

The shapes of incongruent counterparts

Josh Parsons

December 10, 2007

1 Introduction

Common sense thinks that shape properties are intrinsic; more arguably, common sense thinks that chirality properties (the properties that differ between enantiomorphs, such as left and right hands) are a matter of shape, and are intrinsic.

Nevertheless, there are two well-trodden paths away from this commonsensical view. The first path, on which we find the footprints of Immanuel Kant and Graham Nerlich leads towards the position that what makes a left hand left and not right is a matter not of its intrinsic properties, but of its relation to Space. The second path, on which we might find the footsteps of Martin Gardner, leads towards the position that what makes a left hand left and not right is a matter not of its intrinsic properties, but of its relations to other material objects. I will call both of those positions *extrinsicalist*. I want to defend what I take to be the common sense, *intrinsicist*, view.¹

This is a much discussed area, and I don't intend to survey every possible move or argument in it. In fact, I'm setting up the debate slightly differently to the way it is usually set up in the literature — more usually, the debate is construed as being between substantialists and relationalists about space, with both the position I

¹For Kant's and Nerlich's defences of extrinsicalism, see chapter 2 of Nerlich (1976); for Gardner's, see Gardner (1990). A form of intrinsicistism has also been defended by John Earman (though in a very different way from the way I defend it here), for which see the Nerlich citation above. My terminology of intrinsicistism vs. extrinsicalism is a simplified version of van Cleve's (1987) four-way distinction between holism, internalism, externalism, and absolutism. Intrinsicistism is equivalent to the disjunction of the former two of van Cleve's -isms, and externalist to the disjunction of the latter two.

defend, and the second of the extrinsicist positions described about construed as forms of relationalism. Though one attraction of intrinsicism is that it could form part of a defence of relationalism, I think that we can gain a new perspective on the arguments here by considering intrinsicism on its merits, independently of the debate over substantivalism.

I want to point to what seems to me to be a striking (and, some might say, unwelcome) consequence of intrinsicism, and argue that it should not trouble us. I'll begin with a *prima facie* objection to intrinsicism; show how a solution to it entails the striking consequence (section 2); discuss the implications of this (section 3); and finally try to answer a powerful objection to it (section 4).

2 Shape properties and chirality

The common sense view — the view I want to defend — says something like this: left and right hands have something in common, namely the property of *being hand-shaped*. But there are other shape properties with respect to which they are different: my left hand has the property of *being left-hand-shaped*, and my right hand does not. The property of *being hand-shaped* is a determinable property with two determinates, namely its chiral variants: the properties of *being left-hand-shaped* and *being right-hand-shaped*. All of these properties are intrinsic.

But consider: for all we know, the large-scale geometry of Space could be non-orientable. In a non-orientable space, like the surface of a Moebius strip, objects can be superimposed onto their mirror images by rigidly moving them around. Rigid motion does not change the shape (or other intrinsic properties) of an object. Space certainly *seems* orientable; but maybe that's just because we haven't moved far enough yet. Even if we do know that Space is orientable, there seems nothing impossible about it being non-orientable. (And even if we discovered that Space was non-orientable, there would be nothing impossible about its being orientable).

(By the way, when I say that Space could be “like a Moebius strip” I don't mean to imply that the only way that Space could be non-orientable is by being embedded in an orientable hyperspace. What matters for my argument is the Space could be non-orientable).

So to put it in terms of possible worlds, there are two very similar possible worlds, in one of which Space is orientable, and in another of which Space is

non-orientable. Call them w_o and w_n respectively. In w_o , there's no way of rigidly moving my left hand so that it is superimposed on my right (and no way of rigidly moving a left glove so that it fits my right hand); in w_n , there is such a way (though it might involve a very long space-journey).

w_o and w_n are empirically distinguishable. In w_n , Buck Rogers takes off on a long space-flight and returns to Earth mysteriously changed — from his point of view everything on Earth has been replaced with a mirror image. In w_o , Rogers' counterpart takes off on a long space-flight, following what appears to be the very same trajectory, but returns to find Earth just as he left it. Though Rogers' experience could be explained in other ways (perhaps there are two Earths, mirror images of each other, mysteriously kept in harmony) if this type of thing happened frequently, the most parsimonious explanation would be that Space is non-orientable.

In w_n , my hands are intrinsic duplicates (or close enough), because rigid motion does not change the intrinsic properties of things, and in w_n , my hands can be superimposed by rigid motion. In w_o , (says the intrinsicist), my hands are intrinsically different — they differ chirally. But the shape of my left hand in w_n must be the same as the shape of my left hand in w_o , because the difference between w_o and w_n is not in how my hands are, but in the global nature of Space! So, (reductio! says the extrinsicist), my hands are not intrinsically different shaped even in w_o ; differences of chirality are not intrinsic differences; the property of being left-hand-shaped is not intrinsic.

The point is that the relation of intrinsic duplication must be transitive. If the two hands in w_n are duplicates, then the two hands in w_o can't be duplicates of their counterparts in w_n without being duplicates of each other. The lesson for the intrinsicist is plain: since intrinsicism entails that the left and right hands of w_o are not duplicates, she must deny that they are duplicates of their counterparts in w_n . The (apparently) left hand in w_n is hand-shaped, but not left-hand-shaped or right-hand-shaped. The same goes for the (apparently) right hand in w_n .

This entails the striking consequence I want to discuss. It turns out that the determinable property *being hand-shaped* does not have two chiral variants, but three, for it is possible to be hand-shaped without being either left-hand-shaped or right-hand-shaped (as witnessed by the hands in w_n). The consistent intrinsicist position holds that the three determinates of *being hand-shaped* are *being left-hand-shaped*, *being right-hand-shaped*, and *being non-orientably hand-shaped*,

and that all of these properties are intrinsic.² Of those determinate properties, two may be called orientable shape properties, and those two are enantiomorphs of each other (they are mirror images of each other); the other determinate property is a non-orientable shape property, and is homomorphic (it is its own mirror image).

That seems to me to be a striking consequence, and a welcome one. It is welcome because it offers a relationalistic explanation of what I have been getting at by talking about Space being orientable or non-orientable. When I say that, in w_o , Space is orientable, I mean that at least some of the objects in w_o have orientable shapes. When I say that, in w_n , Space is non-orientable, I mean that all of the objects in w_o have non-orientable shapes.

3 The possibility of hybrid spaces

One odd thing that seems to follow from this is that you could have worlds that contain both left hands and non-orientable hands. Afterall, if the property of *being left-hand-shaped* and the property of *being non-orientably-hand-shaped* are two (incompatible) intrinsic properties, why shouldn't two different things having those properties co-exist? Nothing prevents a cube from co-existing with a sphere, or a red thing from co-existing with a blue thing. Why should not a left hand co-exist with a non-orientable hand?

Supposing that that is possible, what happens when a non-orientable glove meets a left (or right) hand? What happens when a left (or right) glove meets a non-orientable hand?

I have two replies to this, and I'm not sure which I like best.

3.1 The conservative view: Hybrid spaces are impossible.

It's impossible for a non-orientable hand to co-exist with a left hand. We should think of an orientable space as having an extra degree of freedom relative to a non-orientable space, in an analogous way to the way that a three-dimensional space has more degrees of freedom than a two-dimensional space. An orientable

²Well, actually there are two other consistent intrinsicist positions: that there is no such world as w_n and that there is no such world as w_o . Those positions seem to me to be lacking in modal imagination.

space is “bigger”, in a sense, than a non-orientable one — it allows for more ways for objects to vary their shapes. So, trying to imagine an orientable object in a non-orientable space is like trying to imagine a three-dimensional object in a two-dimensional space. It just *wouldn't fit*.

Trying to imagine a non-orientable object in an orientable space, on the other hand, is like trying to imagine a two-dimensional object in a three-dimensional space. According to the conservative view, this is also impossible. The shape of a genuinely two-dimensional object is different from that of a perfectly flat three-dimensional one, and the shape of the two-dimensional object is such that it cannot be instantiated in a three-dimensional space. Similarly, a non-orientable object can't exist in an orientable space. An object's shape must fit the space in which it exists — for that reason orientable and non-orientable objects cannot ever exist in the same space.

Advantages and disadvantages. The advantage of this view is that the difficult questions (“What happens when a non-orientable glove meets a left hand?”) are avoided. Nothing happens — the scenario described is metaphysically impossible.

The disadvantage is that we deny the plausible principle of recombination concerning intrinsic properties with which I introduced this section. If f and g are intrinsic properties, how can the having of f by one thing preclude the having of g by another? The explanation I gave, that an object's shape must fit the space in which it exists, was a substantialist one. That just seems to further undermine the idea that shape properties (or, at any rate, the shape properties had by material things) are intrinsic. If *being a cube* is an intrinsic property, how is it that something that has this property must be accompanied by substantial space?

3.2 The liberal view: Hybrid spaces are possible

It is possible for orientable and non-orientable things to co-exist. A non-orientable glove will fit any hand (though it might have to travel a long way relative to the hands in question in between fittings), and a non-orientable hand will fit any glove (subject to the same proviso).

Suppose I have two gloves before me, of *apparently* the same shape; *apparently* both only fit my left hand. However, suppose there's a journey through space, involving only rigid motion, which is such that if glove a went on that journey, it

would fit on my right hand when it came back, and if glove *b* went on that journey, it would still only fit on my left hand when it came back. Then I should say that glove *a* is non-orientably glove shaped, while glove *b* is left glove shaped.

Advantages and disadvantages. The advantage of the liberal view is that the orientability or non-orientability of a space is constituted by the shape of the things in that space. This should please relationalists, who want to explain away global properties of space in favour of the properties of *things* in space. It should also please Humeans: the conservative view has to have necessary connections between the intrinsic properties of distinct objects — necessary connections between the global geometrical features of space and the shapes of the objects in it; and necessary connections between the shapes that distinct objects can have if they are to co-exist in the same space. The liberal view has none of that — any shape can co-exist with any other. The disadvantage of the liberal view is that it makes possible hybrid spaces that contain mixtures of orientable and non-orientable objects. As I've said, I'm not sure which cost is greater, but both views seem consistent, and I am willing to pay either cost in order to preserve the intrinsicity of shape.

4 Action at a distance

I now want to consider a serious and novel objection to the view that chiral shape properties are intrinsic. One important role for intrinsicity to play is of helping to police our understanding of change and causation. McTaggart once claimed that a falling sandcastle on the English coast changes the nature of the Great Pyramid, for the Pyramid no longer has the property of being such that there is a sandcastle on the English coast. He might have added that this change takes place instantaneously over a great distance. But of course, this is not a real change, and not real action at a distance, because the property with respect to which the Pyramid is changing is an extrinsic one. If it were possible to change the *intrinsic* properties of the Great Pyramid, instantaneously, and at a distance, then that would be exciting indeed. It would make possible faster than light communication, and refute relativistic physics.

The objection I am about to consider says that if chiral shape properties were intrinsic, then this kind of spooky real action at a distance would be possible. In fact, it would be possible to change the shapes of an object at a distance by (putting

it loosely) changing the nature of Space. I am going to describe the objection in two forms. The first is easier to understand, but is not as powerful as the second.

Action at a distance objection (Flatland version).

Imagine I have a very long loop of an absolutely flat material — 2 kilometers long, let's say. I have stretched the loop out so that as I stand by one end of it, the other end is a little less than a kilometer away from me. At the far end of the loop, a microscopic two dimensional Flatland-like civilisation is living on the paper; the rest of the loop is empty. Flatlanders sometimes wear gloves; they find that left handed gloves will never fit on right hands, and this is because the left and right handed gloves are intrinsically different — they are different shapes.

Now, I cut the near end of the loop, put a half twist in it, and stick the ends back together. The Flatland civilisation is now living on a Moebius strip! The Flatlanders suddenly find that they can get a left glove to fit on a right hand, by sending the glove on a long enough journey through space. If what I have said so far in this paper is true then, it seems, the Flatlanders' gloves, which were previously intrinsically left-handed or right-handed, are now intrinsically non-orientable. My actions have intrinsically changed the gloves.

But that is absurd: I didn't change the gloves in any way. All the changes I made were to change the Flatlanders' loop at a distance of a kilometer from the gloves. To suppose that the Flatlanders' gloves changed shape when I cut and pasted the loop is to suppose that spooky action at a distance is possible — that I am somehow able to accomplish intrinsic changes instantaneously at a distance of nearly a kilometer.

In this version of the objection, the cutting and pasting action I perform changes the nature of a two-dimensional space embedded within three-dimensional Space. That is the weakness of the example. I think that what we should say is that the Flatlanders' hands and gloves were always non-orientable. They could always (in principle) have rotated an apparently left glove through three-dimensional Space

to put it on a right hand. We might imagine them lacking the technology to do this, but that's beside the point.³

Nevertheless, the Flatland example does give a vivid illustration of how the objection is supposed to go; and the objection can be run without a Flatland.

Action at a distance objection (divine version).

Suppose now that God is standing outside of Space looking down on it just as I might look down on the Flatlanders on my strip of paper. Just as I might cut edges into the Flatlanders' space, and reattach them with a half twist, so God does the same to Space. (And suppose that just as I cut the paper a long way away from the Flatland civilisation, God cuts Space a long way away from Earth).

On the current proposal, when God does this, it seems, all the orientable objects in Space (and in particular, all the gloves on Earth) undergo an intrinsic change instantaneously! But that is absurd — God hasn't changed any of those objects — what he did took place at a great distance from them.

Surely what we have to say is that the objects didn't undergo an intrinsic change when they became non-orientable as a result of God's actions — that the difference between the objects in an orientable space and the objects in the non-orientable space is purely extrinsic — a matter of what sort of space they're in.

It's important that when I say here that we are to think of God being "outside" of Space, we are *not* supposed to think that is in some kind of Hyperspace in which Space is embedded. If God were some higher dimensional being, and Space is in fact some object embedded in a Hyperspace, this case would be analogous to the Flatland case, and susceptible to the same solution — for then my left and right

³The Flatland example has the potential to trick us, I think, because it involves systematic deception of the unfortunate Flatlanders. The Flatlanders, if they never leave their loop, may think that the loop is Space, that it is two-dimensional, and that what they take to be rigid motions are shape-preserving. But it follows from the description of the case that none of this is true. In the case, Space is the three-dimensional space I move about in; Flatland is not two-dimensional — it curves around the third dimension to join up with itself; when the Flatlanders move around through curves in the loop, they are changing shape. That their hands and gloves are orientable is just one more thing the Flatlanders are mistaken about.

gloves would be the same shape, and I could put always, in principle, put a left glove onto a right hand if God would oblige me by rotating it in Hyperspace for me.

Rather, we are supposed to think of God being some kind of completely non-spatial (but temporal, since he acts at a time) entity. Nor is God literally cutting and pasting Space the way I would cut and paste a piece of material. Rather, he's doing whatever is required to change the intrinsic nature of Space, perhaps creating a wormhole or something of that sort.

What the intrinsicist should say about this case depends on whether she accepts the conservative or liberal views about hybrid worlds outlined in section 3.

Suppose that the the conservative view is correct. Then it is absolutely, metaphysically, impossible — even God could not bring it about — that there be orientable objects in a non-orientable space. So, the thing that we are supposed to imagine God doing — changing the global nature of Space without touching the intrinsic properties of the objects in Space is simply impossible. God could change Space so that it is non-orientable only if at the same instant he changed all the objects to having non-orientable shapes. But the possibility of God's doing that does not show anything about the intrinsicity or extrinsicity of shape.

Suppose, instead, that the liberal view is correct. In that case, God's changing Space from being orientable to non-orientable would be *constituted* by his changing the shape of all the orientable objects so that they are non-orientable. Either way, to do what he is supposed to do, God would have to intrinsically change the shape of everything at once. So there would be no mysterious action at a distance, just a widespread miracle.

5 Conclusion

I have shown that it is possible to resist some arguments (and I think that the techniques used in this paper will allow us to resist all such arguments) that chiral shape properties are extrinsic. To do, the intrinsicist must do two things. First, she must accept the “striking consequence” that shapes that might have seemed to be have two chiral variants (left and right handed) in fact have three (left, right, and neither). Second, she must accept one or other of the conservative and liberal views. If she accepts the conservative view, that means departing from some

popular “Humean” principles of recombination; if she accepts the liberal view, that means accepting that a left-handed glove can share a world with a hand that is neither left- or right-handed.

Otago University

References

Gardner, M. (1990). *The new ambidextrous universe*. New York: W.H. Freeman.

Nerlich, G. (1976). *The shape of space*. Cambridge: Cambridge University Press.

van Cleve, J. (1987). Left, right, and the fourth dimension. *Philosophical Review* 96, 33–68.