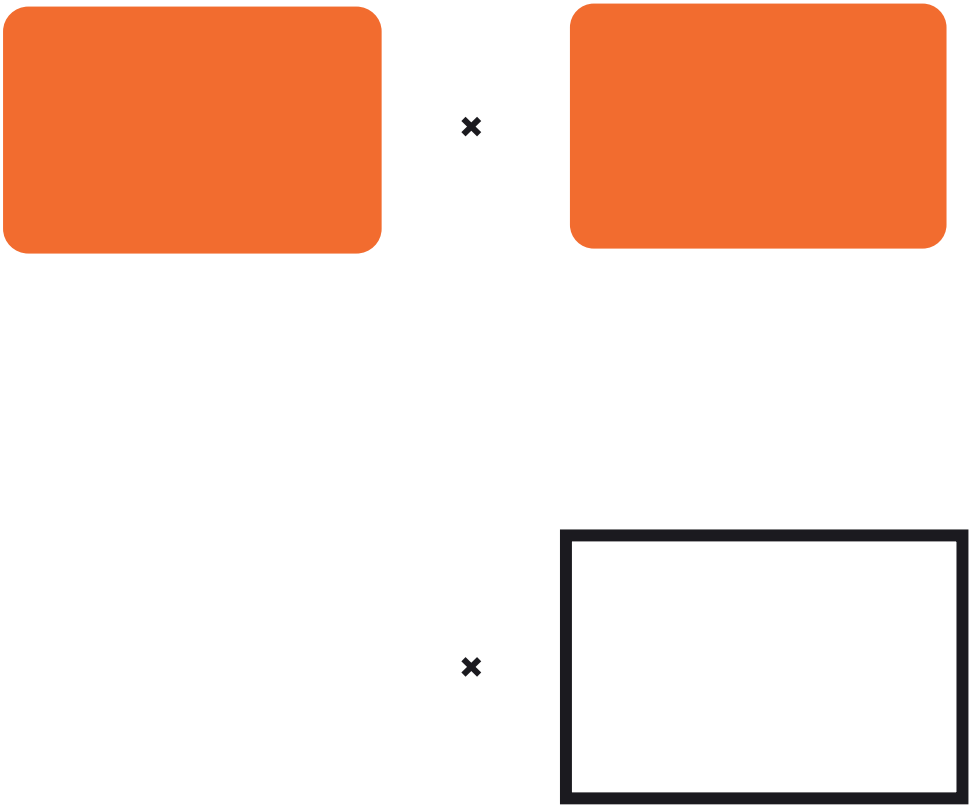


FIGURE 15.1

FIGURE 15.2

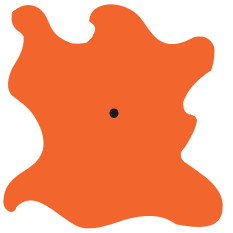


FIGURE 15.3

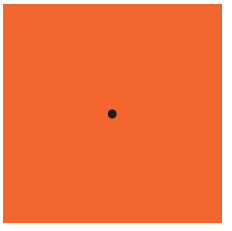


FIGURE 15.4

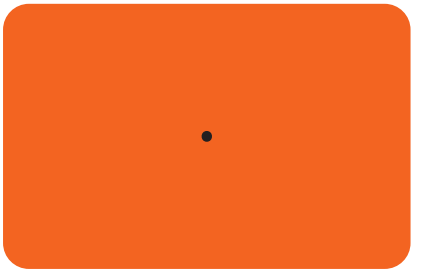
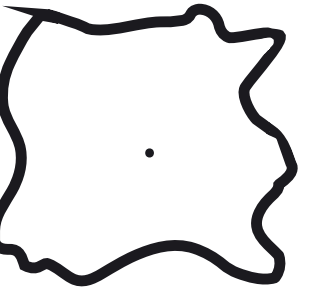
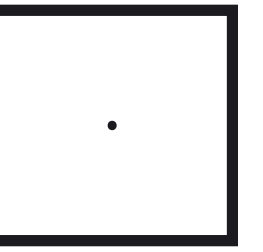
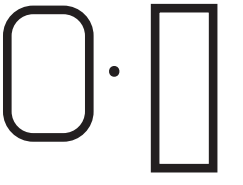


FIGURE 15.5







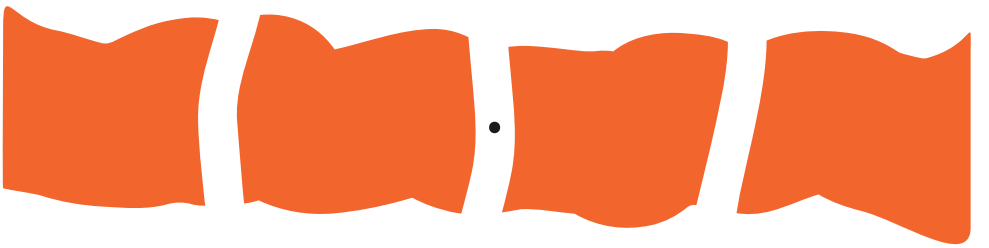


FIGURE 15.6

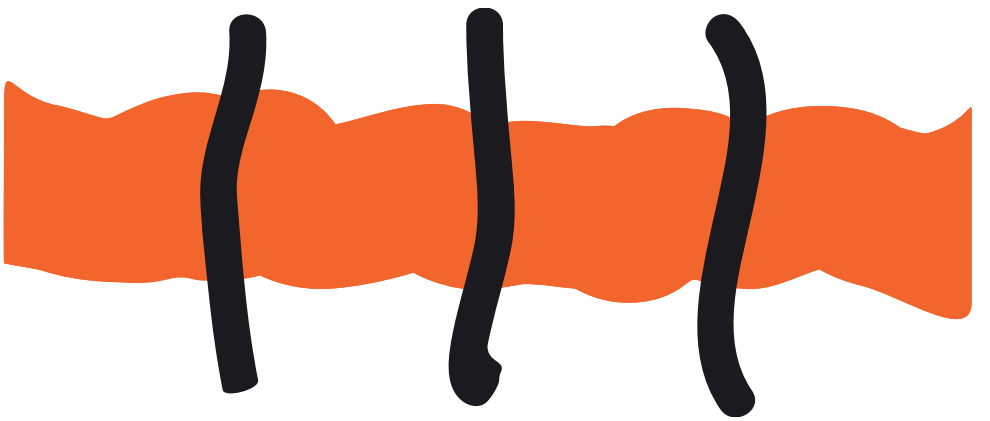


FIGURE 15.7

15

ORIGINAL OBSERVATIONS ON CERTAIN CHARACTERISTICS OF AFTERIMAGES

Translated by Tiziano Agostini

1. A "liquid" model for afterimage colours

Let us consider the simplest and best-known example of an afterimage. A single coloured shape (a square, a disc, a star) is placed on a homogeneous white or light grey surface. You stare at it for quite a long time, in good lighting, and then shift your gaze to a certain point on another homogeneous surface, similar to the first one. You hold your gaze still and immediately, or after a short delay, a very visible ghost of the shape just observed appears, with a different colour, according to the rule that we learnt from Goethe: red-green, blue-yellow, yellow-blue and green-red, though this is subject to variation, owing partially to factors involved in the observation, partially to strictly subjective elements.

This ghost image, the afterimage, is just that, a ghost, for all that it is visible and sometimes – at the beginning – very visible indeed. It is unlikely that someone should mistake this extra coloured shape for an object that can be grasped: as well as having the qualities of its shape and colour, it also has the quality of being an *appearance*. To avoid facile and predictable objections, we may say that it has "the appearance of appearance", the feature of being unreal. This unreality becomes more acute as the seconds pass, because the colour – of itself already diaphanous – tends to pale and seems to dissipate, while the outline, becoming uncertain as well as blurred, gives the image an instability that is not normally found in solid objects, but rather in certain reflections of light, or faint clouds. Moreover, the image comes and goes in unpredictable cycles.

Despite these ethereal properties, the afterimage is usually easy to describe. It may be hard to say what its colour is, both because our vocabulary for colours is impoverished, and because various factors affect it: transparency, background disturbance, the constantly shifting borders, a certain filminess, etc. But its shape and the way in which it changes can be described, as can its size in relation to other objects, how long it stays and for how long it is gone, what its position is in relation to the plane of observation, and so on.

What happens in the brief life of an afterimage can in part depend upon its surroundings. We should bear in mind that, from an abstract and model-building point of view, the image only exists in the eye and the brain. In actual fact, it is to be found among the objects that

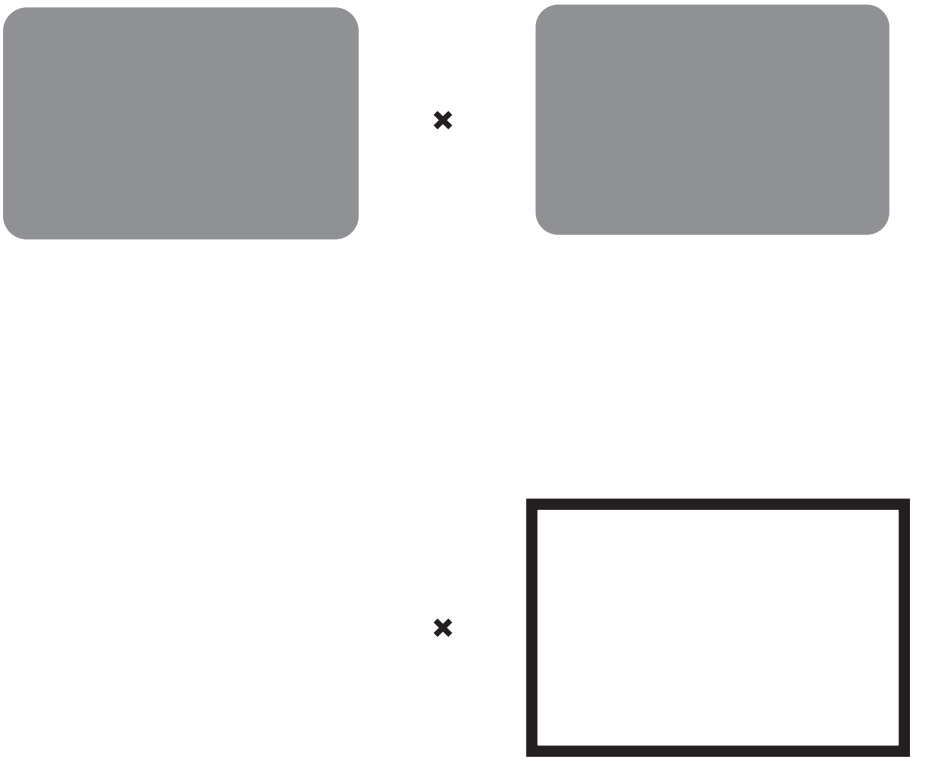
fill the field of our direct observations. Of course, everything can be referred back to those abstractions and models, but to do so, we should have to go and look at what happens in direct observation, when the image is made to interact with other visual events.

A first test can be made by enclosing an afterimage in a frame. The easiest way to make good observations of these things is as follows.

Place two coloured figures together on a homogeneous background, two red rectangles for example, one next to the other, marking a point or a cross exactly halfway between the two, halfway up (Figure 15.1). Then mark another cross under the first and, to its right (or left, of course), draw a black rectangle big enough for the afterimage of one of the red triangles to fit in exactly.

Holding the objects thus prepared at an appropriate distance, the observer places himself or herself straight on and in very good lighting, and starts to stare at the cross between the two rectangles, without ever shifting the gaze. This lasts as long as is necessary, between 30 and 40 seconds. Then they shift their gaze quite quickly to the cross drawn next to the empty frame, and begin staring at that. If everything has been done properly (for example, if the observer hasn't tilted his or her head when shifting the gaze from one point of reference to the other), the afterimage of the rectangle on the right will fall within the frame, while that of the rectangle on the left will remain free in the homogeneous area.

In these conditions, we can make some interesting observations. The afterimage without a frame develops over time, in line with what we already know, and loses and acquires its



(15.1, see Plate Section p. 6)

characteristics as has already been noted. Meanwhile (and the advantage of experimenting with two images at the same time is that they can be compared moment by moment) the other image – the one inside the frame – appears darker, perfectly homogeneous in colour, and often without that feature of unreality mentioned earlier. Thus one might say that the space within the frame actually has that colour, as though it were painted: it is as though the colour appears to have dyed the material within the frame, rather than just being superimposed on the background, as it seems to be in the other case, because of the transparency of the afterimage colour.

Secondly, this colour is very stable over time. While the unframed afterimage comes and goes, fades and then revives, and becomes of uncertain outline, the colour within the frame undergoes a slow but constant deterioration, which is hardly visible in the initial stages. Conversely, once it has completely disappeared, it is unlikely to return.

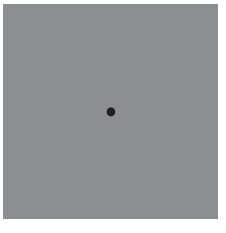
What I now put to you is, of course, a metaphor, but it is difficult to avoid the idea that the colour in the frame is "contained" within it, like a liquid in a container, whose sides limit the possibility of its spilling out. The fraying at the edges of the unframed image, on the other hand, can be compared to what happens to the edges of a splash of liquid on a porous surface, which tends to spread a bit, and is absorbed a bit here and there by what it is lying on.

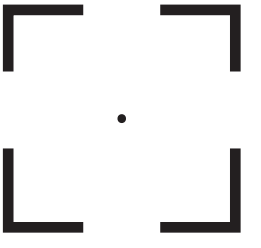
A similar thing happens when, using the same method, we compare an unframed image with one which falls within the borders of an anomalous surface: the almost perceptual edges have the ability to hold in the colour like those of a frame (further proof of the fact that an anomalous surface doesn't just look like an object but effectively behaves likes an object).

If we make a non-continuous frame, but with dashes, so that there is much less total black compared with the previous case and the frame has numerous gaps, once again the colour within it is very stable. Here too, the colour is darker than the unframed image, and lasts noticeably longer. (Only by comparing the two afterimages, one placed in the continuous frame and the other in the frame with dashes, can we see that the latter is slightly lighter, maybe simply because there is less induction of black.)[1]

This changes, however, if we place the afterimage colour in a frame with the same amount of black as in the previous case, but this time marking only the corners of the frame, with large, continuous strokes, rather than using dashes. The afterimage colour, briefly staying within the outline of the square, starts to fill and then overflow from the lateral openings. As the colour spills out towards the exterior, it fades, and often the image quickly disappears (Figure 15.2).

Some observers assert that, if the image doesn't disappear, the spreading of colour stops when it meets other edges possible in this arrangement. Indeed, if we look at the square formed by the four corners without positioning any afterimage inside, it is not difficult to see another square, this time anomalous, resting on it and rotated through 45 degrees.





(15.2, see Plate Section p. 6)

The anomalous square, if it is seen, covers a certain section of each side of the frame (the frame is amodally continuous behind it). This establishes itself as the place for the afterimage, which falls within it. To go back to the liquid analogy, in this case the anomalous square is the container for the afterimage colour.

The analogy with a liquid might inspire us further, still based on what we have seen in the two previous situations, and lead us to consider that the afterimage colour, for all that it behaves as a fluid, behaves as a fairly viscous fluid. It is unable to pass between the dashes, which are too close together, like thick oil in a container with small holes. But it is easily able to pass through larger openings, like those in the last example.

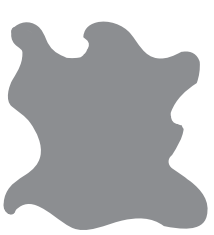
The analogy can be taken further: in cases in which the image pours out, it quickly loses its colour. If we compare the density of the colour with the level of liquid at the bottom of a container, the leaking of the liquid through some hole corresponds to a lowering of its level.

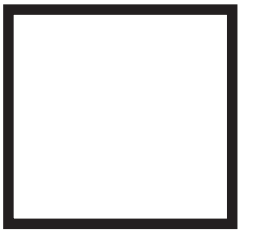
If we place a large drop of quite thick oil on the bottom of a square container, it will momentarily form a disc, or rather a circular blob of a certain thickness. However, almost immediately its edges will move towards those of the container and at the same time it will become flatter: eventually there will be a square of oily matter, less deep than the blob we started with.

Let us see how the analogy works with afterimage colours. Stare at a red disc of a certain diameter for a sufficient amount of time, looking at its centre, without moving your eyes. When the afterimage has formed, move your gaze to the inside of a black, square frame, whose sides are the same length as the diameter of the disc. For a few moments, the afterimage colour has the form of the disc previously observed, and then it starts to spread inside the frame, until it reaches it at all points, all the while losing its colour. The colour, like a liquid, expands, and thus its level decreases.

The same thing happens, of course, if we put a square afterimage inside a circular frame with the same diameter as its diagonal.

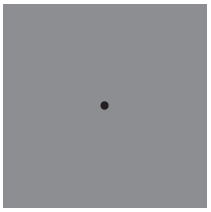
The best way to observe how colour settles in the frame is as follows. Draw a coloured patch with an irregular outline, which can fit entirely within the square frame, but which touches it in several places, with some parts protruding from its edges (Figure 15.3).

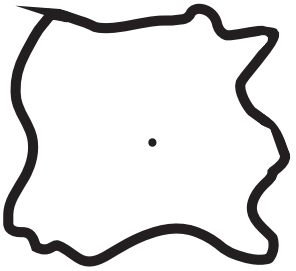




(15.3, see Plate Section p. 7)

Alternatively, construct a sample of a square of colour and a frame with uneven, irregular sides, able to contain the whole afterimage of the square, and in places touching its sides (Figure 15.4).





(15.4, see Plate Section p. 7)

(15.5, see Plate Section p. 7)

In these cases, even though the eye is forced to stare at the central point within the frame (marked by a cross or dot), it is easy to follow where the colour penetrates the empty spaces, in some sections spreading quickly, in others more slowly, and meanwhile fading.

Lastly, I will describe a situation that doesn't always work, and indeed that never works for some subjects. But it does sometime work and when it does, it is easy to see. This too can be explained using the liquid analogy already referred to.

Let the primary stimulus – that is, the object to be stared at to obtain the afterimage – be a red square. Its afterimage will then be directed onto a homogeneous surface, covering a quite large section of it; in the area covered by green, two frames are drawn as in the previous cases, but small enough so that the green doesn't just fill them but also surrounds them to a certain extent (Figure 15.5).

Gradually, the image fades, but often it is possible to note that it fades less inside the frame, so that when the image has disappeared, some colour remains inside the frame, while on the rest of the screen there is no trace left of it. This chromatic difference, which can also appear as a difference in the degree of darkness (the internal areas are darker), persists for a few seconds. This happens more easily if the primary stimulus is a bright colour, or, better still, slightly phosphorescent.

2. A "metaphysical" model for afterimage objects

Bishop Berkeley, who confused perception with what happens at the back of the eye, consistently denied that we could perceive the third dimension of visual space: all perceived objects (and *esse est percipi! – to be is to be perceived*) are in the same plane. Just as consistently, he concluded that we only see what has colour. Hume, who fully understood Berkeley's

theories, discussing the case of a person partially hidden by a fence or a table, explained to his readers that we "imagine" the legs or other parts of that person which are not visible, or we think of them, or postulate them on the basis of our past experiences of similar cases. If *esse est percipi*, on the basis of this theory, a man who is on the other side of the fence has no legs.

Much very good experimental research and a profound readjustment of the basic concepts have relegated this fallacy to narrow circles of pure psychophysicists, or the depths of the minds of a few philosophers.

There is genuine perception of the hidden parts of objects that are not wholly visible because of some obstacle placed between us and them. The properties of the parts perceived as existing behind the obstacle can be empirically determined, and follow rather strict autonomous rules.

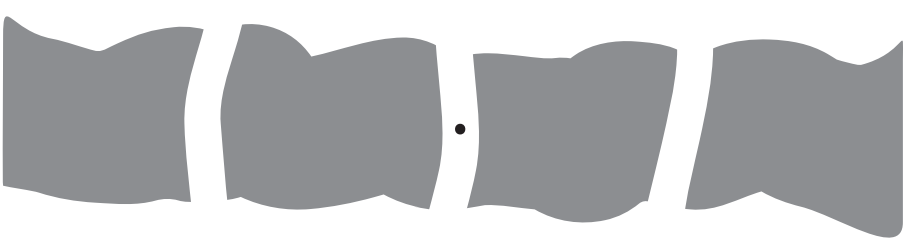
However, even if we are convinced that the actually perceived world consists in large measure of the layerings among things that lie behind other things, and that in turn hide parts of other backgrounds, and for all that we accept that we are able to perceive as present and real those parts of objects whose colour does not reach our eyes, it is very difficult to believe that there can be afterimages of "what has no colour", which is to say, afterimages of these parts.

Yet, at least in certain conditions, which psychologists will have the task of exploring further, it is possible to find examples of afterimages in which the non-exposed parts of a partially hidden object are also represented, which is to say those parts that can be perceived as real on the other side of some obstacle that happens to block them, and whose existence guarantees the integrity of the object.

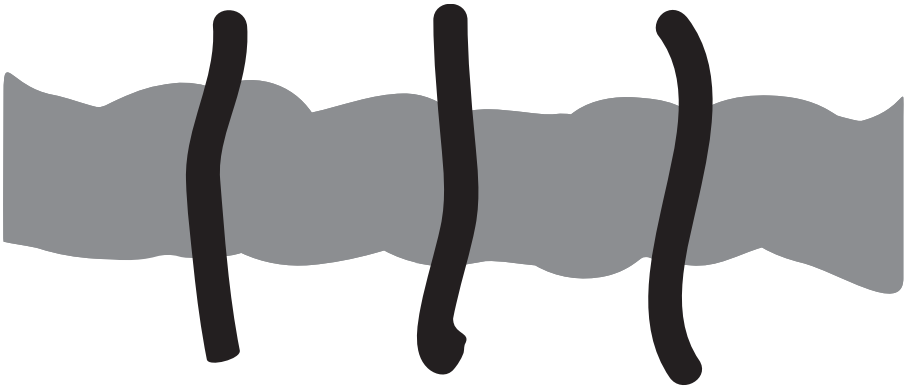
Let us take four red patches, arranged one next to the other (Figure 15.6). If we stare at a fairly central point of this configuration we obtain an afterimage of four patches in the opposite colour: if they are red in the primary stimulus, the afterimage will then be green.

Now, however, we position in the spaces that separate one patch from another in the primary stimulus, three vertical black sticks that are wide enough to completely cover those spaces (Figure 15.7). Here, in the primary stimulus, we have all the conditions for an amodal completion (as the jargon has it), and indeed no-one fails to see a horizontal strip of a certain width and colour (red) running behind three vertical shapes (black), which prevent some small sections of it being seen.

Having obtained the afterimage of such a structure, it is often possible to perceive the presence of a horizontal, coloured strip presented *as a whole*, which now and again disappears



(15.6, see Plate Section p. 8)



(15.7, see Plate Section p. 8)

to be replaced by three vague vertical lines, or by a whole strip in front of which three uncertain light and transparent ghost images hover, or sometimes by a whole strip and nothing else. Very rarely can we see our patches divided from each other, with or without vertical lines.[2]

To take the situation to the extreme (at least in terms of certain hypotheses on retinal processes), green vertical lines can be used – if the four patches are red. By these means, the aim is presumably to excite within the eye an opposite process in the retinal areas corresponding to the intervals between one red patch and the next, and in those corresponding to the red patches themselves. In these conditions and following the logic of retinal processes, the chances of seeing a single horizontal bar should be hindered.

But the experiments carried out with opposing colours give the same results as those carried out with colours that are not opposites of each other, including achromatic black and white. In fact, what have here are afterimages that cannot be interpreted in peripheral terms, but only – possibly – central terms. Which means, in the current state of play, that we must remain vague on the matter.

What can be said in all seriousness is that, after all, the afterimage is an image of what is effectively seen, perceived as existing, phenomenologically real, and not of what falls on the eye or what a photo-sensitive instrument could operationally verify. In the world of direct experience there is something that has that shape, and when only the afterimage of it remains – exactly as in the case of the remembered visual image – it is that form that is preserved. Not what the eye has seen, but what, objectively, has been in front the observer in the act of observation, mother of all things.

Notes

1 The patient experimentation in many of the situations described in this first section is thanks to the skill of Dr. Maria Luisa Vidotto, who also carried out the necessary statistical analyses of the results.

2 Dr. Nicola Bruno, Dr. Cristina Giorgi, Dr. Lidia Martinuzzi, and Dr. Paola Paliaga helped me with these experiments.