Rigidity and Necessary Application*

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Abstract. The question whether the notion of rigidity can be extended in a fruitful way beyond singular terms has received a standard answer in the literature, according to which non-singular terms designate kinds, properties or other abstract singular objects and generalized rigidity is the same thing as singular term rigidity, but for terms designating such objects. I offer some new criticisms of this view and go on to defend an alternative view, on which non-singular terms designate extensions in general, and generalized rigidity is identity of extension across possible worlds. I develop some fundamental positive considerations that make this view virtually inevitable as a view of generalized rigidity, emphasizing its exclusive ability to offer a purely logical justification of the necessity of several kinds of statements that go beyond true identity statements between rigid singular terms.

1. Introduction.

It is hard (though undoubtedly possible) to exaggerate the importance of the Kripkean notion of rigidity in the theory of reference and the understanding of the metaphysics of modality. The notion helped establish clear semantic differences between proper names and contingent Fregean-Russellian descriptions, and, more importantly, it crucially helped in Kripke's demonstration that true identity statements between proper names (which are often *a posteriori*) must be necessary. But reflection on the Kripkean notion, which is only defined for *singular terms*, soon leads one to the question whether the notion can be appropriately extended to other kinds of expressions and used to draw more general, and thus perhaps more important, semantic and metaphysical lessons. I think that the answer to this question is a resounding 'yes', but also that

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this answer and the grounds for it have been clouded in the relevant literature by an inadequate focus on an idea that doesn't properly constitute an extension of the notion of rigidity, and can only be considered an attempt to force the generalized notion into the Procrustean bed of the notion as defined for singular terms.

An ample majority of authors in the relevant literature focus on the question of what is the right notion of rigidity for *general terms* (especially common nouns, adjectives, and noun and adjectival phrases), and subscribe to the view that the appropriate notion of general term rigidity is what we might call the *abstract kinds designation* (AKD) notion (see among many others Donnellan (1973), (1983), Kaplan (1973), Salmón (1982), (2003), (2005), Linsky (1984), (2006), LaPorte (2000), (2013), Soames (2006), and Martí and Martínez-Fernández (2010)). On this standard view, a general term (and presumably any meaningful non-singular term) designates an abstract kind, substance, property or other abstract singular object naturally associated with it, and general term rigidity is defined with a minimal modification of the definition of singular term rigidity: a general term is counted as rigid if it designates the same naturally associated object in all possible worlds. As we will see below, in section 2, the AKD view cannot be used to draw any semantic or metaphysical lessons that generalize the standard Kripkean lessons for singular terms (and this is something that the proponents of the AKD view tend to recognize), but it is also the case that the arguments often given for adopting it are inadequate for other reasons.

An alternative, under-explored minority view holds that the right notion of general term rigidity is the so-called essentialist, or, as I would now prefer to call it, *necessary application* (NA) notion (see Cook (1980), Devitt (2005), Gómez-Torrente, (2006)). On this view, a general term is either straightforwardly a predicate or an expression with a semantically predicative nature, and as such it designates plurally the things that predicate applies to (with respect to a world and a time), or the set of those things; and a general term is rigid when it is a necessary applier, i.e. when it necessarily applies to the same (set of) things, or equivalently, when it designates the

same (set of) things in all possible worlds (and times).[1] This notion straightforwardly generalizes to all non-singular terms, for if we adopt the common Fregean thesis that all meaningful terms are either arguments or appliers (functional expressions), clearly the NA notion directly generalizes to all appliers: an applier can be called rigid in the general NA sense when it has the same extension in all possible worlds. From this we can see also that there are several fundamental reasons that make the generalized NA view virtually inevitable as a view of rigidity in general. In section 3 I will describe these reasons, emphasizing in particular the fact that the generalized NA view can, and is the only view that can, give a justification within philosophical logic of the necessity of several (in fact, infinitely many) kinds of necessary truths beyond true identity statements between rigid singular terms, thus realizing the vital expectation that other kinds of (often *a posteriori*) necessities can be justified to be such on the basis of a generalized notion of rigidity. I will also briefly recall how the view also realizes our other initial expectation above, that a generalized notion of rigidity would help establish semantic distinctions between appliers of the same type.

The NA view, as applied in particular to general terms, has been much criticized in the literature. In the final section 4 I turn to the unavoidable task of indicating where those criticisms went wrong. We will see that there are many reasons to see the NA notion, and none not to see it, as providing the appropriate notion in the touchstone case of general terms.

2. The abstract kinds designation view.

Much of the acceptance gathered by the AKD view is due to its simplificatory proposal that general terms, and presumably non-singular terms in general, designate relatively simple things (specifically kinds, properties, etc.) in the same way in which singular

[1] Yet a third, also minority, view is what we might call the *eliminativist* view (see Haukioja (2012), Nimtz (2019), Schwartz (2021) for examples); on this view, while the notion of singular term rigidity makes good sense, the idea of extending it to non-singular terms has no interest. A full discussion must be left for another occasion, but it will be obvious how our considerations below undermine this view.

terms designate their designata. By contrast, the standard view in logic and linguistics is that a general term, and in general a non-singular term, designates in a way different from that of singular terms, the way (whatever that is) in which *predicates* or *appliers* in general designate, a way in which more complicated things such as pluralities and sets come into play. The non-standardness of the AKD view here has been made palatable largely through the suggestion that in fact it is only copular predicates (such as 'is a cat' or 'is boring') that can be properly seen as plurally designating or as designating a set, while general terms ought to be seen as designating kinds, properties, etc. (see Salmón (2005), LaPorte (2013), ch. 4). Now what is rarely (if ever) emphasized is that, even if it were true that the designation of general terms accompanied by the copula could be reasonably accounted for by the AKD view, one must also consider what the view predicts about uses of general terms *without* the copula. And these predictions are just not good.

For example, if general terms designate kinds, properties, etc., they ought to be invariably usable in subject or object position in meaningful sentences attributing higher-order properties to those kinds, properties, etc. For example, one ought to be able to say meaningfully things such as **Cat is a metaphysically interesting thing* or **Philosophers occasionally contemplate wise*, but one simply can't (even though one can surely say meaningfully *The kind of cats is a metaphysically interesting thing* and *Philosophers occasionally contemplate wisdom*). The standard view, by contrast, has an easy time with these examples, pointing out that in them predicative items are inappropriately used as if they were singular terms.

Or, for another example, think that general terms *are* used without the copula in many positions, e.g. in the subjects of sentences such as *Cats are animals* or *Bachelors like having a good time*, and following quantifiers as in *We need some gold* and *All philosophers eventually go out of fashion*. The AKD view must presumably postulate that 'cats', 'bachelors', 'gold' and 'philosophers' here are accompanied by the copula in something like logical form or deep structure. But then it will lose its original motivation for considering the copula an element of logical form. If the copula ought to appear appended to 'animals' in logical form because it appears so appended in superficial form in *Cats are animals*, then, if 'cats'

appears without the copula, why should we think that the copula is somehow appended to it at the level of logical form? Again traditional views, by contrast, have an easy time here, for according to them all the general terms in those sentences work as semantically predicative (and, indeed, in linguistics it's normal to call NPs and APs that can follow the copula 'predicates'), the copula accompanying the general term *in predicate position* is there basically just to add tense to the predication, and no copula accompanies the general term in other positions because there the predicate doesn't have to be tensed. While surely 'cats', 'bachelors', 'gold' and 'philosophers' are semantically predicative in the examples, the AKD view cannot make sense of their predicative nature in a motivated way.

The AKD view implies that many terms Kripke wanted to come out non-rigid are rigid, for the properties designated by 'bachelor', 'philosopher', 'large carnivorous quadrupedal feline, tawny yellow in color with blackish transverse stripes and white belly', 'liquid filling the oceans', etc. are presumably the same in all possible worlds. Thus, for many the AKD view has an evident problem of *overgeneration* (see e.g. Schwartz (2002), Soames (2002, 259ff.)). This is bad enough, but an even more worrying concern is that of *trivialization*: doesn't the AKD view imply that *all* general terms are rigid, and so that the rigid/non-rigid distinction for general terms just can't do any useful theoretical work? The standard response of the defenders of the view involves examples such as *My true love's eyes are the color of the sky* (from Linsky (1984)). It is uniformly held that 'the color of the sky' here is not a singular term, but a general term, in fact a complex adjectival phrase, that is being used with the copular 'be'. If so, 'the color of the sky' is a general term that doesn't designate the same thing in all possible worlds, for although it designates the color blue in the actual world, it designates other colors in other worlds where the history of Earth's atmosphere is different. But the evidence against the idea that 'the color of the sky' works as an adjectival phrase in Linsky's example is simply overwhelming, and thus the correct assessment must be quite different and incompatible with what the AKD view needs. Let's see just some of this evidence.

First, many replacement tests indicate that descriptions such as 'the color of the sky' are not interchangeable with adjectives like 'blue' so that grammaticality or non-anomalousness are preserved:

Blue things are relaxing / **The color of the sky things are relaxing*;
Please bring me that blue book / **Please bring me that the color of the sky book*;
How blue are my true love's eyes! / **How the color of the sky are my true love's eyes!* (May, unpublished);
My true love's eyes appear blue / **My true love's eyes appear the color of the sky* (May, unpublished);
John is courageous / *#John is the property of courage*[2];
This liquid is sweet / *#This liquid is the taste quality of sugar.*

This casts great doubts on the idea that 'the color of the sky' works as an adjectival phrase in *My true love's eyes are the color of the sky*. For if descriptions cannot work adjectivally in so many other contexts, the fact that one can be used in a context where an adjective could be substituted for it cannot be taken as an indication that it is working as an adjective there; on the contrary, the natural stance is that 'the color of the sky' must still be a noun phrase (and a singular term) in the example but some peculiarity of the sentence generates a *prima facie* appearance that it is working as an adjectival phrase.[3] (See May, unpublished, for more arguments that 'the color of the sky' is a noun phrase in Linsky's sentence.)

More difficulties come from an examination of cross-linguistic evidence. The straightforward translations of *My true love's eyes are the color of the sky* into French, German and Spanish are, respectively,

Les yeux de mon véritable amour sont de la couleur du ciel;
Die Augen meiner Geliebten haben die Farbe des Himmels;
Los ojos de mi verdadero amor son del color del cielo.

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[2] I use the hashtag ('#') to indicate semantic anomaly (and the asterisk ('*'), as usual, to indicate ungrammaticality).

[3] Note that all this is not to say that definite descriptions cannot be predicated; I find it absolutely reasonable to think that they can, e.g. in examples like *Max is the man for the job* (Higginbotham). It is just to say that when they are predicated, they do not work by predicating the thing they designate, but the property they express; see section 3 below.

In the French and Spanish translations 'to be' is not followed by a description, but by a possessive construction translatable back into English as 'of the color of the sky', so that 'to be' there is not copular but requires completion by a prepositional phrase. In German 'to be' is not used, and 'to have' is employed with 'the color of the sky' as direct object. If we attempt to use copular constructions before this description, we don't get sentences with the intended meaning:

> #*Les yeux de mon véritable amour sont la couleur du ciel*;
> #*Die Augen meiner Geliebten sind die Farbe des Himmels*;
> #*Los ojos de mi verdadero amor son el color del cielo*.

Once more this evidence suggests that the peculiarity of the Linsky example requires an explanation that predicts how its exceptional nature comes about. Observe that the AKD view would, as it stands, have no argument that the rigid/non-rigid distinction is non-trivial for French, German and Spanish general terms, which I take to be a sufficiently bad thing in itself. Of course, the evidence reviewed so far also shows that the extant argument for non-triviality in the English case is extremely weak insofar as it's based on an example which is peculiar even in its own language.

What could be an explanation of the exceptional nature of Linsky's example? The ultimate answer awaits specialized work by linguists, including in all probability historical linguists. But we can sketch one conjecture here, just to indicate how the AKD view's take on the example has alternatives which are *prima facie* more reasonable from a linguistic point of view. The conjecture is that uses such as *My true love's eyes are the color of the sky* result from the standardization of a preposition deletion that once seemed ungrammatical or non-standard. Compare the suppression of 'that' in so-called zero-that clauses (*I know Aristotle is great* vs. *I know that Aristotle is great*): it is well known that 'that'-deletion went historically from virtually non-existent in the Middle Ages to fairly frequent in recent times, through a process of gradual standardization.[4] In our case, long ago the standard form seems to have been *My true love's*

[4] See e.g. Rissanen (1991) and Conde-Silvestre and Calle-Martín (2015).

eyes are of the color of the sky.[5] However, predications of color (and shape, length and size) via phrases of the form 'of the color of...' ('of the shape of...', 'of the length of...', 'of the size of...') are sufficiently common that the practice of deleting the 'of' in them generated a sufficiently welcome economy of expression to compensate for solecism, and the 'of'-deleting forms have eventually become conventionalized. If this is correct, the description of the form 'the color of...' doesn't lose its status as a noun phrase (and singular term) after the deletion, just as zero-that clauses are still direct objects of the matrix verb, and don't become, say, independently asserted sentences. What has happened is just that a preposition has been deleted at the level of surface form for reasons of economy, but the grammatical and semantic status of the remainder of the prepositional phrase has not been altered.

The upshot is that, to judge from the very limited set of examples offered by its proponents, the AKD view *does* trivialize the notion of general term rigidity in natural language. As noted above, this constitutes a severe problem for the theoretical ambitions of the view.

Even if descriptions for kinds, properties, etc. do not work like general terms in natural languages, one can define artificial languages where they are stipulated to do some things that general terms do in natural languages. In the construction of their formal languages, Salmón (2005) and LaPorte (2013) (compare also Linsky (1984)) stipulate that letters representing primitive general terms designate relevant kinds, properties, etc. Then *predicates* based on those terms are formed by means of an additional copular device, a "predicate-forming operator" '*is* {}(x)' or '*is a* {}(x)' in Salmón and a binary predicate 'Δ(y,x)' in LaPorte. For example, the predicate 'is blue' is represented as '*is* {blue}(x)' by Salmón and as 'Δ(b,x)' by LaPorte. Now, if the idea that launches these authors into the definition of these languages is the belief that general terms are not predicates,

[5] A look at the Shakespearean corpus confirms that of the two predications of 'the colour of...' in Shakespeare, one is just in an identity statement ("Green indeed is the colour of lovers", *Love's Labour's Lost*, I, 2) and the other is one where the description is indeed preceded by 'of' ("He's of the colour of the nutmeg", *Henry V*, III, 7.) And color questions under what-movement retain always but once a stranded 'of' ("What colour is it of?", *Antony and Cleopatra*, II, 7; "What colour is this cloak of?", *The Second Part of King Henry VI*, II, 1; etc.).

but designators of kinds, then what do they make of the '*is*' and the 'Δ' that they use to generate predicates? They are evidently used as general terms, and, as the notation involving them suggests, they are essentially predicates, or items with a predicative nature. (Note that Salmón's '*is*' is formally, just like LaPorte's 'Δ(y,x)', something that, *applied* to a designator, produces a predicate, just as a binary predicate, applied to a designator, produces a unary predicate.) So even in these languages there are general terms that are predicates by themselves, without the help of a further construction. The question is, then: if even by the AKD view's defenders' lights there is no contradiction in the idea that general terms can be predicates, why go through the pains of constructing a non-standard formal language where general terms that are predicates are hidden as much as possible but can't be completely eliminated? The Salmón and LaPorte proposals share an evident problem of motivation.

AKD theorists often see an argument for their classifying 'bachelor' and 'philosopher' as rigid in the fact that these are syntactically simple terms that in some sense directly "name" their corresponding properties, just as proper names, the paradigmatic rigid singular terms, are in some sense direct names of their designata (see e.g. Martí (2004), Salmón (2005, 133, n. 23), LaPorte (2013, 53ff.)). This argument is very dubious. First of all, the role of rigidity is certainly not that of separating the syntactically simple from the complex—many (singular) descriptions are just as rigid as proper names. Second, more importantly, syntactic simplicity may just hide semantic complexity. The standard view of 'bachelor', for example, is that (in its typical use) it is lexically equivalent to a complex expression such as 'unmarried male eligible for marriage'. In the same way that descriptionality is a (defeasible) sign of non-rigidity, the natural view is that 'bachelor', appearing to be semantically complex, is a candidate for non-rigidity. Third, even more importantly: the force of the intuition that simple natural kind terms like 'cat' or 'water' are not semantically complex is much stronger than any (perforce philosophically controversial) argument to the effect that terms like 'bachelor' or 'philosopher' are not semantically complex (against the standard view of them). A theory of rigidity that (as we'll see the NA view does) marked a distinction

between 'cat' and 'water' on the one hand, and 'bachelor' and 'philosopher' on the other, should evidently be a welcome thing.

To end this section, we turn to the AKD view's handling of the key modal expectation or desideratum on a theory of generalized rigidity. In the touchstone case of general terms, the desideratum adopts this specialized well-known Kripkean form: true theoretical "identification sentences" involving general terms for natural kinds—sentences such as (the presumably true) *Cats are animals*, *Water is H_2O* and *Flashes of lightning are flashes of electricity*—ought to have necessitations derivable from those identification sentences plus the rigidity of the general terms appearing in them; this would be analogous to the fact about singular term rigidity that true identity statements between rigid singular terms are necessary. Now, identification sentences that can be reasonably formalized as identities between rigid kind or property designators (such as *Water is H_2O*) will be necessary if true, in the same way that identities between rigid singular terms are necessary if true. But identification sentences such as *Cats are animals*, *Water is a compound of hydrogen and oxygen* and *Flashes of lightning are flashes of electricity* are problematic for the AKD view: though the general terms they contain are rigid on the view, their necessity doesn't follow from their truth, because many true identification sentences containing rigid general terms are not necessary (we may suppose, for example, that *Bachelors are unhappy*, *Water is a much-loved kind* and *Philosophers are wise* are true (in some world, anyway), but they are evidently not necessary).

On this point reactions among AKD theorists vary. LaPorte (2013, 46-9) flatly rejects the modal desideratum for identification sentences that cannot be understood as identities of some kind. Martí and Martínez-Fernández (2021, 293, n. 21) say that one should interpret these sentences "in terms of the necessary subsumption of one kind under the other rather than as quantified conditionals", but they don't refer to any language plus semantics of philosophical logic where such necessary subsumption statements could be formalized and derived from the corresponding necessitated statements under the appropriate assumption of cross-world identity of designation. Soames (2006), after having accepted the AKD view on the urging of Linsky (2006), nevertheless regrets that the problem "poses a challenge for Kripke's suggestion that his account

of natural kind terms plays an important role in explaining why [the relevant sentences] are necessary, if true" (Soames (2006), 715). Often, the problem is simply not considered, in what is perhaps a tacit rejection of the modal desideratum.

If the modal desideratum is accepted, as in Soames and apparently in Martí and Martínez-Fernández, then the fact that the AKD view has no known way of deriving the necessitations of sentences like *Cats are animals*, *Water is a compound of hydrogen and oxygen* and *Flashes of lightning are flashes of electricity* from their truth and the rigidity of the terms involved is a serious problem for the view. Can the modal desideratum be rejected in some principled way by an AKD theorist? LaPorte (2013, 46-9) gives an argument for his rejection, which is essentially that the sentences involving singular terms that he can see as necessary, and as bearing some analogy to Kripkean identification sentences, are sentences whose necessity cannot be established from their truth and claims about singular term rigidity of the terms involved. He is thinking of sentences that attribute necessary properties to individual objects, such as *Stanley is a mammal* and *Stanley is descended from an egg and a sperm*, which are surely not necessary in virtue of (just) singular term rigidity. From this he concludes that it should not be the job of a notion of general term rigidity to make possible the derivation of the necessity of *Cats are animals*, *Water is a compound of hydrogen and oxygen*, etc.

LaPorte's argument presupposes two clear falsehoods. First, sentences such as *Stanley is a mammal* and *Stanley is descended from an egg and a sperm* cannot be thought of as analogous to *Cats are animals* and the like, as there is no temptation to think that one could derive their necessity from their truth and the rigidity of the singular terms involved, simply because evidently the general terms involved play an intuitively crucial role in that necessity. (As we will see, the NA view *does* derive the necessity of these sentences from their truth and the rigidity (singular and general) of the terms involved.) Second, in fact no sentence, including true identities between rigid singular terms, can owe its necessity exclusively to the rigidity of the involved singular terms: in the case of identities between singular terms, also the properties of the identity predicate, '=', must play a

role.[6] (On the NA view, as we will emphasize later, the relevant property of '=' is also its rigidity). If there are sentences which are relevantly analogous to *Cats are animals* and the like, they ought to be sentences connecting two rigid singular terms by means of a predicate different from identity but with relevantly analogous features. Sentences such as *Stanley is a specimen of the kind of mammals* and *Stanley is genetically determined by the zygote Z* (where 'Z' is a name of the zygote from which Stanley actually originated) are certainly better candidates for analogs of *Cats are animals* and the like. (And, as we will see in the next section, their perceived necessity can be derived from their truth plus the rigidity of the involved singular terms and the natural assumption that their predicates are rigid in the sense that they are necessary relational appliers (just like the identity predicate is).) I conclude that LaPorte's rejection of the modal desideratum is not adequately motivated, and leaves the AKD view with the challenge of dealing in some fruitful way with identification sentences such as *Cats are animals*.

The AKD view derives its initial appeal from the simplifying hypothesis that general terms are just like singular terms in all relevant respects. But it quickly runs into trouble: it requires a non-standard conception of the semantic nature of general terms, it evidently overgenerates, and it can only be argued to avoid trivialization through a non-standard classification of natural language descriptions for abstract kinds as general terms, contrary to linguistic evidence and based on just one kind of dubious example which is idiosyncratic even in English. The AKD view can be given a coherent formal expression only in artificial languages where the required non-standard semantic assumptions are imposed by stipulation. But even here the view cannot provide derivations of the necessity of sentences such as *Cats are animals*, because of its original sin, a failure to take seriously the predicative nature of general terms. We will now turn to the NA view and its generalization to all non-singular terms, which takes this predicative nature as its point of departure.

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[6] For not every true sentence of the form t_1Rt_2 where the singular terms involved are rigid and codesignative is necessary—*Samuel Clemens promoted Mark Twain*.

3. The fundamental reasons for the necessary application view.

In this section I will emphasize three important but generally neglected facts that constitute the basic grounds for the NA view and its generalization to all non-singular terms: (A) The view satisfies in a straightforward way two standard semantic assumptions, namely that general terms are predicative and that a general term designates the things it applies to (with respect to a world and a time), taken plurally or as a set. (B) Unlike the AKD view, the generalized NA view is able to offer an account (indeed, a derivation within a standard system of philosophical logic) of the necessity of several kinds of statements that go beyond true identity statements between rigid singular terms. In making this explicit, we will be able to emphasize a further fact of even greater importance, namely that (C) the NA view has the virtue in (B) because it has a still deeper virtue, which is that, unlike the AKD view, it abstracts away in the direction of uncontroversially true generalizations in standard semantic theory.

To begin with fact (A): The assumption that general terms have a semantically predicative nature is inherent in the NA view, as a part of its original essence, we might say. And this assumption is not itself primitive or groundless. It is a standard assumption both in logic and formal semantics, supported by much evidence concerning predicative uses of general terms in natural language, whether count nouns, mass terms, or adjectives. (A small part of this evidence was mentioned in section 2.) Furthermore, the assumption that general terms, given that they have a predicative nature, must designate plurally or must designate sets (at a world and time), is virtually inevitable if we also accept, as in the theory of singular term rigidity shared by the AKD and NA views, that a description designates the thing it describes. This is shown by strong traditional considerations which trace back to Frege, Church and Gödel (the sometimes called "slingshot" considerations).

It is important to rehearse these considerations here. We assume the compositionality of designation as a basic and (in this context) uncontroversial premise, and also, as we just advanced, that a description designates (when it does) the thing it describes. Besides this, we need only assume that logically equivalent predicates are

codesignative. This is again hard to deny by the rigidity theorist, since, by compositionality and the assumption that a description designates what it describes, if *a* is a name, the logically equivalent predicates ***x=a*** and ***x=(the y such that y=a)***[7] must be codesignative; and it is then hard to see why other pairs of logically equivalent predicates should fail to be codesignative. Under these assumptions, here is then one "slingshot" for the thesis that coextensional predicates have the same designation, assuming this particular case of the codesignation of logically equivalent predicates:

> ($) a predicate F(x) has the same designation as the logically equivalent predicate ***x = (the y such that y=x and F(y))***.

Let P(x) and Q(x) be coextensional predicates (at a world w and time t).

> (1) P(x) has the same designation as ***x = (the y such that y=x and P(y))*** (at w, t). (By ($).)
> (2) ***x = (the y such that y=x and P(y))*** has the same designation as ***x = (the y such that y=x and Q(y))***. (By compositionality and the assumption that a description designates what it describes, since ***(the y such that y=x and P(y))*** and ***(the y such that y=x and Q(y))*** have the same designation (at w and t, w.r.t. any assignment to 'x'), given that P(x) and Q(x) are coextensional (at w and t).)
> (3) ***x = (the y such that y=x and Q(y))*** has the same designation as Q(x) (at w, t). (By ($).)
> (4) P(x) has the same designation as Q(x) (at w and t). (By (1), (2) and (3).)

As is well known, similar arguments show, under the same assumptions, that the designation of a meaningful declarative sentence must be its truth value (at a world and time). In my view,

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[7] Text in boldface italics will abbreviate the same text in normal type but flanked by corner quotes.

arguments of this sort establish beyond reasonable doubt that coextensional predicates must have the same designation, and so that something like the set-extension of a predicate, or the plurality of things it applies to, must play the role of designata for the predicate. Under the standard assumption that general terms are predicative, it follows that general terms must designate plurally the things they apply to (at a world and time), or must designate their set, or something of this sort, just as the NA view postulates. (More generally, the argument above, to the extent that it only exploits the "applicative" nature of general terms, could be extended to show that other kinds of appliers, whether they were traditionally classified as predicates or not, must designate their extensions.)

Note that the argument doesn't show that a general term doesn't have other types of semantic contents or values besides its designatum, just as the argument showing that the designation of a declarative sentence must be its truth value doesn't show that the sentence doesn't have other semantic contents. What these arguments show is that the thing described by a description, the things a predicate applies to, the thing named by a name, the truth value of a declarative sentence, etc., all belong to the same type of semantic content, the type that determines truth conditions at a basic level. But a description such as 'the teacher of Alexander' also has as a semantic value the property of being a unique teacher of Alexander; and a general term such as 'cat' (/'bachelor') also has as a semantic value the kind of cats (/the property of being an unmarried male eligible for marriage). The NA view has no problem with this fact, and in fact I have argued elsewhere that general terms can properly be said to refer to or express the kinds or properties naturally associated with them, which in turn determine their designations at world-time pairs. ((…)) However, the fact remains that designata as normally understood cannot be identified with referents in the sense of the properties or kinds which are also intuitive semantic values of descriptions and general terms. The NA view respects this fact made manifest by "slingshot" arguments, while the AKD view can fairly be said to conflate two levels of semantic values of general terms (and implicitly, of descriptions).[8]

[8] Some defenders of the AKD view go as far as to hold that a description is ambiguous in that it can be taken to designate either the thing it describes or the

The ground is now clear for the introduction of the basic postulate of the NA view and its generalized version, that a general term or an applier in general is rigid when, if it applies to a thing (at a world and time), it necessarily applies to it (which implies in turn that a rigid general term has the same plurality or set as an extension in all possible worlds). We may recall at this point that, unlike what happened with the AKD view, the NA view is intuitively in agreement with natural Kripkean expectations about the extension of the notion of rigidity: *prima facie* 'cat', 'tiger', 'gold', 'water', etc., could not have failed to apply to their instances (even in worlds where these don't exist; see section 4 below), while many general terms, including 'bachelor', 'philosopher', 'large carnivorous quadrupedal feline, tawny yellow in color with blackish transverse stripes and white belly' and 'liquid filling the oceans' clearly could have. Note that the view takes even mass nouns like 'gold', 'water', 'heat', etc. to have a predicative nature, so that they have instances they apply to (as suggested by clearly predicative uses of them, as in *That stuff is gold*, *We need to drink some water* or *There is heat in this body*), but it need not deny that mass nouns have uses that can be formalized as singular term uses, for which the notion of singular term rigidity can presumably be accepted as appropriate. (Count nouns or substantival phrases like 'cat' or 'flash of lightning', on the other hand, not having singular term uses, require in all cases a predicative notion of rigidity.)

Let's now turn to fact (B), the ability of the NA view and its generalization to offer derivations of the necessitations of several kinds of statements that go beyond the basic case of true identity statements between rigid singular terms. In Gómez-Torrente (2006) I noted that if the quantifiers are possibilist, so that they have the same extension or domain in all possible worlds, the following

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property it expresses or refers to. (See, e.g., Martí and Martínez-Fernández (2010, 2021).) On this view, the sentence *Blue is the color of the sky* has two readings, one true on which it says that the color blue is identical with the color possessed by the sky, and one false on which it says that the color blue is identical with the property of being a unique color of the sky (cf. Martí and Martínez-Fernández 2021, 289). I take it to be clear that the only existent reading (as predicted by the standard theory of singular term rigidity) is the first one. The imaginary second reading emerges from a conflation of the level of the designations with the level of the properties expressed (by descriptions and predicates).

argument schema is valid (under other usual assumptions in the semantics of modal logical languages):

(NG) $\forall x\,(Ax \supset Bx)$ is true / $\forall x\,(Ax \leftrightarrow Bx)$ is true;
the predicates A and B are such that, if they apply to a thing in some world, they apply to it in all possible worlds;

$\Box\forall x\,(Ax \supset Bx)$ is true / $\Box\forall x\,(Ax \leftrightarrow Bx)$ is true.

('NG' is for 'necessitation for the general term case'.) So if *Cats are animals* has (or can for present purposes be taken to have) the form $\forall x\,(Ax \supset Bx)$, its necessity does indeed follow from its truth plus the claim that 'cat' and 'animal' are rigid in the sense that they apply to whatever they apply to in all possible worlds (and thus have precisely the same extension in all possible worlds). This shows that, in a clear sense, it can be held that the NA view satisfies the modal desideratum on general term rigidity that we saw the AKD view failed to satisfy.

Now, going beyond (NG), true statements in which an essential property is predicated of a rigid kind term or of a name for an individual, such as *The kind of cats is a kind* and *Stanley is a mammal*, can be argued to have true necessitations as an effect of the validity of this other form of argument:

(EPR) At is true;
t is a rigid singular term (i.e., it designates its object in all possible worlds) and the predicate A applies to the things it applies to in all possible worlds;

$\Box At$ is true.

('(EPR)' is for "essential predication from rigidity".)

Yet another type of argument that yields validly a necessitation from rigidity and necessary application claims concerns sentences such as *Stanley is a specimen of the kind of mammals* and *Stanley is genetically determined by the zygote Z* (where 'Z' is a name of the zygote

from which Stanley actually originated), which we considered when discussing LaPorte in section 2 above. These can be taken as statements of the form t_1Rt_2, where t_1 and t_2 are rigid singular terms and R is a necessary applier as a binary relational predicate, and the relevant valid form of argument is this:

(ERR) $\boldsymbol{t_1Rt_2}$ is true;
t_1 and t_2 are rigid singular terms and the predicate R applies to the pairs of things it applies to in all possible worlds;

$\Box\boldsymbol{t_1Rt_2}$ is true.

('(ERR)' is for "essential relation from rigidity".) In the mentioned applications we must understand 'is a specimen of' and 'is genetically determined by' as applying necessarily to all their instance pairs, as I think is most natural.

Note that (ERR) amounts to a generalization of which (NS) can be seen as constituting a particular case:

(NS) $\boldsymbol{a = b}$ is true;
the singular terms a and b are rigid;

$\Box\, \boldsymbol{a = b}$ is true,

though in (NS) the obvious enthymematic premise, that the identity predicate '=' is a necessary applier, is omitted. ('NS' is for 'necessitation for the singular term case'.) This is one first instance of the third fact, (C), that we promised to emphasize in this section, namely that the theory of rigidity as necessary application, the generalized NA view, abstracts away in the direction of uncontroversial generalizations in standard semantic theory.

We thus see that, as promised, the NA view is indeed able to provide a logical justification of various kinds of true necessitations beyond those of true identity statements between rigid singular terms (unlike the simple but limited AKD view), and in fact able to offer generalizations of which certain claims in the theory of singular term rigidity are particular cases. But this doesn't happen

because of some kind of happy coincidence. The ultimate reason why the NA view is able to account for these other types of necessitations is that it is naturally suited for a generalization that goes beyond singular and general terms. The view doesn't shy away from the idea that all expressions beyond singular terms (to which all non-singular terms essentially reduce, on the conservative AKD view) must have their own peculiar ways of possessing designations that are invariant across possible worlds. Any view, including the AKD view, must acknowledge that not all expressions of a language can designate in the way in which singular terms designate. Even in the artificial languages designed by AKD theorists to isolate predication as much as possible, predicative expressions must appear; and in fact, more generally, applier expressions must appear, expressions that take other expressions as arguments, regardless of whether these expressions are singular terms or non-singular terms: here we will find things such as the quantifiers as standardly understood, as well as connectives, operators in general, and others. It is completely natural to expect that the truth of many necessitations in natural and formal languages will be (at least in part) attributable to properties analogous to rigidity for expressions that are not singular terms in any conceivable sense. The NA view, even in the version restricted to singular and general terms, is a view that sees in particular some necessitations of the forms $\Box\forall x(Ax \supset Bx)$ and $\Box\forall x(Ax \leftrightarrow Bx)$ as susceptible of receiving an explanation of this sort, in terms of invariance properties of the terms they involve; but the phenomenon is more general, as we have seen.

Why should the phenomenon be so general? The reason is that it arises from a very general truth about any language which, as is the case with the standard logical languages, has a semantics that assigns extensions (of various kinds, according to the semantic type of an expression) to expressions relative to worlds and times, and which is compositional in the sense that the extensions of composite expressions are a function of the extensions of their components. This general truth, which codifies the full strength of the fact (C) we are seeking to emphasize, can be given the form of precise theorems if we focus on particular languages and their specific peculiarities,

but can be put very abstractly if we only care for generality, as in our present context:

> (NR) *If a sentence is true at a certain world-time pair, and all its meaningful expressions have the same extension at all world-time pairs, the sentence is true at all worlds and times.*[9]

('(NR)' is for "necessity from rigidity".) Or, put in terms of argument schemata: if $\Phi(X_1, X_2, \ldots, X_n)$ is any sentential form in n variables (an expression coming from a sentence by uniform replacement of n of its terms by variables), then the form of argument (NRS) is valid:

(NR') $\Phi(e_1, e_2, \ldots, e_n)$ is true at a certain world-time pair;
$e_1, e_2, \ldots, e_n$ are all terms that have the same extension at all world-time pairs;

$\Box\, \Phi(e_1, e_2, \ldots, e_n)$ is true at all world-time pairs.

As one can easily observe, all the valid forms of argument above ((NG), (NS), (EPR) and (ERR)) owe their validity to this very general truth (NR), or equivalently to the validity of (NRS). The second premise in these forms of argument codifies the idea that the expressions that one would substitute for schematic letters have the same extension in all possible worlds. As for fixed expressions, in (NG) the first-order quantifiers are enthymematically taken to have the same extension or domain (the class of possible individuals), and the conditional and the biconditional are understood as having as their extensions the same truth-functions in all possible worlds. And in (NS) the identity predicate is understood in the standard way, as having the same extension in all possible worlds (the class of all pairs <o,o> where o is a possible individual)—as we noted a few

[9] The proof of (particular versions of) (NR) is clear: if a sentence S is true at a world-time pair (w,t) but false at a world-time pair (w',t'), some meaningful subexpression of S must have in (w',t') an extension different from that which it has in (w,t)—otherwise, in virtue of compositionality, the truth-value of S in (w',t') will be the same as the truth-value it has in (w,t).

paragraphs back, the identity predicate is uncontroversially a necessary applier. But (NG), (NS), (EPR) and (ERR) are evidently just a few examples at the surface of a universe of forms of argument valid in virtue of (NR) or the validity of (NRS).

The importance of (NR) and (NRS) for a semantic and logical understanding of many statements of necessity in both formal and natural languages seems hard to overemphasize. In the present context, making (NR) and (NRS) explicit allows us to see that the NA view meshes well with the generalization of the ideas surrounding singular term rigidity that (NR) and (NRS) represent, as it exploits some of the particular forms of argument whose validity follows from (NR) or (NRS), and it is open to the inevitable existence of infinitely many others. The same cannot be said of the conservative attitude embodied in the AKD view. This view, unlike the NA view, cannot give to (NR) and (NR') the important role they surely have in a semantic and logical understanding of many necessity statements.

In this section we have seen that the NA view and its natural generalization, unlike the AKD view, is compatible with standard semantic assumptions about general terms, it doesn't obviously overgenerate or trivialize the notion of rigidity, provides logical justifications of many types of intuitive necessities beyond that of true identities between rigid singular terms, and is in perfect alignment with uncontroversial generalizations of the elementary facts about singular term rigidity which can be seen as the ultimate sources of necessity in those cases. Despite this, in the literature the view has been much criticized, specifically as a view of rigidity for general terms. In the next section we turn to these criticisms.

4. On the criticisms of the necessary application view.

One first criticism of the NA view is that there are many adjectives, such as 'hot', 'red', 'humid', etc. which obviously bear a close relationship to natural kinds, and appear in some of the theoretical identification sentences discussed by Kripke, but are not necessary appliers (see e.g. Soames (2002), 259; Salmón (2005), 119; Martí and Martínez-Fernández (2021), 287). However, while Kripke said that it

"holds for certain" that *substantives* or substantival terms such as 'cat', 'water' and 'flash of lightning' "have a greater kinship with proper names than is generally realized" (Kripke (1972), 134), he also said that this conclusion only holds "presumably, suitably elaborated", for "corresponding adjectives" (*ibid.*). It is clear, even in Kripke's text (see Kripke (1972), 127-8), that such adjectives are different from corresponding substantives in that they express descriptive properties, while the substantives are in some sense "referential". What Kripke notes is that the adjectives have a "referential element" (Kripke (1972), 128, n. 66) of their own. I take all this to suggest that for Kripke the exact way in which the adjectives are closer to referential expressions than generally thought must be explored and elaborated, and that they need not be as close to names as typical natural kind terms, including their status as regards rigidity.

The right view about the connection between our relevant substantives and their corresponding adjectives (already sketched in Gómez-Torrente (2006), section 6) is quite simple, and can be illustrated by considering adjectives corresponding to names, such as 'Twainian' or 'Burmese'. These are surely descriptive, but contain a "referential element" derived from the referential character of the name they derive from. Because of this, we might feel some temptation to declare them rigid, but being clearly descriptive, the temptation is assuaged. The temptation here is better resisted, for otherwise we would have to declare rigid all sorts of clearly descriptive and highly derivative adjectival phrases with a referential element, such as 'Twain-loving', 'one-hundred miles off the coast of Burma', etc. The NA view sensibly declares all these non-rigid. But this doesn't mean that they cannot appear in true and necessary identification sentences. On the contrary, given their referential element and in cases where we have pairs of adjectives or adjectival phrases derived from co-referential names, such sentences will emerge: surely *Something is Twainian only if it's Clemensian* and *Everything is such that it is one-hundred miles off the coast of Burma just in case it is one-hundred miles off the coast of Myanmar* are true and necessary. But this must obviously be explained simply by the rigidity of 'Twain', 'Clemens', 'Burma' and 'Myanmar': *x is Twainian* is necessarily equivalent to *x is characteristic of Twain*, which is necessarily equivalent

to *x is characteristic of Clemens*, which is necessarily equivalent to *x is Clemensian*; *x is one-hundred miles off the coast of Burma* is necessarily equivalent to *x is one-hundred miles off the coast of Myanmar*. These necessities hold independently of the rigidity of the adjectives or adjectival phrases, so these are again better left non-rigid.

With adjectives corresponding to natural kind terms, the situation is analogous. 'Hot', 'red', 'humid', etc. are descriptive, as Kripke himself says, and the pluralities of entities to which they apply don't form natural kinds. But they contain a "referential element" derived from the referential character of the natural kind terms they correspond to, 'heat', 'red' (the substantive), 'water', etc. Possessing a referential element, we might feel some temptation to declare them rigid, but being clearly descriptive, the temptation is assuaged. Again the temptation is better resisted, for otherwise we would have to declare rigid all sorts of clearly descriptive and highly derivative adjectival phrases with a natural-kind referential element, such as 'heat-loving', 'one-hundred miles from the closest bucket of water', etc. The NA view declares all these non-rigid, but this doesn't mean that they cannot appear in true and necessary identification sentences. On the contrary, given their referential element and in cases where we have pairs of adjectives or adjectival phrases corresponding to necessarily codesignative natural kind terms, such sentences will emerge: surely *For all bodies x, x is hot just in case x has molecular energy* and *Everything is such that it is one-hundred miles from the closest bucket of water just in case it is one-hundred miles from the closest bucket of* H_2O are true and necessary. But this must obviously be explained simply by the rigidity of 'heat', 'molecular energy', 'water' and 'H_2O': *x is hot* is necessarily equivalent to *x contains heat*, which is necessarily equivalent to *x contains molecular energy*, which is necessarily equivalent to *x has molecular energy*; *x is one-hundred miles from the closest bucket of water* is necessarily equivalent to *x is one-hundred miles from the closest bucket of* H_2O. Those necessities don't hold in virtue of the rigidity of the adjectival phrases, but in virtue of properties of the natural kind terms involved (in virtue of their rigidity, by hypothesis), so the adjectival phrases are again better left non-rigid. The fact that the necessity of theoretical (and other) identifications *in the case of adjectival phrases* is clearly not to be

explained by their rigidity eliminates any remaining temptation to think of them as rigid.

In order to consider the next criticism of the NA view, let's call general terms that apply to their instances in all worlds *where they exist* 'weakly necessary appliers'.[10] One relatively mild way of criticizing the NA view is by denying that natural kind terms are necessary appliers but accepting that they are weakly necessary appliers. These critics claim that 'cat' or 'animal' don't apply in the actual world to non-actual cats or animals, or, in general, that they don't apply in a world to cats or animals not existing in that world (see e.g. Ahmed (2009), Glüer and Pagin (2012)). But the denial that typical natural kind terms apply to things in worlds where they don't exist is counterintuitive. Compare the case of names. If we say, to all appearances felicitously, *Imagine a circumstance such that, in that circumstance, one of the unborn things is Hitler (suppose, e.g., that the sperm and egg that he actually came from do not unite and go on to die)*, the natural interpretation (as Kripke (1972, 78) in effect noted) is that we are describing a counterfactual world in which Hitler does not exist and yet 'Hitler' designates Hitler. (Contrast #*Imagine a circumstance such that, in that circumstance, one of the unborn things is the cruelest dictator*, which sounds anomalous precisely because we don't think that 'the cruelest dictator' can designate in world a thing that doesn't non-exist in that world.) Similarly, if we say, to all appearances felicitously, *Imagine a circumstance such that, in that circumstance, one of the unborn animals is a cat*, the natural interpretation is that we are asking our audience to imagine a world where 'cat' (and 'animal') applies to certain things that don't exist in that world. Note that, by contrast, #*Imagine a circumstance such that, in that circumstance, one of the unborn animals is mischievous* is intuitively semantically anomalous. And many other examples of contrast between sentences that differ only in the replacement of a typical natural kind term by a paradigmatic contingent applier show that these terms don't intuitively behave in the same way when their application to non-existents is concerned. Compare *Among the things that have been actually prevented from developing some are humans* with #*Among the things that have been actually prevented from developing some are philosophers*. And for yet another contrastive

[10] In my earlier papers I called necessary appliers 'obstinately essentialist' and weakly necessary appliers 'weakly essentialist'.

example, recall Salmón's 'Noman'[11]. Once 'Noman' has been introduced, a user of it can say *Noman is a human being—one that has been prevented from developing*, but to say #*Noman is a philosopher (bachelor/ dictator…)—one that has been prevented from developing* is semantically anomalous. In view of all these examples, I think it's unreasonable to deny that there is a relevant intuitive difference here between typical terms for natural kinds and manifestly contingent appliers.

But even leaving aside these clear intuitive differences, there is a more definitive way of dismissing the objection that natural kind terms are only weakly necessary appliers. The idea is this: if we accept that typical natural kind terms are weakly necessary appliers, then one can develop all the relevant results in the theory of rigid general terms for a certain class of not-so-typical but uncontroversial necessary appliers, some of which stand in strict correspondence with typical natural kind terms and could be used interchangeably with them for all practical purposes. And this allows us to see that there is no theoretical obstacle to understanding general term rigidity via the not-so-typical necessary appliers. Let's see how this comes about.

For any general term T, let T^+ be the term ***thing that would be (a) T in all the worlds where it exists***. T^+ is a necessary applier if T is a weakly necessary applier, and applies in all possible worlds exactly to the things that a typical natural kind term T applies to if T is already a necessary applier. Necessary application thought of as a property of +-terms satisfies the natural extensional desideratum on general term rigidity, as +-terms are necessary appliers but most other general terms (possibly aside from typical natural kind terms) are not necessary appliers. And of course, it satisfies the vital modal desideratum on a notion of general term rigidity as well (the validity of (NG) is a logical fact independent of language peculiarities), which implies in turn that true identification sentences involving +-terms, such as *Cats*$^+$ *are animals*$^+$, will be necessary. Besides, it is clear that we could do with +-terms all the useful things that we do with

[11] Salmón ((1982), 39, n. 41) introduces 'Noman' via the reference-fixing description 'the person who would have developed from the union of this sperm and that egg'. Note that under standard assumptions, that description can only have a designation that is actually *a person*.

typical natural kind terms: classify, identify, theorize, etc. So we have in English a class of predicates that work essentially like typical natural kind terms, with a characteristic that distinguishes them from most other general terms (perhaps leaving aside typical natural kind terms, if these are already necessary appliers), and such that true identifications involving them will be necessary *in virtue of that characteristic*. It is then clear that necessary application plays, in the case of +-terms, the role we would have expected rigidity to play. But this strongly suggests that necessary application is a good notion of rigidity *tout court*. For whether a notion of rigidity is good or not ought not to depend on whether the speakers of a language like English use as their preferred natural kind terms +-less terms or the +-terms that they also have at their disposal.

In fact, to avoid an inadequate dependence on peculiarities of a natural language like English (always assuming that typical English natural kind terms are only weakly necessary appliers, which I of course think is false), we might perfectly well *postulate* that a general term T is to be considered rigid *when the term T+ is a necessary applier*. And we might *stipulate* that the modal desideratum on general term rigidity ought to read: rigidity can be used to derive the necessitations of true "identification sentences" containing *+-terms* falling under the extended notion. We might thus accept that *Cats are animals*, if 'cat' or 'animal' are not "really" necessary appliers, is not necessary-if-true (it would be saying that every possible thing that is an existing cat is an existing animal; and the truth of this in our world doesn't imply that it's going to be true in all worlds), but also that *Cats*$^+$ *are animals*$^+$ is necessary-if-true, and that *this* is what is important. These well-motivated postulates would thus leave us with necessary application as a good notion of general term rigidity.

It would be entirely reasonable to assume similar postulates in the singular term case. For t a singular term, let t$^+$ be the description ***the thing that would be t in all the worlds where it exists***. Call a term t rigid when t$^+$ designates the same thing in all possible worlds (which would ensure that proper names are rigid and typical descriptions are not), and let's postulate that the important necessitation property is that true identities between rigid +-singular terms must be necessary. We might then accept that *Hesperus is Phosphorus* is not really necessary-if-true (as we must if we grant that

it's not true in worlds where Venus doesn't exist), but also claim that what is important is that *Hesperus*$^+$ *is Phosphorus*$^+$ must be necessary given that it's true.

Thus, if we accept that typical natural kind terms are at least weakly necessary appliers, there is no objection to seeing necessary application as a good notion of general term rigidity. The next objection to the NA view we must consider, however, is that typical natural kind terms are not even weakly necessary appliers from an intuitive point of view. Objectors of this type claim that a thing *o*, member of a natural kind K, can sometimes undergo a process of transformation that makes it lose the property of being of K, while retaining its identity as *o*. The *prima facie* most substantive arguments for this are two arguments due to Bird (2018).[12] The first is this: think of a uranium atomic nucleus containing 92 protons and 146 neutrons; after an alpha particle is emitted, the resulting nucleus contains 90 protons and 144 neutrons and is a thorium nucleus. According to Bird, "it is natural (...) to regard the nucleus as having retained its identity in the process. (...) Furthermore the components of the nucleus remain mostly unchanged. So we have change of kind with retention of identity" (Bird (2018), 1413). In my view, the case is very dubious. First, although I agree that 'uranium nucleus' and 'thorium nucleus' are natural kind terms, they are not typical natural kind terms from ordinary language, and no lessons about typical terms can be extracted from the example. Second, it's unclear even whether Bird's description of the example is the one determined by ordinary intuitions, to the extent that they apply in the example.

When ordinary macroscopic objects to which ordinary natural kind terms apply are involved, the numbers of microscopic

[12] There are other less substantive arguments of this kind. One is Schwartz's (2002) that in a use of 'frog' that requires instances to be adult, 'frog' is not a necessary applier (though it is also possible, and completely normal, to speak of "frogs in the tadpole stage"); but, as Bird (2018) notes, in that sense 'frog' is not clearly a natural kind term (in the same way in which 'young human' isn't). Another argument is Bird's (2018) that under some biological notions of species, an organism may, in its own lifetime, go from belonging to one species to belonging to another, if it belongs to one of two subpopulations that have begun to drift apart genetically, can still interbreed to some extent at the beginning of the organism's life, but this becomes impossible in the course of it. But as Bird himself admits, one can't obtain this result under the now prevalent cladistic notion of biological kinds, so the idea for this sort of argument is weakened.

components of those objects are huge, and there are clear ordinary intuitions that removal of just a very few microscopic components doesn't alter the identity of the macroscopic objects, perhaps because then neither does it alter their membership in their natural kinds, as it is also the case that the ordinary properties of the objects won't change after the removal. In the case of the nuclei in Bird's example, the number of the relevant components is not huge, and although they remain mostly unchanged after the removal from the first nucleus, this determines that the second nucleus must belong to a different natural kind, as its scientific properties will be very different from those of the first nucleus. The ordinary case and the case of the nuclei are then clearly sufficiently different that no lessons about the first can be extracted from the second, even assuming that the description of the second is intuitively correct.

But it's unclear even that the ordinary intuitive point of view settles what ought to be said about whether the nucleus that subsists after the removal is the same as the initial nucleus. An atomic nucleus might just as well be thought of as an entity whose identity conditions include essentially its number of more fundamental particles; there are just so few of them, and their precise number is so determinative of the nucleus' distinctive physical and chemical properties, that that conception of the nucleus' identity conditions is perfectly reasonable and compatible with ordinary intuitions. In fact, the attentive reader will have noticed that *we* have been describing Bird's example as one involving two nuclei, and I submit that this description has not done any violence to our ordinary intuitions. Since I take this conception of the identity conditions of an atomic nucleus as perfectly intuitive, I doubt that Bird's description of the example is unbiased.

Bird's second argument does involve ordinary things and kinds, but it is even more clearly unconvincing. He says:

> an iron ring that is now rusty is no longer a sample of iron, since it is now a mixture of iron and iron oxide. A ring made of caesium might in due course become a ring of barium. A table made of oak is repaired with pine. Such objects can retain their identity despite changing the kind of which they are samples. (Bird 2018, 1414)

Here there is little intuitive doubt that the ordinary objects in question retain their identity through the imagined changes, but what is implausible is that they are instances of the relevant kinds. The implausibility is reflected even linguistically, as one can't really say #*This ring is iron* or #*This table is (an) oak* (note also that 'made of iron' and 'made of oak' (of which 'iron' and 'oak' in an informal adjectival sense might be taken to be abbreviations) are not natural kind terms; they are just adjectival phrases containing a natural kind term). Bird has confused here the iron of which the ring is initially made with the ring itself. That iron is of course iron, and necessarily so, but the ring is not itself an instance of iron (and the NA view at no point is committed to saying it is), let alone a necessary instance.

One final relatively common criticism of the NA view is that the view is "metaphysical", because of its use of the idea of necessary or essential application—this is often held in comparisons with the AKD view, which is sometimes proposed as "purely semantic". (I have heard this criticism especially in conversation ((…)).) I distrust criticisms of any view on the grounds that it is "metaphysical" (and the AKD view and the NA view, as normally read, are equally "metaphysical": doesn't the AKD view assume the "metaphysical" thesis that kinds, properties, etc. exist and are available for designation by general terms?), so I don't think any criticism of this sort is ultimately going to affect any theory of rigidity as normally interpreted. But I want to note that there is no obligation to interpret theories of rigidity as themselves assuming substantive metaphysical theses. A theory of rigidity can be interpreted as a linguistic theory that seeks to bring into the open implicit assumptions underlying ordinary linguistic practice, be these metaphysical or not. The way we use language is replete with presuppositions and implicit assumptions that may well be called metaphysical, and philosophical or linguistic revelations of these presuppositions and assumptions need not count as "metaphysical" in any negative sense. When Frege (1892, 156) is replying to an imaginary idealist skeptic who objects to his talk of 'the Moon' having a *Bedeutung* because this talk assumes that the Moon exists, Frege rightly answers that he is simply making explicit a presupposition of our linguistic practice, and that he is neither assuming nor seeking to establish a realist anti-idealism. As noted

above, insofar as the AKD theorist intends to bring into the open the alleged implicit linguistic assumption that general terms designate abstract kinds of certain types, her theory may be interpreted as performing a job of this sort and should not thereby be chastised as "metaphysical". But the same goes for the NA view's use of the assumption it sees as implicit in our use of ordinary natural kind terms, that their instances are necessarily members of these kinds; "metaphysical" or not, on the basis of this assumption we can make sense of intuitive differences between natural kind terms and other general terms, and derive the perceived necessity of a number of truths involving natural kind terms, and thus give a coherent account of our linguistic practice with, and intuitions about, natural kind terms. Since theories of rigidity can be viewed as interpretative in this way, and they keep most of their interest when so viewed, the accusation of "metaphysicality" directed at a theory of rigidity (*any* theory of rigidity) has no force whatsoever.

In sum, a strong case can be made that the view of rigidity as necessary application is not affected by the criticisms directed at it in the literature, and that it and its generalized version provide a way of making sense of intuitive distinctions between types of general terms, as well as a way of explaining intuitions of perceived necessity for a large range of sentences that go not only beyond true identities between rigid singular terms but even beyond true "identification sentences" between natural kind terms. There is thus every reason to think of the necessary application view as making explicit and developing a rich field of logico-semantic ideas that generalize and deepen the original Kripkean insights behind the notion of singular term rigidity.

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