TAKING SORITES ARGUMENTS SERIOUSLY: SOME HIDDEN COSTS

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Eubulides' argument of the heap, the sorites, has recently been resurrected as a series of arguments against the existence of a broad range of ordinary objects. Peter Unger, Samuel C. Wheeler, and Quine have urged us to take sorites arguments of this sort seriously – not only as legitimate arguments against the existence of heaps and baldness, which we might do well enough without, but also as legitimate arguments against the existence of swizzle sticks, stones, tables, people, and Peter Unger.[1] Unger and Wheeler conclude, on the basis of sorites arguments, that there are no common objects of these familiar sorts. The extent of Quine's commitment is less clear. Quine concides that we *might* choose to abandon bivalence, on which these arguments clearly rely, so as to maintain the existence of swizzle sticks and stones, people and Peter Unger. But if, with Quine, we are prone to maintain bivalence, we can do so only at the cost of denying the existence of these apparently familiar objects.

For some, the costs of taking sorites arguments seriously will already be too great. But Unger, Wheeler, and Quine are not among these. For them, sorites arguments offer the following lesson: that our ordinary vague terms are in desperate need of precise replacement. Unger, for example, proposes that our task is "not to rescue hopeless concepts from demonstrations of their inadequacy, but to aid in the development of better, precise ideas with which those concepts may be replaced."[2] What is required, Unger claims, is a "rather small" departure from common sense, although even this may involve some difficulties:

> When done properly, we have argued, descriptive semantics shows the poverty of our language and our thought and, thus, it shows the need for invention of new terms, that is, for good *prescriptive semantics*. It is quite unclear to me, however, how we should go about finding a suitable replace-

> ment, or replacements, for one of our ordinary terms, for 'log', to take a representative example. With respect to atomic removals, to cite one difficulty, at a given juncture in a given case, there are millions of removals which seem quite innocuous and favorable. The item resulting from one such does not seem any more 'loggy' than that resulting from any other of them. Which steps are to be ruled out; and why?[3]

Quine proposes precise replacement as follows:

> When we do reach the point of positing numbers and plying their laws, then is the time to heed the contradictions and to work the requisite precision into the vague terms we learned by ostension. We arbitrarily stipulate, perhaps, how few grains a heap can contain and how compactly they must be placed. What had been observation terms are arbitrarily reconstructed, on pain of paradox, as theoretical terms whose application may depend in marginal cases on protracted tests and indirect inferences. The sorites paradox is one imperative reason for precision in science, among others.[4]

In what follows I hope to argue that passages such as those above from Unger and Quine represent much too sanguine a view of our prospects if we are to take sorites arguments seriously. I do not wish to challenge sorites arguments directly, although I am not convinced that they cannot be successfully challenged. What I hope to show here, rather, is that the costs of taking sorites arguments seriously, in particular the costs with respect to hopes for precise replacement, are significantly greater than proponents of sorites arguments have estimated.

In a first section I will argue that the particular type of precise replacements proposed by Unger and Quine will not escape sorites arguments, and in a second section will argue for a similar conclusion regarding a more sophisticated variant on this type of replacement. In a third and fourth section I will consider other strategies involving other types of replacement. There I will argue that any attempt to avoid vagueness and to escape sorites arguments by way of replacement, in whatever sense, is bound to exact quite considerable costs.

I

Consider a typical sorites argument, taken from Unger:

> Here is an indirect argument to deny alleged swizzle sticks, those supposedly popular swizzle stirrers. We note that the existential supposition:

(1) There is at least one swizzle stick,

is inconsistent with the propositions we mean to express as follows:

(2) If anything is a swizzle stick, then it consists of more than one atom, but of only a finite number.

(3) If *anything* is a swizzle stick, then the net removal from it of one atom, or only a few, in a manner most innocuous and favorable, will not mean the difference as to whether or not there is a swizzle stick there.

Supposing (1) and (2), by (3) we get down below two atoms and still say that a swizzle stick is there. That contradicts (2). The only way to maintain (2) and (3), while being consistent, is to deny the existence of those sticks.[5]

We thus seem forced to deny the existence of swizzle sticks, at least if we take the argument seriously enough to maintain bivalence and to accept (2) and (3). It appears that we must also deny the existence of stones, tables and people, for it is clear that similar arguments can be constructed against these. A large range of what appear to be common terms for common objects – 'swizzle sticks', 'stone', 'table', 'person' and the like – will in fact have no application.

But if we give sorites arguments even this much credit, the situation quickly becomes much worse. This can perhaps best be illustrated by considering what terms, if any, will escape the clutches of sorites arguments.

It is widely supposed, even by proponents of sorites arguments, that there are convenient terms, precisely stipulated, against which sorites arguments will not prove effective. Vague terms fall afoul of sorites arguments, it is suppoed, but precise replacements will not. In the passages quoted above, for example, Unger ponders what precise limit to put on our replacement for 'log', and Quine proposes stipulating arbitrarily how few grains a heap can contain and how compactly they must be placed. What this suggests is that we need only introduce a few smatterings of precision in order to avoid sorites arguments. We have been forced to recognize that we cannot deal consistently with 'heaps' or 'logs'. But why not then introduce '250-grains-or-more heaps' and '$2x10^{27}$-atom logs'?

These terms, unlike their vague predecessors 'heap' and 'log', would at least initially seem to resist sorites arguments. For in order to construct an argument against the existence of $2x10^{27}$-atom logs analogous to Unger's argument against swizzle sticks above, it appears, we would need some premise such as (4):

(4) If anything is a $2x10^{27}$-atom log, then the net removal from it of one atom, or only a few, in a manner most innocuous and favorable, will not mean the difference as to whether or not there is a $2x10^{27}$-atom log there.

But (4), unlike (3), is clearly false; removal of even a single atom *will* mean the difference as to whether we have a $2x10^{27}$-atom log or not. Removal of a single grain will likewise, in some cases, make the difference between whether or not we have a 250-grains-or-more heap. Thus it appears that sorites arguments can be stopped by appeal to '$2x10^{27}$-atom logs', '250-grains-or-more heaps', and similar precisely stipulated terms, since in each case a crucial premise will be obviously false.

If denial of the existence of logs in favor of the existeince of $2x10^{27}$-atom logs and the like were the only cost of taking sorites arguments seriously, the costs would not be very great. For any supposed log in which we might be interested at any particular time is composed of some specific finite number of atoms. Thus as far as sorites arguments go there may be plenty of $1x10^{27}$-atom logs or $2x10^{27}$-and-one-atom logs, or whatever, that we can roll down the ($5x10^{34}$-atom) hill and grind up in the ($5x10^{32}$-atom) paper mill. Little will have changed. We were never overly concerned with logs which are not composed of particular numbers of atoms at particular times anyway, and thus their demonstrated non-existence by means of sorites arguments would not be much of a loss.

Sorites arguments are not to be avoided so easily, however. If w we take sorites arguments seriously, we cannot take seriously either Quine's proposed arbitrary limits on heaps or Unger's musings as to where to draw the line on logs. For sorites arguments will prove as effective against 250-grains-or-more heaps and against $2x10^{27}$-atom logs as against our more humble heaps and logs.

Consider a slight variant on Unger's argument against swizzle sticks, for example, which shows the non-existence of $5x10^{23}$-atom swizzle sticks. We first introduce the existential supposition:

(5) There is at least one $5x10^{23}$-atom swizzle stick,

and note that this is inconsisten with the following:

(6) If something is a $5x10^{23}$-atom swizzle stick, then something is a swizzle stick and is composed of $5x10^{23}$ atoms.

(2) If anything is a swizzle stick, then it consists of more than one atom, but of only a finite number,

(3) If anything is a swizzle stick, then the net removal from it of one atom, or only a few, in a manner most innocuous and favorable, will not mean the difference as to whether or not there is a swizzle stick there.

Here (2) and (3) are the premises of Unger's original argument. (6) is an added premise which seems clearly true, since a $5x10^{23}$-atom swizzle stick would be a swizzle stick, composed of $5x10^{23}$ atoms. (Challenges of premises such as (6) will be dealt with at a later point.) But if we are to maintain consistency while accepting (6), (2), and (3), then we must deny (5), and with it the existence of $5x10^{23}$-atom swizzle sticks. Simple variations on this argument would clearly force us to deny the existence of 250-grains-or-more heaps and $2x10^{27}$-atom logs as well.

We might also argue for this conclusion somewhat less directly. Our original hope was that $5x10^{23}$-atom swizzle sticks would escape sorites arguments; that a premise (2) positing the existence of at least one $5x10^{23}$-atom swizzle stick would not lead to contradiction in the way that Unger's (1), positing at least one swizzle stick, seems to. Our original hope, in other words, was that:

(7) The existence of at least one $5x10^{23}$-atom swizzle stick is consistent with (2) and (3) and the legitimate application of sorites reasoning.

But if this were true, together with the same apparently innocuous premise as before;

(6) If something is a $5x10^{23}$-atom swizzle stick, then something is a swizzle stick and is composed of $5x10^{23}$ atoms,

then we would have to conclude that:

(8) The existence of at least one swizzle stick is consistent with (2) and (3) and the legitimate application of sorites reasoning.

But the *denial* of (8) is what we have assumed in taking earlier sorites arguments seriously. Given the validity of the argument above, if we insist that (8) is false, we must renounce (6) or (7). (6) is not a likely candidate. So we must deny (7), and concede that the existence of $5x10^{23}$-atom swizzle sticks is as inconsistent with Unger's original premises and the application of sorites reasoning as is the existence of swizzle sticks *simpliciter*.[6] We must concede, in other words, that precise replacements such as '$5x10^{23}$-atom swizzle stick' fail to escape sorites arguments.

This conclusion should not be too surprising, despite the temptation to think, with Quine, that we can merely "work the requisite precision into the vague terms that we learned by ostension."[7] For if there really are no heaps, there are no heaps with precise numbers of grains, either. And if 'log' is genuinely inconsistent, we will not be able to avoid its inconsistency merely by tacking on further stipulations. So if precise replacement is to save us from sorites arguments, it will at least have to be a more thorough form of precise replacement.

II

$5x10^{23}$-atom swizzle sticks are vulnerable to sorites arguments because they are still *swizzle sticks*, and are specified using a term, 'swizzle stick', which falls victim to sorites arguments. If precise replacement is to save us from sorites arguments, then, we at least shall have to be a bit more subtle in our introduction of precision.

Let us thus attempt more careful stipulation of a precise replacement designed to escape sorites arguments. Consider first the example of heaps. A heap of hydrogen atoms would clearly fall victim to sorites arguments, and a 10^{24}-atom heap of hydrogen atoms would face the difficulties noted above. Instead, we might introduce the invented term 'geap', defined at least for hydrogen atoms as follows. A *geap* of hydrogen atoms is a group of more than 10^{24} hydrogen atoms such that each nucleus of each atom in the group is no more than $1/10^6$ of an inch from the nucleus of some other atom in the group, and such that the nucleus of no atom in the group is more than 2 inches from the nucleus of any atom in the group.[8]

It appears that we have defined 'geap' without recourse to terms such as 'heap' which easily fall victim to sorites arguments. Hydrogen atoms themselves seem to be unsuitable for decomposition by minute bits, or so we will assume, and groups of hydrogen atoms clearly have a minimum; a single hydrogen atom is insufficient for a group, though two are enough for a group of two.[9] Thus it will not be tempting to think, as a sorites argument of Unger's form against the existence of geaps of hydrogen atoms would demand, that the removal of a single atom will always leave us with a group, or a geap, of hydrogen atoms. Perhaps there are further difficulties in defining 'geaps' satisfactorily which we have not envisaged, such as the minor annoyance of moving atoms. But it seems fairly clear that a strategy of further specification could be relied on to resolve such difficulties. We might avoid problems with moving atoms, for example, either by defining 'geaps' as groups of hydrogen atoms at particular instances or by definitionally allowing atoms to move only within certain specified relational limits within a 'geap'.

Other terms might be introduced by way of similar stipulations. Cubical objects, in the vague ordinary sense of that phrase, seem likely candidates for demonstrated non-existence by means of sorites arguments. But we could introduce 'gubical objects' instead. Without actually presenting the required definitions, we can outline the following strategy.

We start, perhaps, with some standard definition of mathematically perfect cubes. 'Gubical objects' could then be defined in terms of a specific range of physical approximations to, say, 1" mathematically perfect cubes.

As a first step, we might introduce 'earthly perfect 1" gold gubical objects' as non-empty sets of gold atoms at a specified time, temperature, pressure, etc., which approximate the requirements of a 1" mathematically perfect cube as closely as is physically possible. Here further specifications would undoubtedly be required, such as specifications regarding relative weights for different variations from mathematical requirements. We might need to stipulate, for example, that a set of atoms which falls short of physically maximal solidity (construed in terms of nucleus proximity at the specified temperature, pressure, etc.) by $1/10^{10}$ of an inch in the placement of a single atom is to be judged closer to mathematical perfection than a set which falls short of edge-length or face-flatness (construed in terms of lines and planes through nuclei of outlying atoms) by a similar distance. But all of this, with patience, could be specified.

'Gubical objects' might now be defined so as to allow a specific range of variation. Something is a 1" gold gubical object, we might propose, if and only if it either is an earthly perfect 1" gold gubical object or is a non-empty set of gold atoms at the specified time, temperature, pressure, etc., which would result in an earthly perfect 1" gold gubical object by the addition of one hundred atoms or less, properly placed.

A similar definitional strategy might be outlined for 'gizzle gick', designed as a precise replacement for 'swizzle stick'. In defining 'gubical object' we started with a mathematical specification for a perfect cube. In the present case we might start with a similarly ideal 'mathematically perfect swizzloid', defined in terms of perfect spheres and rectangular solids of specified relative dimensions. Imagine, if you will, a paradigm swizzle stick. A suitable definition for 'mathematically perfect swizzloid' would be one which specifies the abstract shape of that imagined paradigm in purely mathematical terms, much as a mathematical specification of a perfect cube specifies the abstract shape of an imagined cube.

"Gizzle gicks' could now be defined in terms of a specific range of physical approximations to mathematically perfect swizzloids of, say, five inches in length. We might first define 'earthly perfect 5" plastic swizzloids' as non-empty sets of plastic molecules at a specified time, temperature, pressure, etc., which approximate the requirements of a mathematically perfect swizzloid as closely as is physically possible. Here as in the case of 'gubical object' further specifications would undoubtedly be required, but let us assume that with patience these could be included in our definition. 'Gizzle gicks' might then be defined so as to allow a specific range of variation. Something is a gizzle gick, we might propose, if and only if it either is an earthly perfect 5" plastic swizzloid or is a non-empty set of plastic molecules at the specified time, temperature, pressure, etc., which would result in an earthly 5" plastic swizzloid by the addition of one hundred molecules or less, properly placed.

By some such elaborate means, it appears, we might be able to introduce an appropriate replacement for 'swizzle stick' without using in our definitions any term against which sorites arguments will prove effective. Plastic molecules, at least of a specified kind, would not themselves seem liable to gradual decomposition in the manner of sorites arguments, and non-empty sets of such molecules have a clearly specified lower limit; one molecule or more is necessary and sufficient for a non-empty set. If we take sorites arguments seriously, we will have to do without swizzle sticks. But gizzle gicks will stir our drinks equally well.

But will even this more elaborate introduction of precision save us from sorites arguments? Perhaps not. For consider the following argument against the existence of gizzle gicks.

We start with the existential supposition that

(9) There is at least one gizzle gick,

and note that this is inconsistent with:

(10) If anything is a gizzle gick, that is sufficient for it to be a swizzle stick, in the ordinary sense of the term.[10]

(11) If anything is a swizzle stick, in the ordinary sense of the term, then, it consists of more than one atom, but of only a finite number.

(12) If anything is a swizzle stick, in the ordinary sense of the term, then the net removal from it of one atom, or only a few, in a manner most innocuous and favorable, will not mean the difference as to whether or not there is a swizzle stick there, in the ordinary sense of the term.

Here (11) and (12) differ from Unger's original (2) and (3) only in the addition of 'in the ordinary sense of the term,' which was clearly intended anyway. (10) seems at least as compelling of assent as (11) and (12). Were I to set a 1" gold gubical object (as defined above) before you now, and were I to ask you whether that object is a cubical object in the ordinary sense of the term, I think you would find it very difficult to answer sincerely in the negative. If we construct the definitions suggested above properly, we will have defined 'mathematically perfect swizzloid' on the pattern of an imagined paradigm swizzle stick, and will have defined 'gizzle gicks' in terms of sets of plastic molecules approximating closely the requirements of a mathematically perfect 5" swizzloid. So were I now to set a gizzle gick, suitably defined, before you, and were I to ask you whether that object would qualify as a swizzle stick in the ordinary sense of the term, I think you would have to answer 'yes'. Gizzle gicks have been specified in such a way that, were there such things, they would clearly qualify as swizzle sticks in the ordinary sense of the term. It *is* true that the plausibility of (10) relies on linguistic intuitions concerning 'swizzle stick'. But the same is true of (11) and (12), and of their predecessors (2) and (3). If we are to accept (2) and (3), in Unger's original argument on grounds of linguistic intuitions, there seem little reason not to extend (10) the same courtesy.

If we accept (10) through (12), however, we cannot consistently maintain (9) as well. Thus despite our care in constructing definitions with an eye to precise replacement, we must concede that there are no gizzle gicks. We can also offer a more indirect argument for the same conclusion. Our hope was that 'gizzle gick', suitably defined, unlike '5 x 10^{23}-atom swizzle stick' or 'swizzle stick', would escape sorites arguments. Our hope, in other words, was that:

(13) The existence of at least one gizzle gick is consistent with (2) and (3) and the legitimate application of sorites reasoning.

But if this were true, together with the premise suggested above:

(10) If anything is a gizzle gick, that is sufficient for it to be a swizzle stick, in the ordinary sense of the term,

then we would have to conclude that:

(14) The existence of at least one swizzle stick is consistent with (2) and (3) and the legitimate application of sorites reasoning.

In taking sorites arguments seriously, we have assumed (14) to be false. But (13) and (10) offer a valid argument for (14), so we must deny either (10) or (13). (10), for reasons given, seems a poor choice for denial. So it appears that we must deny (13). However careful we might be in defining 'gizzle gick' and the like, precise replacement of this sort does not offer an escape from sorites arguments.

III

If we accept the reasoning of the preceding sections, hopes for precise replacement of the ordinary terms which fall victim to sorites arguments seem significantly slimmer than proponents of sorites arguments have suggested. Despite Quine's talk of arbitrarily restricting 'heaps', and despite Unger's musings as to where to draw the line on 'logs', '250-grains-or-more heaps' and '2×10^{27}-atom logs' are as vulnerable to sorites arguments as are the ordinary 'heaps' and 'logs' which they are intended to replace. Our failure to find satisfactory precise replacements, moreover, does not appear to be a matter merely of our not being clever enough, or not being thorough enough, in the introduction of precision. "Geaps', 'gubical objects', and 'gizzle gicks', though carefully stipulated without recourse to 'heaps', 'cubical objects'. and the like, are still liable to attack by means of sorites arguments.

In this section and the next I want to consider some further strategies for saving hopes of precise replacement, including appeal to other notions of 'precise replacement'. Even here, I will argue, there are major costs of taking sorites arguments seriously.

What term introduced as a precise replacement *could* resist sorites arguments? On the basis of the discussion above, the only possibility seems to be a term for which no analogue of (10) in the arguments presented will hold. We would need a term, in other words, the application of which would not be sufficient for the application of 'log', 'heap', 'person', 'swizzle stick', or any of the other common terms liable to sorites arguments. Speaking somewhat more loosely of defined objects offered by way of precise replacement, we might ask what object could escape sorites arguments. Here it appears that we would need an object the existence of which would not be sufficient for the existence of a log, a heap, a person, a swizzle stick, or any of the other common objects subject to sorites arguments.

I know not what such terms or objects might be. It is at least tempting to think that any object of the general physical sort at issue must be tiny, small, medium-sized, large, enormous, or of some size in between.[11] And it is at least tempting to think that any term of the general sort at issue must, in a particular application, designate such an object. But then it is equally tempting to think that no object whatsoever of the general physical sort at issue, and no term of this sort proposed, would successfully resist sorites arguments. The existence of any object introduced would be sufficient for the existence of a tiny object, a small object, a medium-sized object, a large object, an enormous object, or an object of some size in between. But tiny objects, small objects, medium-sized objects, and the rest will clearly fall victim to sorites arguments of the form of Unger's original. No object and no term, on this argument, could meet the demands we have placed on precise replacements.

At this point we might consider an alternative strategy, however, in order to maintain hopes for precise replacement. If we accept (10) above and analogues of (10) in similar arguments, we will have to abandon 'gizzle gick' and other precise replacements. But we might choose to retain 'gizzle gick' or some other replacement term, and to maintain the existence of gizzle gicks or some other favored objects, by denying (10) or its analogues. With respect to gizzle gicks, for example, we might insist that (10) is false despite its initial plausibility; were something a gizzle gick, that would *not* be sufficient for it to be a swizzle stick in the ordinary sense of the term. For any chosen replacement, we might hold that the existence of the object at issue is *not* sufficient for the existence of any of the common objects vulnerable to sorites arguments.

I am not sure what grounds could be offered for rejecting (10) and its analogues, other than an insistence that gizzle gicks, or some other objects introduced by way of precise replacement, must be saved at any cost. A rejection of (10) and its analogues on this basis would clearly be suspicious, since it would be fully parallel to a rejection of (2) or (3) of Unger's original argument on the basis of an insistence that common objects must be saved at any cost – a move for which Unger and Wheeler have little patience. So it is not clear that there is any justification for rejecting (10) or its analogues so as to maintain the existence of favored objects introduced by way of precise replacement which would not serve equally well as a justification for rejecting the premises of Unger's original argument so as to maintain the existence of swizzle sticks, stones, and people in the first place. But let us put aside the question of an adequate justification for rejecting (10) and its analogues. *Logical* consistency, at least, could be served by a strategy of insisting on the existence of gizzle gicks or other favored objects and of denying (10) or its relevant analogues in arguments similar to those presented above.

Such a strategy, however, will still exact considerable costs. One cost of denying (10) and its analogues is this; that at least with regard to standard *logical* relations, any notion of 'precise replacement' for 'swizzle stick' has become peculiarly attenuated. In what sense is 'gizzle gick' a *replacement* for 'swizzle stick', if by denying (10) and taking sorites arguments seriously we have denied any substantial logical relation between the two? The existence of a gizzle gick, we are now maintaining, is not sufficient for the existence of a swizzle stick. If 'swizzle stick' is genuinely inconsistent, moreover – an assumption which motivated our search for precise replacements in the first place – then the existence of a swizzle stick would be sufficient for the existence of anything whatsoever, on the familiar grounds that anything follows from a contradiction. The existence of a swizzle stick would be sufficient for the existence of a geap, a gubical object, or anything else, so what isolates 'gizzle gick' rather than anything else as the promised replacement? It thus appears that by denying (10) we have severed the last logical strand between 'gizzle gick' and 'swizzle stick' which might have allowed us to speak in any standard logical sense of the former as an identifiable 'precise replacement' for the latter.

This same lack of logical connection will hold, on the strategy of denying (10) or its analogues, for any term vulnerable to sorites arguments and for any proposed replacement for it. In denying the relevant analogue of (10) we will be denying that the existence of the object introduced by way of replacement – gizzle gick, gubical object, or gerson – is sufficient for the existence of the object replaced – swizzle stick, cubical object, or person. If we hold that 'cubical object', 'person', 'stone', or other terms replaced are genuinely inconsistent, on grounds of sorites arguments, then the existence of a cubical object, person, stone, or other object replaced would be sufficient for anything. This would clearly give us no logical basis for picking out anything in particular as the desired replacement. If we are to retain a notion of identifiable 'precise replacements' at all in such cases, then, it at least cannot be a notion of replacement which requires this sort of logical relation between that which is replaced and that which is meant to replace it.

Here it should be emphasized that it is not merely a notion of precise replacement which calls for *synonyms* in place of *synonyms* that we are forced to abandon. Synonymous replacement, in this context, would have been a vain hope anyway; if 'swizzle stick' is genuinely inconsistent or incoherent, a synonym for 'swizzle stick' would be of little help in avoiding inconsistency or incoherency. What the argument above shows, however, is that we cannot allow even links of *material* sufficiency between replacement terms and the terms they are to replace.[12]

The loss of a logical notion of replacement of this sort, however, might be thought to be of little concern. For it might be held that we can speak of replacement in other terms. Perhaps we can speak of precise replacement in terms of reference, for example, rather than appealing to the disappointing logical connections above. We might thus propose that replacement terms and those which they are designed to replace are to overlap in reference, despite lack of logical connections in the sense above.

An appeal to reference does not seem adequate to save hopes of precise replacement, however. For consider the following argument. Our hope in appealing to reference was that, using 'gizzle gick' as a replacement in some referential sense, sorites arguments would fail to establish the non-existence of gizzle gicks. Our hope, in other words, was that:

> (13) The existence of at least one gizzle gick is consistent with (2) and (3) and the legitimate application of sorites reasoning.

But from (13) we could proceed as follows:

> (15) The existence of at least one referent of 'gizzle gick' is consistent with (2) and (3) and the legitimate application of sorites reasoning.
> (or: The existence of at least one of those things referred to as 'gizzle gicks' is consistent with (2) and (3) and the legitimate application of sorites reasoning.)

(16) If something is a referent of 'gizzle gick', then it is a referent of 'swizzle stick' in the ordinary use of the term.
(or: If something is referred to as a 'gizzle gick' then it is something which is referred to as a 'swizzle stick' in the ordinary use of the term.)

(17) The existence of at least one referent of 'swizzle stick' in the ordinary use of the term is consistent with (2) and (3) and the legitimate application of sorites reasoning.
(or: The existence of at least one of those things referred to as 'swizzle sticks' in the ordinary use of the term is consistent with (2) and (3) and the legitimate application of sorites reasoning.)

(18) The existence of at least one swizzle stick (employing the term in its ordinary use) is consistent with (2) and (3) and the legitimate application of sorites reasoning.

Were we to maintain overlapping reference for 'gizzle gick' and 'swizzle stick', or for any proposed replacement term and the term it is intended to replace, we would have to maintian something like (16). But then, it appears, the object introduced by way of replacement would fall victim to sorites arguments. If we take sorites arguments seriously, we must deny (18). But the argument above from (13) through to (18) appears to be valid, and transition steps (15) and (17) seem to be trivial variations on the steps which precede them. Thus if we maintain (16) we must deny (13), thereby conceding that sorites arguments hold even against the precise replacements, in some referential sense, designed to avoid them.[13]

The basic point here might also be put more simply. Taking sorites arguments seriously, there are no swizzle sticks. So 'swizzle stick' *has* no referent. If so, of course, there is no referent for any precise replacement to share. Taking sorites arguments seriously, there *is* nothing to which we refer in using 'swizzle stick' in its ordinary sense, since the ordinary sense is one in which 'swizzle stick' is used to refer to swizzle sticks, and there are none. If so, of course, it would be hopeless to ask for a precise replacement which preserves reference.[14]

Whatever it is that we are called on to do in the name of 'precise replacement', then, it cannot be something which demands (or even allows) standard logical or referential ties between replacement terms and those which they replace, or between replacement terms and any of the common terms for common objects to sorites arguments. Whatever 'precise replacement' is to amount to, it must burn both logical and referential bridges to the common talk of common objects which went before.

IV

Various appeals for 'replacement' *have* been made at various times which seem to demand neither logical nor referential ties, and we might finally turn to these in order to maintain hopes for avoiding vagueness and of escaping sorites arguments by way of 'precise replacement' in some sense.

Carnapian reduction sentences binding replacement terms or sentences to those which they replace *would* demand logical connections between the two, and precise replacement of such a form would thus fall afoul of the arguments above.[15] But Carnap also occasionally makes a more general pragmatic appeal:

> A question of the second kind concerns a language-system L which is being proposed for construction. In this case the rules of L are not given, and the problem is how to choose them. We may construct L in whatever way we wish. There is no question of right or wrong, but only a practical question of convenience or inconvenience of a system form, i.e. of its suitability for certain purposes (italics omitted).[16]

In a similar spirit, Quine proposes in *Word and Object* that a replacement sentence S′ for S must merely preserve purpose, if even that:

> . . . there is no call to think of S′ as synonymous with S. Its relation to S is just that the particular business that the speaker was on that occasion trying to get on with, with help of S among other things, can be managed well enough to suit him by using S′ instead of S. We can even let him modify his purpose under the shift, if he pleases.[17]

Quine here contrasts purpose-preserving replacement with a requirement of synonymy. For reasons noted above, logical and referential requirements much weaker than synonymy would also have to be abandoned.

As proposed solutions to difficulties of vagueness, it is ironic that in general such proposals are themselves so terribly vague. In the case of purpose-preserving replacement, for example, all that remains to offer any connection between replacement terms, sentences, or languages and what they replace is an historical continuity of our purposes and choices. S′ or L′ is a 'precise replacement' for S or L, in effect, simply in that we chose to deal with S′ or L′ after having abandoned S or L. One danger here is that proposals to avoid vagueness and to escape sorites arguments by way of precise replacement become dismally empty, amounting to little more than the vapid proposal that we should avoid vagueness and escape sorites arguments by doing some unspecified something which will avoid vagueness and escape sorites arguments.

An appeal to purpose-preserving replacement may also face further difficulties in the present case. As Michael Dummett has argued, some of our common purposes, and perhaps some of our most central purposes, *call* for vagueness, and could not be satisfied without it.[18] If so, of course, *these* major purposes could not be served or preserved by any 'precise replacements' designed to eradicate vagueness. There may also be a second and deeper difficulty. It may be that many or most of our purposes are themselves characterized, and that *those* purposes could not but be characterized, in terms subject to sorites arguments. Our purpose with regard to swizzle stick, for example, include primarily the stirring of our drinks. But 'drink' and even 'stirring' can be subjected to sorites arguments as effectively as can 'swizzle sticks'. If sorites-vulnerable vagueness infects even our *purposes* in this way, we can hardly hope to avoid vagueness and to escape sorites arguments by means of a linguistic maneuver which preserves those purposes. Instead, it appears, we would have to adopt new purposes simultaneously with a new terminology designed to satisfy them. But what new purposes are we to adopt, and why?

Let us put aside potential difficulties facing a purpose-preserving notion of replacement in particular, however. For this is not the only notion of 'precise replacement' which might be offered as an escape from vagueness and sorites arguments. We might choose to insist, for example, that replacement calls for the adoption of a totally new language, or language fragment, as a whole. Holistic replacement of this sort might not proceed term by term or sentence by sentence, and in that sense might offer no identifiable 'precise replacement' for each of the terms or sentences replaced. We might even choose to insist on a form of replacement which allows no logical, referential, purposive, or any other links between the replacement language and that which is replaced. Or we might demand only that the replacement language be structurally isomorphic to the original in some way.[19]

Any general notion of replacement offered as an escape from vagueness and sorites arguments, however, will face one final and fairly crucial difficulty – a final cost of taking sorites arguments seriously.

Whatever is to be meant by 'precise replacement', it will have to give us a language, or language fragment, which is sorites-proof; which contains no terms which are subject to sorites arguments. For this reason, as detailed above, such a language or language fragment can have no standard logical or referential connections with our sorites-vulnerable common talk of common objects.

In the absence of these types of connections, however, it appears that the language or language fragment offered as a replacement would have to be learned in its own terms, without reliance on the sorites-vulnerable language it is envisaged as replacing. As Crispin Wright has convincingly argued, however, any term must be vague, and hence vulnerable to sorites arguments, if it is to be learned by ostension. For if an expression is to be learned by ostension, it must be possible to draw attention to features which warrant its application, and those features cannot be indistinguishable from others which do not. As Wright notes, "It would be a poor joke on the recipient of an ostensive definition if the expression applied selectively among situations indistinguishable from one which was originally displayed to him as a paradigm."[20] Ostension thus demands a vague range of application – a range tolerant at least with respect to indistinguishable cases. Given such a range, however, it will always be possible to construct sorites arguments against the expression introduced by ostension, using atoms, angstroms, or other singly indistinguishable but cumulatively crucual bits. Thus none of the envisaged sorites-proof language or language fragment could be learned by ostension, either.

Without recourse at any point to either logical or referential connections with a language already learned, and without appeal to ostension at any point, it is far from clear how any sorites-proof language or language fragment offered as a replacement, in any sense of 'replacement', could be learned at all. The final cost of taking sorites arguments seriously as a mark against our common talk of common objects is that this would seem to leave us no *learnable* replacement language, in any sense of 'replacement', as an alternative.

V

I have attempted above to show some hidden costs of taking seriously recent sorites arguments against the existence of ordinary objects. Unger and Wheeler both urge us to take such arguments seriously enough to abandon common terms for common objects, and Quine's allegiance to bivalence makes him sympathetic to such a position. But Quine speaks as if a fairly simple introduction of precision, such as the arbitrary stipulation of how many grains a heap may contain, will give us sorites-proof replacements for common terms. Unger urges "rather small" revisions in common thought in a similar spirit, and considers where to draw relevant lines in the required replacements for 'log' and other terms. One hidden cost of taking sorites arguments seriously, I have argued, is that we must abandon such sanguine hopes for precise replacement. The types of replacement which Quine and Unger envisage would not escape sorites arguments. More sophisticated attempts at a similar form of replacement face the same problems. Any 'precise replacements' which *did* satisfactorily escape sorites arguments, moreover, could maintain neither standard logical nor referential ties to the common terms that they are intended to replace. And it appears finally that any adequately sorites-proof language or language fragment offered as a replacement, in any sense of 'replacement', could not even be learned.

If we are to take sorites arguments seriously, we must not merely abandon our common language or common objects. We must also abandon any hope of solving our difficulties by finding a replacement for that common language.[21]

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NOTES

1 Peter Unger, "I Do Not Exist," in *Perception and Identity*, ed. G.F. MacDonald (New York: Cornell University Press, 1979), 235–251; "There Are No Ordinary Things," *Synthese*, 41 (1979), 117–154; "Why There Are No People," *Midwest Studies in Philosophy*, IV (1979), 177–222; and "Skepticism and Nihilism," *Nous*, 14 (1980), 517–545. Samuel C. Wheeler, "On That Which Is Not," *Synthese*, 41 (1979), 155–173. W.V. Quine, "What Price Bivalence?," *Journal of Philosophy* LXXVIII (1980), 90–95. Both Unger and Wheeler use the term 'sorites arguments' to refer to adaptations of Eubulides' argument, a practice I will follow throughout.

2 Unger, "There Are No Ordinary Things," p. 128. At various times, Unger and others speak of the inadequacy of common *terms* or *expressions* and of the need for their replacement by other terms or expressions, of the inadequacy of common *concepts* or *ideas* and the need for their replacement by other concepts or ideas, and even of the need to deny or abandon common *objects* or *things* in favor of alternative objects or things 'defined with precision'. I think the argument is most clearly construed in terms of *term* inadequacy and *term* replacement, though I hope that occasional recourse in this paper to these other turns of phrase, where convenient, will be tolerated.

3 Unger, "There Are No Ordinary Things," pp. 149–150.

4 Quine, "What Price Bivalence?," p. 92.

5 Unger, "Skepticism and Nihilism," p. 519.

6 This indirect argument might be put in any of a number of forms. The simplest is perhaps the following. Our original hope was that:

(7′) Sorites arguments fail to establish the non-existence of 5×10^{23}-atom swizzle sticks.

But if this were true, together with (6):

(6) If something is a 5×10^{23}-atom swizzle stick, then something is a swizzle stick and is composed of 5×10^{23} atoms,

then we would have to conclude that:

(8′) Sorites arguments fail to establish the non-existence of swizzle sticks.

But the denial of (8′) is what we have assumed in taking earlier sorites arguments seriously. If we insist that (8′) is false, given the validity of the argument above, we must renounce (6) or (7′). (6) is not a likely candidate. So we must deny (7′), and concede that sorites arguments succeed in establishing the non-existence of 5×10^{23}-atom swizzle sticks.

This simpler form of the argument, however, uses 'fail to establish', which in at least some contexts is plausibly understood as opaque in a way which should block the argument from (7′) and (6) to (8′). We *might* simply insist that 'fail to establish' be given a *transparent* reading here. But in order to avoid confusion I have relied instead on a somewhat more cumbersome form of the argument which I think avoids this difficulty altogether.

7 Quine, "What Price Bivalence?," p. 92.

8 In a similar spirit, Unger proposes in "I Do Not Exist" that "we can define the word 'hoap', for example, so that a hoap may consist, minimally, of two items: for example, beans or grains of sand touching each other" (p. 250). 'Geap' is preferable to 'hoap' however, in that hydrogen atoms do not appear to be as easily subject to sorites arguments as do beans and grains of sand. The precise spatial relations of 'geaps' may be preferable to the vague 'touching' of 'hoaps' for similar reasons.

[9] If 'group' seems troublesome here, on the grounds that a group of two elements is less clearly a group than is a group of three or more elements, we might offer similar definitions for 'geap' using 'couples or groups of hydrogen atoms' or 'non-empty sets of hydrogen atoms.'

[10] Here we might have used instead:

> (10′) If anything is a gizzle gick, that is sufficient for something to be a swizzle stick, in the ordinary sense of the term,

which would avoid identity and is all that the argument demands. I have used (10) instead simply because it seems a more natural way of making the point.

[11] It is similarly tempting to think that any such object must be red, blue, green, or some other color, and must be at, near, a medium distance from, far, or very far from a specified point p. A similar argument would work for these.

[12] Replacement by appeal to Carnapian reduction sentences, for example, intended as an alternative to synonymy, must also be abandoned. On this see also note 15.

[13] Although I will not pursue the matter here, I think that little hangs on what notion of reference is used in the argument; hence the parenthetical variations for (15) through (17).

[14] On reference and use, see the last section of Hilary Putnam's "Models and Reality," *Journal of Symbolic Logic*, 45 (1980), 464–482.

An odd passage concerning reference and use appears in Unger's "Skepticism and Nihilism":

> . . . for a simple example, you and I might agree to use the expression 'perfectly square triangle' to refer to such tomatoes as are both yellow and sweet. But while there might be such tomatoes, we now normally suppose, and while we might thus refer to them, there will not be any perfectly square triangles. There will be entities to refer to which we use the expression 'perfectly square triangle', but there will not be any entity to which that expression actually applies (pp. 536–537).

In the spirit of this passage, one might argue that there *are* entities to which we refer using 'swizzle stick', and to which we could refer using some precise replacement, despite the inconsistency of 'swizzle stick' and the non-existence of swizzle sticks. But this would, like Unger's passage above, involve a confusion. In the artificial use indicated for 'perfectly square triangle, here, 'perfectly square triangle' is *not* an inconsistent expression; it is merely a referring phrase for sweet yellow tomatoes, and in this use has nothing to do with triangles. If we use the phrase in the artificial sense indicated, moreover, we can say that there *are* perfectly square triangles; they are listed in Burpee's catalog and include Early Golden and Golden Girl. If this artificial use of 'perfectly square triangle' is intended to parallel our ordinary use of 'swizzle stick', then, we can say that 'swizzle stick' is not inconsistent and that there are swizzle sticks. In the sense in which 'perfectly square triangle' *is* inconsistent, on the other hand, it cannot be used to refer to tomatoes or to anything else. If, taking sorites arguments seriously, we insist that 'swizzle stick' in its ordinary use is inconsistent, we must deny that anything is referred to using 'swizzle stick' in the ordinary sense just as we must deny that there are any swizzle sticks.

15 In Carnap, a reduction sentence for Q_3 is a universal sentence of the form:

$$Q_1 \supset (Q_2 \supset Q_3),$$

equivalent by exportation to

$$(Q_1 \cdot Q_2) \supset Q_3.$$

If $(Q_1 \cdot Q_2)$ is a condition expressed in the sorites-vulnerable terms to be replaced, however, it appears that sentences of this form will always hold in virtue of a false antecedent, Thus Q_3 as our 'precise replacement' could be anything whatsoever. This is the same difficulty as that noted above regarding logical connections and replacement.

A reduction pair for Q_3 is of the form:

$$Q_1 \supset (Q_2 \supset Q_3)$$

$$Q_4 \supset (Q_5 \supset \sim Q_3).$$

Once again, if $(Q_1 \cdot Q_2)$ or $(Q_4 \cdot Q_5)$ are sorites-vulnerable expressions in need of replacement, Q_3 and Q_3 may be anything whatsoever.

It is tempting on this basis to say that 'precise replacement' by means of Carnapian reduction would give us nothing in particular as 'precise replacements' for terms replaced. But this would not be quite fair to Carnap. Precisely because of difficulties with false antecedants, Carnap specifies that a universal sentence of the form

$$Q_1 \supset (Q_2 \supset Q_3)$$

is to be accounted the status of a reduction sentence *only if* '$\sim(Q_1 \cdot Q_2)$' is not valid, and that;

$$Q_1 \supset (Q_2 \supset Q_3)$$

$$Q_4 \supset (Q_5 \supset \sim Q_3)$$

is to be considered a reduction pair *only if* '$\sim [(Q_1 \cdot Q_2) \vee (Q_4 \cdot Q_5)]$' is not valid. Thus it is fairer to say not that precise replacement by way of reduction sentences would give no particular result in this case but that precise replacement by way of reduction sentences would not be possible in this case.

16 Rudolph Carnap, "Testability and Meaning," in *Readings in the Philosophy of Science*, ed. Herbert Feigl and May Brodbeck (New York: Appleton-Century-Crofts, 1953), p. 74.

17 Quine, *Word and Object* (Cambridge, Mass.: M.I.T. Press, 1960), p. 160. See also Avishai Margalit, "Vagueness in Vogue," *Synthese*, 33 (1976), 211–221.

18 See Michael Dummett, "Wang's Paradox," *Synthese*, 30 (1975), 301–324.

19 I am obliged to Marshal Spector for calling this possibility to my attention.

20 Crispin Wright, "Language Mastery and the Sorites Paradox," in *Truth and Meaning*, ed. Gareth Evans and John McDowell (New York: Oxford University Press, 1976), p. 235. Wright's argument as a whole, however, is more thorough and detailed than I have been able to indicate here.

21 For helpful comments on earlier drafts I would like to thank Rita Nolan, David Pomerantz and Kriste Taylor.