it might be more suitable for formally rendering sophisticated and interesting points made in "Naming and Necessity" such as Kripke's examples

- (5) "Humphrey might have been President"<sup>24</sup>,
- (6) "Nixon might not have been President",
- (7) "Aristotle might not have been the teacher of Alexander" or
- (8) "The Queen might not have existed"
- (9) "If the Queen is the Queen Mum's daughter, then the Queen could never have been the Trumans' daughter".

All those examples have a definitely temporal ring which is easily lost in non-temporal modal logics. This is, however, rendered clearly if we formalize examples (5) to (9).

- (5) is to be formalized as  $P\Diamond Fp$  with  $p$ : "Humphrey is the 37th President"

This is true with  $t=1997$  and with  $w$  as the actual world, since there is a  $t' < t$ , e.g. 1967, at which a world  $w'$  was still accessible from  $w$  such that there is a  $t''$  with  $t' < t''$  (e.g. 1969) with respect to which and to  $w'$  "Humphrey is President" is true.

- (6) is to be formalized as  $P\Diamond\neg Fp$  with  $p$ : "Nixon is the 37th President"

This is true with  $t=1997$  and with  $w$  as the actual world, since there is a  $t' < t$ , e.g. 1967, at which a world  $w'$  was still accessible from  $w$  such that there is no  $t''$  with  $t' < t''$  with respect to which and to  $w'$  "Nixon is the 37th President" is true.

- (7) is the same as (6) with  $p$ : "Aristotle is the teacher of Alexander".  
And (8) is the same as (6) with  $p$ : "The Queen exists". (9) is to be formalized as  $p \supset \neg P\Diamond Fp$  with  $p$ : "The Queen is the Trumans' daughter".

If  $p$  is true in 1997 and in the actual world  $w$ , then, since "the queen" is a natural kind term, according to Kripke, there never was a  $t' < t$  such that at  $t'$

a world  $w'$  was still accessible such that there is a  $t''$  with  $t' < t''$  with respect to which "The Queen is the Trumans' daughter" is true.

### 3.3. Counterparts vs. Kripkean identity

If we accept the thesis of necessity of origin we might think about using necessity of origin as an identity criterion. In order to see how, let us first examine the problem:

If we talk about objects, we should have some idea as to when an object called "A" is the same object as an object called "B". If we do *not* consider what might happen to an object or counterfactually might have happened to it, there is a venerable criterion for this:

- (L) A is the same object as B iff A has all and only those properties that B has.

Here, "properties" are meant to be temporally definite, such as "being red at (a specific) time  $t$ ". If we do consider what might happen to an object, or counterfactually might have happened to it, this criterion (called Leibniz' law) gets problematic.<sup>25</sup> If we imagine the same object in different possible worlds in which different things happen to it, then with respect to one of these worlds it has different properties than with respect to another. For example, it is possible that red object is painted green before  $t$ , even if in fact it stays red. So with respect to a possible world different from the actual world it would have the property of being green at  $t$ , while with respect to the actual world it would have the property of being red at  $t$ . (This is a problem which is totally different from the problem of identity over time, which I will not discuss. Identity over time has difficulties of its own in Kripke's opinion, too.<sup>26</sup>)

There is a way to reconcile this observation with Leibniz' law. One simply says: we never imagine the same object, say A, in any situation different from the one which, we say, is realized. What we really do is to imagine another object A' which is similar enough to A to be called its counterpart. So Leibniz' law holds for both A and A'.<sup>27</sup> One objection to this is that if I think that I might have gone shopping this morning instead of working in the department I don't even dream of thinking of someone else than myself going shopping. Another objection is that it is not quite clear how similar someone has to be to myself in order to count as my

counterpart. The reply "don't ask, just rely on your gut feeling" is not too convincing, since I have no gut-feeling about counterparts.

There is another way of dealing with the situation. It consists in saying that Leibniz' law holds only relative to possible worlds and not *absolute*:

(LW) For any possible world  $w$ : A is the same object as B iff A has all and only those properties with respect to  $w$  that B has with respect to  $w$ .

This leaves us free to say it is in fact the same object which appears in different possible worlds. I think that this is in accord with what Kripke says in "Naming and Necessity".<sup>28</sup> However, this answer is not quite as simple as it looks. One might, for example, object that it leaves us with no criterion for identity *across* possible worlds. So we get a problem which is parallel to one of the main problems of the other view: how far can an object B in another possible world differ from A in the actual world in order to be recognized to be the same object as A? Here, my impression is that Kripke's solution too results in an appeal to our gut feeling.<sup>29</sup> In connection with Kripke's view this is not as bad as in connection with the other view. For example, whereas I have no gut-feeling whatsoever about any counterparts of mine I do have some sort of gut-feeling about myself. Nonetheless, it would be nice to have something more specific here, although Kripke says this is not to be expected.<sup>30</sup>

#### 3.4. *Necessity of origin as a cross-world identity criterion*

We could build a predicate logic based on the same ideas as the propositional logic sketched in 3.2. This logic could be a predicate logic with a global domain (as Kripke's ideas suggest) which contains objects A, B etc. which have biographies: they begin and cease to exist and, while they exist, have different properties at different times.<sup>31</sup>

Interestingly, for such objects as have a history in time, or a biography, we can stress their temporal dimension by formulating Leibniz' law in a slightly different way than above:

(LT) A is identical with B iff for all  $t$  the set of temporal, present-state properties of A at  $t$  is coextensional with the set of temporal, present-state properties of B at  $t$ .

Here a temporal property is a property like "is red at..." in contrast to "is red at t". It may be imagined as the result of replacing the subject of a temporal proposition by subject-place. That the properties referred to must be "present-state" properties means that it is to be excluded that they implicitly involve a future state (e.g. "will participate in a sea-battle tomorrow"), for as to whether an object has the property of participating in a sea-battle tomorrow varies from world to world.

Now if we want to formulate an identity criterion for objects for our temporal modal logic we might have a try saying that

(LTM1) A is identical with B iff for all t and for any two possible worlds w and w' the set of temporal, present-state properties A has with respect to w at t is coextensional with the set of temporal, present-state properties B has with respect to w' at t.

However, this would be too strong, since it amounts to stipulating that Leibniz' law holds unrestricted in modal logic. As we have seen, this does not agree with the purpose of a temporal modal predicate logic, i.e. to render different possible developments of the same object. But if this does not necessarily mean that we should give up hope for an identity criterion. Rather, if we think that necessity of origin is plausible enough to make it an identity criterion, we should modify our first try to:

(LTM2) A is identical with B iff there is an open<sup>32</sup> interval  $I = ]t, t'[,$  however short, such that

- (i) There is no instant t'' such that t' is before t and A exists at t''.  
There is no instant t' such that t' is before t and B exists at t'.  
Both A and B exist at all t''' ∈ I.
- (ii) For any two possible worlds w and w' and for all t ∈ I: the set of temporal present-state properties of A with respect to w at t is coextensional with the set of temporal, present-state properties of B with respect to w' at t.

This is no trivial identity qua coextensionality, but something more complicated. It is an identity criterion via origin, since an origin is what an interval such as specified in LTM2 should be called: it is an arbitrarily short interval of instants, before which neither A nor B existed. Now the object called A can only be identical with the object called B if the object called A and the object called B have such a common origin during which

they share all their properties. Later on they may develop in very different directions.

If one wants to stress the way in which this identity criterion deviates from Leibniz' law one might go so far as to call it *cum grano salis* a counterpart-identity.<sup>33</sup> If one wants to stress its partial coincidence with Leibniz' law one might call it bundle-of-properties-identity. Nevertheless, it is based on Kripke's ideas from "Naming and Necessity".

#### 4. Concluding remark

Time will tell whether necessity of origin should really be thought to be so strong that it provides an identity criterion.<sup>34</sup> At least I hope to have shown by these considerations that time and development can be regarded as important elements of Kripke's ideas in "Naming and Necessity". They are essentially present in the background like members of a good rhythm section of a Jazz band and they deserve the spotlight to be turned on them.

#### Notes

- <sup>1</sup> I owe this question to Peter Rohs of Münster University. I should mention that he thinks the answer must be an unrestricted "yes" and that therefore Kripke's view is counterintuitive.
- <sup>2</sup> In what follows, atemporal use of tenses is given in hollowface in order to prevent any misunderstanding. Of course, p here represents a temporally definite, "classical" proposition like "Water *is* an element".
- <sup>3</sup> The first record of this tradition is found in Plato's "Theaetetus". Alas, it is often thought that this characterization of knowledge is in fact the result of the "Theaetetus". It is not. Plato is very clearly aware of the problems of what "rational" means here (they present themselves to him concerning the word λογος). Because of these problems he explicitly rejects the characterization of knowledge as true rational belief (210b1).
- <sup>4</sup> Clearly, the sketch of semantics provided here is far from constituting a complete logic in which  $\Delta$  is a regular sign. I would just like to suggest building such a logic here, and give an idea of what could be done with it. I hope to elaborate on it in later.
- <sup>5</sup> Taken here, of course, as a sign of a logic in which formulas are not evaluated with respect to times and subjects of belief but with respect to possible worlds.
- <sup>6</sup> Kripke: 'Naming and Necessity', Lecture 3, p. 110-113.
- <sup>7</sup> Loc. cit., p. 118f.
- <sup>8</sup> Loc. cit., pp. 122-126.
- <sup>9</sup> Op.cit., p. 123.

- <sup>10</sup> Loc. cit.
- <sup>11</sup> One can argue that since this is only an *opinion*, this is not self-contradictory. Cp. Sextus Empiricus: *Outlines of Pyrrhonism* I,4; I,19/20. Cp. on this point Malte Hossenfelder's introduction to his translation of the *Outlines* into German (*Grundriss der Pyrrhonischen Skepsis*, Frankfurt, 1985). I am not going to discuss this point.
- <sup>12</sup> An epistemic pessimist might be of the opposite opinion: we used to have knowledge about, say, teleology, creation, heaven and lots of other things, which we have lost by disbelief. So our horizons narrow.
- <sup>13</sup> Possibly, some horizons contain some positive statements which are not scientific statements but statements of metaphysics such as "Critical rationalism is true."
- <sup>14</sup> Kripke, 'Naming and Necessity', p. 123.
- <sup>15</sup> Op. cit., p. 110.
- <sup>16</sup> Kripke, 'Naming and Necessity', Lecture 3, pp. 112-115, esp. footnotes 56 and 57.
- <sup>17</sup> Lecture 3, p. 112f.
- <sup>18</sup> Ibid.
- <sup>19</sup> Lecture 1, pp. 61-63.
- <sup>20</sup> On the thesis of necessity of origin cp. e.g. Hamid, Valid: 1994, 'Origin, Subsequent History and Necessity', *Dialectica* 48(1), 65-71. The thesis is basically defended in: Noonan, Harold: 1983, 'The Necessity of Origin', *Mind* 92, 1-20; and in Forbes, G.: 1980, 'Origin and Identity', *Philosophical Studies* 37, 353-362. Criticisms are found in Price, M.S.: 1982, 'On the non-necessity of origin', *Canadian Journal of Philosophy* 12, 33-45; Elliot, R., Gallois, A.: 1984, 'Would it Have Been me? (Against the Necessity of Origin)', *Australasian Journal of Philosophy* 62, 293; more recently in Hughes, Christopher: 1994, 'The Essentiality of Origin and the Individuation of Events', *The Philosophical Quarterly* 44, 26-44; and in Mark Philpott, chapter 4 ('Why Buy Necessity of Origin When You Can Pay Less for Something that Works') of 'The Genetics of Identity', MLitt Thesis, University of Bristol, 1996 (unpublished). In my view there is an especially interesting counter-example on p. 31 of Hughes: Would an artificial lake not be the very same lake if it had been flooded five minutes later?
- <sup>21</sup> This very elegant way of introducing a combined temporal and modal logic is, for example, found in GAMUT: 1991, *Logic, Language and Meaning*, vol. II (Intensional Logic and Logical Grammar), Chicago/London, p. 41f.
- <sup>22</sup> Which alternative you choose depends on how much tense-logical involvement you are ready to buy. Cp. Prior, A.N.: 1968, 'Tense Logic and the Logic of Earlier and Later', in *Papers on Time and Tense*, Oxford, p. 88-97.
- <sup>23</sup> For historical expressions of this view cp. already Aristotle, *De interpretatione* 9 19a24 and Cicero, *De fato* VI/14.
- <sup>24</sup> This example is implicit in Lecture I, p. 40ff. Humphrey was the candidate who stood against Nixon in 1968.
- <sup>25</sup> I will not elaborate on any of the difficulties Leibniz' law has presented. It is well known that it may be split up into two implications and that these may be of different plausibility. Often the implication from indiscernibility to identity has been thought to be less plausible than the implication from identity to indiscernibility (most no-

- rably by Kant, cp. *Critique of pure reason* A260/B316ff., esp. A 281/B337). I have argued elsewhere that the implication from identity to indiscernability is more restricted than one might think if Special relativity is accounted for (Cp. my 'Einsteins Zug und logische Gesetze', *Philosophia Naturalis* 1/97).
- 26 Cp. 'Naming and Necessity', p. 43.
- 27 This theory has been advocated by David Lewis, for example in 'Counterpart Theory and Modal Logic'.
- 28 Cp. esp. Introduction, pp. 15-21 and Lecture I, pp. 42-54.
- 29 Loc. cit., pp. 42-47; 51-54.
- 30 Loc. cit., pp. 43.
- 31 I will not discuss the point here in how far the domain should contain objects which belong to the inventory of other possible worlds but not to the inventory of the real world. If it did, it would contain non-existent objects which is pretty odd. No logician should use such a domain without at least a bit of bad conscience.
- 32 A's existence might have a first instant in  $t$ . However, I do not think that one single instant would constitute an "origin". For reasons why not cp. part III of my 'The moment of change'.
- 33 Basically the same criterion might clarify the notion of a counterpart in a logic with world-sensitive domains. Of course it requires acceptance of the necessity of origin which is hardly popular among counterpart theorists.
- 34 The strongest point against this I know of is Philpott's idea of using Forbes' example of twins both developing from my origin in a different possible world as an objection. In fact they cannot both be identical with me, since if they were (1) I would be identical with two distinct entities (2) They would be identical qua transitivity of identity, while they are not. My intuition in this case is that each of the twins' origin is not the fertilized egg but rather twin A's origin is the cell(s) from which only A develops and B's origin is the cell(s) from which only B develops. This is even necessary in order to prevent actual twins from being identical qua transitivity of identity. On this view, what I am identical with passes out of being when the twins come into being.

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