Supersaturated red & afterimages

revealing something by hiding something else

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• Appearance vs reality
• Supersaturated red
• Afterimages
Appearance vs. Reality
• According to purists, visual experience can be exhaustively characterized in terms of a subject’s apparent perspective on external, public reality. Visual experience presents us (or if we are subject to illusion, apparently presents us) with aspects of the world beyond us—nothing more, nothing less. According to sensationalists, we cannot adequately characterise experience solely in terms of a subject’s apparent perspective on external, public reality. In addition, or instead, we must appeal to visual sensation, in some sense of that vexed term.

(Phillips, I 2013: 417)
It is practically a platitude that

(a) since things may appear as they are not (by an large)

(b) appearance may be somewhat either separate or autonomous from how things are
• If we could show that, contrary to what it seems,

(a*) things always appear as they are

• Well, why should we persist believing that (b)
Shangri-La

• SL is a place in this world (that is, SL is contingently possible – no metaphysical or nomological license is required)

• SL is a place where, due to historical contingent factors, no one has ever had any illusion, misperception, hallucination, or dream.

• Would SL philosophers indulge in considering the notion of appearance, by and large?
Illusions

- perceiving things that exist differently from what they allegedly are (argument from illusion, I)

- S experiences O as F, but O is not F
Hallucinations

• One experience things that do not exist

• S experiences O as F, but O is not
Hallucinations and time

• Hallucinations takes place in time. Thus no harm in introducing it

• S perceives O as F at time $t$
  and
  O was not, at time $t$.

• However, because of time, hallucinations split in three separate cases
Hallucinations (H1)

• One perceives things that do not exist when one experiences them but that one has actually perceived at another time

• S perceives O as F at time $t$
  & 
  S has perceived O as F at some other time $t^* < t$
  & 
  O was F at time $t^*$
Hallucinations (H2)

- One perceives things that do not exist when one actually experiences them, however, things that one may have perceived, but that one has contingently never perceived

- S perceives O as F at time t
  &
  S has never perceived O at any other time \( t^* < t \)
  &
  O has been F at some other time \( t^{**} < t \)
Hallucinations (H3)

• One perceives things that do not exist when one experiences them, and that one has never experienced and that one could have never experienced

• S perceives O as F at time $t$
\&
S has **never** perceived O at any other time $t^*<t$
\&
O has **never** been F at some other time $t^{**}<t$
(\(O\) cannot be F at any time \(t\))
Empirical evidence

- While H1 is reported frequently (for instance, dream), is there any empirical actual evidence for either H2 or H3?

- Conceivability doesn’t count here.

- My general claim is that, in fact, H3=H2=∅

- But, being an empirical claim, there is no killer argument. However it is possible to debunk one by one all the alleged cases.

  Supersaturated red is one alleged case
Indeed the very fact that cases of H1 have not been considered enough is suspect.

“Frank Jackson’s Mary could come to know what red is like by hallucinating a red thing or by having a red afterimage. Indeed, we shall later encounter a case which implies that, as a matter of empirical fact, the paradigm red – the reddest of the reds – can only be presented in delusive experience.”

(Johnston M, 2004)
afterimage

• After-image (the after is just practical)
• They are taken as paradigmatic example of pure mental images somehow superimposed on the visual field
Supersaturated red

You cannot buy supersaturated red from the Pantone’s company! Or so it has been claimed!
Why philosophers like so much supersaturated red?

- One can come to know what “supersaturated” red is like only by afterimaging it

Johnston M 2004
There is a state that a subject can get into by being exposed to bright monochromatic unique green light (500 nanometers in wavelength) in an otherwise dark room for about twenty minutes. If we then turn the stimulus off, illuminate the room, and have the subject look at a small, not-too-bright achromatic surface, he will see a red afterimage. If the subject turns so that the afterimage is then superimposed on a small red background then something wonderful happens. The subject will then be afterimaging a supersaturated red, a red more saturated than any surface red one can see, a red purer than the purest spectral red light, light with a frequency of around 650 nanometers.
Supersaturated red is
- a missing shade of red,
- which you can only after-image,
- i.e., can never see but only have presented to you as part of uninstantiated complex of sensible qualities and relations.
If the primary excitation in a small foveal field in an otherwise dark surround is produced by, say, 500 nm, it looks green while the stimulus is on. If we turn the stimulus off and look at a small, not-too-bright achromatic surface, we see a red afterimage. If the afterimage is superimposed on a small red field, we perceive a SUPERSATURATED red ("supersaturated" means more saturated than the saturation of a narrow-band spectral stimulus of the same hue). [...] Supersaturation? (Hurvich, 1981, p. 187)
Supersaturated red

Reddish afterimage

?
Let’s do it!

• Is Hurvich & the rest right or is there some details that has been misconsidered?
• According to Hurvich if you look at a green stimulus according to a Herringian view of adaptation you should see a red afterimage (because you adapt in the red vs. green dimension)
• If that were the case you should see a reddish afterimage.
• OK, let’s try!
Experimental Hurvich

• You are going to see three slides.
• The first slide will last 20 sec. Stare the central cross.
• The second slide will last 3 sec.
• The third slide will last as much as you like.
There are two squares. Which one has a shade of color (a hue) closer to your afterimage? Tell which one.
afterimage
Experimental outcome:
No empirical evidence for supersaturated red
Why?

Because the adaptation was in the RGB space and not in the Red vs. Green space
Helmotz’s like color space (retina based)
Herring’s like color space (early processing based)
Herring Like Space (Hurvich)

RGB space

This is empirically wrong!
likewise

\[
\begin{align*}
\text{Red} & \quad \text{Green} & \quad \text{Blue} & \quad = & \quad \text{Turquoise} \\
\text{Red} & \quad \text{Green} & \quad \text{Blue} & \quad = & \quad \text{Red}
\end{align*}
\]
Results

• Which one was closer to what you see?
• I assume that the more common answer (provide some variation among subjects) is the B square (on the right)
• If that is the case, Hurvich was wrong and the adaptation worked on the Helmoltzian RGB space.
• This changes many things
Thus …

• Let’s use a simplified RGB notation. Any color is represented by a triplet (R, G, B).

• So, green is (0,1,0), red is (1,0,0), yellow is (1,1,0) and so forth.

• Let’s use the same notation to express one’s sensitivity to the RGB components with an S at the beginning.

• So, S(1,1,1) is total sensitivity; S(0,1,1) is to be red-blind, S(1,0,0) is to be green blind, S(0,0,1) is to be yellow-blind and so one.

• Intermediate values (like 0.2) are possible
Hurvich’s revisited

• You have normal sensitivity $S(1,1,1)$

• You see a green stimulus (1,0,0)

• You adapt, thus you become kind of red blind $S(0,1,1)$

• You watch the gray patch (0.5,0.5,0.5)

• What you see is the combination of the two, something like:

$$(0.5,0.5,0.5) \otimes S(0,1,1) \cong (0,0.5,0.5)$$

• (0,0.5,0.5) is magentish-purplish and not reddish
Why there was such a confusion?
Ewald Hering explained how the brain sees afterimages, in terms of three pairs of primary colors. This opponent process theory states that the human visual system interprets color information by processing signals from cones and rods in an antagonistic manner. The opponent color theory suggests that there are three opponent channels: red versus green, blue versus yellow, and black versus white. Responses to one color of an opponent channel are antagonistic to those to the other color. Therefore, a green image will produce a magenta afterimage. The green color tires out the green photoreceptors, so they produce a weaker signal. Anything resulting in less green, is interpreted as its paired primary color, which is magenta.

So, if green is opposed to red, why should green produce magenta?
Textbooks confusion

persisting confusion
historical and artists’ confusion
Subtractive vs additive mixing

Additive Colors

Subtractive Colors
What happened was that …

the working trio of subtractive primary colors (CMY) was modified for contingent reasons:

- **Magenta** was kidnapped by red because of its cultural and biological strength.
- **Cyan** was assimilated to blue mostly because of ultramarine pigments (lapis lazuli).
- **Yellow** remained yellow!
Some predictions are then possible

• If green produces a magentish afterimage, what is needed to get a red one?

• Not a green stimulus, but a cyan one, since to see red (out of a gray patch) one need to become both blue blind and green blind.

• That is, a cyan stimulus \((0,1,1)\) will produce an adaptation with sensitivity like \(S(1,0,0)\) thus

\[
(0.5,0.5,0.5) \otimes S(1,0,0) \cong (0,5,0,0)
\]

• Let’s try
• (negative) afterimages
• by and large
• Cyan stimulus → reddish afterimage
• (with frame)
The above considerations lead to an important result, namely that

**An after image is not a mental object but a filter imposed on the visual field**

An afterimage, (contrary to an established tradition since Smart), is **not** something floating in front of one’s field of view.

**Rather**, an afterimage is the result of a sensitivity filter that, in a **limited area** of the visual field, allows one to see different properties of what one is looking at.

Thus, after all, afterimages are veridical perception.
As a further proof that an afterimage is not something floating over and above the external world but it is the result of a localized filter, a few simple experiments may be devised to show that, by means of external stimuli, an afterimage may be

- Split
- Reunited
- Modified

The rational is the following. Usually afterimages are perceived against either a uniform background or a frame. Both conditions emphasize the alleged wholeness of the afterimages. On the contrary, if the afterimage is perceived against a not uniform background, it becomes more clear that the afterimages does not exist by itself.
• Splitting an afterimage in two
• Unifing two afterimages
• (first case)
• Unifying two afterimages
• (second case)
This changes many things: Afterimages are not images but a filter on the world
Afterimage as something more

I report that I have at this moment a roundish, blurry-edged after-image which is yellowish towards its edge and is orange towards its centre.

Afterimage – Gregory’s definition

- AFTER-IMAGE. An image seen immediately after the intense stimulation of the eye by light has ceased. For about a second, the afterimage is ‘positive’, and then it turns to ‘negative’, often with fleeting colours. The positive phase is due to after-discharge of the receptors of the eye; the negative phase is caused by loss of sensitivity of the receptors as a result of bleaching of the photo-pigments by the intense light. (Gregory, 1987: 13)
Afterimages are still images

- A **negative afterimage is an image** whose brightness relations are approximately reversed with respect to those of the stimulus;
- a **positive image is one** whose brightness relations are approximately the same.

Afterimages as batter rams for sensationalists

- Notoriously, afterimages are a central weapon in the sensedatum theorist’s armoury.
- G. E. Moore appeals to them as incontestable examples of sense-data.
- Jackson (1977: 51f.) likewise offers afterimages as paradigmatic examples of sense-data.
- O’Shaughnessy claims that they are the ‘most unproblematic’ (2000: 502) and ‘unexceptional defining example’ (ibid.: 468) of a visual sensation, where a visual sensation is thought of as ‘the immediate material object of ... visual experience’ (ibid.: 467).7
- Afterimages are often cited as a counter-example to pure representationalist views of perceptual experience. They must recognize the existence of a sensory field modified by intrinsic sensational qualities.
- Block (1996) appeals to afterimages as evidence of what he calls ‘mental paint’ or ‘mental latex’;
- Kind (2008) puts forward afterimages as a counter-example to the transparency of experience, and evidence of visual qualia.
• Afterimages – at least the ones that I have tried – don't look as if they are really objects or as if they are really red. They look... illusory. Try it out yourself. Don't get me wrong. I agree that an image experience and a tomato experience share something that one might call a color property. My point is that when one has an afterimage one has no tendency to think thereby that anything is really red, and so the introspective foundation for the theoretical claim that the afterimage represents something in the world as really red is weak.

Block, N. Mental Paint and Mental Latex, 1996.
Afterimages as seeing more by seeing less

- As something less
  - In fact they may be changed in time by external events
  - Changing the background is going to change, or split, or unify the afterimage we are looking at ...
object perception

a)
overlayed model of afterimages
afterimages: a way to see more by substracting something else

Furthermore, afterimages as a case of direct and veridical perception of external colors
Conclusion

• Supersaturated red does not work

• Color negative afterimages takes place in RGB space

• Negative afterimages do not overlay over the visual field

• Negative afterimages are the result of a localized filtering that reveals actual but usually invisible external features

• Seeing more by seeing less