ON THE RAMIFICATION OF INEXACTNESS

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ABSTRACT. I argue that though a satisfactory semantics for the logic of inexact reference may assign no truth value to some statements, it should not assign truth (or falsity) of various degrees. Well-formed assertions are simply true or not. Inexactness does not "ramify."

I distinguish inexactness from other sorts of vagueness, including nonspecificity. I show that arguments from (i) use of quantifiers, (ii) the existence of properties which can be construed as a series of properties (as, e.g., red can be construed as a set of shades of red), (iii) the constructability of apparently paradoxical sorites arguments, and (iv) the presence of prototypes in the extension of a predicate do not show that there are degrees of truth.

Much of the alleged evidence that inexactness ramifies is, in fact, a misreading of the undeniable evidence that there may be uncertainty about the truth value of a claim. In support of my claims, I discuss how cases of deeming that a predicate applies relate to its actually applying. A distinction between predicates of "pure" and "impure" function is essential to this.

Heap or sorites arguments are frequently introduced to beginning philosophy students to exhibit a kind of difficulty to which so-called vague predicates can lead. Beginning with apparently true premisses such as 'This is a heap of rice' and 'If one carefully removes a grain of rice from a heap of rice in such a way as to minimally disturb it, one is left with a heap of rice' and 'A heap of rice has at
least one grain of rice', one is led, by the reiteration of elementary rules of inference such as modus ponens, to the contradiction that there is a heap of rice which contains no rice. The sorites argument is often termed a fallacy (the fallacy of assuming that many small, insignificant changes do not add up to a significant change); but this explanation does not stand up to scrutiny. If an argument has only true premisses and uses rules of inference which are impeccable, reiteration of these rules should not lead to false statements. Thus the sorites argument seems rather paradoxical than fallacious. Either ordinary logic is wrong or ordinary language is not in its range of application. At this point, one may say that vagueness is only the fault of ordinary language and that the precision of ordinary logic determines that it will not always fit the structure of this language. But, is there a logic which fits the vagueness of ordinary language?

My answer joins that of others: There is, indeed. My purpose here, however, is not to present such a logic or even to discuss some of the alternative logics which have been presented. Rather, I wish to argue for a constraint which I think such a logic must satisfy if a successful "solution" to the paradox is to be given. Specifically, this is that the semantics for such a logic must yield two and only two truth values. Gaps—absence of truth value—there may be; but there are no intermediate truth values.[2]

In presenting this defense, I am returning to the foundations of vagueness logics. If I am correct, the two leading candidate theories,[3] the fuzzy set logic of Goguen and others and the supervaluation logic of Kit Fine have basic failings. In the way they are usually interpreted by their proponents, they do not correctly model the phenomenon.[4] An alternative must be developed. In another paper[5] I initiate such a development. The present paper provides a justification for that kind of model.

The sorites argument is, of course, just a symptom. A "successful solution" to the sorites paradox must be a good theory of inexact reference. Any theory will at least include a theory of satisfaction and a theory of truth for sentences containing the problematic expressions. Minimally, in addition to the requirement that truth conditions derived be those which statements actually have, the constraints on the extensions of predicates given by the theory should be correct. If one assumes that the normal connection between truth conditions and satisfaction obtains (as given by a Tarski truth theory) the finding that there are but two truth values should imply that so-called vague predicates have a definite extension. Conversely, if all primitive referring expressions have a definite extension, there should be only two truth values.

A deeper requirement on the "success" of an account is
that its predictions be obtained in a way which mimics the
determination of truth values and extensions in the real
world. Below I will argue that actual extensions are a
function of what we take extensions—to a large extent—to
be. In slightly different terms, whether an actual object
belongs to the extension, boundary or antiextension (exten-
sion of the negation) of a predicate depends, to a signifi-
cant extent, on whether in many, various situations, it is
taken or deemed to belong to that extension.

In what follows, I will use the word 'inexact' rather
than the word 'vague'. 'Vague' is ambiguous and has a
strong and prevalent nonphilosophical use according to which
vagueness is deplorable and should be corrected. To say
that a person's language is vague is to offer a criticism of
her or him. In contrast, the phenomenon with which I am
concerned is not only ubiquitous, and unlikely to be cor-
rected, it should not be corrected.

Philosophers tend to inflate the phenomenon of inexact-
ness because they look at language statically or synchroni-
cally. Much of what is true of a language at any time de-
pends essentially on facts about that language (and perhaps
other languages) at other times. A prime example: The ex-
tension of a proper name in a given context of utterance
depends on the history of uses of that name and the conec-
tion of the use in question with other uses. It does not,
for example, depend only on what the speaker has in mind on
the given occasion. In a similar way, when the dependence
of reference in a given context on past and future uses is
taken into account, many cases of apparent inexact reference
are seen to be exact.

In an early paper on vagueness, C.G. Hempel remarked
that vagueness is strictly semiotical.[6] That is to say,
we have not correctly described or modeled or explained the
phenomenon unless our description, model or explanation in-
volves the use of language. For this reason, it is sur-
prising that the leading accounts do not seem to include
this parameter. For Hempel is correct here. I think this
failing is again a symptom of looking at language synchroni-
cally: In models which are based on many-valued logics and
given either a fuzzy set or supervaluation semantics, there
is no natural way to appeal to variation through contexts.

'Inexactness' is amenable to approximate definition.
The characterization I will offer below is incomplete, but
will serve the present purposes. For example, it is neither
the case that predicates and terms are inexact nor that the
things to which they apply, or which they name, are. Lan-
guage is not fuzzy, and we do not live in a fuzzy world.
Thus, even though there are truth value gaps caused by inex-
act reference, a fully realist position can be correct.[7]

Although this paper is explicitly concerned with predi-
cates, what I say can, without significant change, also be applied to some singular terms. For this reason I will frequently use the noncommittal locution 'expression' in what follows. Where e is an expression, following C.S. Lewis, I call the objects to which it possibly applies or possibly does not apply, the \( H(e) \) the \( comprehension \) of e.

(Here I am using 'possible' in the sense of psychologically possible, a sense which I will not attempt to demarcate, but which is neither contained in nor contains the logically possible, the metaphysically possible or the epistemically possible.) Also, I will use the somewhat ambiguous 'refer to' rather than 'apply to.' These definitions will succeed also if the expressions are singular terms rather than predicates and 'refer to' is understood as 'denote.' Contexts are relevant parts of metaphysically possible situations. I shall say e refers inexactly in a context C if there is an object in \( H(e) \) in C to which e does not refer and to which the negation of e does not refer. Such objects are said to be in the boundary or border of e in C. e refers inexactly if there is a context in which e refers inexactly. e refers exactly in C if its boundary in C is empty. e refers exactly if it refers exactly in all contexts.

The paradigm case of an expression referring inexactly on a given occasion of use is the following. A speaker must judge if a certain object is red or not. It is the sort of thing to which 'is red' can apply--for example, it is not an idea. But there is no truth of the matter as to whether it applies or not.

A caution is in order here. There are many situations in which we are in doubt about the reference of an expression. But, given further evidence, this doubt would be resolved. Following Wheeler, I will call this merely apparent indeterminacy epistemic inexactness. Since our present concern is with metaphysical inexactness, on the other hand, we see that acquiring more evidence about the properties of the object in question--making more careful measurements, for example, will not enable the speaker to determine whether the expression applies. '1" long' will not refer inexactly in the metaphysical sense if every object which has length is either exactly an inch long or not. But there will be epistemic borderline cases.

I will say that e can refer inexactly if e is sometimes deemed to have borderline cases. One might call this phenomenon possible metaphysical inexactness. Note that it is distinct from epistemic inexactness (which is doubt about the applicability of an expression in a particular instance). Most expressions of our language can refer inexactly. But below I shall argue that actual inexact reference is rare.

Given the above, one might think it possible to measure inexactness to some extent. Generally, the comprehension of
a term will be an infinite collection of possible objects. Thus we cannot simply measure inexactness by taking the ratio of indeterminate cases of application to total cases. Some authors have suggested that we can measure inexactness by looking at actual usage in a population,[30] by measuring how much an individual speaker varies in applying the predicate in question. But, on the one hand, this measure would fail to allow for the difference between possible and actual metaphysical inexactness. On the other hand, it would be difficult to distinguish in any principled way suspensions of judgments about reference—epistemic inexactness—from either sort of metaphysical inexactness, and also from cases of lack of attention, misunderstanding, bizarre situations, etc. If, like Hempel and Black, we look at the number of cases where there is disagreement among individuals in a given population over the application of an expression, we have these problems as well as the likelihood that we are seeing variations in idiolect which would be present even in expressions with exact reference.

Yet, it cannot be denied that there are some differences among expressions. We can distinguish some expressions as being more exact than others, because they have no borderline cases. On the other hand, there are some expressions whose deemed application varies persistently over a large part of their comprehension, throughout the relevant population, and in all the contexts in which they could be used. If there is such far-reaching possible metaphysical inexactness and as well epistemic inexactness which is never made exact, even by some small set of experts, it seems to be correct to say that the expression is also more metaphysically inexact than others. The expression 'observational' as applied to properties, may be an example. Concepts expressed by such predicates are the sort over which experts have such persistent and subtly varying disagreement that it is unlikely to be attributable to a difference in language. Nevertheless, I think such cases must be difficult to distinguish from ambiguity of reference or from difficulties in assessing the application of the predicate.

Another phenomenon of reference akin to inexactness should be distinguished from it. Consider the following two cases:[11] Suppose we pick out the reference of an expression as that of the border between the extensions of two given expressions. For example, 'red-orange' applies to the border between orange and red.[12] Secondly, suppose that two expressions have the same comprehension, but the extension of one is properly contained in the extension of the other. The latter is the relation of, for example, 'tiger' to 'feline.' Are these reasons for saying that 'red-orange' refers more exactly than 'red' or that 'tiger' refers more exactly than 'feline'? No, in both instances. There are other senses of 'vague' than inexact, as I have been using it. The previous cases mark a difference in what I would call nonspecificity. Along a continuum of variation of a
given determinable, we can compare classes of partitions of that continuum in terms of how much the determinable varies within the class. Those which vary less are extensions of the predicates which are more specific. Thus, 'has length in the open interval \((1 \pm 0.01)\)' is more specific than 'has length in the open interval \((1 \pm 0.1)\)' because things to which the former applies vary less in the determinable length than do things to which the latter applies. Similarly, 'about a millimeter long' is more specific than 'about a meter long;' 'red-orange,' as described above, is more specific than 'red;' 'tiger' is more specific than 'feline.'

The convention of using 'specific' and 'exact' which is assumed above seems to fit the usage of most recent writers. (However, Russell, in his classic paper,[13] often seems to speak of nonspecificity rather than inexactness.) There is much more which can be said to describe and distinguish between these two notions of vagueness, but a rough, general truth is the following: the specific/nonspecific distinction applies to the structure of a concept throughout, while the exact/inexact distinction applies only to the structure of its borders. This is not to say, of course, that the fact that there are indeterminate cases does not depend in some way on the facts about internal structure of the reference class.

To summarize, comparisons of degree of inexactness would be comparisons of the size of the boundary. But there is usually no clear sense of the latter, except in the extreme cases listed. Confusion of exactness with specificity might have led us to believe that degree of inexactness was more quantifiable than it is. In fact, most inexact reference is on a par.

* Does the phenomenon of inexactness ramify? I will say \(e\) refers ramifiedly (to degree 1) in \(C\) if \(e\) refers inexactly in \(C\) and some objects (in \(C\)) in \(H(e)\) are neither in its extension nor its boundary nor its negation. Further we can say that \(e\) refers ramifiedly in \(C\) to degree \(n\) (where \(n\) is greater than 0) if this lack of fit proliferates to form nonempty boundaries of boundaries of boundaries of boundaries (degree 2), boundaries of boundaries of boundaries of boundaries of boundaries (degree 3), etc. If inexact reference ramified to a large degree, it would be more natural to claim that atomic sentences containing the "culprit" expressions could take on intermediate truth values, in addition to being true or false—or equivalently, that the sentences would have various degrees of truth of the order of the degrees of ramification of the satisfaction of \(e\). This is because truth and satisfaction arguably have a similar structure: If a predicate were satisfiable to various extents, the statements containing the
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predicate would also exhibit truth to various extents. One might claim that there are continuum many truth values analogies to the real valued points between zero (= false) and one (= true); or that there are countably many or even just finitely many truth values. If the last, there might appear to be plausible ordinary language predicates, like 'very true,' 'approximately true,' etc., which pick out these intermediate values.

At this stage of the construction of a formal language to model the natural language, proliferation of truth values is found in fuzzy set logics only. Supertruth theories, like those developed by Fine, have two truth values: A sentence is true (false) if it is true (false) according to all ways of making it completely precise. Up to this point then, the super truth theory does not fall prey to my considerations. However, Fine enriches the basic account by the addition of the sentence operators Definitely and Indefinitely and claims that the existence of first order vagueness makes the existence of higher-order vagueness plausible. In the modal languages with the Definitely and Indefinitely operators, reiterations of the operators need not reduce to an equivalent single occurrence (as in an S5 type of system: For example, it is not the case that indefinitely p is coextensional with indefinitely indefinitely p). For this reason, Fine's full treatment of inexact reference is incorrect if my arguments are successful. To say that truth has various degrees of (metaphysical) definiteness is tantamount to saying that truth has various degrees.

Defenders of the view that there are more than two truth values or that truth can be metaphysically definite to various degrees may point to ordinary usage. F. Waismann in arguing that ordinary language leads us to a logic with a graduated scale of truth values, cites the following replies to assertions that a certain comparison is to the point (p. 90).

Yes, more or less to the point.
Not quite to the point.
Well, so far to the point, but only so far.

He suggests that this sort of reply is to be found given to most statements describing properties capable of gradations. (Having good vision or being red are examples.) But it seems clear that the possibility of gradable properties is the very thing which enables us to keep logic two-valued. If a property is gradable, each of its grades could be expressed by a new predicate. But this seems to mean that the replies above and analogous ones are just alternative ways of saying that one of the grades of the properties applies. Thus we may say, 'That is more or less red,' when we mean that the item in question is an unnamed but determinate shade of pink. Frequently, when using the predicate
'is true' itself, we qualify it. This usage also fails to show that truth has degrees. For most of the assertions we make are complex—even when they are expressible as single sentences. Thus to say something like, 'That is almost true,' is to mean that most of what was said is true. Finally, if the assertion neither involves reference to gradable properties nor is what has been described as qualifiedly true in any clear sense complex, the description may be elliptical for a counterfactual statement such as the following:

If you made a minor (major, etc.) change in your statement, it would be true. I can, for example, change the statement that gold is a yellow metal into a truth by saying that pure gold is a yellow metal.

It seems likely that most cases of apparent appeal to degrees of truth or falsity would either fit one of the kinds of cases given or be uses of 'true' and 'false' which are not literal. The most compelling argument against bivalence rests, for this reason, not on examples from ordinary language but on challenges to its coherence in the form of sorites arguments. It is alleged that one must allow that it becomes less and less true as one removes grains that collections of grains are heaps of rice, if one is to account for the unsoundness of the argument. (Presumably that the argument is unsound and rests on its containing false premisses: Modus ponens and universal instantiation are the only inference rules used.) In contrast, those advocating bivalence must claim that at least one premiss is completely false in sorites arguments. But surely, it is objected, our intuition is that the general conditional premiss is close to true, while the claim that the collection is a heap becomes less true.

As an advocate of bivalence, I do claim that the general conditional premiss

If one carefully removes a grain of rice from a heap of rice in such a way as to minimally disturb it, one is left with a heap of rice.

is false. Further, this is because at some definite point in the argument, the words

This is a heap of rice.

cease to state a truth. It is now my duty to account for the (incorrect) intuition that some premisses using these words are "near truth" etc., to various degrees.

Note first that an appeal to sorites arguments as a justification for the ramification of borders of application and the consequent degrees of truth may itself be specious. If one wants to deny that there are sharp boundaries to our
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concepts, can it be better to claim that there are a larger finite number or an infinite number of boundaries in each comprehension? Such an appeal only gives one more changes of truth values to account for. But I will not rest my case on this tangle. I claim that globally,[17] or in the long run, a statement containing a predicate which refers inexactly is either true or false, or simply fails to have any truth value. Intuitions to the contrary involve our confusing a variation in likeness to a prototype (typical instance) of the concept with a variation in the "degrees of having the property." But the latter does not obtain.

For example, consider the following argument.[18]

Suppose that dying is at least sometimes a process involving a continuum of momentary states no one of which is the last state at which the person is alive or the first state at which the person is no longer alive. If the transition from being alive to not being alive is continuous, it seems appropriate to have a continuum of values to assign to statements that assert that someone is alive.

Later, Sanford (the author of the passage) specifies that these values should be truth values. He also notes that our powers of discrimination (sic) are finite, so that perhaps many finite truth values would be sufficient. But he has argued against having anything between a continuum of truth values and two truth values earlier (pp. 198-9) and notes, in addition, (p. 200) that we cannot say exactly how many truth values we would need. Because of the latter consideration it is simpler to have at least infinitely many values.

But Sanford's supposition of the continuous change in the satisfaction of the predicate 'is alive' seems false. Further, there seems to be no reason to say that the number of possible truth values of

Smith is alive.

should be at least as many as the number of different states Smith goes through as he ceases to be alive. But exactly this connection between states and semantic values is what must be presupposed in Sanford's ploy for an infinity of degrees of satisfaction and an infinity of truth values.

The following reasoning also seems to presuppose this connection. Sanford notes (p. 200) "two borderline cases of the same one-place predicate [e.g., 'is short'] are often definitely related one way or the other by the corresponding binary relation." If Tom and Harry are both borderline cases of 'is short,' it may nevertheless be true that Tom is shorter than Harry. ". . . the discernible difference with respect to the corresponding two-place relation makes it
appropriate to regard the two ascriptions of the vague one-place predicate as having different values. . . . The process cannot literally continue forever, but since there is no definite place where it must stop, it seems appropriate to adopt the Principle of Infinite-Value Semantics."

This second line of reasoning differs from Sanford's first only in that the different states, in addition to being discernible, as in the first case ('is alive'), are linearly orderable according to a ready-made two place predicate. The connection presupposed in both lines of reasoning might be roughly stated in the following way.

If there are a continuum of possible states "between" being A and being not A then there are continuum many possible truth values of 'S is A.'

I contend that this principle and other similar ones relating possible states and truth values in this way is false. Alleged support one might marshal for it is misleading. Firstly, one might think that if there were not continuum many possible truth values, then borderline cases should be indiscernible. But there is no reason for this. Even though S might be closer to a prototypical or even merely clear A's than some S', there is no reason to say that

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S \text{ is A}
\]

is closer to the truth (= has truth value nearer to one) than

\[
S' \text{ is A}.
\]

For, if the discernible difference in the border cases were a reason for multiplying truth values, then so would discernible differences in clear cases. But that there is more than one shade which is clearly red (to take the simplest sort of example) would never be taken to show that statements ascribing redness to objects of these different shades should have truth values which differ. It seems clear that all such statements would have truth value one—be simply true. A similar case: It should not be more (or less) true that a person 6'1" is tall than that a person 6'2" is tall. Though one is taller than the other this does not show that it is more (or less) true that one is tall. An appeal to such principles as the presupposition above seems to regard predicates as simple and unanalysable—as being satisfied by exactly one kind of thing. But most of our predicates are not of this sort.

A second and rather different alleged support underlying principles like the above one may result from introspection about one's thought processes when applying a predicate to a given example. We tend to balk at saying that at a
particular reflected wavelength a given hue ceases to be red because there seems to be no particular reason for the cut-off to be at that particular place than at any number of "nearby" spots. In other words, if forced to make a sharp border we could, but we would think that many alternatives were possible. We can equally well imagine ascribing red as well as not ascribing red to many hues.

This description of the psychology of ascription is correct up to a point. But there is more to said. It is a faulty justification to proceed from this data to the continuum of truth values. For the following forbid that hasty proceeding:

1. Each of these imagined episodes is a case of deeming the color of an object. Whether it actually is red or not is another matter. I cannot make an object red simply by declaring it so: I am a member of a large community of speakers. Thus merely that I can imagine deeming an object a certain color does not show that it is any more that color than something I do not imagine deeming that color.

2. Many episodes of deeming that something is red (or not) do contribute to the fact of whether a particular thing is truly red (or not). But most speakers are not cognizant of this history of usage and this ignorance is crucial in possible borderline cases. We cannot trust mere imaginings here: for what these imaginings are is of ways the language might have been. The language need not be such that a given object is red even if it might have been.

3. What is red can change over a long period of time. That is, the fit between "words and world" can shift as the language undergoes changes of a greater or lesser extent. This tends to happen with expressions which can refer inexacty. But the resulting variation in objects which fall under a given concept should not be confused with objects falling under the concept to various "degrees"--depending, perhaps on how often they fall under it. What has been interpreted as inexactness is often merely the natural shift in the characteristics of the language.

I am suggesting, in sum, that it is our awareness of various possibilities and changes in assigning cutoffs which has led us to many-valued semantics. But clearly, that
there are many possible cutoffs for the concept red does not imply that the possession of each of the possible shades which might have been the cutoff (had the language been otherwise) or which may become the cutoff (if the language changes) does not require actually that we assign a different truth value to ascriptions of redness to objects of these different colors.

If we accept the above points, the standard considerations (I have taken Sanford's case to be typical) do not support the claim that there should be infinitely many semantic values. A plausible construal of our actions in applying predicates preserves two truth values. If this is the present state of the argument: if there is no reason to deny two-valued semantics and if we have explanations which block attempts at denial, then its familiarity, simplicity, and understandability require it to win the argument. There may or may not be a problem about what it means for a statement to be true; but there is certainly a problem about what it means for it to have truth value n (for n taking real values between zero and one). What follows is a more detailed development of the above view of what occurs when we apply a predicate, a brief discussion of how this relates to whether the predicate applies or not[19] and a justification of the claim that most plausibly the premises in a sorites argument are simply true, false, or fail to have a truth value.

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Let $\mathcal{C}$ range over contexts as before, $\mathcal{P}$ over predicates, and $\mathcal{S}$ over speakers of the language. In $\mathcal{C}$ we suppose that $\mathcal{S}$ is to decide whether $\mathcal{P}$ applies to an object or not. Either $\mathcal{S}$ deems that $\mathcal{P}$ does apply or that it does not or deems neither or suspends judgment. For fixed $\mathcal{C}$ and $\mathcal{S}$, we get a deeming function which assigns to $\mathcal{P}$ an extension and an antiextension. This reference notion is entirely epistemic;[20] but letting $\mathcal{C}$ and $\mathcal{S}$ vary, we get a total picture of the use of $\mathcal{P}$. In a very complex manner which will certainly involve appeals to other parts of the language (where reference for these parts is determined in a similar way), the deeming functions (or total pictures of the perceived application of the expression) may help determine a global reference function: an assignment to each context of the actual extension and antiextension of $\mathcal{P}$ in that context. (I say 'may' because actual usage could be too diverse to get a coherent result.) The determination will involve considering the epistemic functions in all contexts, where the weight of the context depends on its centrality for $\mathcal{P}$ and the expertise of the speaker using $\mathcal{P}$, the state of the speaker at the time, etc. If there are relativised global functions, there may be little enough diversity in these for there to be a nonrelativised global function as well: the absolute extension and antiextension of the predicate. But
such a summation would obliterate the diachronic structure of the language and in particular would not enable one to see trends toward changes in reference. Further, to use the summation would be to make a mistake akin to that made by those who take supertruth and superfalsity to be the proper sets of truth values for statements. Only akin: the context-independent reference function is not like a complete "specification" since the extension and antiextension are not likely to exhaust the comprehension.

I find it useful to distinguish two kinds of predicates which, for the lack of more ingenious locutions, I call 'pure' and 'impure.' Some predicates, those whose application is relative to the intentions of the speaker with respect to the object in question are relatively impure. Consider 'is a table.' Whether I think that predicate is applicable to a given object depends in part on the aspect of being a table which is important to me. Thus, if I am concerned only with the object's ability to function in a certain way, a very fragile, table-like object may not be deemed by me to be a table. If I am concerned with appearances, this object may be deemed a table, while two barrels and a board, though capable of functioning as a table, may not be deemed a table. Being a table has several aspects, none of which is a necessary or sufficient condition for being a table. Thus, the property of being a table is a cluster property and only some of the appropriate conditions need apply in a given situation in order to have correct usage. Which subset of the conditions forms a necessary and sufficient condition in a given context will depend on that context—as well, of course, on how much this context is like similar contexts to which it is connected by means of the community of speakers. Further, what I deem to be a table locally will have some weight in determining what is a table more globally. And this, in turn will determine whether my particular local assessments are correct.

Now the impurity which cluster-concept predicates exhibit is found in so-called natural kind predicates—even though it may not be correct to say that the latter predicates possess a cluster definition which appropriately picks out the extension in a context. We associate a stereotype (in the sense of Putnam [21]) with a natural kind term and we may in fact discover some "essence" (tied to some explanatory theory) which things belonging to the kind share. This will be a set of necessary and sufficient conditions for belonging to the kind and will be described in some independent "theoretical" way. This empirically determined essence may also be a cluster. (For example, there are a variety of chromosomal structures which tigers can have.) But, beyond this, members of a natural kind may have some function which colors our decisions about what does or does not belong to the kind. A plant otherwise exactly like a carrot, but containing a deadly poison would probably not be deemed a carrot; whereas a plant like a carrot except for
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containing an extraneous harmless chemical would probably be deemed a carrot. If this sort of anthropocentric criterion of classification were persistent, it would help to determine the kind. [22]

If pure predicates are those for which correct application does not depend on the individual speakers' intentions for the object considered, there may be no genuinely pure predicates. The best contenders among predicates with inexact reference are perhaps the simple phenomenal predicates: 'is red,' 'is hot,' etc. The criterion for application, if it can even be called such, is simple, vague and nonverbalizable. It is also varying. An object which is deemed phenomenally cold at one time can, even though it has the same temperature, be deemed not cold or even hot, in a different context. This variation, even when extreme, is quite independent of the variation which results from impurity: Phenomenal redness is not judged to be in virtue of fulfilling any function. In contrast, things are judged to be tables largely in virtue of what they are designed to do and what they are able to do. Also, even though we use things judged to be red for particular purposes: to attract bulls, to represent political parties, to match other red things; our judgment as to whether the thing can be used for such purposes is normally subsequent to, and not coincident with or prior to our judgment that it is phenomenally red. The latter judgment is simple and non-relative. The former is made with the aid of complex comparisons.

We can make a good assessment as to whether an expression is impure or not by thinking of various kinds of hypothetical situations. In what I will call sorites experiments different results ought to parallel differences in purity. In addition, we can make use of these experiments to see an important source of our belief that inexactness ramifies. However, a proper construal of the mechanism of these experiments shows this belief false. The thought experiments I discuss may seem to test epistemic reference only; but, as I have noted, the reference of any expression is dependent upon what we, in myriad local contexts, deem to be correct reference. The structure of the sorites experiment is the following: [23] A subject is queried. An object, portion of an object, a demonstrated phenomenon, etc., is systematically varied in such a way that some predicate which is clearly applicable to it at the beginning is clearly inapplicable to it at the end (or the reverse). The changes in the sample are made as subtly as possible—consistent with practical limits of control, on the one hand, and the lack of discernment of the subject on the other. For example, in varying a table-like object, practical limits prevent us from removing or adding one molecule at a time, but, as well, the coarseness of the perceptions of the subjects in which we are interested makes such subtlety useless.
We mark stages in the changes in the object. At each stage, we query the subject by asking her if we have, say, something red or not. We would expect that subjects would require more time to make judgments about the sample at points when it is far away from prototype redness. And, in fact, in actual experiments which are, in important respects, similar to these hypothetical ones,[24] this has been a result. We interpret this as showing that the subject is doing more than simply making a straightforward judgment about what is present. The judgments are in fact comparative. As the sample changes, the subject will not view each stage as an isolated entry. She will find it difficult to look at it without remembering what the sample was previously like and, once she sees what the pattern of change is, without anticipating what it will be like. Moreover (and this will also apply in other sorts of experiments where the changes of hue are not ordered in the natural way) she will think of what the sample could be like if the situation were varied slightly. Judgments then, are partly based on these comparisons to what is not present or actual. Thus the sample may be judged red partly because it was previously red or because it is expected that in the future it will seem to be clearly red.

But this way of making judgments—by comparing the object judged to other similar objects and to an internally represented paradigm—is a way of making judgments as to what properties an object has in ordinary life. The background comparisons in the judgments can give the illusion of ramification of inexactness, because various "difficult," or possible borderline, cases have different distances from the paradigm. But we have seen above the different distances from the paradigm have no need to be mirrored in different degrees of satisfaction of the predicate. Moreover, since even clear cases may differ from each other and we do not say they satisfy the predicate to different degrees, but rather that they satisfy it in different ways, we have a reason for not attributing degrees of satisfaction to the less clear cases.

Further, the background comparisons do result in a judgment. The difference will be of conviction only. And the differences in conviction result only from the fact that the samples have different distances from a prototype. We have no reason to say that things are not simply red (or not, or are neither) because these things are discernibly different from others we might put in the same class. With more impure predicates this point becomes overwhelming. The predicates are impure because the things to which they apply (e.g.,) are quite different from each other. A robin or a sparrow may be a prototypical bird. But a swan is also a bird (period). And a penguin, though still farther from the prototype, is not thereby less a bird.

The responses of a subject in such experiments as these
are more easily interpreted for purer predicates since they vary over fewer dimensions. Yet in practice, impure predicates often have an empty boundary of application because the subjects have secondary criteria that result from the intended use of the object and that determine a sharp cutoff to the extension. With a certain vase to be sat upon it in mind, the reference of 'is a table' may be exact for a given subject in a real context. A small piece of wood may make all the difference if the table is intended to have a particular use. On the other, and this is most true in an artificial testing situation, the subject may experience additional bafflement with impure predicates because various criteria, which might determine different answers in a real-life situation, are confused.

However, if it were possible for a subject to purify her concept for the sake of the experiment—to judge tablehood only by how the object looks, for example—the result for this kind of predicate ought to be analogous to the result for predicates like 'is red.'

Note that in real situations a person does not normally make judgments about an object undergoing a sorites decomposition or accumulation.[25] An object under scrutiny will stay more or less as it is in the duration of a person's concern with it. Or alternatively, the person need not make judgments while an object changes. In order to correctly judge that a loaf of bread is done, one need not judge that it goes through various stages of undoneness.

The upshot of this is the following. Our judgments about actual objects which are "difficult cases" are made on the basis of what amounts to carrying objects, in imagination, through some of the relevant stages of appropriate sorites experiments. The stages of the experiment are conflated and viewed as stages of a single unimportantly varying object. When the variations from a prototype are seen as unimportant, the object is classed as satisfying the predicate. If they are important, it is classed as not satisfying it. And, in some cases, there may be no truth of the matter as to whether the variation is important or unimportant.

Further, note the following. If the situation does not simply involve one's making a judgment as an idle pastime, in only a negligible number of cases will there be inexactness at all. In the ordinary situation, if what is in question is whether a certain object is a table, the answer will usually be "yes" or "no," simply because we require an answer. If there threatens to be no answer and the question has been asked for some reason beyond the sake of a philosopher's experiment, an answer may be given by fiat. But even if somewhat arbitrary, such local pronouncements are a necessary and important part of the determination of reference.
The application of these observations to sorites argument premisses is obvious. Those who advocate ramification will say that it doesn't make sense to have a premiss which is true, become false (or perhaps cease to have a truth value) when only a tiny variation has occurred in the object referred to. The advocate will then point to the sequence of tiny variations as needing to be mirrored in different semantic values. They bolster this alleged need by the claim that those who advocate a sharp change in truth value could well locate the sharp change at any number of stages. We can grant that the location of the change could have been made elsewhere. But it was not. If we lack conviction about the location it is because we see these various possibilities. But first, what the location actually is is what counts. And second, any single judgment about where the cutoff is to be just doesn't count that much. What a single person says does not, by itself determine the predicate's extension. Throughout the use of the predicate, many such deemings enter the determination.

With the feathers gone from the bolster, the claim that changes in semantic values must match each of the object's changes dissolves. We can accept the sharp cutoff, understanding that its relative arbitrariness is balanced by its relative impotence.

Let me consider a possible objection to my claim against ramification. Consider the relatively pure predicate, 'is red.' Suppose the case to be one of discrimination between red and orange. The subject, if asked, will probably find some shades which are neither red nor orange. Now, if pressed further, the subject will often be able to see a difference among these cases and also among those which have been classified as red or as orange, as we have noted. Won't there be cases in which the subject will not be able to tell whether she has neither-red-nor-orange or orange? In other words, is not this apparent lack of ramification just the fault of the silent experimenter who is not allowing the subject to express all the distinctions she can make?

In reply, I note that it is very important to remember which predicate is being tested. I might leave the field open and simply ask the subject what colors she sees. In that case she may respond with as many different color words as she can appropriately use. And there may be an area of uncertainty between any two colors. If we ask her to discriminate red and orange, on the other hand, she will encounter at most one area of uncertainty. If she is asked to discriminate red, red-orange, and orange, she will possibly
have two borders or regions of indeterminacy. But this does not imply ramification in the sense which an objector would need. This is not a case in which the border between red and orange branches. It is as though, for a time, S considered a small part of the world in terms of only two colors. This simplified conceptual system will have a certain structure: that of two extensions and a boundary. At the next stage the conceptual system has three colors. If we consider our language, there will be many more concepts to be accounted for. Here, my claim that inexactness does not ramify is simply the claim that the structure of the whole system of predicates at any given time is just that of extension, antiextension, and boundary.

If this is the true structure of the reference of predicates, then the semantics for statements containing them will be one which ultimately assigns 'true' or 'false' to their occurrences. At most, some sentences in a context will fail to have any truth value.

FOOTNOTES

1. I wish to thank referees of the Philosophy Research Archives, who offered helpful criticisms. A draft of this paper was read for the May, 1979, meeting of the New Jersey Regional Philosophical Association. I am indebted to Fabrizio Mondadori, who was commentator. Further thanks are due to my colleagues, Robert Van Gulick, Peter Klein, and Martin Bunzl, who offered suggestions for revising a later draft.

2. The thesis that almost any given use of a predicate either applies to or fails to apply to the thing of which it is predicated does not conflict with the prevailing view among psychologists that our determination of the reference of a category term tends to be analogy and is based on a projection from a prototype (See, in particular, Eleanor Rosch, "Human Categorization," in Advances in Cross-Culture Psychology, Vol. 1 (London: Academic Press, 1979)) It is clear that some reds are closer in hue to a paradigm than others and that this affects the speed and outcome of our judgments about predication. But this variation need not and does not determine a difference in the truth value of statements of the form, 'this is red.'


4. In this paper I use the word 'model' to apply to a theory—for example a formal semantics—which we posit as duplicating some of the
salient structure of a phenomenon. Such a theory may have isomorphic counterparts which have distinct interpretations. The closer the natural interpretations of a theory are to the phenomenon, the better, more correct is the theory in question as a model. Thus, even though Go­guen’s or Zadeh’s and Fine’s theories may have cores which are isomor­phic to the model which I think best approximates the phenomenon, the former two may be incorrect in this sense. See my "Diachronic Semantics for Inexact Reference," The Notre Dame Journal of Formal Logic, vol. 24, number 1 (January, 1983), 67-88. (DS)

5. See DS.


7. I allude to one argument which Michael Dummett has given for his intuitionistic idealism.

8. I intend by this device to rule out referential indeterminate­ness caused by such things as the failure of presuppositions being satis­fied and by nonsensicalness.


10. See for example, Hempel, op. cit. and M. Black, "Vagueness, An Exercise in Logical Analysis," Philosophy of Science 4 (1937), 427-455.

11. The following is an answer to a criticism given by Professor Mondadori.

12. There are other difficulties in this example. It presumes some notion of some color terms being more basic than others. Other­wise, not only is there no difference in exactness between 'red-orange' and 'red' or 'orange,' there is also no difference in specificity. Which concepts are basic along a given continuum might seem to be at least culture relative—although there is some evidence that this is not so for purer concepts like color concepts. See Berlin and Kay, Basic Color Terms: Their Universality and Evolution (Berkeley: University of California Press, 1970). Only when there is a clear notion of what is varying along the continuum (as wave length varies as color changes) and there is some clear notion of refinement of partition along the continu­um, do we have a nonambiguous notion of specificity. But I believe this is so for a number of complex concepts. These are mainly those which are describable in a relatively successful science.

13. "Vagueness," Australasian Journal of Philosophy and Psychology I (1923), 84-92. For example, when he says that the possibility of knowledge varies directly with vagueness, I believe he is thinking of specificity.


15. If it is nonepistemic, the core of the supervaluation account has another fault. Sanford has noted that to say that a sentence is
true no matter how it is made precise is not to decide how truth is determined for sentences in a natural language. We do not make these precise. ("Competing Semantics of Vagueness: Many Values vs. Super Truth," Synthese 33 (1976), 206.) Though he notes that the criticism may be simple-minded, I think a deeper charge is behind it. Precisifications are neither part of the structure of our use of language nor are they explanatory useful. (Sanford advocates an infinite-valued interpretation and modal "determinacy" operators in "Borderline Logic," American Philosophical Quarterly 12, 1 (January, 1975), 29–39.)


17. The "regions" to which the words 'local' and 'global' apply are contexts which vary in time and place and possibility. The reference of a single expression may vary from one local region to another even though, in a broader sense, the expression does not change reference. Global reference is what is determined when all the evidence is in.

My talk of reference being global should not be confused with the views of Davidson, Quine, and others, which imply that the reference of a single expression is subordinate to and totally dependent upon a coherent scheme of reference for the entire language. Though I believe that the reference of an expression is dependent upon the reference of other expressions, I do not think a reference scheme for the language is prior to the reference of the expression.


19. See DS for a fuller discussion.

20. That is, the world—the truth about reference—makes no independent contribution.


22. One might argue that a kind so determined would not be natural. I only point out that some properties relevant to the reference of a kind term are dependent on we who use them. Perhaps what underlies my tendencies here is a belief that there need not be, independent of us, joints in nature.

23. A number of variations, which stem from variations in sorites arguments, are possible. See Unger, "There are no Ordinary Things," for a host of examples.

24. See Rosch, op. cit., 32.

25. There are very important exceptions to this. For example, many of us make judgments about the growth of children. But note that in such cases, if an important distinction—like coming of age—is to be made, it is usually made in a relatively arbitrary manner. Persons over
21 are, in our culture, adults, even though people do satisfy enough of the cluster of properties associated with being an adult initially at different ages.