

*(Draft, September 2003. Please do not quote.)  
(Presented in the 3rd “Principia” International Symposium, 8-11 September 2003.)*

## **What is ontic vagueness?**

**Silvio Seno Chibeni**

Departamento de Filosofia – Universidade Estadual de Campinas

Caixa Postal 6110, Unicamp, 13083-970 Campinas, SP, Brasil

[chibeni@unicamp.br](mailto:chibeni@unicamp.br)

[www.unicamp.br/~chibeni](http://www.unicamp.br/~chibeni)

### *Abstract:*

There is ample divergence among students of vagueness as to what exactly should be understood by a vague object, or by ontic or metaphysical vagueness in general. In fact, the very intelligibility of the notion of a vague object has been called into question by important philosophers in the recent past, indicating that the task of finding a coherent, philosophically fertile characterization of the notion is not a simple one. This article aims to contribute to this undertaking, by identifying, examining and comparing some of the main proposals in the literature. It is suggested that we should try to characterize vague properties and relations independently of any particular view about vague objects, and then to formulate a criterion for vague objects in terms of indefinite instantiation of sharp properties. It is shown that this approach makes it easier to evaluate certain semantic-epistemic dismissive strategies concerning the possibility of there being vague objects. In particular, it is indicated that if the objects are analysed with the theoretical and conceptual resources of quantum physics (and not of classical physics, as is ordinarily done), such dismissive strategies are seriously undermined.

There is ample divergence among students of vagueness as to what exactly should be understood by a vague object, or by ontic or metaphysical vagueness in general. As is well known, in his seminal 1923 article on vagueness Bertrand Russell maintained that “[v]agueness and precision alike are characteristics which can only belong to a representation” – linguistic or mental. To attribute vagueness to the represented objects would be, according to him, to commit the “fallacy of verbalism – the fallacy that consists in mistaking the properties of words for the properties of things” (Russell 1923, p. 62, as reprinted in Keefe and Smith 1997b). Also, Michael Dummett claimed, in an often-quoted phrase, that “the notion that things might actually *be* vague, as well as being vaguely described, is not properly intelligible” (1975, p. 260, as reprinted in Dummett 1978). David Lewis agrees: “The only intelligible account of vagueness locates it in our

though or language. The reason it's vague where the outback begins is not that there's this thing, the outback, with imprecise borders; rather, there are many things, with different borders, and nobody has been fool enough to try to enforce a choice of one of them as the official referent of the word 'outback'. Vagueness is semantic indecision." (1986, p. 212).

Although nowadays the arguments against ontic vagueness put forward by Russell, Dummett, Lewis and other influential philosophers no longer deter research into the topic, the fact that the very intelligibility of the notion of a vague object has been called into question by such important thinkers indicate that the task of finding a coherent, philosophically fertile characterization of the notion is not a simple one. This article aims to contribute to this undertaking, by identifying, examining and comparing some of the main proposals in the literature.

It is difficult to characterize vagueness *in general* without prejudging the issue in favour of one or another of the main interpretations of vagueness (semantic, epistemic, ontic). Arguably, the central element in the notion is the existence of a *fuzzy boundary*. Vagueness is also commonly defined in terms of *borderline cases*.<sup>1</sup> Thus, according to the semantic interpretation, a word is vague if its meaning is not precise. Vagueness is semantic indecision, as Lewis put it. Proponents of the epistemic interpretation maintain, in their turn, that vagueness results from imprecise knowledge as to whether an object or process has a certain property, or stands in a certain relation to other objects or processes.<sup>2</sup>

As to ontic or metaphysical vagueness, a straightforward, general definition is that it is the view that, in some sense, the world itself is fuzzy. But this characterization is much too vague. The world can be understood as containing objects, properties, relations, processes, properties of properties and relations, properties of processes, etc. Undoubtedly, thoughts on, and statements about, or involving these items are usually vague. Is vagueness restricted to the mental and linguistic levels, or can it also be taken as extending to the basic ontological elements too? This paper is not intended to discuss this question, not at least directly. It addresses, rather, the issue of what can reasonably be *meant* by the assertion that some, or all, of the mentioned ontological items are vague. The present analysis will be restricted to the case of objects and first-order properties and relations. (For the sake of simplicity, 'properties' will often be taken as referring also to relations.)

---

<sup>1</sup> The existence of borderline cases follows from the existence of fuzzy boundaries, whereas the converse does not seem to hold (Keefe and Smith 1997a, pp. 15-16; see also Sainsbury 1997, sect. 5), so the definition in terms of fuzzy boundaries is more general.

<sup>2</sup> See Williamson 1994 for a recent, thorough defense of this position.

Much of the confusion surrounding the issue of ontic, or metaphysical, vagueness stems from a widespread carelessness of students to distinguish clearly vagueness of *objects* from vagueness of *properties*. When a property is predicated of an object and the resulting statement is acknowledged to be vague – i.e. indefinite in truth-value –, this vagueness may *prima facie* be either “due” to the object or to the property (leaving aside, as will always be in this paper, the trivial possibility of semantic indefiniteness). But an immediate objection may be raised to this way of putting the issue: how could we discuss objects (vague or otherwise) abstracting from their properties? This would look too metaphysical, even to those of us who aren’t much too frightened by the positivistic legacy. Of course objects cannot be fruitfully discussed in isolation from at least some of their properties. Let us begin the analysis of this issue by quoting two definitions of ontic vagueness which are totally blind to the distinction between vague objects and vague properties:

There is vagueness of this variety [metaphysical] if, for some object and some property, there is no determinate fact of the matter whether that object exemplifies that property. (Merricks 2001, p. 145)

An object *a* is vague iff it is indeterminate with respect to some property *F*: it is neither *F* nor non*F*. (Zemach 1991, p. 323)

Other authors have made a step towards making things more precise, by defining vague objects in terms of vague properties (a move that will be criticized below):

Those [...] who defend ontic or metaphysical vagueness usually take a vague object as an object whose physical properties are blurred or indeterminate. Another way of expressing this point is to say that a vague object is an object whose properties are not – as a matter of fact – all precisely specifiable or definable. (Chibeni 2004b, p. 29)

A vague object, then, can be regarded as one which has imprecise properties [...] (French and Krause 2003, p. 97)

But perhaps the most common view is that a vague object is an object whose *spatio-temporal* borders are blurred:

Then I shall classify a concrete object *o* as vague (in the ordinary sense in which Everest is vague) if, and only if, (a) *o* has borderline spatio-temporal parts and (b) there is no determinate fact of the matter about whether there are objects that are neither parts, borderline parts, or non-parts of *o*. (Tye 1990, pp. 535-6)<sup>3</sup>

A similar view emphasises the vagueness of the part-of relation, without explicit reference to the spatio-temporal properties of the object:

---

<sup>3</sup> In fairness, it should be mentioned that although this is Tye’s formal definition, he concedes, in a footnote appended to the quoted sentences, that if there can be non-spatial concrete objects “this account will need to be revised”. Unfortunately, he does not develop this important issue. For an example of a more resolute commitment to spatio-temporal properties as the root of ontic vagueness, see Rolf 1980.

[O]rdinary objects are vague because there is sometimes no saying whether one of them is part of another. (Morreau 2002, pp. 333-4)

A different account has it that ontic vagueness stems from another particular relation, namely, the *identity* relation. Much of the contemporary discussion on this account hinges on Evans's controversial one-page result against ontic vagueness (Evans 1978), which is based on a purported proof that there can be no vague identity statements containing only precise singular terms. Unfortunately, the import of the result to the issue of ontic vagueness has not been explicitly worked out by Evans. On the most popular reading, to bridge the gap from the linguistic to the ontological level Evans implicitly presupposes what Brian Garrett called the *Identity Criterion*:

[P]rovided that there are precise singular terms in a language of sufficient expressive power, there are vague objects iff there are identity statements – containing only precise singular terms – which are indeterminate in truth-value due to vagueness. (Garrett 1991, p 349)

Thus, the proposed link between vague identity and ontic vagueness in general is double. In one direction, the existence of a vague identity is taken as a sufficient condition for the existence of vague objects. This is *prima facie* plausible, given that being vague in respect of identity appears to be just a special way in which an object can be vague.<sup>4</sup> In the other direction, that condition is taken as also necessary for the existence of vague objects. Notice now that is this implication that matters for Evans's main goal: to show that there can be no vague objects in general. It is puzzling that Evans assumed, without offering any justification, this rather controversial implication. But while some authors (e.g. Keefe and Smith 1997a, p. 51, Garrett 1988) attempted to devise arguments in Evans's behalf, others claimed that these arguments are flawed (e.g. Williamson 1995, pp. 255-6, Sainsbury 1989, Heck 1998). Without going into details, the latter appear to be right: as Sainsbury remarks, “not all forms of vagueness in objects have any special connection with vagueness in identity” (1989, p. 101).

Although the other two criteria for vague objects mentioned above are not as clearly associated to a specific no-go result as the Identity Criterion,<sup>5</sup> they too may introduce a strong bias against the possibility of ontic vagueness. Take, for instance, the case of spatio-temporal vagueness. Perhaps the popularity of this account stems from the fact that when, as laymen, we think of a vague object, the image most likely to occur to us is that of an object whose *spatial* properties are

---

<sup>4</sup> But even this natural implication has been questioned in the literature; Garrett himself does not accept it.

<sup>5</sup> Notice, however, that Sorensen's (1998) detailed argument against vague objects depends crucially on defining ontic vagueness in terms of spatial properties. See Markosian 2000 for a reply.

fuzzy. Clouds and mountains, for instance, do not appear to have a precise shape or size or position. *Temporal* properties also integrate this unsophisticated notion of a vague object. We ordinarily do not take Bertrand Russell, for instance, as having precise beginning and end of existence.

As it happens, however, this kind of vagueness is easily dismissible as merely *superficial* vagueness, especially if the scientific background for the understanding of physical objects is provided by theories of classical physics.<sup>6</sup> To block this way out we may either update our scientific presuppositions, or enlarge the scope of the notion of vague object, to include properties other than spatio-temporal properties. The first alternative was explored by us elsewhere.<sup>7</sup> Here we shall briefly inquiry into the possibility of following the latter route.

When we attempt to broaden the notion of vague object, to include properties such as hotness, hardness or colour, an immediate difficulty arises, as Keefe and Smith pointed out (1997a, p. 50, footnote 47): are we really prepared to admit that an object is vague just because its *colour* is borderline red? This is rather counter-intuitive. The most natural stand would be to regard the object's colour as being, in itself, entirely precise, and to take the vagueness of the assertion that it is red as having its root in the un-sharp meaning of the word 'red' (or in the partial fuzziness of the *concept* of redness). It is easy to see that a similar puzzlement would arise with many, or perhaps most, of the usual properties common sense attributes to ordinary objects.

Faced with this difficulty, we could backtrack and try to restrict again the notion of vague object, by identifying a class of "fundamental" properties, germane to characterize ontic vagueness. The idea seems attractive, but on what criterion (or set of criteria) shall we rely? Before examining a promising recent proposal, let us give some attention to a well-known analysis of ontic vagueness by Mark Sainsbury (1989). He attempted to distinguish and formulate carefully several kinds of ontic vagueness: compositional, modal, temporal and individuating. Sainsbury's approach allows the subsumption of all these kinds of vagueness under a same formal pattern. The author does not explicitly express this pattern, but it can easily be abstracted from the inspection of a couple of cases. Take, for instance, compositional and temporal vagueness:<sup>8</sup>

---

<sup>6</sup> For the important distinction between superficial and fundamental vagueness, see Peacocke 1981, Burgess 1990, Keefe and Smith 1997a, pp. 56-57, and Hyde 1998.

<sup>7</sup> Chibeni 2004b. Details will not be repeated here, but the issue will be briefly discussed in the final paragraphs of this paper.

<sup>8</sup> 1989, p. 101; the notation is standard in the literature: '[x]' means 'x is such that', and '∇' means 'it is vague that'. For explicitness, we added the word 'object' to the first definition.

(CV)  $x$  is compositionally vague =<sub>df</sub>  $[x]$  for some object  $y \nabla$  Part-of ( $y, x$ );

(TV)  $x$  is temporally vague =<sub>df</sub>  $[x]$  for some time  $y \nabla$  Exists-at ( $y, x$ ).

Given the openness of Sainsbury's scheme, it is worth trying it to some of the paradoxical cases mentioned above. In the case of colour, for instance, it would read:

(ColourV)  $x$  is colour-vague =<sub>df</sub>  $[x]$  for some colour  $C \nabla Cx$ .

The scheme formally works, but the resulting definition appears to be intuitively unacceptable.<sup>9</sup> Why?

It is time to take stock, and to return to the suggestion made in the beginning of this article: to distinguish clearly vagueness of objects from vagueness of properties. The proposals examined thus far attempt to capture the notion of a vague object through reference to borderline cases of applicability of certain properties, but little attention is paid to the nature of these properties, and no justification is given for singling out the properties among a wide range of candidates.<sup>10</sup>

One can see that this is a sensitive point by considering a difficulty pointed out by Michael Tye (1990). After proposing that a concrete object is vague if, and only if, it has borderline spatio-temporal parts, he passes on to the case of vague properties. The initial suggestion is that a property  $P$  is vague *only if* it could have borderline instances.<sup>11</sup> Tye immediately explains why this is not also a sufficient condition. He asks us to consider the property of being 2000 feet in height. "Intuitively this is a precise property", he adds (p. 536). But this property satisfies his condition, since conceivably a concrete object with vague boundaries could constitute a borderline case of applicability of the property. The solution, Tye suggests, is to define vague properties with reference to *precise* objects only. Thus, the amended definition would be:  $P$  is vague if, and only if,

---

<sup>9</sup> We are here assuming, for the sake of argument, that the four cases explicitly considered by Sainsbury are unproblematic; but further inquiry may well reveal difficulties even in these cases.

<sup>10</sup> In his chapter on vagueness in the world, Timothy Williamson discusses the general issue of the vagueness of *universals* (1995, pp. 256 ff.). In the course of his analysis, he attempts to distinguish vagueness of properties and relations themselves from vagueness of objects, *in the sense that* the objects are such that it is vague whether certain properties and relations apply to them. However, Williamson, like others, does not examine the issue of *which* properties would be germane to this end. Furthermore, his analysis is framed in terms of the epistemic interpretation, which lies beyond the scope of the present paper.

<sup>11</sup> Here and below, we omit, for brevity, the second clauses of Tye's definitions (see the above quotation), as they are not essential for the present discussion.

it could have as a borderline instance a concrete object that does not have borderline spatio-temporal parts.

Although Tye's discussion hits on a crucially important point, the specific suggestion made by him suffers from two defects. First, there is the problem that his definition of vague object arbitrarily selects spatio-temporal properties as the exclusive locus of vagueness. Secondly, while vagueness of properties is defined in terms of vagueness of objects, the latter is not altogether independent – as the case would require – of the issue of vagueness of properties. To decide whether an object has borderline spatio-temporal parts one has to know first how it stands with respect to properties such as shape, size, duration, etc. But if the status of these latter in respect of vagueness or precision is not independently settled, one runs the risk of getting intuitively false borderline instances of vague properties.

Another proposal in the literature which pays due attention to the distinction between vague objects and vague properties had been presented a decade earlier by Bertil Rolf (1980). Rolf's technical analysis of the issue is liable, however, to similar objections. First, like Tye, Rolf also characterizes vague objects in terms of spatio-temporal properties. Secondly, Rolf's sophisticated definition of a vague property has the unwelcome (and unnoticed) consequence that precise properties can never have borderline cases! Rolf himself comments an example, without however showing any sign of dissatisfaction with it: the property of having a diameter of exactly  $1.39 \times 10^9$  meters is precise "and *so* there should be no borderline cases for it" (pp. 315-16), in conflict with common sense,<sup>12</sup> which would hold that the Sun, for instance, could well be a borderline case of the property. This problem renders the exact content of Rolf's definition of vague *objects* rather obscure.

But we have no space to examine further these works here. They are mentioned just because they have been the first to suggest that what is needed is an *independent* and *intuitively plausible* characterization of either vagueness of properties or of vagueness of objects (or both). From what we saw, it is apparent that they haven't quite succeeded in making much headway. Only recently important further progress has been made in this direction, in a forthcoming article by Gideon Rosen and Nicholas Smith (2004).

---

<sup>12</sup> As will be argued below, the view that precise properties cannot have borderline cases in the world is at odds also with contemporary physics.

A preliminary point made by the authors is that whether the world contains vague *properties* depends in part on the semantics for vague sentences. On the “fuzzy” view, a vague predicate, such as ‘tall’, is supposed to refer to a single property, tallness, which would accordingly be taken as vague too. On the supervaluationist view, however, ‘tall’ is taken as referring to an entire class of precise properties. In this case, vagueness is purely semantic; if one wished, one could eliminate or reduce it through artificial meaning delimitation. Undoubtedly, the former view is closer to common sense; but this does not, of course, constitute an inexorable philosophical argument for the existence of vague properties.

As to vague objects, Rosen and Smith begin by examining the view according to which an object is vague when it is a borderline case of a vague property. They reject this account, for essentially the reasons we indicated above, when we considered a possible extension of Sainsbury’s formula to the case of colour. As the authors remark, “not every property makes a vague object out of its borderline cases” (p. 5, preprint). Intuitively, the properties that do not serve this purpose are just the *vague* properties. How, then, can this class of properties be characterized rigorously, and independently from the definition of vague objects? This is the central issue investigated by Rosen and Smith. Their analysis is sophisticated and original, and proceeds by introducing the notion of “point property”, as a rigorous version of the common sense idea of sharp property. A simplified version of the proposed criterion is the following.

Properties are assumed to fall into categories (colours, shapes, sizes, etc.). It is assumed, furthermore, that for each category  $F$  there is a relation of exact similarity,  $\approx_F$ . The expression ‘ $P(x) = r$ ’ is taken to mean that object  $x$  has property  $P$  to degree  $r$ ,  $0 \leq r \leq 1$ . Now  $P$  is a *point-like* property in category  $F$  iff, for any objects  $x$  and  $y$ :

- (a) If  $P(x) = P(y) = 1$ , then  $\approx_F(x, y) = 1$ , and
- (b) Possibly, there is an  $x$  such that  $P(x) = 1$ .

Finally,  $P$  is a *point property* in category  $F$  iff it is point-like and satisfies the further condition:

- (c\*) There is no point-like property  $Q \neq P$  in  $F$  such that for  $x$  to be a degree-1 instance of  $P$  just is (in whole or in part) for it to be a degree- $r$  instance of  $Q$ .

Vague objects are then defined in terms of point properties. The initial formulation of the criterion – stated in advance of the above characterization of point properties – is:

for an object to be intrinsically indeterminate [i.e. vague] in respect of some category [of properties] is for it to be an intermediate instance (a borderline case) of a point property in that category, and that an object is indeterminate *sans phrase* when it is indeterminate in respect of some category. (p. 7)



Curiously, a later restatement of the criterion holds that

$x$  is indeterminate in respect of  $F$  just in case  $x$  is not a degree-1 instance of any point property in  $F$ . (p. 17)

Notice now that the two criteria are *not* logically equivalent. It is easy to see that, at least in principle, there could be objects that are vague according to the former but sharp according to the latter. It would be incumbent on the authors to argue that this important logical asymmetry does not impair the specific analysis of ontic vagueness proposed in the article. Pending this possible development, we will provisionally take the first, broader criterion to guide the remaining of our discussion. (We intend to explore the issue further in an improved version of this paper.)

It is interesting now to see how the proposed criterion fares with respect to the intuitive, common sense classification of certain properties and objects as vague or sharp. Apparently, the definition of a vague property succeeds in adequately classifying as vague (non-point) properties such as red, tall and fat, which common sense takes as vague, whereas having wavelength  $\lambda = 6550 \text{ \AA}$ , being exactly 1.8 meter tall or weighing exactly 101.2 kilograms are classified as point properties. As to vague objects, the paper curiously offers no examples, except for a brief reference to a paradigmatic case, namely, clouds. But this example is analysed in the course of the discussion of a broader, if related topic, and as a consequence some important aspects remained somewhat obscure.

We suggest the following concerning the case of clouds. Such objects are usually regarded as vague because they lack (e.g.) a precise shape. Following Rosen and Smith, we should consider here the family of shapes, constituted of an infinite number of point properties (spheres, cubes, dodecahedra, etc.). Is there one such property of which a typical cloud could constitute a borderline case? This is a very perplexing question! On the one hand, the fact that the family contains infinite members renders a negative answer strictly unprovable. Thus, one could never rigorously show that a cloud is *not* a vague object. On the other hand, a putative positive answer would also raise serious difficulties. Let us suppose that we are before a cloud that at first sight looks spherical. If we examine it more closely, however, doubts may arise as to its exact shape, because some chunks of matter neither clearly belong to the cloud nor fail to belong to it. We could then plausibly assume

that the cloud is neither spherical nor non-spherical. The condition for a vague object proposed by Rosen and Smith would then be satisfied, and the cloud declared a vague object.<sup>13</sup>

But this verdict is not irrevocable. An obstinate opponent of ontic vagueness could retort that if we go to extremes, and consider the detailed microscopic constitution of the cloud, we would end up with a perfectly sharp array of micro-constituents. Now if supplement this analysis by an appropriate semantic sharpening of the word ‘cloud’ – in terms of an exact minimum density or something of the sort – we could perhaps decide for sure whether our cloud is spherical or not (and similarly for any other point shape property).

We submit that a similar way out is possible for the other examples of vague objects usually considered in the literature (mountains, deserts, islands, cats, heaps of sand, heads of hair, etc.), *provided* that the background physical theories implicitly evoked to supplement sensorial experience are theories of *classical* physics. This is because these theories involve ontologies with perfectly sharp objects and properties, *and* obey the principle of supervenience of the macro level on the micro level. Only in contemporary physics there are theories (quantum mechanics, quantum field theory) capable of blocking the way to a semantic-epistemic defence of the thesis that all physical objects are sharp. These points have been argued in some detail by us elsewhere.<sup>14</sup> Here we just mention (omitting technical details) a simple example considered in that paper.

According to quantum mechanics, electrons (to take a stock example) are entities such that, in *most* quantum states, they are indeterminate instances not of one, but of *all* point position properties (such as lying on the  $x$  axis at exactly 1 meter from the origin of the coordinate system). Such entities are, thus, genuinely vague in a very strong sense.<sup>15</sup> Furthermore, in the mentioned article we remarked that certain important theoretical and experimental results in microphysics have strengthened this conclusion, by showing that any microphysical theory that eventually supersede quantum mechanics must (in a sense explicated in the article) incorporate the theoretical aspects leading to this extreme kind of ontic vagueness.

---

<sup>13</sup> Notice, incidentally, that if Rosen and Smith’s second statement (p. 17) of the criterion for vague objects were adopted instead, the difficulties pointed out in this paragraph would be entirely reversed. This would suffice to show that the choice between the two statements is far from immaterial.

<sup>14</sup> Chibeni 2004b. For a more detailed discussion of the violation of the principle of supervenience macro-micro by quantum mechanics, see Chibeni 2004a and 2001.

<sup>15</sup> They would be vague even according to Rosen and Smith’s second, more stringent criterion for vague objects, which requires that there should be *no* point property (in the relevant class) of which the object is a degree-1 instance.

Summing up, we believe that, at least for the time being, the best prospects for clarifying the rather intricate question asked in the title of this paper lie in the further exploration of the lines laid down by Rosen and Smith in their forthcoming paper. In a nutshell, we should try to characterize vague properties and relations independently of reference to any particular view about objects, and then formulate a criterion for vague objects in terms of indefinite instantiation of sharp properties. We believe further that, with these characterizations, the thesis that ordinary objects are vague becomes vulnerable to semantic-epistemic dismissive strategies: if the objects are analysed with the theoretical and conceptual resources of classical physics, their vagueness can be regarded as merely superficial. If, however, this scientific framework is replaced by that of quantum physics, such dismissive strategies are seriously undermined. Room is made then for genuine ontic vagueness, at both the micro and the macro levels.

## References

- Burgess, J. A.: 1990, 'Vague objects and indefinite identity', *Philosophical Studies* **59**, 263-287.
- Chibeni, S. S.: 2001, 'Indeterminacy, EPR and Bell', *European Journal of Physics* **22**, 9-15.  
(<http://www.iop.org/Journals/ej>)
- Chibeni, S. S.: 2004a, 'Holism in microphysics', *Epistemologia*, **27** (2), 227-244.  
(<http://www.tilgher.it/epistemologiae.html>)
- Chibeni, S. S.: 2004b, 'Ontic vagueness in microphysics', *Sorites*, n. 15 (December 2004), 29-41.  
([www.sorites.net](http://www.sorites.net))
- Dummett, M.: 1975, 'Wang's paradox', *Synthese* **30**, 301-24.
- Dummett, M.: 1978, *Truth and Other Enigmas*, London, Duckworth.
- Evans, G.: 1978, 'Can there be vague objects?', *Analysis* **38**, 208. Reprinted in Keefe and Smith 1997b, chap. 17.
- French, S. and D. Krause: 2003, 'Quantum vagueness', *Erkenntnis* **59**, 97-124.
- Garrett, B. J.: 1988, 'Vagueness and identity', *Analysis* **48**, 130-5.
- Garrett, B. J.: 1991, 'Vague identity and vague objects', *Noûs* **25**, 341-351.
- Heck, R. G.: 1998, 'That there might be vague objects (so far as logic is concerned)', *The Monist* **81**, 274-296.
- Hyde, D.: 1998, 'Vagueness, ontology and supervenience', *The Monist* **81**, 297-312.
- Keefe R. and P. Smith: 1997a, 'Introduction: theories of vagueness', in Keefe and Smith 1997b, pp. 1-57.

- Keefe R. and P. Smith (eds.): 1997b, *Vagueness: A Reader*, Cambridge, MA, MIT Press.
- Lewis, D.: 1986, *On the Plurality of Worlds*. Oxford, Blackwell.
- Markosian, N.: 2002, 'Sorensen's argument against vague objects', *Philosophical Studies* **97**, 1-9.
- Merricks, T.: 2001, 'Varieties of vagueness', *Philosophy and Phenomenological Research* **62**, 145-157.
- Morreau, M.: 2002, 'What vague objects are like', *The Journal of Philosophy* **99**, 333-361.
- Peacocke, C.: 1981, 'Are vague predicates incoherent?', *Synthese* **46**, 132-33.
- Rolf, B.: 1980, 'A theory of vagueness', *Journal of Philosophical Logic* **9**, 315-25.
- Rosen, G. and Smith, N. J. J.: 2004, 'Worldly indeterminacy: a rough guide'. Forthcoming in *Australasian Journal of Philosophy*. (Preprint available at: <http://www.btinternet.com/~justin.needle/index.htm> )
- Russell, B.: 1923, 'Vagueness', *Australasian Journal of Philosophy and Psychology* **1**, 84-92.  
Reprinted in Keefe and Smith 1997b, chap. 3.
- Sainsbury, R. M.: 1989, 'What is a vague object?', *Analysis* **49**, 99-103.
- Sainsbury, R. M.: 1997, 'Concepts without boundaries', in Keefe and Smith 1997b, pp. 251-64.
- Sorensen, R. A.: 1998, 'Sharp boundaries for blobs', *Philosophical Studies* **91**, 275-295.
- Tye, M.: 1990, 'Vague objects', *Mind* **99**, 535-557.
- Williamson, T.: 1994, *Vagueness*, London, Routledge.
- Zemach, E. M.: 1991, 'Vague objects', *Noûs* **25**, 323-340.