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WHY AFTERIMAGES ARE METAPHYSICALLY MYSTERIOUS

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Given how important colour is to us, it's not surprising that we have learned a great deal about colour over the centuries. However, what is much less well known – almost completely *unknown outside philosophy – is the fact that colour remains a* mystery*: there are some simple facts about colour that lead to paradoxes that no one has been able to solve* for centuries.

In this article, I will present a metaphysical puzzle about colours that appear to be solely in our minds: afterimages. There are other metaphysical puzzles about colour, but I won't say anything about them.

The Story

Afterimages can be amusing. There are many little experiments one can do to experience a wide variety of afterimages. We are going to focus on one that is easily accessible: you can do it right now.

Suppose you have a very bright light bulb in the shape of a cow. So, you've got a strange life. The light is on and you stare at it from 2 feet away for about 30 seconds straight. Then you close your eyes tightly and put your hands over your eyes. What will happen with your eyes closed?

You'll experience an afterimage. You'll experience a cow-shaped blob of colour – one that changes colour over time. For me, it starts out orange, then it's red, then it's pink, then it's violet, and then it fades away. And like I said, it was roughly cow-shaped the whole time (but with fuzzy edges). Let's introduce some times into the scenario:

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4:00:00pm: You close your eyes after staring at the brightly-lit cow-shaped light bulb.

4:00:01pm: You start experiencing a cow-shaped-and-orange-but-not red patch.

4:00:01pm: Someone breaks the light bulb; your eyes are still closed and you're still experiencing the cow-shaped-and-orange-but-not red patch.

4:00:10pm: With your eyes still closed you gradually stop experiencing a cow-shaped-and-orange-but-not-red patch and start experiencing a cow-shaped-and-red-but-not-orange patch.

Once you have the experiences vividly imagined – please do so, as vividly as you can; it would be good to actually do it with an ordinary light bulb – it certainly *seems* as though there was this thing, *a cow-shaped-and-orange-but-not-red patch*, in your visual field from 4:00:01 to 4:00:10. Thus, it certainly *seems* as though this is a correct description of how you started out:

There was spread of colour, call it X, that

(a) you were visually experiencing from 4:00:01 to at least 4:00:10 even though your eyes were closed,

(b) was cow-shaped (at least approximately, like a drawing of a cow) during that whole time, and

(c) was orange during that whole time.

So now the question is this: *what is X?* In other words, what is the thing that satisfies all three of (a)–(c)? I'll briefly go over the five candidate answers that people typically think of when trying to answer that question:

1. X just doesn't exist at all.
2. X exists and is an external physical object: the surface of the light bulb perhaps.

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3. X exists and is an internal physical thing: some part of the eye, eyelid, or brain perhaps.
4. X exists and is a non-physical object.
5. X exists and is a visual experience.

My goal is merely to present the views and very briefly sketch their main serious problems. My thesis regarding X is not that such-and-such an option is false but that each option faces difficult objections.

Option 1: The Afterimage Does Not Exist

Many people end up denying X exists at all. What they mean is this: there is nothing that satisfies *all* of (a)–(c). At first, this may seem crazy: when one is gazing at the afterimage it certainly seems as though there is some image that you're experiencing! How could it not exist for goodness' sake?

1. If the afterimage X didn't exist, then when you closed your eyes you would experience just *darkness*, uninterrupted by any coloured expanse. That's precisely what it would be like if there were no afterimages at all.
2. But of course that's not what happened when you closed your eyes. On the contrary, when you closed your eyes it wasn't just darkness! All one has to do is briefly look, and one will see that breaking the darkness was *colour* and *shape* instantiated in something. The something in question may be subjective or ephemeral in various ways, but there was definitely *something there* that had colour and shape.
3. Thus, X really does exist. So, option (1) is false.

That is a pretty good argument, but the defenders of the 'X doesn't really exist' view have at least the beginning of

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an intelligent response: what exists is not an afterimage, which is a coloured patch or spread or whatever you would like to call it, but an *experience of* the old light bulb, which is a kind of mental process or event you're having and which is not coloured or cow-shaped. For comparison, when you see a star at night, sometimes what you are seeing no longer exists: the star blew up millions of years ago but the light from it takes so long to get to earth that it's still arriving here. So even though you are, at midnight, visually experiencing star X, X doesn't exist at midnight while you are experiencing it.

Unfortunately, there are serious problems with this defence of option (1). For one thing, on the face of it after you closed your eyes you were indirectly experiencing the light bulb *via the presence of the afterimage X*. That is, it's partly *in virtue of* the existence of the image that you are experiencing the light bulb: the presence of the image, at 4:00:02, was the primary (but not sole) *means* to experience the non-existent light bulb at 4:00:02. Here is the key point: the bulk of the reason you can, right now at 4:00:02 after the light bulb has been destroyed, experience the light bulb, is this: right now, at 4:00:02, there is an image that is in your visual field, and the image was generated in the appropriate way from looking at the light bulb. So, the image has to exist: otherwise you wouldn't be experiencing the light bulb after it was destroyed.

When it comes to the star case, the realist about afterimage X wants to know what it is about one's midnight visual experience that allows one to see the non-existent star. It's all well and good to say that the current light coming into the eye somehow allows one to experience the non-existent star, but what is it that the light is doing to make that happen? The realist has an answer: the light is helping to produce an image, a white one, that exists at midnight. The eliminativist about the white spot that exists at midnight has to come up with a story that doesn't require any midnight image at all.

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Think about it this way. When you looked up into the night sky you didn't experience just uniform darkness. Instead, there was a white spot S in your visual field. If the white spot S didn't exist at all, *while you were looking into the sky*, then all you would have experienced was darkness. But of course, that's not what happened: *while you were looking in the sky* there was a white spot. But the white spot S can't be the star: the white spot existed at midnight while you were looking at the sky; the star didn't exist at midnight while you were looking at the sky; thus, the spot S $\neq$ the star. Experiencing S was your means for experiencing the star, or so it seems to lots of people. So, what is S?

The option (1) advocates, who want to insist that X doesn't really exist, don't give up at this point. Typically, they will give something like the following speech:

> When you have an afterimage, there is some process going on in your visual system that is *importantly similar* to what goes on in your visual system when you see an external object with your eyes open in normal circumstances. For instance, suppose you take some LSD and hallucinate a pumpkin. So you are, in some sense of 'experience', experiencing an orange patch in your visual field. But strictly speaking, there is no orange patch there; it's just a hallucination after all. Your eyes and brain are functioning *as though* you are seeing a real pumpkin, at least approximately, but that doesn't mean there is any actually existing orange patch.

So, their idea is this:

i. When you're hallucinating a pumpkin, you are having a certain visual experience.
ii. When you see a real pumpkin, in perfectly ordinary circumstances, you are having a certain visual experience.

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iii. The two experiences are highly similar – similar enough that they seem pretty much the same visually from the inside, from the point of view of the one having the experiences.
iv. Even so, whereas in the ordinary experience you are seeing a really orange object (the pumpkin) *in the hallucinatory experience you aren't seeing any orange object at all*.

The main questionable claim is the second part of (iv) – the claim that in the hallucinatory experience you aren't seeing any orange object at all.

The problem with that part of (iv) is revealed when we try to figure out exactly *how* the two experiences are similar. On the face of it, the answer to

> Precisely *how* are the two visual experiences so similar? In what *respects* are they so similar? What is it about them that *makes* them so damn similar?

is this:

> They are similar in the sense that for each one there is something that is orange, not red, and pumpkin-shaped: with the ordinary experience, the thing in question is a pumpkin; with the hallucinatory experience, the thing in question is an image that looks like a pumpkin. It's the *presence* of the two orange-but-not-red-pumpkin-shaped things that *makes* the two experiences so similar. The similarity is obvious and open to introspection. It is the presence of the orange image in the second experience that makes that experience so similar to the first experience; the experiences are alike *in virtue of* the fact that the image and the pumpkin are so similar. Thus, in the case of the hallucinatory experience there is an orange-but-not-red-pumpkin-shaped thing, contrary to (iv).

If that's right, then the second part of (iv) is false, which sinks the 'X doesn't really exist' view.

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The advocates of the 'X doesn't really exist' view have the burden of offering a detailed proposal on exactly what goes on – what has to exist – when one is experiencing the afterimage. Vague talk about how the hallucinating person is having a 'visual experience' that's similar to the one a person has upon seeing a real pumpkin clearly won't do, as it fails to tell us *how precisely* the experiences are similar – and when we try to say what it is that makes the experiences similar, it is highly natural to end up admitting that X really exists.

When a person actually generates the afterimage, and looks at it, they almost inevitably think it's implausible, even ludicrous, to deny that there was something cow-shaped and orange. They are of course hesitant to admit that it's physical or that it's 'objective'. But the idea that there is nothing whatsoever there that's coloured – nothing subjective, nothing non-physical, nothing at all – is something they almost always reject. They think that although the 'something' may be ephemeral, temporary, fuzzy, perhaps non-physical and ultimately mysterious, it seems as certain as anything ever gets that it was there when they closed their eyes, that it existed in some way, and was obviously orange in some way (that's the business about orangeness being 'spread out' again). When one has the afterimage experience upon closing one's eyes, something is 'lit up', they claim, even if it's very difficult to say what it is. Upon closing one's eyes the darkness is interrupted by a coloured expanse; simple observation is sufficient to establish that small but crucial point. Again, maybe the image isn't coloured in the very same sense that an ordinary external object is coloured, but it's obvious that it is coloured in a very robust way – if anything, it's coloured in a way more robust than that of an ordinary material object such as a pumpkin.

That's my evaluation of option (1). I'm not saying that option (1) is false. I don't know if it's false! All I know is this: there are some serious, damaging objections to option (1) and it's quite difficult to see how a defender of option (1) can parry them. The bad news is that this pattern will hold for all the options, as we are about to see.

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Option 2: The Afterimage is an External Physical Object

So perhaps X does exist. Fine what is it?

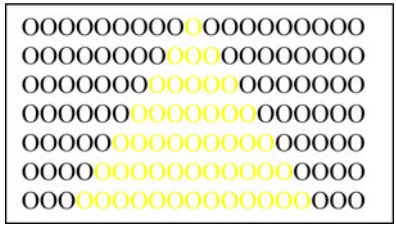
Right away, we can see excellent reasons to think something really odd is going on and X just can't be the cow-shaped light bulb. After all, with the demise of option (1) we are admitting that something, X, was cow-shaped from 4:00:01 to 4:00:10. But that means X can't be the light bulb (or the surface of the light bulb), since it was destroyed at 4:00:01. Since X existed from 4:00:01 to 4:00:10 and the light bulb did not exist during that time, X isn't the light bulb.

This criticism also shows that X can't be some light waves either: your eyes are closed and there are no light waves coming from the light bulb anymore.

Option 3: The Afterimage is a Physical Part of Your Body

So, X isn't the light bulb. Here's a better proposal: maybe some physical part of your eye was cow-shaped, orange-but-not-red, and was the thing you were experiencing. In particular, perhaps some *part of your eye* was cow-shaped and had that colour. X was part of your eye.

Obviously, your retina isn't cow-shaped. But consider this array of 'O's:



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> Let T be the triangle of yellow 'O's. Perhaps afterimage X is just an array of cells just like T is an array of 'O's. If you take a bunch of little things, light them up with the right colours in the right pattern, you could get a cow-shaped-orange-but-not-red image.

Perhaps the cells on the retina are like that: when you closed your eyes and had the afterimage, a cow-shaped pattern of cells in your retina was lit up orange while the surrounding cells were just dark, thereby producing a cow-shaped orange patch. And then those cells slowly changed colour to red, pink, violet, etc. Maybe that's the true answer: *X is just an array of numerous cells on your retina*. That's option (3).

There are problems with this option. First, scientific investigation shows that no part of your eye is cow-shaped. But since X was cow-shaped (look again at its characterization given above), X can't be some part of the eye. Second, scientific investigation shows that no part of the eye was orange, then red, then pink, and then violet – which again is inconsistent with identifying the image with some internal physical thing. And that seems to be the end of the matter.

In addition, it still seems pretty weird to say that when one closes one's eyes and has an afterimage one is literally seeing part of one's eye: it seems awfully weird to say we see parts of our eyes (especially when our eyes are closed). Hence, it doesn't seem that X could be the surface of your eye – although this is not a *proof* that this proposal fails. (I actually think this option is correct, but I won't defend that claim here.)

So, what on earth is X?

Option 4: The Afterimage is Non-physical

As a result of puzzling over those questions, some people find themselves tempted to think that X had to have

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been a *non-physical object* that (a) was something you experienced, (b) was cow-shaped and (c) was orange. And that would prove that aspects of our sensory life are non-physical even though coloured and having certain shapes!

In order to see the oddity in that view one needs to understand what 'physical' comes to. When philosophers use the term, they mean to include, as physical, trees, ice cream cones, planets, brains, earthquakes, supernova, electrons, photons (which are invisible), atoms, air, water, forces (like gravity), electromagnetic waves, magnetic fields, kinetic energy, etc. Pretty much anything that boils down to the behaviour of atoms and their constituents counts as physical. Our bodies are of course entirely physical: we are made of atoms. And the processes going on in our bodies are all physical as well: the digestion of your lunch, your eye movements, your muscle twitches, the electrochemical processes involving neurons in your brain, the blood flowing through your veins, etc. Pretty much anything studied in physics, chemistry, and biology is, by definition, 'physical'. To say that something is *not* physical is to say it lies outside the realm of the physical. It means that the thing in question, the 'non-physical' thing, doesn't boil down to atoms or processes involving atoms at all: so, it lies completely outside the molecules, atoms, forces, fields, and waves studied in physics, chemistry, and biology.

People who endorse option (4) say that the visual experiences you have when you close your eyes are not things going on in your brain or brain stem or eyes. They are not neurological processes at all. They are *caused* by physical processes going on in your head, but they are utterly separate from them, lying outside the physical world. More to the point, they are saying that X, the afterimage, has shape and colour but in spite of that fact isn't physical at all. For what it's worth (maybe not much), most people who have investigated these issues think this option is mad, for several reasons:

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(i) If the afterimage is caused to exist by physical processes, then it certainly seems that it's got to be physical as well and located more or less where its physical causes are. And yet, option (4) is saying the image isn't physical and isn't located in physical space.
(ii) If it has shape and colour, then it's got to be physical. And yet, option (4) says it's not physical.
(iii) The whole notion of non-physical aspects of the mind is fraught with difficulties that philosophers have discovered over the centuries (which I won't go over here).

Option 5: The Afterimage is a Visual Experience

It's hard to see how X could be a *visual experience*, the one you started having at 4:00:01. After all, what are the options here? What is a 'visual experience' anyway?

One idea is that it's a physical process, either in the eye or from the eye to the brain. We have already dealt with those ideas above.

Another idea is that it's a non-physical process – one that is orange, cow-shaped, and something you experienced from 4:00:01 to 4:00:10. We already examined that idea as well.

So, unless one has some other idea in mind, there's nothing new here with option (5). We can't just throw around ambiguous terms like 'visual experience' and expect to get anywhere.

What is Left?

We have seen that all five options for answering 'What is X?' have grave problems: for each one, there are excellent reasons to think it just can't be right. But one of the views has just *got* to be right, no? Hence, we are faced with a

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paradox: one of the five options has got to be true, but for each one there are excellent reasons to think it's false.

You might be tempted to conclude that afterimages are minor things, so we don't need to worry about them. I don't think so! For one thing, just because something is 'minor' doesn't mean it can't have major implications for our world-view. In the late nineteenth century there was this 'minor' issue about a physical phenomenon called 'Brownian motion'. Einstein studied it and came up with some very important, *major*, advances (this wasn't his work on relativity theory). For another thing, many of the considerations in this article apply to the colours we see in ordinary perception when there isn't anything funny going on like afterimages or hallucinations. Colour is a metaphysical mystery in multiple ways.

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