

Painters centre one eye in portraits

The importance of the centre of the canvas has long been appreciated in art¹, as has the importance of the eyes in revealing the personality of subjects of portraits. The centre of symmetry of the face is often discussed in art analysis¹⁻⁵ and might be expected to be used as an explicit principle of composition by artists trained according to such analysis. However, I have found that portraits painted throughout the past 600 years adhere to a different compositional principle not discussed in the literature: one eye is consistently centred horizontally in the canvas.

Fig. 1 illustrates the degree to which an eye tends to be set near the horizontal centre in six classic portraits selected with the heads in a variety of poses, with no attempt at a scientific sampling. Artists often set one eye on the centre line even when the portrait departs from the classic three-quarter pose.

To quantify the relation between eye position and the canvas frame, the horizontal positions of the eyes were measured in portraits from the past 600 years — including many from the 20th century — by all 265 portrait painters represented in a variety of published summary sources. Portraits selected were the first occurring in each source by every artist that were hand-drawn (oil paintings, watercolors, drawings or engravings), and that depicted only one person, from above the waist, with both eyes visible. Figure 2a, b and c shows the distributions obtained. For comparison, the positions of the centres of the mouths were also measured (Fig. 2c).

I defined the most-centred eye of a portrait as the one closest to the vertical centre line. If eyes were positioned according to the centre of symmetry of the two eyes in relation to the vertical axis, both eyes will be about the same distance from the axis and the choice of eye will make little difference to the result. Conversely, if the head is positioned randomly around the centre vertical, choice of the closer eye as the one for analysis will narrow the distribution somewhat, but by no more than a factor of $\sqrt{2}$, the standard deviation of the minimum of two samples from a gaussian distribution.

The artists surveyed placed one eye in a narrow distribution peaking at the horizontal centre (s.d. = $\pm 5.6\%$ of the frame width). A similarly narrow distribution (s.d. = $\pm 5.5\%$) was exhibited by one-third of the sample in which the faces were the most frontal, estimated at less than 10° head-turn on the basis of the displacement of the tip of the nose from the halfway point between the eyes. The narrowness of this distribution shows that the eye centring is not simply a result of the head-turn common in portraits.

Conversely, the position of the mid-point

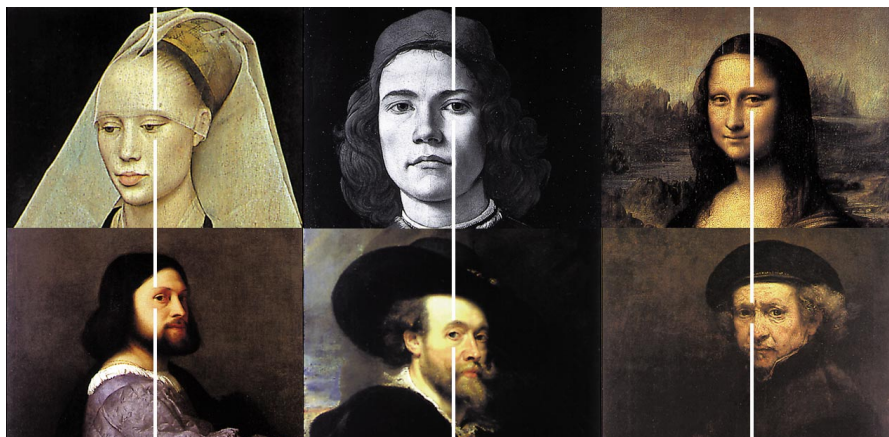


Figure 1 Eye-centring in classic portraits. The portraits are reproduced at the full width and arbitrarily cropped at the bottom; the white line runs down the centre. The examples (left to right within each layer) are by Rogier van der Weyden (c. 1460) Sandro Botticelli (c. 1480), Leonardo da Vinci (1505), Titian (Tiziano Vecellio; 1512), Peter-Paul Rubens (1622) and Rembrandt van Rijn (1659).

between the two eyes forms a bimodal distribution (Fig. 2b) as expected if one or other eye were being centred (s.d. = $\pm 12.0\%$). This mid-point distribution is significantly different from a gaussian distribution at $P < 0.01$ on the χ^2 test, whereas the best-centred eye distribution is well-fitted by a gaussian distribution at $P > 0.1$. Again, the most-frontal third of the paintings exhibited a distribution for the mid-points that was significantly broader (s.d. = $\pm 11.1\%$, $P < 0.01$) than that for the most-centered eye, and not significantly narrower than for the whole sample. So even in frontal portraits, where the face is shown in its most symmetrical view, it is not typically placed symmetrically in the frame.

Other features of the face seem to be in-

accurately centred. The horizontal position of the mouth, for example, was spread across the frame (Fig. 2c), with a distribution about three times wider than that of the best-centred eye (s.d. = $\pm 15\%$, significantly wider than $1.414 \times 5.6\%$, $P < 0.01$).

However, one exception to the eye-centring principle is for the side view of the head. In the smaller sample of side views from the same sources⁴⁻¹¹, the eye positions were scattered widely throughout the frame (s.d. = $\pm 25\%$, significantly wider than $1.414 \times 5.6\%$, $P < 0.01$). It is unclear what aspect of side views changes the rules of composition. Perhaps, now the subject's attention is seen as being directed away from the viewer, the principle becomes the

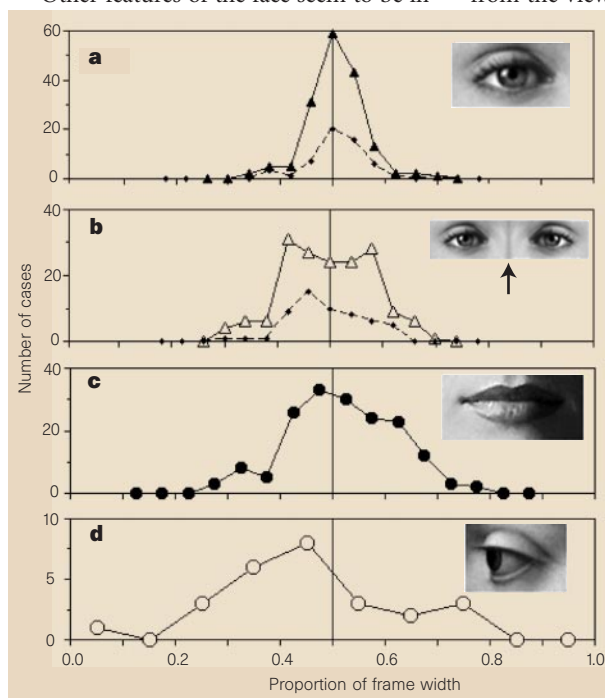


Figure 2 Relation between eye or mouth position and canvas frame in portraits painted over the past 600 years. **a**, Histogram of the middle of the opening for the most-centred eye. Triangles, all 265 portraits; diamonds, one-third of the sample in which the faces were most frontal. **b**, Distribution of the mean position of the mid-point between the eye centres. Triangles, all 265 portraits; diamonds, distribution of the one-third of the sample in which the faces were most frontal. **c**, Horizontal mouth positions in portraits. **d**, Horizontal eye positions in the 23 profiles (portraits with only one eye visible) from the same sources.

centring of the head in the frame because the head dominates the composition.

Classical texts on composition lack any mention that the eyes should be positioned relative to the frame of the picture, but instead typically emphasise the placement of centres of mass in the frame, or relative to the vanishing point in cases of central perspective^{1–5, 12–18}. If art analysis omits eye-centring as a compositional principle, its manifestation throughout the centuries and varieties of artistic styles must be essentially unconscious.

It is interesting to compare the placement accuracy in portraits with that in a psychophysical study of error in the placement of elements within a frame¹⁹. Reproduction of the position of a single dot was accurate to about $\pm 2\%$ of frame width, while accuracy fell to about $\pm 5\%$ for the placement of four or more dots simultaneously. It seems that the unconscious (or unexpressed) placement of the eye in portraits is nearly as accurate as the attentive performance of those focusing on positioning as their sole task.

My analysis shows that explicit compositional principles are implemented with an unbiased accuracy of $\pm 5\%$ over the past six centuries. This precision results from perceptual processes that seem to be unexpressed by the artists themselves, suggesting that hidden principles are operating in our aesthetic judgements, and perhaps in many realms beyond portraiture.

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Ball court design dates back 3,400 years

Excavations at the archaeological site of Paso de la Amada, in the Soconusco region of Pacific coastal Chiapas, Mexico, have uncovered an earthen ball court dating to approximately 1400 BC (uncalibrated), which is at least five centuries older than any previously excavated ballcourt in Mesoamerica¹. Moreover, this discovery reveals that the design of ball courts dates back 3,400 years.

At the time of the Spanish Conquest, ball courts were elaborate open-air masonry structures with two parallel platforms and a central alley where players competed to pass a rubber ball through a wall-mounted hoop. Ball games and their associated rituals were more than simple sporting events. They were integral to the political, religious and social life of most ancient Mesoamerican societies². The importance of the ball game is reflected in the frequent placement of ball courts around ceremonial plazas in city centres and their close association with temples, palaces and other administrative buildings³.

The ball game itself has been thought to pre-date the appearance of formal ball courts. Archaeological evidence of the ball game includes ceramic representations of ball players in their regalia^{4,5}, as well as the water-logged remains of latex rubber balls⁶ dating to about 1250 BC.

The Paso de la Amada discovery demonstrates that formal ball courts have long been an important component of the ball game complex and have been present from

the very inception of settled village life.

The initial discovery of the ball court at Paso de la Amada was accidental. In the course of the 1995 excavations at the site, we began probing Mound 7 in search of remains of Early Formative Period (1600–900 BC) households (Fig. 1a). As this mound was the largest of 54 visible mounds at the site, measuring 110 m by 50 m by 2 m high, we anticipated finding evidence of residential structures similar to those encountered in other areas of the site. Unexpectedly, a trench bisecting the mound revealed two parallel earthen platforms, with benches 2.5 m wide and 35 cm high flanking a central alley 80 m long (Fig. 1b). These architectural elements are unique to ball courts and are similar to those found in later sites.

Further excavation of the mound allowed us to determine its stratigraphy and document the following sequence (Fig. 1b): (1) pre-construction use of the location during the Barra phase (1550–1400 BC); (2) initial ball court construction early in the Locona phase (1400–1250 BC); (3) amplification of the ball court later in the same phase; (4) gradual sedimentation of the alley during the Locona and Ocós (1250–1100 BC) phases; and (5) the abandonment of the court and erosional infilling of the alley during the Cherla phase (1100–1000 BC).

Two radiocarbon samples bracketed the construction dates of the ball court. The court was built some time after the Barra phase surface (1490 \pm 50 BC, B-82233) on which it sits and before the accumulation of sediments that washed down from the lateral platforms onto the alley floor late in the Locona phase (1270 \pm 60 BC, B-82234).

The discovery and dating of this ball court indicates first, that large-scale ball courts, requiring significant amounts of labour, were in use much earlier than previously thought; and second, that ball court form was conserved with few modifications until the Spanish Conquest. We suggest that this ball court could have been part of a network of similar courts in the Soconusco region during the Early Formative period.

Although we know very little about this early version of the ball game, we can infer from its later variants that a strong element of conflict and competition — both real and ritualized — was involved in playing the game. A network of ball courts may have provided villagers in the Soconusco region with a means of intervillage competition, while simultaneously helping to maintain community solidarity. If this were the case, we would expect to find more early ball courts in the region, but so far no others have been found.

We also suggest that emerging elites within villages may have sponsored the construction of ball courts in order to enhance their status and prestige both locally and regionally². This implies that the earliest ball courts

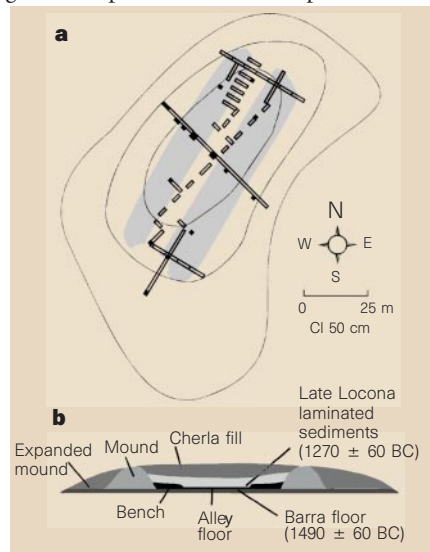


Figure 1 The ball court at Paso de la Amada. **a**, Plan view showing the outline of the ball court and the 1995 excavations at Mound 7. CI, contour interval. **b**, Cross-section of Mound 7 showing features of the ball court and locations of the radiocarbon samples. Radiocarbon dates and archaeological phases are presented in uncalibrated radiocarbon years.