MODAL LOGIC WITHOUT ESSENCES

ABSTRACT

Modal statements can be understood in a way that neither requires the metaphysical doctrine of essences nor restricts statements of necessity and possibility to statements of logical necessity and possibility. The view advocated is in accord with our usage of counterfactuals and can be maintained with considerable ontological economy.

When a Lewis counterpart set (of entities in various possible worlds) is formed, the members of the counterpart set need not be grouped together on the basis of essence properties. Counterfactual and modal talk are best understood as involving counterpart sets based on conventional (but not arbitrary) groupings instead of essences.

In accord with this analysis even iterated *de re* modalities can be symbolized in first-order predicate logic. This analysis is also compatible with parsing away possible worlds in favor of world-descriptions. Thus modal logic without essences yields a first-order predicate logic analogue of modality without ontological commitment to possible worlds.

MODAL LOGIC WITHOUT ESSENCES

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An essential property of an entity a is a property of a such that nothing could be a without having that property. If one countenances such logical properties([1]) as, *e.g.*, the property of being self-identical, then there are properties which are essential to any entity that exists.

Some philosophers believe that the essential properties of an entity a are a proper subset of the total set of a's properties and yet include more than just a's logical properties. This is the metaphysical([2]) doctrine of essences.([3]) Let us call the thus defined subset of the properties of a *the essence properties of* a. It is an open question whether or not there are essence properties.

Such modal statements as "It is necessary that a have property ϕ" are easily understood as saying that ϕ is essential to a.([4]) Such modal statements as "a is ϕ and it is possible that a be not-ϕ" are easily understood as saying that ϕ is not essential to a (even though a does have property ϕ).

If the properties a is said to have necessarily are not all of a's properties, but include more than just its logical properties, then this understanding of modal statements requires the metaphysical doctrine of essences. It is one purpose of this paper to point out that modal statements can be understood in another way that neither requires the metaphysical doctrine of essences nor restricts statements of necessity and possibility to statements of logical necessity and logical possibility. It is further argued that this view of modality is in accord

([1]) Given the interdefinability of existence and self-identity, those who argue that existence is not a property may refuse to acknowledge self-identity as a property.

([2]) An epistemological doctrine of essences is that a proper subset of the properties of an entity a are necessary and sufficient as criteria for the individuation of a.

([3]) A stronger version (the doctrine of individual essences) includes the claim that no two distinct entities have all and only the same essence properties.

([4]) The direct concern of this paper is with properties said to be necessary of entities, rather than of kinds.

with our usage of counterfactuals and can be maintained with considerable ontological economy.

Trans-world identity

Several relationships between modal logic and the doctrine of essences have evolved since Kripke's semantics for modal logic first appeared. ([5]) The informal ([6]) discussion of the semantics involved talk of possible worlds and of objects that exist in several possible worlds. This invited the problem of trans-world identity understood as the question "What are the identity conditions of an object in various possible worlds?"

If possible world W differed from possible world W' in *any* respect whatsoever, then there would be at least some relational property of an entity a in world W that nothing otherwise similar to a could have in world W'. Thus it would not be possible for an entity a to have all and only the same properties in two different possible worlds.

To the issue of identity-across-possible-worlds thus raised, some expected to find answers in a set of necessary and sufficient properties of a--properties that anything identical to a in any possible world must have (a's necessary properties) and properties that could serve to individuate a in each possible world in which a exists (a's sufficient properties). In "Naming and Necessity" [2] Kripke rejected this notion of trans-world identity and its need for sufficient properties. However, he retained reliance on necessary properties (albeit for another purpose than trans-world identification) and those are the ones that are associated with the metaphysical doctrine of essences.

Philosophers were wrong, he argued, to imagine that they need a means of figuring out which entities from possible world W are identical with members of possible world W'. This is stipulated, not figured out from other data (such as the properties of the members of the domains of each world). Thus trans-world identity needs no theory of sufficient properties of a (for identifying a in each possible

([5]) For a summary see [1].

([6]) The formal requirements of the abstract semantics are discussed later in this paper.

world where a exists). However, the reliance on necessary conditions remains; not because they are needed for picking out entities identical to a in each world, but because it is the necessary properties of each entity a stipulated to exist in a world W that determine whether or not W is possible.

For example, Kripke writes:

> Why can't it be part of the description of a possible world that it contain *Nixon* and that in that world *Nixon* didn't win the election? It might be a question, of course, whether such a world *is* possible.([7])

To determine whether or not there is a possible world in which Nixon did not win the election we need to know about the necessary properties of Nixon. That is, were winning the election a necessary property of Nixon, then if we gave as part of the description of a world Nixon's losing the election, the world so described would not be a possible world. (It could also fail to be a possible world if, *e.g.*, there were necessary properties of the political parties or electorate *etc.* which somehow required Nixon's winning the election.)

On Kripke's analysis we can stipulate that a is a member of whatever world we care to describe and thus an answer to the question "Which member of world W is a?" does not require that we know identity conditions for a. However, once world W is described, if we want to know whether W is possible, we must know if any part of the description of W conflicts with the necessary properties of any entity in W. Thus for this latter concern we need to know the necessary properties of the entities stipulated to be in each world.

This alone does not involve the metaphysical doctrine of essences. It requires only that necessary properties of each entity be acknowledged before we can determine which worlds we may stipulate are indeed possible. We could hold that all properties, or only logical properties, are necessary without holding the metaphysical doctrine of essences. If one does, however, hold the metaphysical doctrine of essences, then that will affect which properties of an entity

([7]) See [2], p. 267.

a are considered to be necessary which will, in turn, determine the constraints put on the possibility of worlds in which a is stipulated to exist. This is the range of metaphysical views and the associated constraints on world possibility:

(1) All properties of a are essential to a.	If a exists in world W and W' is different from W, a cannot exist in W'.
(2) Some non-logical properties, but not all properties, of a are essential to a.	If a world W is described as having a as a member, W is not possible if a is described as having in W a property that is (logically) incompatible with any essential property of a.
(3) Only logically necessary properties of a are essential to a.	If a world W is described as having a as a member, W is not possible if a is described as having a property that it is logically impossible for a to have.

(3) equates necessity and possibility with logical necessity and possibility in which case there is no need for modal logic.

(2) is the metaphysical doctrine of essences which traditionally goes hand-in-hand with modal logic.

(1) is another metaphysical position which, I shall argue, is compatible with modal logic.([8])

Counterpart theory

(1) is compatible with modal systems for which the alternative

([8]) Oakes offered an epistemological argument against this metaphysical view. His argument, however, relies upon a purported entailment from (1) "A veridical experience is an experience to which veridicality is essential" to (2) "A veridical experience is self-authenticating".

However, (1) guarantees only that *if* an experience is veridical, then it is necessary that it is veridical. It does not guarantee that there is any sufficient condition (such as self-authentication) of veridicality. [3]

relation is reflexive only.(9) In such a very limited system of modal logic, no world would be an alternative to the actual world itself.

If one claimed that what is necessary is what is true in all worlds alternative to ours and that there are no worlds alternative to ours except our world itself, then one would conclude that everything true in our world is necessary. Furthermore, if one held that what is possible is what is true in some world alternative to ours and that our world is the only world alternative to our world, then he would conclude that nothing is possible unless true in our world. Thus necessity, possibility, and truth would collapse to one; namely, truth in our world.

This is to be expected according to a metaphysical doctrine of type (1) which says all properties of an entity are essential to it. But even such a metaphysician may wish to make sense of counterfactual talk. He may believe that *strictly* speaking all counterfactual claims have an impossible antecedent (and that strictly speaking nothing is possible but what is and all that is, is necessary) and yet want to make sense of *looser* uses of counterfactuals (and of looser talk of necessity and possibility).

He could turn with some hope to counterpart theory developed by David Lewis [5] as providing a modal logic compatible with metaphysical doctrine (1) because counterpart theory does not require entities existing in more than one world. As Lewis explains:

> The counterpart relation is our substitute for identity between things in different worlds. Where some would say that you are in several worlds, in which you have somewhat different properties and somewhat different things happen to you, I prefer to say that you are in the actual world and no other, but you have counterparts in several other worlds.
>
> Your counterparts resemble you closely in content and context in important respects. They resemble you more closely than do other things in their worlds. But they are not really you. For each of them is in his own world, and only you are here in the actual world. Indeed, we might say, speaking casually, that your

(9) Similar results follow if, in quantified modal logic, no assumption is made about members of the actual world existing in other worlds. See [4].

> counterparts are you in other worlds, that they and you are the same; but the sameness is no more a literal identity than the sameness between you today and you tomorrow. It would be better to say that your counterparts are men you *would have been* otherwise.([10])

However, as countenanced by Lewis, counterpart theory is still committed to essences.

> Essence and counterpart are interdefinable. We have just defined the essence of something as the attribute it shares with all and only its counterparts; a counterpart of something is anything having the attribute which is its essence.([11])

Where should one break into this ring? Is E the essence of a because all of a's counterparts (and nothing else) have E, or do all of a's counterparts have E because E is the essence of a?

If we think of ourselves as stipulating worlds and counterparts (on analogy with Kripke stipulating worlds and which member of a possible world is identical to a member of our world), then it will be our beliefs about the essences of entities that determine what properties we ascribe to their counterparts (if any) in other worlds we wish to be possible. If we think of possible worlds as already existent worlds, then our beliefs about essences will determine which member (if any) of another world be picked out as the counterpart of an entity in our world. So essences are here relied upon either as the necessary properties needed for making sure that stipulated worlds are possible or as the necessary and sufficient properties needed for identifying counterparts.

What is needed for an understanding of modal logic that does not require essences, but is not so strict as to collapse necessity and possibility to truth, is Lewis' notion of counterparts as a replacement for identity without his commitment to essences as determining

([10]) See [5], pp. 114-115.

([11]) See [5], pp. 122-123. In his recent work, Lewis is still committed to metaphysical doctrine (2). In [6] he wrote: "A daggar has some property essentially if it shares that property with all its counterparts." (p. 7)

counterparts. While holding that nothing in world W is itself *identical* to anything in any W' different from W, metaphysician type (1) can make use of W' counterparts of W entities to make sense of looser usages of counterfactual talk and claims of necessity and possibility. This approach to identity-across-possible-worlds is similar to one used in discussion of identity-through-time.

Identity through time

In discussions of identity-through-time it has long been noted that the properties an object has at one time differ from the properties it has at a later time. Thus no temporally specified object o (1) at time 1 is identical with (has all and only the same properties as) any temporally specified object o (2) at time 2.([12]) For example, though they might be the same person, the boy when he is six has properties different from the man when he is thirty. We refer to object o (1) at time 1 and some object o (2) at time 2 as two time-slices of the same object 0 when we have a reason for grouping o (1) and o (2) together as time-slices of (temporal parts of) the same object 0.([13]) One who maintains a metaphysical doctrine of essences might maintain that it is only because the boy age six and the man age thirty share essence properties that we group them together as time-slices of the same person. However, it is certainly possible for us to select time-slices which do not share essence properties and form from them an object, a set. One who does not maintain the metaphysical doctrine of essences may claim that when time-slices are regarded as temporal parts of an object, it is on the basis of utility rather than of essences.

([12]) See for example, the use made of time-flagging properties in [7]. One very important difference between identities-through-time and identities-across-possible-worlds is that time slices (and their entities and all properties of those entities) are givens to be taken account of whereas possible worlds (and their members and all properties of those members), excepting the actual world, are stipulated by us and probably parsed away in our most serious theory. That is why the problem of matching entities that Kripke avoids across worlds is still a problem across time.

([13]) From here on, capital letters "O" and "A" will designate that which has, as either members or parts, entities designated by "o", or "a" respectively. Subscript "n" indicates non-actual world and subscript "r" indicates real world.

Thus we have a use for grouping the boy aged six with the man aged thirty. This is a conventional, but not arbitrary way of grouping time-slices into objects.

Similarly, in handling identity-across-possible-worlds we may note that no world specified entity a(n) in a non-actual world is or can be stipulated to be identical with any a(r) in the actual world (because a(n) and a(r) do not have all and only the same properties). One who believed in the metaphysical doctrine of essences could do one of the following:

(i) argue that we may count a(n) and a(r) as identical (though not strictly identical) if they have certain, essence, properties in common or (ii) avoid the loose identity versus strict identity dichotomy by counting a(n) and a(r) as counterparts of each other if they share essence properties.

In either case a set A could be formed whose members are entities from various possible worlds that are grouped together into this set on the basis of shared essence properties. The only difference between these two versions (i and ii) of the doctrine of essences as applied to transworld identity is whether one opts for (i) or (ii):

(i) identity theory:	the set A is regarded as one entity A with world parts a_n and a_r, etc. (on analogy with o_1 and o_2 as temporal parts of one object O) such that A has all the (world-flagged) properties of a_n and a_r.
(ii) counterpart	the set A is regarded simply as a set whose members such as a_n and a_r are counterparts of each other (because of shared essence properties).

One need not maintain the metaphysical doctrine of essences in order to account for grouping of entities across possible worlds. If one does not believe in essence properties, he may still regard entities in various possible worlds (entities such as a(n) and a(r)) as counterparts of each other. However, as there are no essence properties to serve as the sole basis for grouping members of various worlds into a set A, there will be as many ways of grouping together entities from various

possible worlds into counterpart sets as there are properties of entities and ways of combining properties of entities. As a matter of practicality, some of the ways of grouping will be more useful than others. Which groupings are used will depend upon utility. Groupings are conventional, but not arbitrary. This account, dropping the metaphysical doctrine of essences in favor of conventional groupings, accounts for the fact that what is regarded as possible for an object varies with the context (*e.g.*, physics, fiction) in which the object is being discussed.

Semantics for modal logic

This view of what is being done by modal logic does not conflict with the formal account of the semantics. The abstract formal system does not even require worlds. For example, Hintikka's semantics for modal logic does not employ worlds.

Talk of possible-worlds and counterparts aids our grasp of modal logic. (Also the motive for developing modal logic came from an interest in necessity and possibility that could be understood in terms of possible-world talk). But the theorems of modal logic follow from its axioms (and definitions, if any) by its rules regardless of any relation those axioms and definitions and rules and theorems may have to possible worlds (if any).

What Kripke semantics formally requires, is a set of sets K one of whose members is designated G and a binary relation R among members of K. For quantified modal logic $\gamma(G)$ is introduced as the domain of G and sometimes U is introduced as the union of the domains of all members of K. K is often referred to as a set of possible worlds and $\gamma(G)$ as the population of world G, etc.; but these are aids to the understanding and not part of the formal semantics. We can keep most of these aids to the understanding and still divorce modal logic from essences by the suggested adjustment in what we think of ourselves as doing when using the formal system.

Kripke suggested we think of particular entities existing in alternative worlds. This need not be part of the semantics; but a way of thinking about what is going on if, *e.g.*, "Fa" appears in the specifications of two different worlds or a appears in the domain of

more than one world. It is up to the philosopher of logic to discuss whether one would want to think of the *a* members of various domains as world parts of one entity or as counterparts of each other. And if one elects to think of them as counterparts, he may also explain what counterparts are as either groupings based on essences (à la Lewis) or groupings that vary with the purposes at hand as suggested here. These metaphysical considerations do not affect the abstract semantics for modal logic.

Counterfactuals

One uses counterfactuals to discuss possibilities: what would happen if some possibility were the case. The analysis of possibility and necessity advocated in this paper is actually closer to some of the ways in which counterfactual talk is used than are explications that invoke essences.

Think of any likely essence property of a person and you can construct a counterfactual that invites you to imagine the possibility of that person not having that essence property. We can imagine the person having different genetic material, being born in another age, *etc*. and still make sense of counterfactuals regarding the person. For example, we understand the claims: "If Nixon had inherited genes that made him more handsome, he would have been more popular with the lady voters," and "If Reagan had lived before the advent of electronic media, he would not have been as successful."([14]) In making these claims, we invite our hearer to imagine someone who is like Nixon in respects other than genetic material or someone who is like Reagan in respects other than lifespan. What these respects are, is left vague. In effect we use the words "Nixon" and "Reagan" as shorthand for a vaguely specified list of properties and invite the hearer to imagine what would happen to an entity with that list of properties. We consider a Reagan or Nixon counterpart formed on the

([14]) I have chosen examples that vary a person's origin (understood as his beginning at a certain time of certain genetic material) in order to demonstrate that there are counterfactuals which do not treat personal origin (Kripke's rigid designation for people) as essential. (This concept of source as essence is still current. See also [8]).

basis of Reagan or Nixon properties, but not all purportedly essence properties need be included. We are better off without essences in our understanding of counterfactuals as it is likely that, for any essence of an entity someone might propose (apart from logically necessary properties), there will be counterfactuals which might reasonably crop up in conversation and yet ascribe to the entity properties that conflict with its purported essence.

Indeed, within a single conversation we often shift what we wish to hold constant in counterfactual talk. The premises of the following argument([15]) are typical of counterfactual discourse. We do not typically make the mistake of drawing the given conclusion:

> If Aunt Brachia had a baby, she would be an unwed mother.
> If Aunt Brachia were married, she would have a baby.
> Therefore:
> If Aunt Brachia were married, she would be an unwed mother.

The inference is blocked if each premise is read as claiming that there is an Aunt-Brachia-counterpart-set such that...
It is only when both premises are understood to be about the same counterpart-set that the inference is valid.
Given the following assignments:

W = "____ is a world"
M = "____ is a member of set ____"
H = "____ has a baby in world ____"
S = "____ is single in world ____"
C = "____ is an Aunt-Brachia-counterpart-set"
b = the Aunt-Brachia-counterpart-set
U = "____ is unwed in world ____"

The Aunt-Brachia argument is valid if it is symbolized as follows:

$(\forall x)\ (\forall y)\ [(Wx\ \&\ Myb\ \&\ Hyx) \supset Uyx]$

([15]) The argument is taken from [8]. There is an extensive literature on what is to be held constant in conditional discourse. The point made here is that while one may formulate theories that match what people *often* hold constant, there is no property (at least, no non-logical property) of a named individual that *must* be held constant. See the bibliographies for [8] [9] and [10].

$(\forall x)\ (\forall y)\ [(Wx \ \&\ Myb \ \&\ \sim Syx) \supset Hyx]$
Therefore:
$(\forall x)\ (\forall y)\ [(Wx \ \&\ Myb \ \&\ \sim Syx) \supset Uyx]$

It is not valid if it is symbolized as follows:

$(\exists z)\ [Cz \ \&\ (\forall x)\ (\forall y)\ ((Wx \ \&\ Myz \ \&\ Hyx) \supset Uyx)]$
$(\exists z)\ [Cz \ \&\ (\forall x)\ (\forall y)\ ((Wx \ \&\ Myz \ \&\ \sim Syx) \supset Hyx)]$
Therefore:
$(\exists z)\ [Cz \ \&\ (\forall x)\ (\forall y)\ ((Wx \ \&\ Myz \ \&\ \sim Syx) \supset Uyx)]$

Note: The argument is also invalid if each sentence asserts there is a world in which something is true of anything that is its member of the Aunt-Brachia-counterpart-set.

$(\exists x)\ (\forall y)\ [(Wx \ \&\ Myb \ \&\ Hyx) \supset Uyx]$
$(\exists x)\ (\forall y)\ [(Wx \ \&\ Myb \ \&\ \sim Syx) \supset Uyx]$
Therefore:
$(\exists x)\ (\forall y)\ [(Wx \ \&\ Myb \ \&\ \sim Syx) \supset Uyx]$

All we need to do in order to talk about what is possible, is to postulate a possible world in which there are entities that are, not identical with entities in our world, but similar to certain members of our world in the respects which we consider to be important for the discussion at hand. To imagine *a* being somewhat different is more accurately characterized as imagining something similar to but different from *a*. What similarities to *a* we require may vary.

When we talk of entities in various possible worlds as being similar to each other, what we mean is that they share all the properties that we regard as important or interesting; that they resemble each other in the ways that, for present purposes, we consider important. If we import the modal operator([16]) for *de re* necessity, we speak not of entities that exist in more than one possible world, but of a collection whose members are in various worlds. Even iterated *de re* modalities

([16]) It is only when the modal operator is inside the quantifier that we need an entity that exists in more than one world. "$(\forall x)\,\Box\,..$;" is understood as indicating what some x does in all possible worlds and thus seems to require an x that at least may exist in more than one world. Actually all that is needed is that various worlds may have x members. Why they are the x members of these worlds can be explained in terms of identity or of counterpart.

are not the problem for this analysis that McMichael [11] expected them to be for what he calls atomistic actualism theories.
McMichael is perplexed by the following case:

> There is a world W which includes the state-of-affairs of there being someone X who does not exist in the actual world, and who performs some action Y, and there being a world W'' which includes the state-of-affairs of X existing and not performing action Y.

Let S be "____ is a set of persons", S' be "____ is a set of actions", W be "____ is a world", B be "____ belongs to world ____", D be "____ does ____ in world ____", M be "____ is a member of set ____",
and r be "the real world". The symbolized version of McMichael's case is:

$(\exists x)\ (\exists x')\ (\exists x'')\ (\exists y)\ (\exists y')\ [Sx\ \&\ Mx'x\ \&\ Mx''x\ \&\ S'y\ \&\ My'y\ \&$
$(\forall z)$
$(Mzx \supset \sim Bzr)\ \&\ (\exists w')\ (\exists w'')\ (Ww'\ \&\ Ww''\ \&\ Bx'w'\ \&\ Dx'y'w'\ \&$
$Bx''w''\ \&\ (\forall z)$
$(Mzy \supset \sim Dx''zw''))]$

(Just before the closing bracket, one may chose to add alternative relations between r, w', and w''.) Here the x quantifier ranges over sets of individuals. These individuals are in various worlds and are treated as counterparts of each other.

The collection used (when we import modal operators) will be formed according to our interests for the discussion at hand. Thus statements about "metaphysical necessity" would not be about necessary properties of entities in our world (unless in the sense that all properties of entities are necessary) or any other, but would be about sets we have formed with these entities as members. The sets so formed (hence the so-called "metaphysical necessity") would be relative to our purposes.([17])

([17]) We may now give a better explanation of the difficulties of Oakes' argument against metaphysical view (1). Oakes claims that at least some of his veridical experiences are accidental which is correct if he means there is a possible world in

Ontology

All talk of possible and alternative worlds is a heuristic way of speaking that need not carry ontological commitment. Talk of worlds can be paraphrased into talk of world-descriptions. Then to say that an object a has a counterpart (in this world or any other) is to say that there is a world-description which includes a description that is the counterpart to the description of a. Thus we trade in counterpart objects in alternative worlds for counterpart-descriptions in alternative world-descriptions. Note that descriptions (including world-descriptions) need not be *of* anything, just as a painting need not be a painting *of* anything.([18])

What descriptions are counted as counterparts of an object's description need not depend upon any purported essence properties of the object. As explained above in heuristic language regarding counterpart objects in alternative worlds, the predicates two descriptions must have in common to be regarded as counterpart descriptions may vary with the context of the discussion.

Implications

The net effect of positions maintained in this paper is that one may use modal language (and modal logic) without ontological commitment to alternative worlds and without ontological commitment to essence properties. Maintaining that all properties of an object are essential does not mean we have no use for modal logic. We may continue to consider what would be the case if the description of the world were different (*i.e.*, to consider what would follow from an

which those experiences do not befall his counterpart. That alone does not conflict with the claim of metaphysical view (1): that all his properties are essential to him and thus if he has a veridical experience, it is essential to him that he have it (meaning that having this veridical experience is a necessary condition of being Oakes). Having a certain veridical experience may be a necessary condition of being Oakes without being a necessary condition of being an Oakes counterpart. Nothing would be Oakes without having that experience, but the set formed of Oakes counterparts may include individuals which did not have a counterpart experience.

([18]) See, for example, the first chapter of [12].

alternative world-description that is not a description *of* any world). In such considering we choose to hold some parts of the description of the world constant and vary others. Those held constant are regarded as necessary, those allowed to vary are regarded as possibilities.

Modal logics capture the forms of reasoning permitted in such considerings. These logics are useful for such reasoning; but theoretically they are dispensible. If one were able to specify the set S of all those statements he intended to keep constant during these considerings, then statements called necessary would be those derivable from S and statements called possible would be those consistent with S.([19])

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([19]) The metaphysicians of type (2) could also do this, but they would countenance only one set of non-logical axioms, namely, those ascribing to each entity the properties held to be its essence properties.