Inverted faces
Investigations of the human face have featured prominently in perception and in *Perception* over recent years. Much debate has concerned whether the face is a special stimulus or one that is both very familiar and important for social interactions. A robust aspect of face perception is the difficulty posed when faces are presented upside down. As Rock (1973) noted: “Along with printed and written words, faces represent one of the few types of material that do look different enough to impede recognition when retinally tilted by 90° or more” (page 59). Indeed, one of the novel manipulations on this theme was introduced in *Perception*. Peter Thompson (1980) demonstrated that inverted elements of the face, like eyes and lips, are more readily tolerated when the rest of the face is inverted than when upright: upright elements in an inverted face do not look as grotesque as inverted elements in an otherwise upright face (see [http://www.essex.ac.uk/psychology/visual/thatcher.html](http://www.essex.ac.uk/psychology/visual/thatcher.html)). The particular face Thompson used for this demonstration was that of the then Prime Minister, Margaret Thatcher, and it is now known as the Thatcher illusion. Another manipulation of her visage is shown in figure 1, where three faces are seen—two three-quarter profiles and a central mannequin. The two profiles alternate in apparent depth rather like the Necker rhomboid. The symbols defining the faces are not arbitrary, and this cannot be considered as a truthful rendition! The title of the illustration is after a quotation from her Cabinet Secretary when, as a witness in a spy trial in Australia, he admitted to having been economical with the truth.

![Figure 1. “Economies of the truth” by Nicholas Wade.](image-url)
Another difficulty in the perception of faces relates to their visibility when inverted in depth. That is, viewing a hollow mask of a face from the back results in it appearing as protruding rather than receding, and this survives rotation of the mask. The facial features appear to rotate in the opposite direction to the frame, until parts of it are optically obscured. The effect is also robust and is frequently used as a perceptual demonstration (see http://www.richardgregory.org/experiments/index.htm; Gregory 1998). Depth reversals have a long history (see Wade 1998), but the facial variant is more recent. In the context of converting cameos into intaglios, David Brewster (1781 – 1868) described that similar effects were possible with masks:

“We have succeeded in carrying the deception so far, as to be able, by the eye alone, to raise a complete hollow mask of the human face into a projecting head. In order to do this, we must exclude the vision of other objects; and also the margin or thickness of the cast. The experiment cannot fail to produce a very great degree of surprise in those who succeed in it; and it will no doubt be regarded by the sculptor who can use it as a great auxiliary in his art.” (1826, page 108)

Playing on the difficulty of seeing upside-down faces with the ease of upright ones is not so novel artistically. Rex Whistler (1905 – 1944) utilised the technique of presenting two faces in one with great wit. The two faces typically shared eyes but the inverted one was generally unrecognisable until the design was itself inverted (see figure 2). According to his brother, Laurence, Rex first saw an illustration of an inverted face when visiting his publishers:

“In 1682 a certain Peter Berault published a book called The Church of Rome Evidently Proved Heretick, and for a frontispiece provided a drawing of the Pope, very smooth and smiling, which, when turned the other way up, proved His Holiness to be entirely repellant and (evidently) heretick. Naturally this fold-out is nearly always missing from copies of the book—itself quite rare—but there was one copy that still retained it, and the copy belonged to Roger Senhouse, a partner in the firm of Secker.” (Whistler and Whistler 1978; page numbers are not given in the book because, like the earlier ¡OHO!, it can be read upright or inverted!)

![Figure 2. Rex Whistler’s Young man/Old man presented in both orientations (after Whistler and Whistler 1946).](image)
Little is known about Pierre Bérault. He was a French divine who moved to London and converted to the Protestant faith there in 1671; he also changed his name to Peter Berault. The book cited by Laurence Whistler was first published in 1680. The copy in the British Library conforms to the expectations given above—there is no fold-out frontispiece illustration, nor is there any sign of there having been one. Three years later, Berault (1683) wrote another book with an equally provocative title—*The Church of England Evidently Proved the Holy Catholick Church*—but this does not have any illustrations of any sort in it either. Little in the way of clarification is provided in Rex Whistler’s biography (L Whistler 1948). Although Rex Whistler is best remembered for his upside-down drawings, they hardly feature in his brother’s account of his life and drawings.

Most of Whistler’s amusing portrayals were initially produced as advertisements, and words were added to them after his death by his brother (Whistler and Whistler 1946, 1978). The majority of the illustrations are full-face with both upright and inverted figures sharing eyes. A few are in profile. Our perception of faces is confined principally to the region below the eyes, and it is in the hair or headdress that Whistler made his subtle transformations.

Somewhat earlier in the twentieth century, Gustave Verbeek or Verbeck (1867—1937) produced cartoon sequences that could be read in one orientation and then rotated and read ‘backwards’. A static example of a cartoon is reproduced in Frisby (1979, page 17), and dynamic versions (which invert the illustrations) of several strips can be seen at [http://privatewww.essex.ac.uk/~alan/GL/Verbeek/](http://privatewww.essex.ac.uk/~alan/GL/Verbeek/). Verbeek was born in Japan and moved to New York around 1900; he produced his topsy-turvy cartoons a few years later.

At about the same time, George Malcolm Stratton (1865—1957, figure 3) published his observations on the consequences of wearing an inverting lens. He viewed the world with an upright retinal image (optically inverting the inversion in the eye) and described his experiences over a period of days (see Wade 2000). The strangeness of the inverted world gradually declined over eight days of optical inversion and the

**Figure 3.** Two views of George Malcolm Stratton (1865—1957). The dual image on the left is inverted on the right.
strangeness continued briefly when the device was removed. It would be of interest to
determine whether the oddity of inverted faces declined with prolonged exposure to them.
Paradoxically, Stratton said virtually nothing about the appearance of faces during the
period of visual inversion.

The purpose of this editorial is to draw attention to a much earlier example of
such facial manipulation. On display at the Budapest History Museum, located in the
Castle overlooking the city and the Danube, is a second-century Roman beaker which
utilised the principle of inverted faces. A photograph of the terracotta beaker is shown
in figure 4. A pair of eyes is shared by an upright and an inverted face modelled
over the surface of the drinking vessel. The normal orientation of the beaker (shown
on the left of figure 4) is obviously determined by its function. The inverted face is
more difficult to discern, but it is helped in the museum by the placement of a mirror
beneath it, so that the reflection can also be observed. The inverted face in the beaker
is not based on the vagaries of two-dimensional representation, as is the case with
Whistler’s drawings, but it is presented in three-dimensional form. Our discovery was
most apposite as the beaker was first drawn to our attention during a conference on
“Image and brain” held in Budapest in October 2002. It is clear that second-century
Roman potters were struggling with similar perceptual problems to those addressed
at the conference! They were, however, representing them in solid form rather than as
flat shapes.

Figure 4. A second-century Roman beaker viewed in its normal (functional) orientation on the
left, and inverted on the right. The eyes are common to both faces, but the inverted one is difficult
to see in both instances. The beaker is on display at the Budapest History Museum. This figure can
be seen in colour on the Perception website http://www.perceptionweb.com/misc/p3201ed/.
Roman illusions are more often associated with architecture than with perceptual paradoxes (see Johannsen 1971). Vitruvius (c 88 – 26 BC, figure 5 left) noted that parallel columns in temples do not appear so when viewed from the ground, and so their dimensions were modified in order to look uniformly wide:

“Therefore what the eye cheats us of, must be made up by calculation .... It is on account of the variation in height that these adjustments are made. For the sight follows gracious contours; and unless we flatter its pleasure, by proportionate alterations of the modules (so that by adjustment there is added the amount to which it suffers illusion).” (1962, page 179)

This was an example compensating slight departures from size constancy in the construction of buildings.

Vitruvius was greatly concerned with human proportions, and their relation to circles and squares, as is famously recorded in the many versions of ‘Vitruvian man’ (a modern variant of which is shown in figure 5). He wrote:

“Now the navel is naturally the exact centre of the body. For if a man lies on his back with hands and feet outspread, and the centre of a circle is placed on his navel, his figure and toes will be touched by the circumference. Also a square will be found described within the figure, in the same way as a round figure is produced. For if we measure from the sole of the foot to the top of the head, and apply the measure to the outstretched hands, the breadth will be found equal to the height, just like sites which are squared by rule.” (1962, page 161)

The system of human proportions was the guide to the dimensions of temples.

This was an example compensating slight departures from size constancy in the construction of buildings.

Vitruvius was greatly concerned with human proportions, and their relation to circles and squares, as is famously recorded in the many versions of ‘Vitruvian man’ (a modern variant of which is shown in figure 5). He wrote:

“For Nature has so planned the human body that the face from the chin to the top of the forehead and roots of the hair is a tenth part... the head from the chin to the crown, is an eighth part ... a third part of the height of the face is from the bottom of the chin to the bottom of the nostrils; the nose from the bottom of the nostrils to the line between the brows, as much; from that line to the roots of the hair, the forehead is given as the third part.” (1962, page 159)
Thus the face featured in the proportions and symmetries that should be applied to buildings. The location of the eyes approximately midway in the head enables facial inversions of the type practiced by the Roman potters and by Rex Whistler.

It would be most interesting to determine whether this is an isolated Roman example of facial inversion. Perhaps it was more widely employed in antiquity. However, an archaeologist and specialist of the Roman period from the Aquincum Museum, Budapest, was not aware of any other examples. Irrespective of how widespread such examples were, it is clear from the existence of the Roman beaker that perceptual paradoxes were part of their art as well as their architecture.

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