Elisa Paganini[1]

Vague Objects within Classical Logic and Standard Mereology, and without Indeterminate Identity

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Abstract

Weatherson [8] argues that whoever accepts classical logic, standard mereology and the difference between vague objects and any others, should conclude that there are no vague objects. Barnes and Williams [1] claim that a supporter of vague objects who accepts classical logic and standard mereology should recognize that the existence of vague objects implies indeterminate identity. Even though it is not clearly stated, they all seem to be committed to the assumption that reality is ultimately constituted by mereological atoms. This assumption is not granted by standard mereology which instead remains silent on whether reality is atomic or gunky; therefore, I contend that whoever maintains classical logic, standard mereology and the difference between vague objects and any others, is not forced to conclude with Weatherson that there are no vague objects; nor is she compelled to revise her point of view according to Barnes and Williams's proposal and to accept that the existence of vague objects implies indeterminate identity.

Keywords: vague objects; mereology; determinate/indeterminate identity; classical logic; Brian Weatherson; Elizabeth Barnes; J.R.G. Williams

[1] Dipartimento di filosofia, Università degli Studi di Milano, via Festa del Perdono 7, 20122 Milano, Italy

Brian Weatherson [8] presents an argument against vague objects. His line of reasoning is quite cautious: he bases his argument on assumptions he does not expect to be shared by the supporters of vague objects and he claims that whoever shares these assumptions should recognize that there are no vague objects. More specifically, Weatherson argues that whoever maintains classical logic, standard mereology and that any vague object (if there is one) is different from any other one, should conclude that there are no vague objects.

Even though Weatherson does not explicitly state it, he seems committed to the assumption that reality is ultimately constituted by mereological atoms. This assumption is not granted by standard mereology which instead remains silent on whether reality is constituted by mereological atoms or by atomless gunk. [2] Therefore, I will claim that Weatherson's is not a sound argument: even accepting classical logic, standard mereology and the difference between vague objects and any others, one of the assumptions of Weatherson's argument is not granted if reality is gunky. Before presenting my point, I will consider a different reaction to Weatherson's argument by two defenders of vague objects, Barnes and Williams [1], who claim that in order to defend the existence of vague objects within classical logic and mereology it should be maintained that the existence of vague objects implies indeterminate identity. I will argue instead that their argument is not sound either.

My exposition is organized as follows: first I give a short presentation of Weatherson [8]'s argument against vague objects (§1), then I consider Barnes and

[2] See for example Lewis ([3], p. 74): "These axioms [i.e. Transitivity, Unrestricted Composition and Uniqueness of Composition] do not settle all questions that can be raised in the language of mereology. Does Reality consist entirely of atomless gunk? Entirely of atoms? Or some of each? […] the basic axioms of mereology are silent about which of these hypotheses are true."

Williams [1]'s reaction to it (§2), and I claim that the existence of vague objects is not called into question by Weatherson's argument even if classical logic and standard mereology are adopted and if indeterminate identity is rejected (§3).

1. Weatherson's argument

Weatherson considers the African mountain Kilimanjaro (from now on, K)[3] which is supposed (for *reductio*) to be a vague object because vaguely composed; among the reasons of its indeterminate composition there is an electron around its base, called Sparky, such that it is indeterminate whether it is part of K or not. It is moreover supposed that there are two more objects, Kilimanjaro(+) and Kilimanjaro(-) (from now on, K(+) and K(-)): K(+) is defined "to be the body of land constituted … by the atoms that make up Kilimanjaro together with Sparky [and K(-) to] be the body of land constituted … by the atoms that make up Kilimanjaro other than Sparky" (McGee and McLaughlin [5], p. 129, quoted by Weatherson [8], p. 487).[4]

Now, the argument for the non existence of the vague object K is based on four assumptions: one is the adoption of classical logic, two assumptions allegedly

[3] The example is discussed in McGee [4] and McGee and McLaughlin [5].

[4] It may be useful to note that McGee and McLaughlin's definition is made in terms of "atoms", while mereology is neutral with respect to there being mereological atoms or atomless gunk. For someone looking for a more neutral presentation of K(+) and K(-), I propose to substitute the occurrences of "atoms" with "parts" in McGee and McLaughlin's definition quoted in the text. I am indebted to an anonymous referee for highlighting the importance of distancing myself from McGee and McLaughlin's definition.

It may be useful to note moreover that K(+) and K(-) are vague objects. Although K(+) determinately includes Sparky, while K(-) determinately excludes it, they share the vagueness of K for all the other parts except Sparky.

reflect mereology and one is about the relation between K, K(+) and K(-). The assumptions are the following:

1) classical logic, and in particular excluded middle, holds
2) if two things have the same parts setting aside Sparky, then they coincide if Sparky is part of both or if Sparky is part of neither[5]
3) if two things coincide, they are identical[6]
4) if there is a vague object K, K is different from K(+) and K(-)

The argument starts off with an instance of excluded middle (allowed by 1), i.e. either Sparky is part of K or it isn't. The two alternatives are then separately considered. On the one hand, if Sparky is part of K, then K coincides with K(+) (by 2) and K is identical to K(+) (by 3). On the other hand, if Sparky is not part of K, then K coincides with K(-) (by 2) and K is identical to K(-) (by 3). In either case, K is not different from K(+) and K(-) and therefore (by 4 and modus tollens) there is no vague object K. Let me put it in more schematic terms:

[5] 2) is a rewording of Weatherson's principle: "if for all x other than Sparky, x is part of y iff x is part of z, then if Sparky is part of both y and z, or part of neither y nor z, then y and z coincide" (Weatherson [8], p. 491). It is quite important to note that Weatherson's principle includes "for all x other than Sparky" and not "for all x not identical to Sparky". According to the Oxford English Dictionary, "other" means "existing besides, or distinct from, that already mentioned or implied; further, additional". This is relevant because a part of Sparky is obviously not identical to Sparky, but it is *not* other than Sparky; therefore, according to Weatherson, the domain of the universal quantifier is restricted to everything that is neither Sparky nor part of Sparky.

[6] Weatherson [8] takes into consideration some variants of assumption 3) and presents a different argument taking into consideration one of these variants. I will not consider any of these variants because my claim is independent of assumption 3).

[1] Either Sparky is part of K or it isn't	1	(ass. 1)–Excluded middle
[2] If Sparky is part of K, then K coincides with K(+)	2	(ass. 2)
[3] If K coincides with K(+), then K=K(+)	3	(ass. 3)
[4] If Sparky is part of K, then K=K(+)	2,3	2,3–Hypothetical Syllogism
[5] If Sparky is not part of K, then K coincides with K(-)	5	(ass. 2)
[6] If K coincides with K(-), then K=K(-)	6	(ass. 3)
[7] If Sparky is not part of K, then K=K(-)	5,6	5,6–Hypothetical Syllogism
[8] Either K=K(+) or K=K(-)	1,2,3,5,6	1,4,7–Constructive Dilemma
[9] If there is a vague object K, then K≠K(+) and K≠K(-)	9	(ass. 4)
[10] There is no vague object K	1,2,3,5,6,9	8,9-Modus Tollens

2. Barnes and Williams's argument

Barnes and Williams [2] argue that the defender of vague objects, who wants to maintain classical logic and mereology, should drop assumption 4) and should assume the following thesis instead:

4*) If there is a vague object K, K is indeterminately identical to K(+) and K(-)

As a matter of fact, if assumption 4) is dropped, Weatherson's argument may be put forward up to the point where it is stated that either K is identical to K(+) or K is identical to K(-) (i.e. until line [8] of the above schematic reconstruction of Weatherson's argument). Now, Barnes and Williams argue that the disjunction "Either K=K(+) or K=K(-)" is compatible with K being indeterminately identical to K(+) and to K(-) in the following way:

> "Plausibly, what it [i.e. Weatherson's argument without assumption 4)] shows is that classical logic and mereology commits the believer in vague objects to the disjunction: the vague object K is identical to K+ or identical to K-. But consistently with this, one might say there is no fact of the matter about which one it is identical to. The disjunction is determinate, but neither disjunct determinately holds." (Barnes e Williams [2], p. 179)

Their conclusion is therefore that a supporter of vague objects who accepts classical logic and mereology, should adopt 4*) and drop 4). It is quite useful to note that Barnes and Williams' argument is parasitic on Weatherson's: according to Weatherson's, 4) together with other assumptions forces us to conclude that there are no vague objects; Barnes and Williams argue that if we substitute 4) with 4*) we are not forced to this undesirable conclusion and therefore we have a reason to adopt 4*). I will claim instead that 4*) is not a necessary assumption for a defender of vague objects who adopts classical logic and standard mereology because Weatherson's argument is not sound.[7]

[7] It may be tempting to believe that Barnes and Williams could easily propose another argument (not parasitic on problematic assumptions of Weatherson's argument) for the thesis that vague objects imply indeterminate identity. Here is a proposal of such an argument by a referee: (1) Either Sparky is part of K or it is not (assumption - EM); (2) If Sparky is part of K, then K=K+ (from Weatherson's argument and not under discussion); (3) If Sparky is not part of K, then K≠K+ (as Sparky is part of K+ by definition and not of K by the antecedent of the conditional); (4) Either K=K+ or K≠K+ (by Constructive Dilemma from 1, 2 and 3). The argument is valid and sound up to this point. Then, if it is assumed that: (5) it is indeterminate which disjunct holds [in (4)]; it follows that it is indeterminate whether K=K+. As I see it, (5) presupposes what is argued for, i.e. that there is indeterminate identity. A supporter of vague objects who believes that identity is a determinate relation would not accept (5), she would probably say that K≠K+ is true and K=K+ false.

3. Vague objects within classical logic and standard mereology and without indeterminate identity

Let us now consider someone who accepts classical logic and standard mereology and who is ready to admit that if there is a vague object, it is distinct from any other. It is quite tricky to say what she accepts when she adopts standard mereology as there are well known disputes concerning its correct axioms. Nonetheless, there are certain basic principles which, even if not unquestionable, are considered to be the basis of any standard mereological theory and which depend on the idea that the relation "being part of" is reflexive, anti-symmetric and transitive.[8] Given these assumptions about the relation "being part of", one may introduce other relations among objects, for example it may be acknowledged that an object may not only be a part of another, but it may also be the case that an object overlaps another without being part of it and that an object is disjoint from another without being part of it. The idea may be roughly represented as follows:

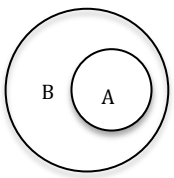

Figure 1 - A is part of B

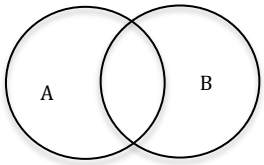

Figure 2 - A overlaps B – A is not part of B

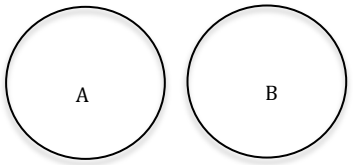

Figure 3 - A is disjoint from B – A is not part of B

Given these possible relations between objects, it is reasonable to expect that they can also be instantiated by Sparky and Kilimanjaro. In this regard, it is important to note that Sparky cannot be assumed to be a mereological atom as

[8] These principles are axioms in Casati and Varzi ([2], chapter 3, pp. 36) and in Varzi ([7], §2.2), and theorems in Simons ([6], chapter 1, p. 38).

standard mereology does not give any better reason to suppose that reality is constituted by mereological atoms than by atomless gunk.[9] Therefore, Sparky may be part of Kilimanjaro, but it may also be the case that Sparky is not part of Kilimanjaro because it overlaps Kilimanjaro or because it is disjoint from it. Suppose that Sparky is the grey figure below and the white one is constituted by all the parts of Kilimanjaro, setting aside Sparky:

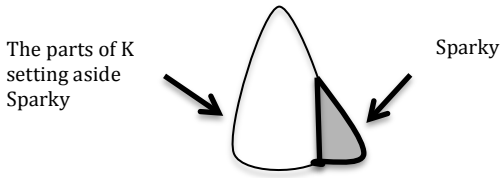

Figure 4

Sparky is part of K(+), it is disjoint from K(-), but it may also overlap an object K* without being part of it.[10] The situations may be graphically represented as follows:

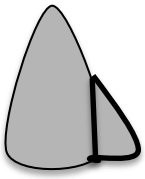

Figure 5 - Sparky is part of K(+)

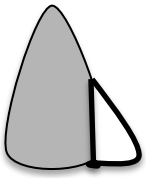

Figure 6 - Sparky is disjoint from K(-) – Sparky is not part of K(-)

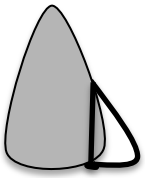

Figure 7 - Sparky overlaps K* - Sparky is not part of K*

Given these possible mereological relations, let us now reconsider Weatherson's assumption 2) i.e.:

[9] By the way, Sparky is assumed by Weatherson to be an electron. And it is not clear weather an electron is a mereological atom.

[10] Note that Sparky, K(+), K(-) and K* are not assumed to be precise, they may well be vague. Do not be misled by figures 5-7 below where mereological relations are represented, it is not to be inferred from them that the represented objects have precise boundaries or precise composition.

2) if two things have the same parts, setting aside Sparky, then they coincide if Sparky is part of both or if Sparky is part of neither

Let us keep in mind K(+), K(-) and K*. It is the case that K(+), K(-) and K* have the same parts, setting aside Sparky, and therefore they satisfy the antecedent of the conditional. It is moreover evident that if Sparky is part of two of these objects, they coincide (they actually coincide with K(+)). But it is not the case that if Sparky is not part of two of these objects, then they coincide: although Sparky is neither part of K(-) nor of K*, K(-) and K* do not coincide. In general, it is not the case that if an object is not part of another, then it is disjoint from it, it may well overlap it. It is therefore shown that 2) cannot be granted by standard mereology. A more reasonable substitute of assumption 2) seems to be the following:

2*) if two things have the same parts, setting aside Sparky, then they coincide if Sparky is part of both or if Sparky is *disjoint from both*.[11]

Now, if 2) is granted to be inadequate by standard mereology, whether it is substituted by 2*) or not, Weatherson's argument is not sound. Let us reconsider the argument substituting 2) with 2*). The assumptions are the following:

1) classical logic, and in particular excluded middle, holds

[11] An even better formulation is the following: "if two things have the same parts, setting aside Sparky, then they coincide if and only if every part of Sparky that is part of one is part of the other, and vice versa." I am indebted to Achille Varzi for suggesting this to me. I stick to 2*) in the text because it better suits the second step (i.e. [2]) of Weatherson's argument.

2*) if two things have the same parts, setting aside Sparky, then they coincide if Sparky is part of both or if Sparky is disjoint from both

3) if two things coincide, they are identical

4) if there is a vague object K, K is different from K(+) and K(-)

Let us now reconsider the argument:

[1] Either Sparky is part of K or it isn't	1	(ass. 1)–Excluded middle
[2] If Sparky is part of K, then K coincides with K(+)	2	(ass. 2*)
[3] If K coincides with K(+), then K=K(+)	3	(ass. 3)
[4] If Sparky is part of K, then K=K(+)	2,3	2,3–Hypothetical Syllogism
[5] If Sparky is not part of K, then K coincides with K(-)	5	?
[6] If K coincides with K(-), then K=K(-)	6	(ass. 3)
[7] If Sparky is not part of K, then K=K(-)	5,6	5,6–Hypothetical Syllogism
[8] Either K=K(+) or K=K(-)	1,2,3,5,6	1,4,7–Constr. Dilemma
[9] If there is a vague object K, then K≠K(+) and K≠K(-)	9	(ass. 4)
[10] There is no vague object K	1,2,3,5,6,9	8,9-Modus Tollens

Line five (i.e. [5]) of the argument is ungrounded: it is not true that if Sparky is not part of Kilimanjaro, then Sparky is disjoint from Kilimanjaro and therefore it is not true that if Sparky is not part of Kilimanjaro, then Kilimanjaro coincides with Kilimanjaro(-). It may well be the case that Kilimanjaro coincides with K* for example and in this case it does not coincide with K(-).

Let me sum up my claim. I have argued that if someone maintains classical logic, standard mereology and the difference between vague objects and any others, she

is not forced by Weatherson's argument to conclude that there are no vague objects; and given this, it follows that if a supporter of vague objects accepts classical logic and standard mereology, she is not compelled to follow Barnes and Williams: she may well maintain that vague objects are different from any others.[12]

References

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