Vagueness

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Abstract. Vagueness is a fundamental, pervasive, and characteristic feature of natural language meaning. Almost every predicate whose applicability depends on gradient properties—which includes most content words in every language—exhibits vague uncertainty in borderline cases. The Sorities Paradox (the Paradox of the Heap) is the hallmark of vagueness: how can infitessimal differences add up to a qualitative change? Any adequate theory of vagueness must also explain the behavior of comparatives, interactions with discourse context, participation of vague terms in tautologies and contradictions, and higher-order vagueness. The main theories of vagueness to date include multi-valued (fuzzy) logic, supervaluation, and epistemological ignorance.

Vagueness is the name of a particular kind of uncertainty about the applicability of a predicate. The standard example of a vague predicate is the class of gradable adjectives, including *tall*. If Bill is not quite tall enough to be clearly tall, and not quite short enough to be clearly not tall, then he is a borderline case. The reluctance we feel to assert either that Bill is tall or that Bill is not tall is due to the vagueness inherent in the meaning of the word *tall*.

The Sorities Paradox (Paradox of the Heap). The tension between small changes and big consequences gives rise to the Sorities Paradox, sometimes known as the Paradox of the Heap (Kamp 1981, Williamson 1994). The paradox consists of two main premises. Base premise: Clearly, 1 grain of sand does not qualify as a heap. Inductive premise: Adding a single grain of sand is never sufficient to turn a collection of sand grains that is not a heap into one that is a heap. If we accept both of these premises, then it follows that no matter how many grains of sand are added to the first grain, the result will never be a heap. Yet eventually, if we add enough sand, there will come a point at which there is a heap, and we have arrived at a paradox.

There are many variations. Raffman (1994) imagines a progression of color chips arranged in order from clearly red to clearly yellow. Each color chip in the sequence differs in hue from the next by an amount that is significantly less than the just-perceptible-difference in for normal humans under normal circumstances. If so, then by construction, no normal human perceiver can distinguish the hues of any adjacent pair of color chips, which establishes the relevant inductive premise. Yet if the sequence is extended far enough, the endpoints will clearly

be in different color categories. This form of the paradox allows consideration of the difference between being red (a question of fact), and seeming red (a question of perception).

Vagueness is (almost) ubiquitous. Much of the research on vagueness studies gradable adjectives such as *tall*, *red*, or *fun*. An adjective is GRADABLE if it undergoes comparative formation (*taller*, *redder*, *more fun*) and superlative formation (*tallest*, *reddest*, *most fun*).

In any case, vagueness is by no means limited to gradable adjectives. Even among (arguably) non-gradable adjectives such as *circular* or *level* (*?*more circular*, ?*most level*), whether something is sufficiently circular to qualify as circular is a matter of degree, and it takes only a slight effort to coerce a non-gradable adjective into a grading context (most famously, *pregnant*, as in *She is more pregnant than I am*, meaning closer to term).

Members of other lexical categories besides adjectives can be vague. Nouns, for instance: whether an object counts as a chair depends on the degree to which it resembles or functions as a chair. Kamp and Partee (1995) discuss connections between psychological research on categorization, prototypicality, and concept formation, and linguistic compositionality issues in noun-noun compound formation such as *male nurse*, *striped apple*, or *stone lion*.

Verbs are equally susceptible to vagueness. Just how tuneless can a vocalization be and still count as singing? Similarly for prepositions (how far exactly do you have to tilt your head before your left eye is below your nose?), and adverbs. In general, any grammatical element whose contribution to truth conditions requires perception, categorization, or judgment of gradient contingent facts—including tense, aspect,

and plurality—suffers from an incurable susceptibility to vague uncertainty.

In fact, vagueness is so pervasive that it is worth remarking that there are some concepts that have no vagueness whatsoever, such as the mathematical concepts expressed by the noun *integer* or the adjective *prime*. Since a positive integer is prime if and only if it has exactly two distinct factors, any uncertainty concerning whether a number is prime can only come from uncertainty as to what its factors are. Nor is there any relevant sorities series for which any competent and alert speaker would agree to the inductive premise.

There are a number of linguistic phenomena that resemble vagueness in certain ways, including tolerance for small deviations and uncertain applicability, but arguably are distinct from vagueness. For instance, it is unclear how many kinds of birds must be capable of flight in order to justify the claim *Birds fly*, and it is similarly unclear how strongly disposed to smoke John must be in order to justify the claim *John smokes*. In these uses, *birds* names a natural kind, and *john smokes* is a characterizing sentence, both of which are usually treated as types of genericity. [Cross reference: GENERICITY.]

In addition, we can say that *Mary arrived at 3 PM* even if Mary arrived shortly before or after the stroke of 3. Likewise, we can say that *Everyone in the town was asleep* even if a small number of people were awake. Lasersohn (1999) suggests that these are instances of speaking loosely for the sake of pragmatic convenience, and argues that they behave differently than genuine vagueness.

Finally, although the prototypical vague predicates are gradable adjectives, Kennedy and McNally (to appear) argue that a subtype of gradable adjectives that they call ABSOLUTE adjectives, including *empty*

or *awake*, do not have a context-dependent standard of comparison and therefore are not vague.

Vagueness is often contagious, in the sense that complex expressions built up from vague predicates are often themselves vague as a result. For instance, if *tall* is vague, then the complex predicates *become tall*, *appear tall*, *meet a tall person* etc. will also be vague.

Comparatives, superlatives, measure phrases. Interestingly, vagueness is not always contagious. For comparative constructions such as *Bill is taller than Sue*, or *Bill is 5 centimeters taller than Sue*; for superlatives such as *Bill is the tallest person in the room*; and for measure phrases such as *Bill is two meters tall*, there is no entailment that Bill is tall, and there is no vagueness. Since in most languages the comparatives and superlatives are formed by adding suffixes such as *–er* or by means of other independent formatives, there must be some way of incorporating the vague meaning of *tall* into a more complex meanings that exhibit no vagueness. Von Stechow (1984), Klein (1991), and Kennedy (1999) survey and critique linguistic theories of comparatives that provide explanations for these facts. [Cross-reference COMPARATIVES.]

Vagueness in context. The evaluation of vague predicates is both context-dependent and context-changing. The context-dependence of vague predicates consists in at least three related but distinguishable factors: reliance on a contextual standard (threshold); reference to a comparison class; and dependence on conversational and other purposes.

Reliance on a contextual standard is typical of gradable adjectives. We can say that Bill will count as tall just in case Bill is tall at least to degree d, where d is a threshold for tallness provided by the context. At this point we are setting aside whether the threshold can ever be known precisely or with certainty, and considering instead what determines whether the tallness cutoff falls closer to 150 centimeters, 160 centimeters, etc.

For gradable adjectives at least, one important factor affecting the location of the threshold is the set of objects with respect to which the property in question is being judged, the relevant COMPARISON CLASS. What counts as a tall basketball player is different than what counts as a tall kindergarten student, which differs again from what counts as a tall mushroom. A straightforward way of capturing dependence on comparison class is to relativize the denotation of a vague predicate to a class of objects. One argument in favor of this approach is that (for some vague predicates in some situations) the comparison class can optionally be overtly specified with a *for* phrase, as in *he's tall for a basketball player*. When the comparison class argument is not overtly specified, it presumably receives its value from context.

As Graff (2000) notes, when comparison classes appear overtly, they must be natural kinds. We can say that someone is *tall for a basketball player*, since basketball players form a natural kind, but we cannot say that someone is *tall for a person in this room*, since people do not normally constitute a natural kind by virtue of occupying a particular room. Nevertheless, the objects in a room can affect the location of a vague threshold. For instance, I can tell you *Hand me the big book* in a situation in which one book is larger than the others on my desk.

Yet I might be unwilling to describe the very same book as big after a number of even larger books have been placed on my desk.

Vague predicates not only depend on context for their applicability, their use affects the context with respect to which subsequent uses of vague predicates get evaluated. In fact, vague predicates may sometimes be primary or entirely used to negotiate a suitable standard (Kyburg and Morreau 2000, Barker 2002). For instance, if I tell you that Bill is tall, you may come to know something new about Bill. That is a typical descriptive use. But if Bill's height is well known (perhaps he is standing in plain sight), then I can assert that Bill is tall as a way of informing you of what counts as tall in our community (i.e., that henceforth in our discussion that the relevant standard for tallness is less than Bill's maximal degree of height).

Vagueness versus Ambiguity. The difference in applicability of a vague predicate due to context is generally not considered as a type of lexical ambiguity. One argument supporting this claim presented in Zwicky and Sadock (1975) comes from the interaction of lexical ambiguity with VP ellipsis: if we say *Ann went to the bank and Bill did too*, then either Ann and Bill both went to a river, or they both went to a financial institution. The idea is that the meaning of the elided VP is determined after the ambiguity of lexical items such *bank* has been resolved. Even words with semantically related but distinct senses count as ambiguous by this test: it is odd to say *Bill waved, and the flag did too*, since people wave a greeting in a sense that is distinct from a flag waving in the wind. But there is no difficulty inserting a vague predicate into a VP ellipsis antecedent even if the subjects correspond to different comparison classes. Thus it is fine to say *Bill is*

tall, and his six-year old daughter is too, even though the standard for tallness is quite different for adults versus kindergarten-age children.

Logical behavior. Constructions involving vague predicates and especially scalar adjectives obey a number of logical rules that constrain what an adequate theory must explain. For instance, any theory should guarantee that if Bill is tall, then it certainly isn't the case that Bill is not tall. Furthermore, if the theory in question recognizes the existence of borderline cases, it must guarantee that Bill cannot simultaneously be tall and also borderline tall.

Particularly important from the point of view of theories of vagueness is the claim that vague predicates obey the law of the excluded middle, which says that a sentence like *Bill is tall or Bill is not tall* is valid (always true). Even if Bill is a borderline case, and we therefore do not know whether Bill is tall or not tall, many people judge that we nevertheless know that it must be the case that Bill is either tall or not tall.

Vagueness as ignorance. We have seen that when asked to apply a vague predicate to a borderline case, people experience uncertainty. Williamson diagnoses this condition as ignorance: there is a fact of the matter, we just don't know which judgment is the fact. If so, then the statement *Bill is tall* is either true or false, even if sometimes we don't know which. One way of interpreting this situation is that we have only partial understanding of the meaning of a vague predicate like *tall*, and that our knowledge of its meaning remains incomplete with respect to borderline cases. This approach has the virtue of keeping intact the theorems of classical logic, including the law of the excluded middle.

Fuzzy logic (multi-valued logic). A different, perennially popular strategy holds that truth itself a scalar concept: sentences are true to some degree. If tautologies are true to degree 1, and contradictions are true to degree 0, then contingent propositions may be true to any degree corresponding to a real number between 0 and 1. For instance, the claim that *Bill is tall* might be true to degree .76. Such theories often do not guarantee the law of the excluded middle.

Supervaluation. Van Fraassen (1966) originally proposed truth value gaps to handle presupposition failure: sentences (such as *The King of France is bald* [cross-reference PRESUPPOSITION]) whose presuppositions are not satisfied simply fail to have a truth value, in which case there is a TRUTH VALUE GAP. Kamp (1975), Fine (1975), and others applied the technique of truth value gaps to vagueness. Fine in particular proposed to account for the logical behavior of vague predicates by making a distinction between truth and "supertruth" by using using valuations and supervaluations. A valuation associates each predicate with a partial function that maps the set of individuals onto a positive extension, a negative extension, or neither (this last corresponds to borderline cases). Then a valuation maps a sentence like *Bill is tall* onto true just in case Bill is in the positive extension of *tall*; it maps the sentence onto false just in case Bill is in the negative extension of *tall*; and otherwise the sentence fails to have a truth value.

The excluded-middle sentence *Bill is tall or Bill is not tall* fails to have a truth value for any valuation for which *Bill is tall* fails to have a truth value. But sentences can be SUPERTRUE: if every way of making a valuation more precise by dividing up the borderline cases between the positive extensions and the negative extensions results in a fully precise

valuation in which the sentence comes out true, then that sentence is supertrue. For instance, no matter how we divide up the set of individuals between tall and not tall, in a fully precise valuation Bill will have to either be tall or not tall. Either way, the disjunction *Bill is tall or Bill isn't tall* will be true, so the sentence is supertrue.

Though supervaluation improves upon (most implementations of) multi-valued logic with respect to explaining the logical behavior of vague predicates, it has two main vulnerabilities: the Sorities Paradox, and higher-order vagueness.

In a supervaluation theory, it will normally be supertrue that one grain of sand is not a heap, and supertrue that a collection of 50 million grains is a heap. The explanation for why the inductive premise seems so appealing is that for any valuation that fails to be fully precise, i.e., that classifies even one element in the sorities series as a borderline case, the inductive premise comes out true. The reason is that there is no position in the sorities series where one element is in the negative extension of a predicate and the next element is in the positive extension, because there will always be a buffer of borderline cases intervening.

However, in every fully precise valuation, there will be no borderline cases (by construction). Therefore for every precise valuation, there will always be some number n such that n grains of sand is not a heap, but $n + 1$ grains of sand is a heap. This means that the following sentence is supertrue: *There is a number n of grains of sand such that n grains of sand is not a heap, but* $n+1$ *grains of sand is a heap.* This intuitively seems to contradict the inductive premise of the Sorities Paradox, which is one reason why some people remain unsatisfied with supervaluationism.

Higher-order vagueness. Fine's original supervaluation theory recognizes three crisp possibilities: a vague predicate clearly applies, it clearly fails to apply, or it clearly neither applies nor fails to apply. But just as there can be uncertainty about precisely where the border between tall and not tall falls, there can be second-order uncertainty about the boundary between clearly tall and borderline tall: is Bill clearly clearly tall, or only sort of clearly tall?

Fine (1975) and Williamson (1994, 1999) consider elaborating supervaluation theories to handle a `definitely` operator. Williamson adds a modal notion of accessibility over the class of precise valuations, so that *Bill is definitely tall* comes out as true at a world just in case *Bill is tall* is true in that world under every precise valuation accessible from that world. As long as the accessibility relation R is not both transitive and symmetric, `definitely definitely p` can receive a value different from `definitely p`, and we have higher orders of vagueness as desired. The problem then becomes finding and justifying a suitable choice for the accessibility relation R.

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