

## Editorial

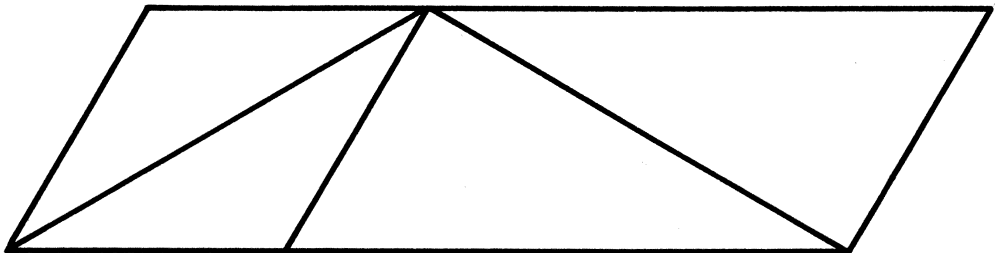
### Delusions

Illusions are failures of *perception*, delusions are failures of *conception*. So illusions are errors of the perceived here and now; but delusions are errors of understanding that may be very general, even to madness. Illusions of perception can create delusions when the cause of the illusion is not recognised. Thus, a rainbow is a delusion if we expect to walk under it as through an arch or brick or stone. For, unlike an architectural arch, a rainbow recedes as we approach it, never to be reached.

Can physical phenomena, such as refractions and reflections of light, give *perceptual illusions*? This is really a matter of terminology. But as it is useful to put phenomena into categories, let's try to decide. If we define illusions as disturbances of normal perception, then we might well say that rainbows and mirages are illusions. But for the physicist, interested in the phenomena of refraction and so on, these disturbances of vision are the evidence needed for discovering and investigating these phenomena of physics. Perceptually the rainbow is a fictional arch; but it is a particularly interesting phenomenon of optics well worth studying and explaining by the physicist. The mirage shows to eye and brain touchable objects, but displaced; so this is a distortion illusion. It is also a delusion—when we are fooled by this disturbance of vision to a false belief, perhaps to walk for miles through the desert, to die.

We have defined illusions as perceptual departures from truths, pointing out that these are selected truths, serving as references for perceptual departures. For a mirage, the reference is the map position of the oasis, or whatever, seen in a different place. The rainbow does not have such a reference, for its appearance departs from *nothing*. As the reference truth is nothing, though something is seen, this is an illusion of fiction.

When an optical (or physiological or cognitive) illusion is accepted as true, we are deluded. Thus a straight line seen as curved in an illusion figure, is a *delusion* when accepted as really curved though it is straight. Such errors can be life-threatening, as in driving or flying. A well-known visual distortion illusion could upset the concepts of a geometer (figure 1).



**Figure 1.** Delusion from illusion. Sander's parallelogram. The two inner obliques are the same length, though the right-hand line looks considerably longer. This illusion could upset a geometer's concepts (making him try to prove an illusion!)

### *Illusions and delusions in animals*

What of illusions and delusions in animals? Their sensory systems can be upset very much as ours so they have similar illusions. But could a simple animal be *deluded*? One does not think of simple organisms as having understanding, so how could they have delusions?

Illusions may show up in us as inappropriate behaviour; such as trying to walk through the arch of a rainbow, or rejecting a straight ruler seen as curved. There are also observed behavioural illusions in animals including simple organisms. But should we extend 'delusion' to brainless organisms?

We are deluded by illusions when they go unrecognised as illusions. On this account we should expect more illusion-driven delusions in people with less understanding, and still more in simple animals lacking checks of understanding. Birds fly into glass windows; swans try to land on shiny roads—presumably as they have little or no understanding of glass or roads. These are illusions producing behavioural errors through lack of understanding of glass or roads—one might say through lack of concepts—for understanding might have warned of the danger.

Human delusions can produce bizarre behaviour quite apart from sensory illusions. Can this occur for animals? One can hardly say a beetle is deluded in this way: though one might say of one of the Beatles that he is deluded—perhaps a delusion of no grandeur. A beetle can have no such idea as grandeur, though in some conditions it may misbehave even when its sensory systems are working normally. Would this be a beetle delusion, even though there is no illusion? The point is that even beetles' behaviour is not entirely controlled by their senses. They have innate and some learned knowledge, which may not be appropriate to the situation.

Delusions can be from unidentified perceptual illusions, which we may call illusion-driven; or from inappropriate knowledge, when not corrected by perception. Schizophrenia is a case in point as sensory control is lost and fantasies take over. A mirror can delude us into mysterious reversals, and reflections of still water to ghostly beings and gods in the sky seen in a sacred lake.

The evolution of perception and of understanding has been driven by illusions and delusions. Orchids delude bees into sexual activity, for pollination; the bark of the dog can be worse than his bite. The red warnings of poisonous insects are adopted by other species that are safe to eat. Illusions and delusions, of predator and prey, have driven evolution of the senses and conceptual sense. For learning comes from correcting errors.

### *Reflections*

A particularly puzzling though very familiar optical illusion is mirror-reversal. When a book is held to a looking-glass, the writing is right–left, though not up–down, reversed. Why? This has puzzled philosophers ever since Plato.

There is a principle in physics, Curie's principle, which says that asymmetries cannot be produced from symmetries.<sup>(1)</sup> More precisely, Curie's principle says that systematic asymmetries cannot be produced from symmetries; but mirrors, normal to the observer, such as a looking-glass, are symmetrical right–left and up–down. Yet every time one glances into a looking-glass, things look reversed right–left though not upside–down.<sup>(2)</sup> Why? What is the cause?

There must be a hidden asymmetry; but what is the asymmetry, so that the reversal is only sideways? Is the reversal optical, psychological, physiological—or what? Philosophers have, over hundreds of years, suggested such causes and more. Is the asymmetry the horizontal separation of our eyes? Crossing of light in the eyes? Neural crossings in the brain? Right or left hemisphere dominance? Mental rotation, in perception or imagination? A quirk in the nature of space? Ambiguity of the words 'right' and 'left'? All of these have been suggested, though all are wrong. As they would be the first to admit, philosophers can be deluded.

<sup>(1)</sup> This is known as Curie's principle after the French physicist Pierre Curie (1859–1906).

<sup>(2)</sup> There is asymmetry in depth, but this can have no effect, as the depth axis is normal to the horizontal and the vertical axes.

What is happening? If none of the kinds of explanations suggested above is correct, what is the answer? It may be obvious to the reader but I shall assume it is not. Try looking at a book, in a plane looking-glass. The writing is horizontally reversed, so an E looks odd though an A looks normal. For almost everyone who thinks of it, this is a teasing puzzle, generally remaining unsolved for life. Yet the answer is simple.

The mirror is behind the reflected objects (such as a book or the matchbox), so it shows the object from its further side. We see the *front* of the object directly, but we see its *back* reflected via the mirror. The point is: the book, or the matchbox or whatever, must be *rotated from direct view* for the writing to be seen in the mirror behind it. The reversal in the mirror is due to the object being rotated from direct view to face the mirror.

Try looking at writing on a transparency in a mirror. The writing in the mirror and on the transparency is identical—as no rotation is needed. But an opaque object must be rotated for its front surface to be visible in the mirror behind it. The asymmetry comes from the way the object is rotated to face the mirror. This is usually around its *vertical* axis—giving right–left reversal. But it is perfectly possible to rotate, say a book, around its *horizontal* axis to face the mirror. Then the book appears upside down—not right–left reversed in the mirror. One sees the object as it has been rotated from direct view.

This is all very well for a small object, such as a book or a matchbox; but how does this apply to the scene in the driving mirror of a car? Why is the scene behind, including the number plates of the following cars, reversed right–left? What is rotated here? Surely not the whole scene. No. What is rotated here, is the observer's head. It is rotated 180° from direct viewing of the scene behind. It is this that causes the reversal. We are deluded when this is not recognised, into some false theory, such as light crossing at the mirror, or the brain switching things around.

Mirror-reversal is given by rotation of the object, or rotation from direct-view of the head and eyes to face the mirror.<sup>(3)</sup> It is surprisingly difficult to realise that mirror-reversal is due to the eyes being taken out of one's head and moved to a different place—to see from the mirror.

It is a fine point whether mirror-reversal should be called an 'illusion'. Vision is disturbed from normal, which suggests it is an illusion; though once understood we see exactly what we should expect to see. What is disturbed is the effective viewing position. Normally it is from the eyes, but now the eyes are effectively in the mirror, and see from its position in space. This allows the backs of things to be seen—the further side of opaque objects, and the normally invisible world behind the observer—with corresponding rotations.

As mirrors are invisible when clean and highly polished, they are immensely useful to conjurors for evoking delusions. The trick of the box that appears empty, though a couple of assistants are in it, depends on angled mirrors being invisible and not known. Conjuring is a fascinating mix of illusions and delusions.<sup>(4)</sup>

### *Conjuring*

It is essential to keep tricks secret or they look obvious and silly, as the delusion is lost. Surely, conjuring is a special case, though; for, generally, we gain pleasure from understanding, and are irritated by lack of understanding or being tricked. Delusions are generally counterproductive and some are dangerous; yet delusions of conjuring have a universal appeal, which is odd.

<sup>(3)</sup> This is discussed at length in my book *Mirrors in Mind* (Gregory 1997).

<sup>(4)</sup> There are really two delusions: of the *object* of the illusion; and of the physical, physiological, or cognitive *cause* of the illusion.

Conjuring is full both of illusions and of delusions. Some of the delusions are created from illusions, others from false assumptions based on knowledge of the normal world. Perception is fooled by 'sleight of hand', but this is far more subtle than mere speed to defeat the eyes. Above all, conjurers are masters of controlling attention.

Let's look at a simple trick that is worth trying, as it does not need special skill, and shows a delusion from not applying knowledge we all share. Take a jar, or a mug. Turn it upside down to show it is empty. Pour some water in it. Swirl it around for a few seconds (uttering a magic word) then turn it upside down, to pour out not water—but an ice cube! How did the water freeze so quickly?

This trick depends on well known though unsuspected simple physics. The jar contains a sponge jammed in the bottom. An ice cube has been placed on the sponge. When the water is poured in it is soaked up by the sponge. So when turned upside down no water comes out—but only the ice cube—the missing water apparently turned to ice.

Although we all know that sponges soak up water, when this knowledge is not called up the trick works. This is a little like the mirror-reversal puzzle, which also has nothing in it we do not all know; but it is hard to access the knowledge needed to stop it looking like a trick. Isn't this generally so for science? The whole universe looks like a conjuring trick when we don't understand what is going on. Unless one is *very* keen on conjuring, this is a good reason for learning some science.

Some tricks, and no doubt paranormal phenomena, depend on not appreciating probabilities. In conjuring, skills of sleight of hand allow improbable, and assumed to be impossible, hand and finger movements, as the conjuror has learned unusual skills. So even when one is close to the conjuror, he performs the apparently impossible. For most of us it is indeed impossible. For a different example, as identical twins are rare, it is easy to transport one girl instantly to somewhere else, when only their names are different. So identical twins are valuable to conjurers, as they are unlikely and easily confused. The audience sees a girl transported instantly across the stage—a kind of conceptual phi movement.

The conjuror sets up expectations while distracting attention from crucial events or features of the situation. This is truly an art. The audience is fooled even though they know they are going to be tricked. The phenomenon of change blindness—changes going unseen as perception assumes continuity—must be a great help to the conjuror. Quite large changes go unnoticed when give-away movement is avoided. Seeing movement may be avoided with a sudden bang or some other distraction. Conjurors have unique practical knowledge of controlling attention, still quite mysterious in psychology.

### *Attention*

Vision signals many features—position, movement, colours, and so on—in parallel systems, and modular processors, though we experience unitary objects. How it all comes together is not at all fully understood. How do we see objects combining separately sensed and processed characteristics? This is mysterious as the various signals and processed data do not seem to converge to centres in the brain. A suggestion is that:

"Features are registered early, automatically, and in parallel across the visual field, while objects are identified separately and only at a later stage, which requires focused attention. ... Thus focal attention provides the 'glue', which integrates the initially separable features into unitary objects. ... However the features may 'float free', once more, or perhaps recombine to form 'illusory conjunctions'." (Treisman and Gelade 1980, page ....)

---

This account makes attention extremely important for perception. The passage continues: “Without focused attention, features cannot be related to each other.” It is found that features can float free when attention is overloaded, or directed elsewhere.

The phenomenon of change blindness is almost certainly related to attention, or rather inattention. We tend to assume that things continue unchanged, so evidence of change is needed; but without focused attention even large changes can go unnoticed. Change blindness is further evidence that the apparent richness of perception is largely illusory. How much the apparent richness of the scene around us is created, or assumed, is an important and controversial question. Of course thinking of perceptions as *constructions*, as we do, implies they are more than the available data, and fortunately fictions are not necessarily false. Attention is often thought of as like a spotlight directed to regions of our mind. But it is more likely that there is nothing there in the mind outside the attention when our immediate reality is created.

Richard L Gregory

**References**

Gregory R L, 1996 *Mirrors in Mind* (New York: W H Freeman/Spectrum)

Treisman A M, Gelade G, 1980 “Selective attention and stimulus integration” *Cognitive Psychology* **12** 97–136



ISSN 0301-0066 (print)

ISSN 1468-4233 (electronic)

# PERCEPTION

VOLUME 32 2003

[www.perceptionweb.com](http://www.perceptionweb.com)

**Conditions of use.** This article may be downloaded from the Perception website for personal research by members of subscribing organisations. Authors are entitled to distribute their own article (in printed form or by e-mail) to up to 50 people. This PDF may not be placed on any website (or other online distribution system) without permission of the publisher.