Things are Not What They Seem

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1 Introduction: Colour

Colour is a puzzling phenomenon. Perhaps nothing could be more obvious than colour; but one thing that Modern Philosophy has taught us is that, concerning colour, things are not what they appear. We all naively think that things exist in the world with their objective colours. Grass in green; the sky is blue; coal is black. But in reality, colour is merely the way that things with certain objective properties—notably the ability to reflect, emit, or absorb electromagnetic radiation of particular frequencies—appear to sensory apparatuses of certain species-specific (and even individual-specific) kinds.[1]

In what follows, I want to argue that colour is not what it appears, in a quite different way. Coloured states—however one wants to understand them—appear to be quite consistent. If something is green, it is green... end of story. But, I shall suggest, some coloured states may actually be inconsistent: something may be both green and not green. We will see why, and look at some of the ramifications of the matter.

2 Sorites Paradoxes

The central phenomenon which will concern us here is the sorites paradox. Sorites paradoxes arise when a predicate is vague in a certain sense. That

[1] For a general discussion of colour, see Maund (2012).

is, the applicability of the predicate is tolerant with respect to small changes of a certain kind. Employing such predicates, we can argue that an object which manifestly lacks a property possesses it. Let me illustrate.

Colour predicates are paradigm examples of tolerant predicates; and since colour is the topic of this essay, I'll use a colour example. Let $a_0, a_1, ..., a_n$ be a sequence of coloured patches such that a_0 is clearly green, and a_n is clearly red, and so not green; but such that the colours of any two adjacent patches are indiscriminable. Thus, we might cut up the following strip very finely.

Since consecutive patches are indistinguishable in colour, then, for any $0 \leqslant i < n$, if a_i is green so is a_{i+1} (and of course, if a_{i+1} is green, so is a_i; but this fact does not feature in the argument). Since a_0 is green, n applications of *modus ponens* deliver the conclusion that a_n is green, which it manifestly is not.

3 Inclosure Paradoxes

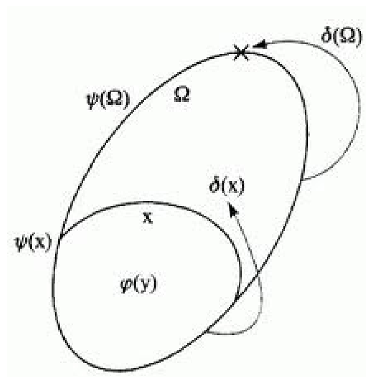
Sorites paradoxes such as this have occasioned an enormous literature in the last 40 years, and, it must be said, there is absolutely no consensus as to the solution. This is not the place to review matters.[2] Let me just explain my preferred solution.

Let us write A_i for 'a_i is green'. Then A_0 is clearly true, and A_n is clearly false. A patch situated mid-way between a_0 and a_n is clearly symmetrical poised with respect to them. So if i is midway between 0 and n, one would expect A_i to be symmetrically poised between truth and falsity. There are two such options: A_i is either *neither* true nor false, or *both* true and false. Whilst the *neither* option has been more popular of recent years, the *both* option strikes me as preferable. The reason is as follows.

There is a general structure that underlies the paradoxes of self-reference. They all fit the *inclosure schema*. The schema arises when there is an operator, δ, and a totality, Ω, which appear to satisfy the following conditions. Whenever δ is applied to any subset, x, of Ω, of a certain kind—that is, one

[2]For a good review, see Hyde (2011).

which satisfies some condition ψ—it delivers an object that is still in Ω (Closure) though not in x (Transcendence). If Ω itself satisfies ψ, a contradiction is forthcoming. For applying δ to Ω itself will then produce an object that is both within and without Ω, so that $\delta(\Omega) \in \Omega$ and $\delta(\Omega) \notin \Omega$. We may depict the situation as follows (φ is the defining condition of the set Ω, and $\times$ marks the contradictory spot—somewhere that is both within and without Ω):



Thus, consider Russell's paradox, for example. Ω is the set of all sets; $\delta(x) = \{y \in x : y \notin y\}$; and $\psi(x)$ is the vacuous condition, $x = x$. Or consider the Liar paradox. Ω is the set of all truths, $\psi(x)$ is 'x has a name', and $\delta(x)$ is a sentence, σ, of the the form $\langle \sigma \notin \dot{x} \rangle$ (where angle brackets are a name-forming operator, and $\dot{x}$ is a name of x). In each of these cases it is easy to show that the inclosure conditions appear to be satisfied.[3]

Now, I advocate a dialetheic solution to the paradoxes of self-reference: one should accept the inclosure conditions as veridical. So the conclusion delivered by the paradox, $\delta(\Omega) \in \Omega$, is both true and false.[4] Again, a more popular position on these paradoxes is that the conclusion is *neither* true nor false. But such a solution appears to be beset by "revenge" paradoxes. One can formulate extended paradoxes deploying the notion of being neither true nor false, which still end in a contradiction. True, one can formulate extended paradoxes employing the notion of being both true and false, as well; and if one does this, one also gets a contradiction; but, given the *both* solution, we had some contradictions in the first place, and the new ones seem no worse than the original ones. Hence, a *both* solution appears preferable to a *neither*

[3] See Priest (1995), Part 3.

[4] See, e.g., Priest (1987), Part 1.

solution. The literature on all of this is enormous, and again, this is not the place to go into matters.[5]

I bring the preceding up here, simply because the sorites paradox is an inclosure paradox too.[6] To illustrate, take our colour sorites. Ω is the set of all a_is which are green, ψ is the vacuous condition, $x = x$. If $x \subseteq \Omega$ there is a maximum j such that $a_j \in x$. $\delta(x)$ is a_{j+1}. $a_{j+1} \notin x$, by construction; and $a_{j+1} \in \Omega$, by tolerance, since a_{j+1} is next to j, and a_j is green. The contradiction is that the first thing that is not green is green.

Now, since the sorites paradox is an inclosure paradox, it should have the same kind of solution as the paradoxes of self-reference—the Principle of Uniform Solution: same kind of paradox, same kind of solution.[7] And given a dialetheic solution to the paradoxes of self-reference, the Principle of Uniform Solution recommends a dialetheic solution to the sorites paradoxes.

4 The Dialetheic Solution

What, then, does such a solution look like? First, since the solution must tolerate contradictions, it must be based on a paraconsistent logic.[8] There are many such logics, and nearly any of them will do in the present context. But one of the simplest and most natural is LP. We need concern ourselves only with propositional logic here. Take a language which contains the connectives $\vee, \wedge, \neg$. An interpretation, ν, assigns each propositional parameter, p, a non-empty subset of $\{0, 1\}$. We define what it is for a sentence to be true, $\Vdash^+$, and false, $\Vdash^-$, in an interpretation, as follows:

- $\Vdash^+ p$ iff $1 \in \nu(p)$
- $\Vdash^- p$ iff $0 \in \nu(p)$
- $\Vdash^+ \neg A$ iff $\Vdash^- A$
- $\Vdash^- \neg A$ iff $\Vdash^+ A$
- $\Vdash^+ A \wedge B$ iff $\Vdash^+ A$ and $\Vdash^+ B$

[5] One place to start is Beall and Glanzberg (2011).

[6] For a much fuller discussion of all aspects of a dialetheic solution to the sorites paradoxes, see Priest (2010).

[7] See Priest (1995), Part 3.

[8] For a survey of these, see Priest (2002).

- $\Vdash^- A \wedge B$ iff $\Vdash^- A$ or $\Vdash^- B$
- $\Vdash^+ A \vee B$ iff $\Vdash^+ A$ or $\Vdash^+ B$
- $\Vdash^- A \vee B$ iff $\Vdash^- A$ and $\Vdash^- B$

An inference is valid if it preserves truth in all interpretations. That is, $\Sigma \models A$ iff for all ν such that $\Vdash^+ B$, for all $B \in \Sigma$, $\Vdash^+ A$.

We may define $A \supset B$ in the familiar way, as $\neg A \vee B$. $A \equiv B$ can be defined, again in the usual way, as $(A \supset B) \wedge (B \supset A)$. A notable feature of both the conditional and the biconditional is that they do not satisfy detachment. That is, neither of the following is true:

- $A, A \supset B \models B$
- $A, A \equiv B \models B$

(Make A both true and false, and B just false).

A dialetheic solution to the sorites paradox can now be explained very simply: all the premises are true, but *modus ponens* is invalid. Thus, take our colour sorites again. The premises are A_0, and $A_i \supset A_{i+1}$, for $0 \leqslant i < n$; the conclusion is A_n. Choose some $0 < j < k < n$, and take an interpretation, ν, such that $1 \in \nu(A_i)$ iff $0 \leqslant i \leqslant k$, and $0 \in \nu(A_i)$ iff $j \leqslant i \leqslant n$. We may depict the interpretation thus:

A_0	...	A_j	...	A_k	...	A_n
1	...	1	...	1		
		0	...	0	...	0

It is easy to check that all the premises are true, and the conclusion is not true. ($A_i \supset A_{i+1}$ is both true and false if $j - 1 \leqslant i \leqslant k$.)

Since this is an inclosure paradox, we know that there is some a_i that is both green and not green, though the premises do not tell us which one. That is, they do not entail $A_i \wedge \neg A_i$ for any particular i. But the premises and the negation of the conclusion do deliver $\bigvee_{0 \leqslant i \leqslant n} (A_i \wedge \neg A_i)$.[9] That is, they entail that a contradiction occurs somewhere in the progression.

[9] Let $B!$ be $B \wedge \neg B$. Then A_0 and $A_0 \supset A_1$ entail $A_0! \vee A_1$. This, plus $A_1 \supset A_2$ entail $A_0! \vee A_1! \vee A_2$, and so on, till $A_0! \vee ... \vee A_{n-1}! \vee A_n$, whence $\neg A_n$ delivers the last contradictory disjunct.

I note that just as the transition strip is both green and not green, it is red and not red. We can reach this conclusion by running the sorites in the other direction, though considerations of symmetry would have established it in the first place.

Let me end this section with two comments. One might suppose that to formulate the premises of the argument with a material conditional, and not some detachable conditional, is to misrepresent it. Not so. A material biconditional, $A \equiv B$, expresses the thought that A and B have the same truth value. We have:

- $A \wedge B \models A \equiv B$
- $\neg A \wedge \neg B \models A \equiv B$
- $A \equiv B \models (A \wedge B) \vee (\neg A \wedge \neg B)$

The tolerance of a vague predicate is expressed exactly by the thought that successive members of the progression have the same truth value: both true or both false. (Being true and false is not a third truth value. It is the possession of two truth values.) So the material biconditional is the correct connective to use to express tolerance. For any detachable conditional (assuming there to be one) one can, of course, formulate a version of the sorites paradox using this. But since it is the material biconditional which expresses tolerance, there is no particular reason to suppose that the major premises of the argument, thus formulated, are true.

Secondly, an obvious problem with a classical solution to the sorites paradox is that any point where one might suppose the sequence of statements to turn from (just) true to (just) false is arbitrary. One may object to the present solution in the same way. Indeed, we now have a double arbitrariness: *j and k*. This is the problem of so called "higher order vagueness", and it is the nub of any proposed solution to the problem of vagueness. However, to go into this matter here would mean that we never get to the matter of colour.[10]

[10]Discussions of the issue from a dialetheic perspective can be found in Priest (2010), (201+), and Weber (2011). I note, however, that in a certain sense, the theory in question rules out higher order vagueness. What about a borderline region between those things that are green, Gx, and those that are not green, $\neg Gx$? If there were such a region, then, on the current analysis, we would have $(Gx \wedge \neg Gx) \wedge \neg(Gx \wedge \neg Gx)$. But the first conjunct entails the second, so the conjunction is logically equivalent to $Gx \wedge \neg Gx$ itself. To be in a borderline state of a borderline state is already to be in that borderline state.

5 Contradictory Colour

So to colour. Let us suppose that the preceding thoughts are right. What follows about colour? Most obviously this: certain colour states are contradictory. These can be seen. So one can see certain contradictory states. Is this surprising? Yes and no.

One can see contradictory states in certain visual illusions.[11] The most famous of these is the *waterfall effect*. After conditioning the visual system with constant motion in one direction, one then looks at something stationary. Because of the negative after-image, this appears to be moving in the other direction. But if a subject focuses on a particular point in their field of vision, it appears stationary. Subjects report that the point appears to be both stationary and in motion.[12] Another example concerns colour itself. Subjects are presented with a screen, the left half of which is red, and the right half of which is green. The two halves are separated by a vertical black line. If the line is suddenly removed, many subjects report that the space where it was is now both red and green.[13] One can, then, it would seem, have perceptual fields whose contents are contradictory.

The case concerning transition-states in sorites progressions is different in two important ways, however. First, in the two examples just cited, the situations perceived are not really there: they are illusions. Though a contradiction may be *perceived*, the actual situation is quite consistent. In the sorites case, the contradiction is no illusion: the situation itself *is* contradictory.

Secondly, in the case of the illusions the situation *appears* to be contradictory. But when one looks at a transition-state of a sorites progression, it does not *look* at all contradictory. There is little temptation to describe it in phenomenologically contradictory terms in the same way.

In both cases, then, appearance and reality do not line up—but in opposite directions. In the case of the illusions, the actual situation is consistent, but it appears contradictory. In the sorites case, the actual situation is contradictory, but it appears quite consistent. In both cases, though, things are not what they appear.

In the case the illusion, we have little disposition to suppose that reality *really is* inconsistent: its illusory nature is all too evident. We certainly have a

[11]For a fuller discussion of this matter, see Priest (2006), 3.3.

[12]See Gregory and Gombrich (1973), esp. p. 36.

[13]See Crane and Piantinada (1983).

disposition to suppose that reality is consistent in the sorites case, however. It looks to be so. But then, how does one know what a contradiction *must* look like?[14] A contradictory state may not be as obvious as one might suppose. In many cases, we look to theory to tell us what it is we are looking at. The image on an MRI may look nothing like a defective heart-valve. But medical science may tell us that that is exactly what it is. In the present case, it is our theory of vagueness and sorties paradoxes which informs us what it is we see; and that is a dialetheia.[15]

6 The Consistency of the World

In *Doubt Truth to Be a Liar*, I argued that the observable world is consistent. The argument is to the effect that if the observable world were inconsistent we would be able to see it, which we do not.[16] The preceding considerations clearly undercut not only this argument, but its conclusion itself. The observable world *is* inconsistent, and we can see it—though we may not realise what, exactly, it is that we see.

I did point out there that the conclusions reached were defeasible, however:[17]

> These considerations, like all *a posteriori* considerations, are defeasible. Observation is a fallible matter, and what appears to be the case may not, in fact, be so. If it turned out, for example, that supposing grass in Australia to be both red and green all over allowed us to explain and predict every fluctuation of the Australian dollar, but had no other untoward consequences, we would have strong evidence that Australian grass is red and green.

Vagueness was even cited as a possible defeater:[18]

[14]The question is well asked in Beall (2000), and Beall and Colyvan (2001). Indeed, they use sorites, and particularly colour sorites, to make their point.

[15]There is a story about Wittgenstein, which may, for all I know, be entirely apocryphal. Wittgenstein asked a friend why people had thought that the sun goes round the earth. His friend replied that it was presumably because it appeared that way; to which Wittgenstein replied by asking how it would look if the earth went round the sun.

[16]See Priest (2006), 3.3, 3.4.

[17]Priest (2006), p. 62.

[18]Priest (2006), p. 63, fn. 17. Italics original.

> Suppose it were to turn out that, according to our best theory of vagueness, statements about the borderline area of a sorites progress are true and false. Then one would have to accept that contradiction might appear as how things appear in the borderline of an observable sorites (e.g., reddish blue)—which would *seem* to be quite consistent.

We are now in the position of that defeat.

The chapter of *Doubt Truth to be a Liar* also infers a corollary of the consistency of the observable world: that the world itself (that is, the totality of that which is the case) is non-trivial. We have an *a posteriori* argument that not everything is the case. Does this conclusion suffer a similar fate?

No. It is true that sometimes the world may be inconsistent, though we don't perceive it as so. We have to look to our best theories to tell us what it is that we see; and the theory of vagueness tells us that, in a borderline state, what we see *is* inconsistent. The extension and anti-extension of 'green' overlap in the borderline area. But equally, our the theory of vagueness tells us that the extension and anti-extension *do not* overlap at the ends of the progression. At one end, the strips are simply green; at the other end, they are simply not green. There is therefore no reason to suppose that things are *not* what they appear in those cases. Indeed, the theory provides reason to suppose that the *are* what they appear. We have good reason to suppose, then, that the world is not trivial: 'a_0 is not green' is not true.

7 The Sorites of Appearances

Let me now turn to another matter: the sorites of appearances.

To remind: we have a soritical series of objects, $a_0, a_1, ..., a_n$, and a corresponding sequence of statements, $A_0, A_1, ..., A_n$, where A_i is 'a_i is green'. Then, I have argued, the solution to the sorites paradox is to take it to be the case that if a_i is in the border region of the sorites, then:

1. $A_i \wedge \neg A_i$

Moreover, I have argued that things in the borderland do not appear to be inconsistent. Thus, if we write Θ for 'it appears that', we have:[19]

[19] Using the phrase 'appears that' raises the question 'appears to whom?'. In what follows I assume that it is to an observer with normal colour vision viewing the sorites sequence under normal conditions of light, etc.

2. $\neg\Theta(A_i \wedge \neg A_i)$

The situation *appears* to be consistent.

Now, the predicate 'x appears to be green' is just as tolerant as 'x is green': if x appears to be green and y is very close in apparent colour to y, then y appears to be green. Thus our soritical sequence of objects generates another sorites argument with the sequence of sentences $\Theta A_0, \Theta A_1, ..., \Theta A_n$. Call this the *appearance sorites*. Its solution is exactly the same. In particular, if a_i is a borderline case of this sorites, we have:

3. $\Theta A_i \wedge \neg\Theta A_i$

But does this situation appear to be consistent? That is, do we also have:

4. $\neg\Theta(\Theta A_i \wedge \neg\Theta A_i)$

Or does it appear to be inconsistent:

5. $\Theta(\Theta A_i \wedge \neg\Theta A_i)$

Personally, my intuitions—sensory and otherwise—seem to be of little help here. Theoretical considerations push both ways.

First, an argument for 4. Consider the following principles of inference:

6. $A \dashv\vdash \Theta A$

7. $\neg A \dashv\vdash \Theta\neg A$

These are obviously not valid as general principles about appearances. Something can be the case (or not to the case) without this appearing to be so; and something can appear to be the case (or not to be the case) without it being so. But for colours, 6 and 7 have more plausbility. Perhaps not if one is operating with an objective notion of colour: maybe something can be green but not appear so because of an optical illusion.[20] But for a phenomenological notion of colour, they seem right. Arguably for this notion, something is green iff it appears to be green; and something is not green iff it appears not to be green. Next, consider the principle that appearance commutes with negation:

8. $\Theta\neg A \dashv\vdash \neg\Theta A$

[20]Thus, for example, the background of a coloured patch can affect the colour it appears to be. See Hardin (1988), plate 2 (after p. 88).

This has no plausibility in general, either: *neither* A nor $\neg A$ may appear to be the case. Perhaps more controversially, *both* may appear to be the case. (Remember the waterfall illusion.) But again, the principle has more plausibility when phenomenological colour is involved. An object does not appear to be green iff it appears not to be green. Given 7 and 8, we have:

9. $\neg A \dashv\vdash \neg\Theta A$

Now in LP if A and B are inter-deducible and $\neg A$ and $\neg B$ are inter-deducible, then A and B are inter-substitutable in all contexts. Hence, given 6 and 9, 2 gives us 4—and quite generally, our two sorites are identical.

Of course, if 3 is true, but 5 is not true, then things can be *thus and so*, without it appearing to be the case that they are *thus and so*, even when the *thus and so* itself concerns appearances. But then, the fallibility of our ability to introspect our own mental (phenomenological) states is hardly news.

Next, an argument for 5. The general logic of Θ is not at all obvious. However, it is plausible that:

- $\Theta(A \wedge B) \dashv\vdash \Theta A \wedge \Theta B$

It appears to be the case that A and B iff it appears to be the case that A and it appears to be the case that B. Call this the *conjunction principle*.

Now, consider the following general principles concerning appearance:

- $\Theta A \dashv\vdash \Theta\Theta A$

- $\neg\Theta A \dashv\vdash \Theta\neg\Theta A$

Something appears to be the case iff it appears that it appears to be the case. And something doesn't appear to be the case iff it appears that it doesn't appear to be the case.[21] These seem to be plausible if one does take appearances to be reliably open to introspection. Call these *positive introspection* and *negative introspection*, respective.[22]

[21] Here, it is important that the observer is actually looking at the situation in question. If it is not the case that, e.g., something appears to the observer because they are dead, it clearly does *not* follow that it appears to them to be the case that *anything*.

[22] A possible-world semantics for Θ might, however, raise doubts about positive introspection. According to these, ΘA is true at world w iff for all w' such that wRw', A is true at w'; where wRw' iff w'realises all the things that appear to be the case at w. Now, the validity of positive introspection, left to right, is determined by the transitivity of R.

Given these, 3 entails $\Theta\Theta A_i \wedge \Theta\neg\Theta A_i$, and so by the conjunction principle, $\Theta(\Theta A_i \wedge \neg\Theta A_i)$. So we have 5.

With some extra assumptions, these principles can also be used to deliver another argument for 4. Contraposition is not valid in LP. (Thus, $A \vee \neg A$ is logically equivalent to $B \vee \neg B$, but their negations are not logically equivalent.) But special cases can contrapose (such as the logical equivalence between A and $\neg\neg A$) and, one might think, positive introspection contraposes:

10. $\neg\Theta A \dashv\vdash \neg\Theta\Theta A$

If A does not appear to be the case, it does not appear to appear to be the case. Moreover, one might think, so does the conjunction principle:

- $\neg\Theta(A \wedge B) \dashv\vdash \neg(\Theta A \wedge \Theta B)$

Given this, and De Morgan's Law (which is valid):

- $\neg\Theta(A \wedge B) \dashv\vdash \neg\Theta A \vee \neg\Theta B$

(It doesn't appear to be the case that A and B iff either it doesn't appear to be the case that A or it doesn't appear to be the caese that B.) Hence, in particular:

11. $\neg\Theta A \vdash \neg\Theta(A \wedge B)$

by disjunction introduction. But now, the second conjunct of 3 entails 4, as follows:

$\neg\Theta A_i$	
$\neg\Theta\Theta A_i$	By 10
$\neg\Theta(\Theta A_i \wedge \neg\Theta A_i)$	By 11 (with appropriate substitutions)

The fact that arguments for both 4 and 5 can be based on the essentially the same principles reminds us of that we are in a dialetheic context, and so we cannot rule out the possibility that both are true—at least without further considerations.

What to make of these matters, I leave as an open question.

But, one might well suppose, R is not transitive, simply because indiscernibility is not transitive. Interestingly, no similar problems seems to arise for negative introspection (left to right). In a world semantics, this is delivered by the symmetry of R, which raises no similar worries.

8 Conclusion

Colour is a puzzling phenomenon; perhaps nothing could be more obvious. But it is not just Modern Philosophy, with its distinction between primary and secondary properties, that teaches us that things may not be as they appear. As we have seen, contemporary logic may teach us that things with respect to colour are not what they seem—for a quite different reason. The phenomenology of colour tells us the way the world appears. Metaphysical theorisation is required to tell us how it actually is.[23]

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