

Towards a Pragmatic Solution to the Problem of Vagueness

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Abstract

This paper examines how reference, sense, and pragmatic issues are taken to be constitutive of meaning, and argues that pragmatics has been systematically undervalued in semantical theorizing. Affording pragmatics its proper place in semantics is argued to enable a resolution of the problem of vagueness and the sorites paradox.

1.0 Language and meaning

Semantical theories examine the relationship between language and meaning. The generally accepted view (following Dummett 1975) is that meaning involves some combination of reference, sense, and pragmatics. For example, consider the two sentences below:

(S1) Marilyn Monroe was blonde.

(S2) Norma Jean was blonde.

1.1 Reference

The *reference* of a word is what that word refers to in the world. An account of reference will explain the relationship between the name ‘Marilyn Monroe’ and the object named by it, between the adjective ‘blonde’ and the set of objects which have the property of blondeness, and so on. Such an account seeks to answer the question ‘in virtue of *what* does *this* name refer to *this* object?’. A treatment might start with a simple context (say, two people pointing to a thing they can both see and introducing a name for it) and build out towards more complex cases. (Note that since sentences without language users are presumably meaningless, semantical theories tend to discuss the key relationship as being between *mind* and object, or as between *interpreted*

sentences and object, rather than simply between *word* and object.)

1.2 Sense

The *sense* of a word is what the speaker grasps. For example, (S1) and (S2) describe the same object of reference in different ways, such that it is possible to believe one but not the other. If they, or the sentences ‘Norma Jean is Marilyn Monroe’ and ‘Marilyn Monroe is Marilyn Monroe’, mean different things, then meaning must include something other than the reference, since the reference is the same: that extra component is the *sense*.

1.3 Pragmatics

Finally, *pragmatics* looks at how social context can help determine meaning. The same sentence (even referring to the same objects and with the same sense) can perform different functions depending on a range of contextual factors. For example, the sentence ‘The candidate shows excellent taste in neckties’, uttered twice by me in reference to the same person, could function as high praise in the context of a selection panel for a necktie designer, but as damning with faint praise in the context of a selection panel for a surgical position. If these different functions constitute differences in meaning, then a semantical theory needs to include pragmatics.

1.4 The role of pragmatics in determining reference has been undervalued

The tripartite division of meaning above might seem to suggest that pragmatics is distinct from reference and sense. Indeed, historically, semantical theories have been primarily the domain of philosophers who take mathematics as an ideal, and fall back on logic as an ideal where mathematics is shown to be problematic (this was for example for project of Whitehead & Russell 1910). Their examples of reference therefore tend to stretch from proper names (the paradigmatic case of reference), through picking objects from a set, to large astronomical objects (the sun, stars) and a few respectable physical kinds of things such as water and gold. Pragmatics, concerned with a more messy and complex social aspect of meaning, is seen as part of a sepa-

rate and more empirical endeavor, required to explain how language is used to perform some social tasks (such as damning with faint praise) distinct from the proper logical or set-theoretical goals of language as it ought to be. (It is telling that the author studied semantics, logic, and axiomatic mathematics as a single strand of courses in a philosophy department and towards a science degree, but had to cross to the English literature department to study a separate strand that included pragmatics and sociolinguistics – with no classmates or teaching staff in common, and towards an arts degree.)

However, this distinction seems entirely artificial. For example, for (S1), the relationship between my mind and Monroe, who died years before my birth, is a complex one. Making out, for example, a causal link between the object of reference and me, by way of explaining how I can refer successfully to her (in virtue of *what* does *this* name refer to *this* object?), would bring into view a broad community of language users and media, extended in time at least from an act of naming in 1926 through to today. The sense of the name as I grasp it centers around a 1973 pop song and a 1959 film I watched on an airline screen so poor I still have little idea what Monroe looked like – and yet I still, presumably, can be made out as referring here to Monroe. Sense and reference in the case of this unexceptional proper name seem ineluctably and messily social, which is to say, pragmatic.

The meaning of ‘blonde’ (the extension of the predicate ‘is blonde’, possession of the property of bloneness, membership in the set of blonde things), likewise, does not seem to me to be something we can divorce from a richly pragmatic context. Just as with the proper name ‘Monroe’, what I grasp as the sense of the term is a pragmatic issue that brings into view my previous encounters with it and related terms, and making out what I refer to (or, assuming I refer to some real property or set of blondness, making out in virtue of what I manage to so refer), again brings into view a broad community of language users, of how they use (apply, deny, avoid, and so on) ‘is blonde’.

This general point about how pragmatic considerations determine sense and reference is easily overlooked when dealing with sentences like ‘The Morning Star is Venus’ or an imagined utterance of ‘I call this stuff “water”’, as the tacit assumption that there are distinct objects (stars, for example)

somehow independent of our socially-mediated language or concepts is superficially credible. On this view, a messy and complex social account of how I gained the sense I have of ‘star’ or of how I come to refer to Venus in particular is unnecessary because it seems too obvious: a star is *that* kind of thing, and let’s call *that one* ‘Venus’.

This view seems unlikely to survive an encounter with a radically different human culture – let alone a non-human one – which would I think reveal that our shared agreement about the nature of ‘a star’ and of ‘this one’ is a contingent one which does depend on socially-mediated language or concepts. Imagine for example how incomprehensible ‘This star is Venus’ would be in a culture of blind diggers; or of people who view lights in the sky as glimmerings through a cloak of night and not durative objects to be individuated.

In any case, the necessary pragmatic considerations are less easily overlooked when dealing with Monroe and blondeness, when the latter in particular has a somewhat arbitrary and socially-constructed flavor. They could presumably be made more obvious yet by using words so new (and likely transitory) that we are actually consciously aware of the social processes that introduced them and continue to negotiate their proper applicability: for example, evaluating the truth of ‘Taylor Swift’s Girl Squad all Tebowed at the awards’ would require a nuanced understanding of who was and wasn’t in the ‘squad’ at the time and also what pose constitutes a Tebow, an understanding which has altered as the internet meme has developed. I suggest that making out the sense or reference of any of these terms – Venus/star, water/stuff, Monroe/person, blonde/person’s property, Taylor Swift’s Girl Squad/squad, Tebow/person’s action – necessarily involves ineluctably pragmatic considerations. Astronomical stars and girl squads are different types of things, but referring to either involves processes of social negotiation whereby we agree that each is a distinct type of thing (or action or property etc.), and how we should individuate instances of that thing, and that we shall use a particular term to refer to this instance.

2.0 The sorites paradox and the problem of vagueness

Vague predicates are characterized by being subject to sorites reasoning. To give a classic example:

(1) A man with no hairs on his head is bald.

(T) There is no number, n , such that a man with n hairs on his head is bald but a man with n' (the successor of n , $n+1$) hairs on his head is not bald.

Therefore (2) A man with a million hairs on his head is bald.

(1) is true; to claim otherwise is surely to fail to understand 'bald'. (T) looks plausible, given that the hairs are of similar distribution, color, thickness, and so on; it can presumably be made more plausible by reducing the increment from one hair to, say, an extra micrometer of hair strand. (2), though clearly false, is derived from (1) and (T).

The intuition expressed by (T) can be thought of as vague predicates being 'tolerant' or 'boundaryless' – such that tiny changes cannot make the difference between the predicate applying and not. Vague predicates are therefore to be contrasted with precise predicates, for example 'weighs under 1 kg', which have a boundary (1 kg) around which even tiny changes (in weight) could make the difference between the predicate applying and not.

Almost every empirical expression in natural language seems to be sorites-susceptible. For example, we might rerun the sorites on 'can constitute an everyday macro object' (with n standing in for number of atoms) and conclude that no number of atoms are sufficient. Or we might proceed via the contraposition of (T) from the premiss that some large number is sufficient, and conclude that even one atom can constitute an everyday macro object. Even the example above of a precise predicate – 'weighs under 1 kg' – is vague if a version of (T) that adds or removes a single atom, or a lone hadron, is accepted.

Sorites produce absurd conclusions apparently licensed by accepted standards of argument, and thus pose a serious challenge to those standards, making vagueness a major topic in the philosophy of logic and language and in

metaphysics (see for example Williamson 1994, 2007).

2.1 The sorites paradox can be reformulated logically in various ways

As an aside for logicians, this version of the sorites reaches the paradoxical conclusion through repeated applications of universal generalization, *modus ponens*, cut, and then contraction. It is worth considering a fuller version of this proof, since moves so far suppressed may be singled out as being objectionable. I will represent (I) by 'B₀'; and (T) as $\forall n(B_n \rightarrow B_{n+1})$ (equivalently $\forall n \neg(B_n \& \neg B_{n+1})$, or $\neg \exists n(B_n \& \neg B_{n+1})$).

(T) $\therefore B_0 \rightarrow B_1$	universal instantiation
$B_0 \rightarrow B_1, B_0 \therefore B_1$	<i>modus ponens</i>
$B_0, (T) \therefore B_1$	cut (transitivity)
(T) $\therefore B_1 \rightarrow B_2$	universal instantiation
$B_1 \rightarrow B_2, B_1 \therefore B_2$	<i>modus ponens</i>
$B_1, (T) \therefore B_2$	cut
$B_0, (T), (T) \therefore B_2$	cut

Repeating this entire process 500,000 times will produce:

$$B_0, (T), (T), \dots \text{ [a total of 1,000,000 instances], } (T) \therefore B_{1,000,000}$$

Using contraction to dispose of the unwanted repetitions of (T):

$$B_0, (T) \therefore B_{1,000,000}$$

However, the paradox can be reformulated to avoid each of these logical rules, making an easy logical solution to the paradox unavailable. For example, taking (T) as $\forall n \neg(B_n \& \neg B_{n+1})$, *modus ponens* can be avoided in favor of a *reductio ad absurdum*. Universal instantiation can be avoided by including as premisses instances of (T) for all required values of n; if (T) is convincing as a premiss, instances of it are more so. A series of questions ('Is a man with n hairs bald?') seems to give rise to the same paradoxical results; we must change answers at some point in defiance of the intuition expressed in (T). Premisses (I) and (T) with the Peano arithmetic induction axiom ($B_0 \& \forall n(B_n \rightarrow B_{n+1}) \rightarrow \forall n B_n$) deliver $\forall n B_n$. Conversely, the denial of this paradoxical conclusion, with premiss (I) and the least number principle, deliver $\exists n(n \geq 0 \& (B_n \& \neg B_{n+1}))$,

again in conflict with the intuition expressed in (T). And again, contraposition of (T) and the premiss that a man with million hairs on his head is not bald will yield through the same steps that a man with no hair is not bald.

2.2 The relationship of logic and language

This logical puzzle seems to me to have proved so insoluble (despite concerted efforts since the time of Aristotle) because of a mistaken view of the relationship between language and logic, leading to the aforementioned failure to accord pragmatics with its proper place in semantics. The general view of logic is that it is (in the words of Kant, worth quoting at length):

... a science *a priori* of the necessary laws of thinking, not, however, in respect of particular objects but all objects in general: it is a science, therefore, of the right use of the understanding and of reason as such, not subjectively, i.e. not according to empirical (psychological) principles of how the understanding thinks, but objectively, i.e. according to *a priori* principles of how it ought to think. (1974: 18).

On the popular view Kant here seems to be endorsing, natural language is an attempt to approach the perfect model of logic. In this case, the logical puzzle of vagueness is deeply worrying, and seemingly requires that we acknowledge that our vague natural language expressions, such as ‘bald’, are incoherent, since the sorites shows that all people are both bald and not bald – a route taken by some (see for example Dummett 1975; Eklund 2002), but leaving us with the task of explaining how natural language is useful despite being incoherent.

An alternative view of logic is that it is an idealization of our actual linguistic practice, not Kant’s ‘objective’ science of the necessary laws of reasoning. On this alternative view, logical rules or axioms (such as *modus ponens*, *reductio*, and the Peano arithmetic induction axiom mentioned above) may be powerful, useful, and revealing, but will ultimately be defeasible in the sense that we may discover aspects or contexts of our reasoning practice which clash with the logical rules or axioms, and which upon reflection, we take to reveal not incoherence in our linguistic practice, but rather a failure of those rules or axioms to correctly model our practice in that context.

As an illustrative parallel, our practice of identifying faces can be idealized as involving a small set of geometrical measurements: distance between eyes versus distance to top of lip, and so on. Such idealizations can be tremendously powerful, enabling algorithmic facial recognition despite partial obscuration or changes over time, resulting in insights into aspects of human visual processing, and even in corrections to our practice (for example, we may decide on the basis of data from the algorithm that we might have mistakenly identified someone in a photograph). That said, the discovery of human-distinct faces which are indistinguishable to the algorithm would *not* be treated as a discovery that actually these faces are indistinguishable and our practice is somehow incoherent. Rather, the discovery would show us a way in which the idealization fails to capture our actual practice. Whether the idealization should then be changed in order to capture our actual practice more faithfully would depend on the context of use. Where the idealization is unchanged, uses of the idealized practice might need to at least be made sensitive to where the idealization fails (for example, if glitter eye shadow is found to affect facial recognition in an automated passport control gate, we might add a separate initial check for it).

On this view, the logical puzzle of vagueness in conjunction with our generally unproblematic ability to identify bald and blonde people tells us that our idealization has missed something relevant in our linguistic practice, not that this practice is incoherent.

3.0 Towards a pragmatic account of meaning

3.1 The failure of set-theoretic semantics

Again since the time of Aristotle, logicians have struggled with set-theoretic semantics: with giving lists of necessary and sufficient conditions for membership in sets, which were intended to serve as the meaning of terms. On the set-theoretic view, chairs are elements with the features (say) ‘supported by legs’, ‘raised surface’, ‘designed to sit on’; baldness is presumably defined as a function of number of hairs, or volume of hair, and so on. However, all such

lists admit of counter-examples (just not to all conditions at once) – many chairs have no legs, there are ornamental chairs not designed to sit on, and so on – such that they cannot be used to identify the reference of terms (the set of all chairs).

Given also that we can correctly use terms even without the conceptual resources to understand or evaluate many of these conditions (a child, say, who can pick a chair from a furniture line-up, but may have never considered that someone made the chair, let alone what their design intention might have been), these conditions do not seem to be part of our *sense* of terms. Indeed, the difficulty of creating such lists suggests likewise: if we do chance upon a term which admits of definition through necessary and sufficient conditions, this feels like a *discovery*, not a mere explication of our practice.

To put these two points another way, the set-theoretic approach clashes with the intuition expressed in (T) that vague terms do not have a precise boundary of application, as would be the case if their semantics were based on such lists of features. So, set-theoretic semantics fails to give the reference of terms, seems largely unrelated to the sense of terms, and has a fundamental difficulty with vague terms.

3.2 An alternative view: concepts defined by prototypes

However, now unburdened by the need to fit our practice to a particular logical idealization (§2.2), we can seek an alternative account. A productive place to start is Rosch's (1978) work on 'prototypical' members of categories, which uses 'similarity [to a central prototype]' in place of necessary and sufficient conditions. This model, I think, neatly accommodates the intuition given in (T) that boundaries are *not* a part of the meaning of vague terms. That is, rather than defining the set of bald people by the edges our intuition denies exist, the set is defined by its central prototype; elements which are sufficiently similar to the prototype of 'is bald' are bald.

This model also seems to fit well with how concepts are learnt: we point to an example of baldness and name it. Teaching or learning concepts in this way requires a rich shared understanding of how the process works, for example of how examples are used (which aspect of the person pointed out as

bald comprises their baldness?). There is a rich language used to negotiate or better understand a new concept, including giving multiple examples and comparing how bald they are, helping establish what criteria of similarity baldness operates with; we indicate how prototypical examples are by using language like ‘*clearly* bald’ (prototypical), ‘*quite* bald’ (marginal but on the right continuum) or ‘*kind of* bald, but ...’ (marginal by virtue of differing from the prototype in a relevant respect).

Note that categories may have multiple prototypes. People in many communities, for example, may have one prototype of dogs (of the sole endemic breed), while the modern urbanite may be forced to have several prototypes to accommodate Chihuahuas and Rottweilers and so on; while a more general term like ‘animal’ is likely to have a large number of prototypes, mirroring the varieties of animal considered important in each context. Prototypes may presumably also be non-objects, such as functions, histories, and so on. My intuition is that an understanding of ‘chair’ requires both a form-prototype (a 3D model of a chair) and a function-prototype (something like ‘portable object for a person to sit on’). This does not mean, however, that ‘chair’ is ambiguous – we evaluate items as chairs, a single lexical item and concept, with regard to both form and function. It is, perhaps, somewhat like being a celebrity – there are a number of ways one can be a celebrity (through wealth, lifestyle, controversial actions, connection to other celebrities, social media followers, and so on), and genuinely prototypical celebrities will fit more of these than will marginal celebrities, but being a celebrity is not thereby multiply ambiguous. Objects that are sufficiently similar to both form and function prototypes are clearly chairs; objects that fit one but not the other are marginal and can be considered chairs or not chairs depending on the context (a form-perfect doll’s chair is likely not a chair in a conversation where people are looking for a portable object to sit on; a function-perfect beanbag is likely not a chair in a conversation about the evolution of the ornamented cresting rail).

Note also that prototypes may presumably be given linguistically. Indeed, in my own case at least, even prototypes I have learnt ostensibly (through an actual example) seem in some ways linguistic rather than based on an image. That is, my memory seems less like a detail-rich photograph and more

like a quick sketch or a couple of notes that can be used to imaginatively recreate an image on demand: there is, for example, a bald pate, but I would be creating details were I to add any particular face or body, or indeed color. Having once understood what continuum ‘is bald’ operates over (from shiny pate to luxuriant head of hair), irrelevant details in my mental image have fallen away until I’m no longer sure if my prototype is a linguistic description or a radically incomplete sketch. That said, my prototype images of a chair, or of a bald man, whether these are remembered as images or reconstituted from language-like cues, are credible candidates for my sense (§1.2) of ‘chair’ and ‘bald’.

Returning for a moment to our vague predicate examples, the identification of number of head hairs as the appropriate continuum on which to run a sorites for ‘is bald’ has attracted remarkably little comment in the 2400 years or so that the puzzle has been creating a literature. It seems to me that baldness is more about a gestalt lack of distributed hair volume than about numbers of hairs, such that I would be happier applying ‘is bald’ to a man with a million imperceptibly short and fine hairs than to a man with one thick frayed hair coiled across his head – though in this latter case a high wind might make me change my mind. Similar comments apply to ‘is blonde’: while candidate tiny changes for (T) presumably include a decrease in the luminance of a hair, or the addition of one eumelanin molecule to a hair, and so on, blondeness seems to be less about the number of eumelanin molecules or some kind of sum of hair luminances than about a gestalt luminance, which brings into view the overall *distribution* of pigment (reduced eumelanin in the form of adding white stripes to black hair, for example, would not constitute blondeness), and possibly attention to eyebrows, skin tone, and so on. This dissatisfaction with ‘number of hairs’ or ‘number of eumelanin molecules’ is, I think, a symptom of the failure of the project of set-theoretic semantics noted in §3.1 above – no number of hairs, or of eumelanin molecules, constitute necessary and sufficient conditions for membership of the respective sets. The problem is, again, neatly avoided by the prototype theory. I have one or more prototypes of ‘blonde’ – on reflection, probably two, a natural blonde with yellow-hued hair, and a bottle blonde with white hair and dark eyebrows – with re-

spect to which I evaluate candidate blondes. Which (if any) prototype gets primacy, and exactly how I evaluate similarity, and what degree of similarity is sufficient, depends on the context – on pragmatic issues.

3.3 Communicating and reasoning using concepts defined by prototypes

Let us consider, then, how we evaluate and use ‘John is bald’ in reasoning. With ‘is bald’ defined by a prototype (‘looking sufficiently like *this*’) rather than a precise necessary and sufficient condition (‘having less than 7,341 head hairs’), logical semanticists who believe necessary and sufficient conditions are constitutive of meaning may be concerned that in the absence of a boundary, we will be unable to judge whether a borderline John is bald; or that given the information that John is bald, we will be somehow restricted in the ways we can use this information in reasoning because we cannot locate the precise area on the continuum of baldness where John lies (as, for example, ‘John is bald, so he has between 0 and 7,340 head hairs’ would).

The short answer is presumably that having shown that necessary and sufficient conditions are *not* constitutive of meaning (§3.1), and that we have an alternative account of the meaning of concepts (§3.2), lacking such conditions is not a concern we are bound to address. Further, since our actual linguistic practice is prior to logic (§2.2), our actual linguistic practice clearly involves successfully communicating and reasoning with vague concepts, then if any work is to be done, it is to be done by the classical logicians whose idealization of our practice is thus revealed to be insufficient.

However, a sketch of a more positive answer is easy to give. Vague predicates such as ‘is bald’ apply to the set of items which are sufficiently similar to a prototype. Similarity can be evaluated in a variety of ways, and depends not only on the features of the prototype and of other related prototypes, but also on a range of pragmatic issues, including the conversational purpose and what other competing predicates are available as alternatives. That is, John may be ‘bald, *as against hairy*’, but ‘not bald, *as against balding*’; he may be bald in a conversation about hypothermia (his fine fuzz has no heat retentive value), but not bald in a conversation about hat chafing.

The methods noted above (§3.2) as used to indicate similarity to prototypicality (*clearly, quite, kind of bald*) can be used to adjust the extension of a predicate. That is, if John is not clearly bald, we do not count his hairs or in general worry about the boundaries of applicability in an attempt to decide whether he is bald or not; instead, we modify ‘bald’, or choose a different and clearly applicable term. For example, John may be clearly balding, *quite bald, thinning, or receding*, and so on. In this way, the communicative (informational) value of the utterance is maximized: ‘John is [*ceteris paribus* clearly] balding’ is more informative than ‘[It is true or borderline that] John is bald’.

Put another way, our being able to obey the general conversational maxim that we should be as informative as is required for the purposes of the exchange (Grice 1989) depends on our ability to modify vague predicates so that our utterances are *not* borderline. That is to say, all else being equal, we choose a (modified) predicate which is clearly true – is true on all reasonable variations of interpretation (of the current conversational purpose and of personal differences in prototypical similarity evaluation; in other words, of what the person I’m talking to might reasonably understand me to mean by ‘bald’ etc. in this case) – so that what is thereby communicated is not just true but clearly true.

Indeed, it is surely when there *are* precise boundaries that problems with applicability and reasoning occur. If ‘is bald’ means ‘having less than 7,341 head hairs’, we would be in the ridiculous situation of having to count hairs in order to determine the applicability of the predicate. And a not-bald John could unknowingly become bald by losing a hair in the time it takes us to perform some minor act of reasoning.

4.0 Responding to the sorites

This improved understanding of the relationship of logic and language (§2.2) and the semantics and pragmatic use of vague terms (§3) does not however, directly avoid the sorites paradox. Though the stakes no longer seem so high (the sorites indicates a problem in classical logic, not ubiquitous incoherence in our linguistic practice), we need to identify which of (I), (T), and the logical

rules used to derive the paradoxical conclusion (§2.0) are objectionable, and confirm that this solution is sufficient to the various possible formulations of the sorites (§2.1).

4.1 A response can be logically *ad hoc* but pragmatically acceptable

I believe this task is simplified by the primacy of our linguistic practice, because it is open to us to look for whatever aspect of our linguistic practice is violated by each sorites formulation. If logic were prior, we would be bound to find a logically principled and presumably singular response to the sorites; but we can now, I suggest, object to different moves in different contexts or for different formulations, just as in our linguistic practice it is open to us to respond to different communicative demands in different contexts by changing the language we use and the standards we are using to apply or judge that language.

If we grant that capable speakers would assent to (1) and deny (2), then (T) and its repeated application is the obvious target.

A prototype theorist might deny (T) outright, on the grounds that having one hair makes the man no longer prototypically bald; a man with one hair is of course highly similar to the prototype, but in the specific context of facing interrogation regarding the meaning of the term, even this similarity might not be enough to make ‘bald’ applicable. However, this strategy won’t work for all vague predicates – ‘is hairy’ is presumably clearly true at 1 million hairs, but the loss of a hair does not represent a convincing qualitative change, so a sorites paradox using a million applications of the contraposition of (T) will yield that a man with no hair is hairy. More generally, while ‘is bald’ and ‘is dark’ and ‘is quiet’ may admit of this solution (as there is a qualitative difference between perfect baldness/dark/quiet and there being some hair/light/noise), many other vague predicates will not admit of this solution and so the problem remains.

One reason (T) is convincing is that there is a pragmatic assumption that ‘is bald’ means ‘is [clearly] bald’ – because otherwise, we would say something else – and a small difference should indeed not take us from ‘[clearly] bald’ to

[clearly] not bald' (such a transition would require going through 'nearly bald' and so on first). The sorites denies us the opportunity to start equivocating at some point ('well actually maybe that's only *nearly* bald') and then, acknowledging the intuition expressed by (T), to revise some earlier answers to likewise be '*nearly* bald', and so on – in other words, to repeatedly revise our interpretation of 'is bald' in response to the changing context, which includes our previous answers, the intuition that (T), and a changing understanding of what the purpose of this strange conversation is. So, if the sorites is taken as a series of a million questions, with the classical logician pushing us to break the pragmatic rules governing the proper use of 'bald' by insisting that each question is answered with simply 'yes' or 'no', *not* with an evasion or a recast, we should feel quite unapologetic about not playing along.

4.2 Rejecting cut (transitivity)

However, the sorites in §2.0 abbreviates the steps during which such equivocation could occur: a million repeats of universal instantiation and *modus ponens* and cut followed by additional applications of cut (§2.1).

One response, then, is to reject cut, or restrict repeated application of it when reasoning about vague terms. Indiscriminability, we might note, is an intransitive relation, and (T) is credible because it represents an indiscriminable change; but chaining indiscriminable changes together can result in a discriminable change apt to change the applicability of a vague predicate.

While some formulations of the sorites may require such a response, the inductive formalization does not use cut. Proceeding to therefore reject both cut and induction feels unnecessarily radical.

4.3 Rejecting bivalence (the 'fuzzy logic' approach)

An alternative response is to take 'true' as itself a vague term admitting of degrees, taking seriously talk of 'clearly true' and 'somewhat true' and so on. This fits well with my suggestion in §3.3 that a sentence is 'clearly true' (or: completely similar to a prototype of a true sentence) when it is true on all reasonable variations of interpretation (of the current conversational purpose and of personal differences in prototypical similarity evaluation).

Degrees of truth can be formalized logically as, say, the closed interval $[0,1]$ where 0 and 1 represent perfect falsehood and perfect truth respectively, and where generalization of bivalent truth-functionality is by means of arithmetical operations on values (for example, $v(P\&Q) = \min(v(P), v(Q))$; see Cope-land 1997: 518). If (T) has a truth value of 0.9999, then each use of (T) results in a tiny drop in truth-value, such that (1) is perfectly true and (2) perfectly false. This, I think, accords well with our intuitions regarding the sorites: (T) is true for all practical purposes, the reasoning is acceptable; each step is almost perfectly convincing, each small section of steps looks quite convincing, but the series as a whole is unconvincing.

The natural fuzzy logic understanding of validity is I think that an argument is valid to the degree in which it is truth-preserving: that it, valid to degree α just in case when all its premisses are true to degree β , then its conclusion is true to degree at least $\beta - (1 - \alpha)$ (see for example Williamson 1994: 123). The sorites is thereby perfectly invalid, for the conclusion can take a value arbitrarily close to zero while the premisses take values arbitrarily close to one. *Modus ponens*, in contrast, is valid only to degree 0.5, a result which leads Williamson to reject this understanding of validity (1994: 124). However, *modus ponens* is perfectly valid in the special (classical) case of reasoning with integral truth values, and is highly valid when reasoning with formulae taking values close to integral values. This is, I suggest, appropriate: reasoning with half-truths can yield conclusions that are mostly false, and this is one more reason why we are generally at pains to say only what is clearly true (§3.3). Induction, likewise, preserves perfect truth but not nearly perfect truth, so the inductive version of the sorites fails; and the least number principle comes out as true to only degree 0.5 in the presence of non-integral truth values, so that version also fails, and so on.

4.4 Higher orders of vagueness

The consensus in the philosophical literature seems to be that a fuzzy logic response to vagueness is unacceptable because it introduces arbitrary boundaries, violating our intuition that (T), in particular where the truth of B_n switches from an integral to a non-integral value (see for example Sainsbury

1991: §4, Tye 1994: 191, Williamson 1994: 127-31, Burgess 1998: 236). A similar objection can be made to my suggestion that a sentence is 'clearly true' when it is true on all reasonable variations of interpretation. That is, while the machinery of pragmatically 'reasonable interpretations' or of fuzzy logic has avoided the need for a sharp line between true and false cases, we now need a sharp line between the 'clearly/perfectly true' cases and cases that are not clearly/perfectly true. Claiming that this boundary is also vague introduces *second-order* vagueness, and moves the objection to the sharp boundary between 'clearly clearly true' cases and 'not-clearly clearly true' cases, and so on.

However, the force of this objection is I think largely lost if linguistic practice is considered prior to logic. The notion of borderline borderline cases seems coherent: Sorenson (2010) suggests borderline hermaphrodites as a real-world example, and we can perhaps imagine talk of borderline borderline hermaphrodites. But even 'borderline hermaphrodites' is ambiguous between people who are perhaps a little too male to be hermaphrodites and people who are perhaps a little too female to be hermaphrodites; and 'borderline borderline hermaphrodites' is ambiguous between *four* groups, and so on, making it an entirely unhelpful predicate and one which we would therefore avoid.

Even merely 'borderline hermaphrodite', which Sorenson offers as an example of second-order vagueness, might be better understood as first-order vagueness. That is to say, 'hermaphrodite' does not simply mean 'borderline male-female', but rather has its own criteria of use. As a parallel, establishing a country C on the border between countries A and B does not introduce second-order vagueness: rather, A and B no longer share a border, which are now between A-C and C-B. Once C is established, that area is no longer borderline A-B, but includes an area of clear C which is thereby clearly neither A nor B.

In any case, logic is intended to model our linguistic and reasoning behavior, and there is little by way of 'higher order vagueness' behavior to be modelled, with even what was intended as a clear example of second-order vagueness liable to collapse back to first-order. We can certainly apply our chosen treatment of the logical problem of vagueness (I argue above for al-

lowing degrees of truth) to higher orders, but any infinite regress is simply a formal possibility, an artifact of the model, similar to the possibility of creating predicates like ‘clearly clearly borderline clearly bald’. Complex predicates expressing higher orders of vagueness are multiply ambiguous, communicatively unrewarding, and are avoided, but can be accommodated if necessary by both our language and our fuzzy logic model of it.

5.0 Conclusion

I have argued that pragmatic issues (how social context can help determine meaning) have been systematically undervalued in semantical theorizing (§1.4). Making out the reference or sense of terms without taking the social context into account is generally impossible, given that language is a (largely) social activity.

I have also argued that language is prior to logic, in the sense that logic is a defeasible idealization of our linguistic practice of reasoning (§2.2). While logic can *inform* our practice, logical paradoxes such as the sorites are more apt to show how logic fails to adequately model our practice than to show that our practice is broadly incoherent. Where such a failure is identified, an alternative logical model (potentially a logically *ad hoc* one for a limited context, §4.1) may be offered. Fuzzy logic offers such a model for contexts such as the sorites which appears sufficient to the range of different possible formulations of the paradox (§4.3). It is computationally more complex than classical logic, but yields classical logic as a special case where truth values are integral, which given our usual pains to say only what is clearly true, means that classical logic can be retained in most contexts. Attempts to object to the fuzzy logic model by claiming that higher-order vagueness introduces a regress of sharp boundaries are not convincing because the fuzzy logician can model as much of a regress as is necessary to accommodate our actual practice, and deny the necessity to continue the regress further (§4.4).

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