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The Identity of Indiscernibles as a Logical Truth

ABSTRACT

The Identity of Indiscernibles seems like a good enough way to define identity. Roughly it simply says that if x and y have all and only the same properties, these will be the same object. However the principle has come under attack using a series of thought experiments employing the idea of radical symmetry. I follow the history of the debate including its theological origins to assess the contemporary arguments against the Identity of Indiscernibles. I argue that the principle is viable as a logical truth, and so can be put to work in our idea of objects.

BIOGRAPHY

Gerald Keaney is a Phd student in the Department of Philosophy at the University of Queensland. His thesis reaches back to the idea of Heraclitean flux in an attempt to bring a new argument to bear on how we can account for the identity of an object through change. Gerald is a published creative writer who has performed experimental material at several festivals, and he is currently writing material hoping to combine analytic philosophy with science fiction. His other research interests include ultra left politics, utopianism and fashion.

THE IDENTITY OF INDISCERNIBLES AS A LOGICAL TRUTH

1. Introduction

Famously a motivation for the Identity of Indiscernibles, a principle intended to establish the identity relation, was Leibniz's request to courtiers to find two leaves with all the same properties. Granted they would fail, this was supposed to encourage belief in the form of divine reasoning that could ground Leibniz's proof that God did not create two objects with all the same properties.ⁱ Forrest tells us the Identity of Indiscernibles (hereafter II):

[i]s usually formulated as follows: if, for every property F , object x has F if and only if object y has F , then x is identical to y . Or in the notation of symbolic logic:

$$\forall F(Fx \leftrightarrow Fy) \rightarrow x=y.$$
ⁱⁱ

Leibniz claimed II was true because any object with a given set of properties would be identical only to itself. This would give us an identity principle reliant only on properties that could be discerned, an attractive prospect to philosophers who want entities amenable to the senses.ⁱⁱⁱ Of course it may simply be the case that the courtiers did not have the ability to look long or hard enough for objects with all the same properties, and Leibniz did little more than take a gamble. If so he does seem to be on a good bet. Today the possibility of detecting even more minute differences could similarly motivate II for objects differentiable by references to smaller scales. These would at least be everyday and what Forrest calls medium-sized objects like trees and rocks. In this domain, since no two objects have the same F properties, II could well be true, though this might not settle the issue of II as logically true.^{iv}

Before we turn to this issue of modes of truth, problem cases outside the everyday lead into the question of what we mean by properties, and if we mean more than properties as are often conceived. Forrest has pointed out that in the literature there are various things we can mean by property that will give us different versions of II. We could even apply II to different types of object, including abstract objects like numbers with properties like "being prime" or "being even". Since Armstrong recently revived doubts about II where physical objects are concerned, for the purposes of exploring canonical criticisms I will follow his versions of II and what these mean for the F properties and the truth of the principle.^v

Let us for now call properties that are monadic predicates "non-relational". This would include any property predicated of an object and involving no other objects. The relation involved in the predication is actually one place: that between the object and what is predicated of that object, but because we have not referred to anything outside the object itself, the terminology "non-relational" is adequate. Examples of such properties are "is colloid" or "is porous." If we only allow non-relational properties in II, that is restrict F to these properties in the above formulation, then we have what Armstrong calls strong II. The object could still have non-relational properties, these would just not count for II.

Now let us allow relational properties. These are relations to things beside the object, including to other objects. The relation involved is 2 or more places, the object the property and at least one other thing. As involving more relations than a monadic predicate we can term such properties relational. The relation involved is n -place, where n is greater than one. Examples include "slimier than" and "between". If it is to be "slimier than" at all, an object a must be slimier than another object b and likewise for a to be "between" is for it to be between two further objects b and c . The relations need not be to objects, I will be discussing relations to times and places. We could also imagine relations to numerical entities, and we might want to restrict the type of relations allowed. If we allowed the relational properties to count as F s as well as the non-relational properties, we would have what Armstrong calls weak II.

The question is now how these versions of II might be true or false. The best way to consider this in relation to the debate on II, and which invokes the idea of contingency and necessity, is to divide our attention between what is and what must be the case. The contingent is the former, the necessary is the latter. For instance it might be the case that as a matter of fact Leibniz was right that there are no two objects such that for every property F , object x has F if and only if object y has F (I will call such objects supernumeraries). However his belief in God or how God thinks may be wrong, and so he may also be wrong that it is the case that an omnipotent being ensured he was right that there are no supernumeraries. Now if, as we shall explore, the existence of supernumeraries poses a problem for II, Leibniz could in these circumstances be right that II is true as the cosmos stands. But we could imagine how things might have been different and supernumeraries exist. II could then be contingently but not necessarily true. If Leibniz was right about God, then II could be necessarily true.

Likewise if Leibniz was just wrong about supernumeraries, II could be contingently false, while if God was such that she must create supernumeraries, II could be necessarily false.

2. Why the Logical Truth of The Identity of Indiscernibles is Important.

Since Aristotle, a number of philosophers have thought of objects as a set of properties that inhere in a further entity that is itself not thought to be a property. Here I will term that entity “the thin particular”. The term “thin” suits the use to which this idea has been put in recent philosophy. Today, if an object b has two properties F and G , we write:

$$Fb \& Gb$$

Here the b stands in for the thin particular. It is no one property, and has no properties in itself, properties are only predicated of it. This is the sense in which it is “thin”: there is nothing more to it, just as we might say there is “not much” to a thin person. All we need to identify the object is to note that

$$b=b.$$

This was Wittgenstein’s position, also supported by Black’s argument as we shall encounter here,^{vi} and today this idea of the thin particular has something of an air of orthodoxy.^{vii}

If we reject the thin particular we have to be able to make sense of an object that is not more than a bunch of properties. The most widely-known way of doing this is to have properties as instantiated universals.^{viii} The same universal could appear at any time or place, but we are interested in those that occur together and at a specific time and place such as to make up an object. Thus instantiated universals become properties under the reduction of universals to particulars. The conjunction of properties F and G usually written as $Fb \& Gb$ would then have to stand in for nothing more than

$$F \& G$$

The object being nothing more than the collection of these and whatever other properties it may possess. The “reduction of particulars to universals” nomenclature fits as well, what is described is exactly an eliminative reduction. There is nothing more to particulars (that is objects) than a collection of instantiated universals. So there is no room for thin particulars and theories espousing thin particulars are incompatible with those reducing particulars to universals.

Without the thin particular we can not distinguish between objects by reference to different thin particulars. Instead, given the reduction of particulars to universals we have to rely on groupings or bundles of properties to tell us what object is what. We are now committed to an identity principle that does this, and Forrest’s formal expression of II shows us that it is the identity principle we want. Thus any theory that reduces particulars to universals implies II. The theory can not be true and II be false; it is committed to II. So if there is a problem with II such a theory is in trouble. Any such a problem with II lies outside the ambit of the theory proper. It applies across the board to any and all theories reducing particulars to universals. The charge that II can not be defended is termed an “external” criticism of a theory reducing particulars to universals.^{ix}

I want II as a necessary truth, for as I shall show, in the right context this leads to it being a logical truth. Identity is a logical relation, so an identity principle should be a logical truth. In this way it can be part of a working inferential system. I also take that the more necessary components a theory has, the more compelling reasons there are for believing that theory. Any theory depending on II would then be more attractive as it rested on an established logical truth. Thus because I believe I can show II is a logical truth, I also believe that I should.

3. Indiscernibility and Identity.

Russell tabled identity as a topic for discussion having developed his ideas in the later 1930s and first published these in 1940. This was part Russell’s project of developing his own version of the reduction of particulars to universals. Leaving that theory aside and concentrating on the possibility of an external criticism, according to Russell, Wittgenstein’s rejection of II put identity outside philosophical consideration.^x Influenced by Wittgenstein, Max Black attacked II in the context of Russell’s committed to 1). Armstrong relied mainly on Black’s tactics to also reject II. In other words, Armstrong mounted an external criticism on any attempt to reject the thin particular.

The way Armstrong went about this is to invoke the supernumeraries already mentioned in connection with Leibniz. There are two ways to follow his argument. Firstly one could have it that if there were supernumeraries, and II declared these to be one in the same object on account of the fact these shared any and all of each other's properties, then II would have declared that an identity relation existed where it did not. So II could not be an expression of the identity relation. I will accept that II can be contraposed to get the Dissimilarity of the Diverse, formally expressible as:

$$x \neq y \rightarrow \neg \forall F(Fx \leftrightarrow Fy).$$

So for objects to be different it is also true one object must have a different property to the other. If there were supernumeraries that were numerically distinct and yet did not possess the differentiating property, II would be false.

Armstrong argues that strong II is not necessarily true because we could imagine two objects alike in every non-relational way. There is no logical reason why there might not be two metal spheres with exactly the same colour, weight and so on. Because we are here referring to strong II, then we have to be dealing with non-relational properties. In this case strong II would not be true since numerically distinct objects would be taken as identical under the principle, or again because different particulars would not differ in the possession of any non-relational property. From this it follows that strong II is not necessarily true.^{xi}

At one point Russell endorsed the idea of numerically distinct yet identical objects in different times and places,^{xii} however this is not viable. He ruled out the form of weak II I am defending, that which permits of space and time as non-relational properties, on the basis that space and time can not be established independently of objects. He then found that space and time can not be used to distinguish objects without threat of circularity. I will contest his first premise here, and he himself later rejected it. Granted weak II is tenable as I am suggesting, Russell does not have the antecedent that allows him the identity consequent under II, to then derive multiple identicals from supernumeraries. If Russell had performed what I believe to be the impossible feat of showing II permitted multiple identicals, he would have effectively shown that as an identity principle II should be rejected. The notion II would provide is not the logical one of identity. It would not be reflexive as the identity relation is, as applying only to a single object itself, and would result in a host of absurdities. If there were multiple identical Eiffel Towers and a secret service organized for an aircraft to fly into the one in Paris, it would not follow the one in (say) New York was also attacked. The Eiffel Tower both would and would not be subject to attack, both be and not be the cause of public concern etc. Multiple identicals would sever the link between logic and mathematics; one would equal many and there could be no counting or number line. Understandably Russell later also retracted this strange position.

Armstrong argues that strong II is contingently false because certain sub-atomic particles actually do seem to be alike in every non-relational way. Philosophers do have reservations about using science to justify positions in logic. Science could change, logic is supposed to at least be found on certain immutable principles, and an identity principle would be one such principle. Still, when we are talking about the contingent truth of something, the move seems acceptable, and in any case I believe science could provide reasonable motivation for rejecting or accepting a philosophical belief. I will certainly not quibble with Armstrong on the point. As for the supernumeraries above, in this case strong II is not true since numerically distinct particles would be taken as identical under the principle, or again because different particles would not differ in the possession of any non-relational property. From this it would follow that strong II is contingently false.

It may not be such a bad thing that we have thus knocked out necessary and contingent strong II. It could clear the air to leave us committed to a more viable weak version of II. Leibniz's theology notwithstanding, strong II is not a very appealing position on account of the way it lusters us with very specific commitments about how the cosmos is, namely that there are no supernumeraries. To attack weak II, Armstrong first puts an obstacle in the way of a tempting defence of this version of the principle. By admitting $n+1$ adic relational properties, the weak form of II does not fall prey to either of the above objections. If the spheres were in the room where I am writing this, these would be different since each would be in different positions to in relation to myself and other objects in the room, and the same applies to any supernumerary particles also in the room. However circularity looms. If, for instance, we took two related particulars c and d , relations to c are used to identify d and relations to d are used to identify c . The point applies if we reduce universals to particulars. We are using weak II to differentiate objects because these can not be differentiated using the thin particular. We then use the objects that we have not yet differentiated to differentiate each other by weak II. We import identities we have not established to establish an identity, or we seem forced into thin particulars.^{xiii}

Casullo has pointed out that Russell always agreed with the objection that using relations between objects in the weak form of II led to circularity.^{xiv} So the obvious path, and one taken up later by Russell, is to rely upon spatio-temporal position as relational properties in weak II.^{xv} However if objects give us our ideas of time and space as Russell thought at one point,^{xvi} we could not be able to use space and time to give us attributes permissible in the weak version of II to identify objects; only once we had the object would we be entitled to space and time. So space and time would have to be established independently of objects.

Armstrong calls on Blackean arguments to knock out the suggestion we use time and space as relational properties in weak II, so I will now rehearse Black's argument. Black imagines two supernumerary spheres such as we encountered in the argument against the necessity of strong II, but this time alone in the cosmos. Spatially, the two are mirror images of each other, reflected in space and with all the same relations to a central axis. Relational properties can now not be used to differentiate the spheres. On weak II these are falsely declared to be a single sphere, and the weak Dissimilarity of the Diverse is unable to pick a single relational property by which to differentiate the objects. We know the cosmos is not really like this since there is no room in such a world for these words etc. But the cosmos might have been like this. Weak II is not a necessary truth.

Finally, Armstrong admits that weak form of II "appears in fact to be true."^{xvii} This is because it is difficult to find not just objects alike in everyway like the spheres or the electrons, but ones that stand in the same relations to for instance space and time. So even if we rule out relations to other objects as Armstrong does above, we still have contingent weak II. In a way this returns us to Leibniz's point, the cosmos is just too complex for us to believe two objects could be that alike, and this is the case whether or not that cosmos was created by an omnipotent agent who wanted to avoid supernumeraries.

However even the contingent truth of weak II can be thrown into doubt. Another objection, similar to Black's, has ancient origins in Stoicism.^{xviii} It claims that the cosmos repeats, and we might think of a series of identical Big Bangs and Big Crunches. Additionally Black's attack can also be modified so it is not about two hypothetical spheres, but about our actual cosmos. In the looking glass cosmos, there is a central pane of reflection, everything on one side of which is faithfully replicated on the other.^{xix} In either the repeating cosmos or looking glass we cannot be certain the actual cosmos is not like this. In the first repeating case cosmic sets of supernumeraries exist regularly through time and no relational properties can distinguish either that set itself from other sets, or any members of that set from its supernumerary counterpart in another set. In the second reflected case there are no relational properties to distinguish one object from its reflection. In either case we must doubt that relational properties can distinguish between actual objects, and then doubt that II is contingently true.

One relational property I will not raise in defence of any form of II is the property an object d has of being identical to d . At this point I will note Forrest also thinks invoking at least some relational properties could trivialize the principle. Beside seeming to assume the objection Armstrong raised regarding the circularity of defining objects off against each other, Forrest is afraid of the " x being x " property. If the object was termed y it could not have this property, so if we relied on the property to distinguish objects, the ys in Forrest formulation of II would have to be replaced by xs , trivializing that formulation:

$$\forall F(Fx \leftrightarrow Fx) \rightarrow x=x.$$

In addition the property does give an object d a unique relation to object d : the reflexive relation of identity. Reliance on " d being d " simply declares what II seeks to establish by appeal to properties: the fact that any object is identical to itself. Such a declaration can do nothing to prove or disprove the necessary truth of II.

Instead we should not be too hasty in making concessions regarding Black's approach, as celebrated as it is. Casullo has noted the claim that "II is not a necessary truth has been left unchallenged. The arguments in support of this claim typically consist in pointing out the possibility of radically symmetric universes whose occupants have all qualities in common. Max Black's is the most widely discussed of the alleged counterexamples."^{xx} The challenge would show we have no reason to suspect a Black-style cosmos is an objection to II. To defend the necessary truth of II we then must examine both Black's and the similar Stoic objection. Casullo argued that the Black thought experiment cannot throw the necessity of II into doubt. Casullo notes two ways of approaching thought experiments like Black's. The first is logico-linguistic, the second psychologicistic.

The logico-linguistic approach rests on the claim that a proposition p is necessarily true just in case its negation

is self contradictory. Secondly that p is necessarily false just in case p is self-contradictory. Lastly that p describes what is possible just in case p is not necessarily false. Black wants to show that weak II is necessarily false as self-contradictory, but that weak II is not an explicit contradiction. Black now has to derive a contradiction from weak II using only necessary truths. The procedure is circular since it is the question of what truths are necessary that is at stake. The usual response is to reclassify necessary truths as logical truths and definitions. Circularity is avoided as definitions and logical truths have to be established outside the logico-linguistic procedure. Casullo argues this will not work in the Black case since the cogency of his thought experiment “turns on what propositions one admits as logical truths.” Many systems hold some form of II is a logical truth, the inclusion of weak II as a logical truth is “no more question begging than the failure to include it.”^{xxxi} Once weak II is included it is Black’s description of the universe that is contradictory and in need of qualification, not weak II. Nothing Black argues resolves the issue either way. If we wanted II to be a logical truth, we would take it as necessarily true and claim this was the logical truth that gave us the definition of identity.

This brings us to exploring possible psychologistic foundations for Black’s thought experiment. Black would claim that the thought experiment is conceivable, but in doing so runs up against the problem that conceivability is “notoriously obscure.”^{xxxii} The clearest response give it the sense of a visualized a state of affairs. Unfortunately for Black this does not get him what he wants. Russell pre-empted here: as visualization suggests, the spheres in a perceptual field could be distinguished as occupying different places in that field: right or left or up or down.^{xxxiii}

Black could return to the logico-linguistic basis of the thought experiment: how could there be anything wrong with his description of the looking glass cosmos? At this point we might note Black himself had his doubts. At one point in the dialogic form of his article, the sceptic about weak II is made uncomfortable about the details of how a hypothetical two-sphere cosmos works.^{xxxiv} Ian Hacking plays upon this moment of ambivalence points to problems with Black’s thought experiment. Hacking believes in an emptied universe different laws could describe the behaviour of spatiality because the amount and distribution of mass would be different.

Hacking gives the example of Ernst Mach’s response to Newton’s thought experiment involving a bucket. A universe contains nothing but a bucket of water. This begins to spin. The hypothesis makes no sense if space is a relationship. Nothing would have changed because none of these relations change, and so the bucket does not spin. Yet the water rises up on one side of the bucket. The thought experiment encourages us to make sense of the raising water by suggesting there is a spin after all, and so (since spin requires space) by rejecting the idea space is made up only of spatial relations between objects, and accepting instead that there exist absolute points in space, i.e. points that are there irrespective of the distance relations between objects. Against this Mach pointed out in an emptied universe there could be different laws to describe the behaviour of masses and of inertia because spatiality would be different. These different laws could explain the rising water level some other way. Hacking thinks Mach was vindicated by 20th Century physics: physical laws and the physicality of space are interdependent — Hacking is referring to the Theories of Relativity. So even granting the water in his bucket would rise, Newton is not entitled to his conclusion.

Hacking wants to use the idea that in a thought experiment about a different universe we can not simply assume the same spatial rules. He wants to then question if we really can assume there are two spatially separate spheres as the counterexample requires. In the sphere case, if we list all the propositions true in a Black world without begging the question of the number spheres we find these are consistent with just a single sphere. We can not assume the two sphere cosmos is not a non-Euclidian space in which the sphere reflects itself. We cannot be sure what space would be like in a one or two sphere universe so the example is insufficient to deny weak II is a necessary truth.^{xxxv}

Hacking’s argument could be applied to the looking glass cosmos. As Hacking points out about a Black world that is a simple version of such a cosmos “[i]s not a world with two matching gloves different from a world with only a left-hand glove? Even if, in the one glove world, it makes no sense to say whether the glove is left or right, at least we may say, of the two glove world ‘For every glove there exists a glove that is its incongruous counterpart.’”^{xxxvi} The idea here is that Hacking would not be able to claim the reflected gloves are one the way he claimed the reflected spheres are one because a left hand and a right hand glove are not just reflections but different. Aside from being supernumeraries gloves are enantiomorphs. However Hacking is objecting that what makes these supernumeraries enantiomorphs are also spatial relations, and these are up for grabs in a one or two glove cosmos. The incongruity may there be ironed out and an enantiomorph not produced by the novel spatiality of the thought experiment. Space could then be curved in such a way as to give us but the one handed glove that is only itself. Nor can we assume that the split space of looking glass cosmos would give us any

incongruity around enantiomorphs. On the scale where a whole cosmos is reflected, reflection may not work as we experience it in a bathroom mirror. We can we not then assume that we have numerically separate cosmii, any more than we could assume numerically separate spheres in the original Blackean thought experiment.

This application to the glove and looking glass cases shows up an advantage of the Hacking's response. It can accommodate variations on, and elaborations of, Black's thought experiment. A collision of the two spheres can be explained as distortions of shape of a single sphere. Cumulative properties are something Hacking did not touch upon, though Black hints at these in mentioning magnetism.^{xxvii} Black could claim a two sphere universe would have twice the mass of a single sphere one, preventing us explaining the former as the latter. Again though, if laws of mass and weight were up for grabs, there could be one sphere of twice the weight we would expect.

For Forrest, Hacking's tactic is less plausible where there are three spheres including a central one to preserve the symmetry.^{xxviii} Forrest's reservation could be reinterpreted to show how the commonsense that serves us in our own cosmos would be inapplicable in radically different space-times. Forrest also notes a recent point of discussion. With almost perfect symmetry the weak version of II allows 2 spheres. The imperfections then decrease until perfect symmetry seems to be a limiting case of a two sphere universe.^{xxix} But here, again perhaps strangely, the limiting case could be held to be radically different in that it is a one sphere universe. Finally, though it could be objected that Theories of Relativity can not be assumed (as for instance incompatible with quantum physics), an ongoing trend in the history of recent science towards dynamically interrelating space, time and mass should be given credibility. If this is the case, then whatever theory we accept in the future, or however we modify our existing theories, it will be Hacking, not Black who will be convincing; and (for instance) the truth of the General Theory of Relativity itself will not be at issue.

The looking glass cosmos and repeating cosmos are the most powerful attack in the Blackean arsenal since it threatens even weak contingent II. Most importantly what we have is an insight into how Casullo is right, that is how it is possible that Black's description of his own looking glass cosmos is the problem, not the necessity of weak II. It gives us all the more reason to agree with Casullo's diagnosis of Black's logico-linguistic problems. Black only shows that with limited resources the cosmos on one side of the looking glass can not be distinguished from that on the other.^{xxx} If weak II is a logical truth, then additional resources, such as the relativistic ones invoked by Hacking, must be imported.

The repeating cosmos still has to be taken into account. Given this is a temporal analogue of the looking glass cosmos, we have good reason to suspect that the importation of the right resources will nullify this thought experiment as an objection to the logical truth of weak II. Hochberg argues that the notion time is circular and repetitive is coherent, but this does not give us grounds for thinking of cosmic repetition. There would be no outside framework on which to gauge successive states of the cosmos that were exactly the same. If there was an observer, then in their perception or biography the different states could be distinguished as coming before or after, and so be distinguished in their temporal perspective. Without this observer, we are not entitled to the idea the same cosmos exists a number of times since there is nothing to distinguish the repetitions. Rather, it exists before and after itself, time in this way being conceived of as curved.^{xxxi}

Hochberg does not allude to Hacking. Nor, incidentally, had Casullo felt the need to mention Hacking's counter move to Black, but a similarity of response is clear. As space is possibly curved in the looking glass cosmos, so time is curving in the supposedly "repeating" case. In both cases if we assume the logical truth of weak II we implicitly assume that further resources can be imported to deal with symmetrical scenarios. The assumption proves plausible and revered arguments against II do nothing to throw it into doubt. If Black *et al* turn to the conceivability criterion, and try to show that further resources can not deal with their thought experiments because we can imagine ourselves observing the scenarios they evoke, then we have imported further resources, those of perceptual space, and in Hochberg's case, perceived time. And here, as Russell pointed out at the start of the debate, the objects possess non-relational attributes: qualities of their position in a perceptual field. Even a numbered x and y axis on which to plot the position of the spheres would do, though here Leibniz feared such resources suspecting the resulting points would be further supernumeraries.^{xxxi} Still further resources could be imported to deal with the problem: an independently established spatiality may give these points varying relations to something else — Russell was later to argue that the Theory of Relativity could be counted upon to do this.^{xxxi}

4. Conclusion

Armstrong never came to terms with the full force of Casullo and Hochberg's rejection of the supposedly

decisive arguments against the reduction of particulars to universals. As late as 1997 Armstrong was still insisting that anyone committed to the position is also committed to denying two or more objects could be exactly alike as complexes or groupings of the same universals. He still believed such a philosopher must therefore “pronounce what seems to be a distinctly arbitrary ban on such likenesses.”^{xxxiv} In insisting upon this, Armstrong does not give any reason why exactly alike objects would not be distinguished by spatio-temporal relations, and nor why, if these were not, we would still have supposedly problematic exact likeness rather than the full-blooded reflexive numerical identity. Armstrong just seems to believe that Black and Black-style arguments had foredoomed any move to salvage the necessity of weak II.

Against this assumption, II is viable as a logical truth. The only way to dismiss II as a logical truth is to beg the question against it. The celebrated arguments against II come down to such question begging, and that has thrown the advantages of II into an unjustified neglect. With II we have an appealingly empirical identity principle, and furthermore, against the external criticism, we can keep open the reduction of particulars to universals as a possible view of objecthood.

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- ⁱⁱⁱ Rodriguez-Pereyra, ‘Leibniz’s Argument for the Identity of Indiscernibles,’ 429. Rodriguez-Pereyra also notes Leibniz’s theological agenda was his primary motivation, his empiricist sympathies a secondary.
- ^{iv} Forrest, ‘The Identity of Indiscernibles,’ section 1.
- ^v David Armstrong, *Nominalism and Realism* (Cambridge, Cambridge University Press, 1978), 92-94.
- ^{vi} Max Black, ‘The Identity of Indiscernibles,’ *Mind*, 61(1952), 153. Ludwig Wittgenstein, *Tractatus Logico-philosophicus*, trans. David Pears and Brian McGuinness (London, Routledge, 1974), 139.
- ^{vii} Albert Casullo, ‘Russell on the Reduction of Particulars,’ *Analysis*, 41 (1981), 197. Casullo writes that “very few philosophers have argued particulars are reducible to universals.” The latter position is detailed in the coming paragraph.
- ^{viii} Casullo, ‘Russell on the Reduction of Particulars,’ 199. Hochberg also notes a third option of “particular quality instances (moments, tropes)”. Here I simply want to keep the reduction of particulars to universals as an open possibility by defending the truth of the Identity of Indiscernibles. Herbert Hochberg, ‘Particulars as Universals,’ *Journal of Philosophical Research*, Vol 20 (1995), 84.
- ^{ix} For the “internal” and “external” terminology inspired by Armstrong’s criticisms in *Nominalism and Realism*, see Casullo ‘Russell on the Reduction of Particulars,’ 200.
- ^x On the dating of Russell’s initial support of II see Bertrand Russell, *An Inquiry into Meaning and Truth* (Harmondsworth, Penguin 1973), 7. Wittgenstein’s position, found in the *Tractatus Logico-Philosophicus*, was prepared during the First World War and published in 1922. See G.Von Wright, ‘Biographical Sketch’ in *Ludwig Wittgenstein, a Memoir*, ed. Norman Malcolm (London, Oxford University Press, 1962), 7-11.
- ^{xi} Armstrong, *Nominalism and Realism*, 92.
- ^{xii} Russell, *An Inquiry into Meaning and Truth*, 92.
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- ^{xiv} e.g. Albert Casullo, ‘Particulars, Substrata and the Identity of Indiscernibles’ *Philosophy of Science*, Vol 49 (1982), 597.
- ^{xv} Bertrand Russell, *Human Knowledge: its Scope and Limits* (London Allen and Unwin, 1948), 294 ff. Also emphasised by Hochberg, ‘Particulars as Universals,’ *passim*, against what he thinks is on-going misinterpretation. Casullo ‘Particulars, Substrata and the Identity of Indiscernibles,’ 600, had also emphasised the same point.
- ^{xvi} Russell, *An Inquiry into Meaning and Truth*, 93-98.
- ^{xvii} For necessary strong II and the weak versions see Armstrong, *Nominalism and Realism*, 94-97.
- ^{xviii} On the influence of Black see Albert Casullo, ‘A Fourth Version of Bundle Theory,’ *Philosophical Studies*, Vol.54 (1988), 135. On the influence of the Stoic objection, popularised in this context by Ayer, see Hochberg, ‘Particulars as Universals,’ 95.
- ^{xix} Black, ‘The Identity of Indiscernibles,’ 160 ff.
- ^{xx} Casullo, ‘Particulars, Substrata and the Identity of Indiscernibles,’ 597.

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- ^{xxi} Ibid., 599.
- ^{xxii} Ibid.
- ^{xxiii} Ibid., 600. Russell, *Human Knowledge: its Scope and Limits*, 316-317.
- ^{xxiv} Black, 'The Identity of Indiscernibles,' 161.
- ^{xxv} Ian Hacking, 'The Identity of Indiscernibles,' *Journal of Philosophy*, vol. 72, no. 8 (1975), 249-250.
- ^{xxvi} Ibid., 254.
- ^{xxvii} Black, 'The Identity of Indiscernibles,' 162.
- ^{xxviii} Forrest, 'The Identity of Indiscernibles,' see the section entitled 'Recent arguments for and against the Principle'.
- ^{xxix} Ibid.
- ^{xxx} Hochberg, 'Particulars as Universals,' 100.
- ^{xxxi} Ibid., 96 ff.
- ^{xxxii} Rodriguez-Pereyra, 'Leibniz's Argument for the Identity of Indiscernibles' 431.
- ^{xxxiii} Bertrand Russell, *Human Knowledge: its Scope and Limits*, 294 ff.
- ^{xxxiv} David Armstrong, *A World of States of Affairs* (Cambridge, Cambridge University Press, 1997), 98.