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# Eye centring in portraits: A theoretical and empirical evaluation

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**Abstract.** Tyler (1998 *Nature* 392 877) proposed that ‘painters centre one eye in portraits’, and that this is a hidden aesthetic principle used implicitly by artists and by viewers of portraits. We assess that hypothesis in three related studies: a Monte-Carlo analysis of eye placement in synthetic faces randomly placed within a frame; a survey of eye position in 786 painted portraits from Western art of the past six centuries; and an experimental study in which fifty subjects were asked which of two versions of 60 pairs of portraits they preferred, in only one of which the eye was precisely centred. Taken together, the three studies showed no evidence to support Tyler’s hypothesis, and in particular there was no evidence for subjects having an aesthetic preference for a centred eye in portraits. We conclude that one eye tends to be relatively close to the vertical midline because of geometric constraints on the placing of a relatively large object, the head, within a pictorial frame.

## 1 Introduction

In April 1998, Tyler (1998b) published in *Nature* a paper whose title made the claim that “Painters centre one eye in portraits”, where by ‘centred’ Tyler is referring to the vertical midline of the picture. Tyler’s opening paragraph suggested that “portraits painted throughout the past 600 years adhere to a ... compositional principle not discussed in the literature: one eye is consistently centred horizontally in the canvas”. The final paragraph suggests that eye centring results “from perceptual processes that seem to be unexpressed by the artists themselves, suggesting that hidden principles are operating in our aesthetic judgements ...”.

Similar claims have been made in three other papers published on the Internet (Tyler 1998a, 2000, 2006), and these papers also provide some additional data. At the time of its original publication, the paper in *Nature* attracted much attention in the world’s media, but according to the *ISI Web of Knowledge*, as of January 2006 it has since been cited only twice in the peer-reviewed scientific literature, on each occasion without the presentation of new data [although that search did seem to miss the study by Cassandro (2001)]. The work was also cited by Bruce and Young (1998) in their book, *In the Eye of the Beholder: The Science of Face Perception*, which accompanied a well-reviewed exhibition entitled *The Science of the Face* at the Scottish National Portrait Gallery in Edinburgh in Spring 1998. Bruce and Young commented that “Tyler’s findings reveal a highly consistent tendency of artists to place one eye close to the picture’s vertical axis. This must be based on unwritten rules about what feels right when one looks at a picture ...” (page 214).

The evidence for Tyler’s claim consisted of measurements of 265 portraits, each painted by a different artist during the past 600 years of Western art. The position of the centre of each eye was measured in proportion to the total width of the painting, with 0% representing the left-hand edge of the picture, 50% the centre, and 100% the right-hand edge. A histogram of the position of the eye nearer to the centre of the picture (henceforth, the ‘centred eye’) shows that it is close to the centre of the picture. Despite the emphasis of the paper being on the precision with which an eye is placed at the centre of the picture, the mean position of the centred eye is not actually

described, although the mode is clearly close to the midpoint of the picture. However, in the paper Tyler does describe the standard deviation (SD) of the position of the centred eye, which is 5.6% of the picture width—a value shown to be smaller than that for the bridge of the nose or the centre of the mouth. The position of the centred eye is described as being “in a narrow distribution”, and mention is also made of the “precision” with which the eye is placed near the centre. In an analogous study, Cassandro (2001) looked at 187 black-and-white photographic portraits and found that, although one eye tended to be centred (mean position = 49% of picture width), the spread was nearly twice as wide as in painted portraits (SD = 9%).

Whether or not a standard deviation of 5.6% of the picture width is ‘narrow’ or not depends in part on what one expects. However, it is worth emphasising that with an SD of 5.6%, almost 95% of pictures will be within  $\pm 5.6\% \times 1.96 = \pm 10.92\%$  picture widths of the centre, and therefore the 95% interval covers 21.8% or over one-fifth of the entire picture width. The six illustrative examples given by Tyler (1998b) “with no attempt at a scientific sampling”, despite in several cases having the centre of the eye visibly distant from the centre of the picture, in fact have a standard deviation of only 1.5%, about a quarter of the 5.6% distribution from which they have been drawn. They are not therefore representative of portraits in general. A more systematic sampling (in Tyler 1998a) shows the reality of the distribution with the use of a “sequential series of 21 classical portraits from Schneider’s *The Portrait*” (presumably Schneider 1994), in which many of the centred eyes are far removed from the pictorial centre.

In interpreting the centring of the eye, Tyler (1998b) notes that he has been unable to find any reference in books on or about painting of the compositional desirability of centring one eye<sup>(1)</sup> [although Arnheim (1982) does describe “the power of the centre”], and therefore Tyler concludes that, “if art analysis omits eye-centring as a compositional principle, its manifestation throughout the centuries and varieties of artistic styles *must be essentially unconscious*” (our italics).

In this paper we wish to assess Tyler’s eye-centring hypothesis using three approaches. First, we use a Monte Carlo method to assess the extent to which a randomly placed head in a frame is likely to result in one eye being near to the centre; second, we follow Tyler and survey eye centring in a large number of painted portraits; and, third, we describe an experimental analysis whether subjects show an aesthetic preference for pictures in which one eye is precisely centred.

## 2 Monte Carlo analysis

Although Tyler claims that the position of the centred eye shows a “narrow distribution”, it is not clear that there is a null hypothesis against which that hypothesis is being tested. Tyler is correct that the distribution of the centred eye is *narrower* than the distribution for the bridge of the nose or the centre of the mouth, but that still does not show that the distribution is narrow in an absolute sense. It is also the case that, given how the centred eye is defined, the mathematics inevitably means that the distribution of the uncentred eye must be wider than that of the centred eye (and also bimodal), and hence the distribution of the midpoint between the eyes will also be wider than that of the centred eye and narrower than that of the uncentred eye.

Perhaps the simplest form of null hypothesis was provided in a newspaper comment by Charles Saumarez Smith, then director of the National Portrait Gallery in London: “If you make a portrait slightly unsymmetrical then the likelihood is that one or other of the eyes of the sitter is going to be on the central axis” (*The Guardian* April 30, 1988, page 6). In other words, the eyes have to be somewhere, as does the head; there

<sup>(1)</sup> However, Tyler (2000) comments that “a survey of classical texts on composition has turned up only one mention of the idea that the eyes as such should be positioned relative to the frame of the picture”, but the source itself is not cited.

are constraints on where that head can be, and it is then more likely than not that one eye will be fairly close to the midline.

### 2.1 Method

In the Monte Carlo analysis we created a series of 'portraits' in which a head of variable size was placed within a frame, and the eyes were placed within the head. All measurements are in terms of percentages of the total width of the picture (= 100%), and absolute locations are referred to as the left-hand edge at 0%, the centre at 50%, and the right-hand edge at 100%. The width of the 'head' was on average 30% of the pictorial width, normally distributed with a standard deviation (SD) of 15%, and constrained to be at least 10% of picture width (actual values: mean = 34.3%; SD = 12.4%, 5th percentile = 15.8%; 95th percentile = 56.7%). The 'head' was placed on average at the pictorial centre, normally distributed with SD = 5% (actual values: mean = 50.1%; SD = 5.0%; 5th percentile = 41.6%; 95th percentile = 58.2%). The interocular distance of the 'eyes' was set at 50% of the actual 'head' width, with an SD of 15% of actual 'head' width (actual values: mean = 10.9%; SD = 4.7%; 5th percentile = 4.3%; 95th percentile = 19.4%, all expressed as a percentage of pictorial width). The 'nose' was placed exactly midway between the eyes, and on average the 'nose' was at the centre of the 'head', with a standard deviation of 10% of actual 'head' width (actual values: mean = 50.3%; SD = 6.1%; 5th percentile = 40.3%; 95th percentile = 60.3%, all expressed as a percentage of pictorial width). Portraits were excluded if the simulation resulted either in the 'head' being outside the frame limits, the 'eyes' being outside the head limits, or the 'head' width was less than 10% of total picture width. We simulated 1000 'portraits' that were within these constraints, and calculated the position of the bounds of the 'head', the positions of the two 'eyes', the position of the 'nose' (equivalent here to Tyler's mid-binocular position), and the positions of the centred 'eye' (ie the one nearer to the vertical midline) and the uncentred 'eye' (ie the one further from the vertical midline).

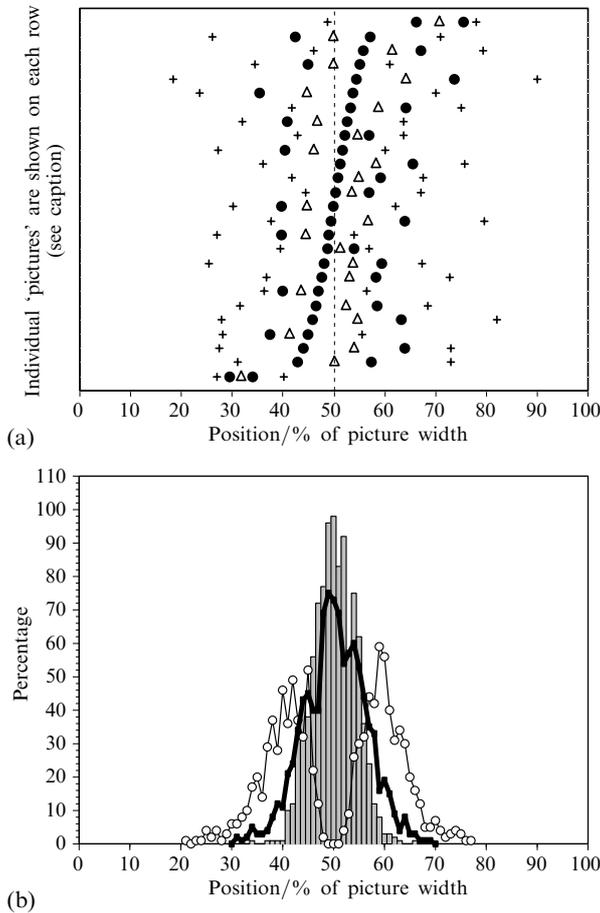
### 2.2 Results

A representative subset of 26 of the simulated cases is shown in figure 1a. The entire sample was ranked in terms of the position of the centred 'eye', and the figure shows the two most extreme cases, along with the cases at the 4th, 8th, 12th, 16th, etc percentiles. On each row the positions of the two 'eyes' are shown by solid circles, the extrema of the 'head' by crosses, and the mean binocular position by an open triangle.

Figure 1b shows the distribution of the centred 'eye', which looks similar to that presented in figure 2a of Tyler (1998b). The standard deviation of 4.2% is somewhat less than that of Tyler's value of 5.6%. Figure 1b also shows the distribution of the uncentred 'eye', which as expected is very clearly bimodal. The distribution of what Tyler (2000) calls the mean binocular position, and which is described by Tyler (1998b) as "the midpoint between the eye centres", is not bimodal as such in contrast to that shown by Tyler, although it is undoubtedly flatter than the distribution of the centred eye, as would be expected given its contribution from the bimodally distributed uncentred 'eye'.

### 2.3 Discussion

Although Tyler (1998b) claims that a "narrow distribution" with an SD of 5.6% must reflect "hidden principles", in our case there are no obvious such principles, the only constraints being that the head must not be too large relative to the frame, that it must be fairly near the centre of the picture, that the eyes must be not too far apart or close together, and that the eyes are fairly cell centred in the head. If there is a compositional principle at work here, it is merely that of the "power of the centre" (Arnheim 1982), with centre being used very vaguely (ie the head must not be crammed up against the edges of the frame).



**Figure 1.** Results of the Monte Carlo simulation of placing a portrait ‘head’ within a frame. (a) A representative sample of portraits at the extremes, and at the 4th, 8th, 12th, etc percentiles, ranked in relation to the position of the centred eye. The solid circles show the position of the two eyes, the triangle the mid-binocular position, and the crosses the positions of the left and right extremes of the head. (b) Histogram of the positions of the centred eye (shaded area), the uncentred eye (open circles and fine line), and the mid-binocular position (small solid squares and thick line).

### 3 Survey of portraits

Tyler’s evidence for the eye-centring hypothesis is entirely based on his analysis of the distribution of the position of the eyes in a large number of painted portraits. We wished to replicate and extend Tyler’s analysis. Tyler (1998b) emphasised that “portraits painted throughout the past 600 years adhere to [this] compositional principle”, and therefore we used portraits sampled across a wide historical range of Western painting.

#### 3.1 Method

In the current study we looked at a convenience sample of portraits based on a wide range of books in the art library of University College London. In general, books were chosen because of their broad survey of a historical period or a country, or because they provided a detailed analysis of the works of a single artist. Over 80% of the portraits from general sources were taken from ten books, each of which contributed at least 10 examples (Goldscheider 1937; Henty 1955; Haak 1984; Simon 1987; Lucie-Smith and Kelly 1987; Jenkins and Fox-Pitt 1989; Pointon 1993; Wintermute 1996;

Anonymous 1997; Forty 2000). All pictures were included in which both eyes of the subject were visible and the picture contained only one person who was obviously the subject. The total width of each picture was measured as accurately as possible with a transparent ruler, and the distance was also recorded from the left-hand edge to the centre of the pupil of the left-hand eye and to the centre of the pupil of the right-hand eye of the subject.<sup>(2)</sup> Distances were expressed as percentages of the frame width, measured from the left-hand edge. The date of the picture was recorded to the nearest quarter of a century, and other information such as the sex of the sitter was also recorded.

### 3.2 Results

Eye position was measured in 786 portraits taken from 40 different books, with 2.3%, 19.1%, 26.1%, 10.2%, 20.0%, and 22.4% painted in the 15th, 16th, 17th, 18th, 19th, and 20th centuries, respectively. On average, the left eye was placed at 43.7% of picture width from the left-hand edge (SD = 7.24%; range 21.8% to 71.1%) and the right eye was placed at 54.6% of picture width from the left-hand edge (SD = 7.31%; range 27.1% to 93.3%). The centred eye was on average 49.8% of picture width from the left-hand edge (SD = 5.05%; range 27.1% to 71.1%), with a standard error of 0.18%. The standard deviation of 5.05% is therefore compatible with the value of 5.6% reported by Tyler (1998b).

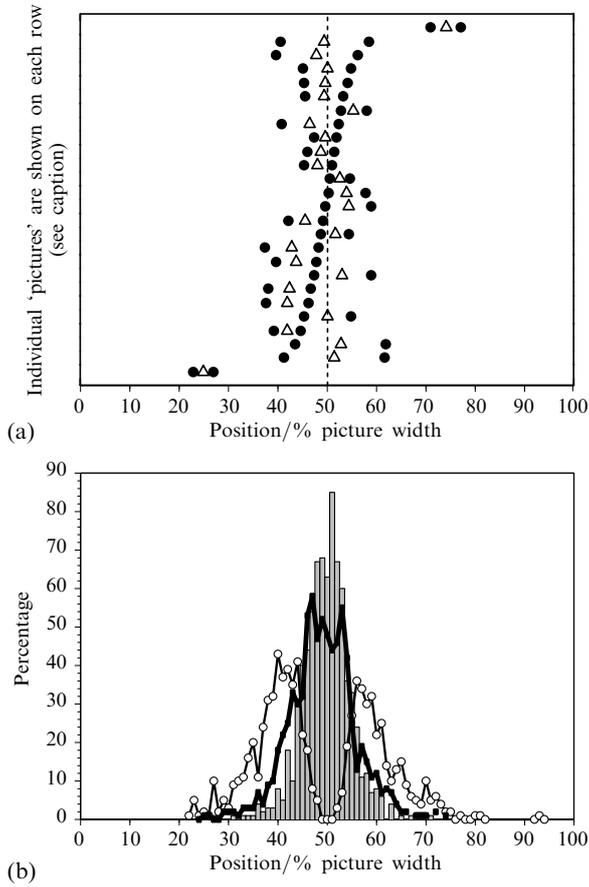
A representative sample of 26 of the cases is shown in figure 2a; the entire sample was ranked in terms of the position of the centred eye, and the figure shows the two most extreme cases, along with the case at the 4th, 8th, 12th, 16th, etc percentiles. The positions of the two eyes are shown by solid circles, and the mean binocular position by an open triangle. Note that in this study, unlike the simulation shown in figure 1, we did not measure the position of the sides of the head. Apart from that, the distributions of figures 1 and 2 look remarkably similar.

Figure 2b shows a histogram of the position of the centred eye, the uncentred eye, and, following Tyler (1998b, 2000), the mean binocular position. The mean position of the centred eye is close to the picture centre (mean = 49.8%) with an SD of 5.1%, similar to the 5.6% reported by Tyler. As expected, the distribution of the non-centred eye is very bimodal, and the mean binocular position also appears bimodal, with a definite dip at 50%.

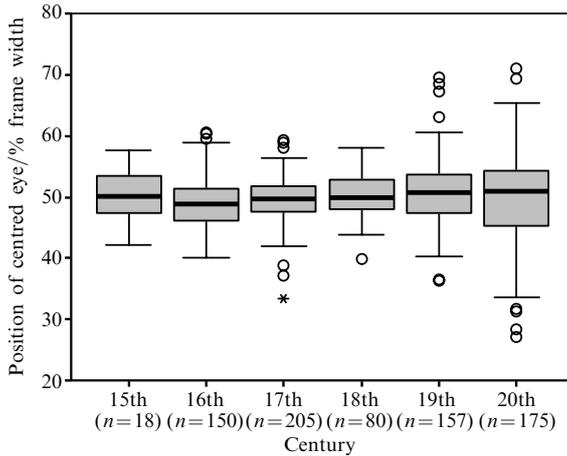
Figure 3 shows a boxplot of the position of the centred eye in relation to the date of the portrait. A one-way analysis of variance found no differences in the mean position across the six centuries ( $F_{5, 779} = 1.84$ ,  $p = 0.102$ ), although there was a highly significant difference in variance between the centuries (Levene test,  $F_{5, 779} = 20.921$ ,  $p < 0.001$ ), with the standard deviation being lower in the 15th, 16th, 17th, and 18th centuries (SD = 4.23%, 3.92%, 3.51%, and 3.41%, respectively), and higher in the 19th and the 20th centuries (SD = 5.32% and 7.33%, respectively).

The books we used as sources could be divided into general art books, which provided overviews of the broad history of art or the art of a specific period ( $n = 27$ ), or monographs on particular artists ( $n = 13$ ). 349 (44.1%) portraits were from general books and 437 (55.2%) from monographs, with the latter particularly including portraits by great portraitists such as van Gogh ( $n = 67$ ), Rembrandt ( $n = 97$ ), Titian ( $n = 99$ ), Velázquez ( $n = 51$ ), Lucian Freud ( $n = 41$ ), Augustus John ( $n = 23$ ), and David Hockney ( $n = 14$ ). Overall, the position of the centred eye in portraits from monographs did not differ in variance (SD = 5.04%) from those from general art books (SD = 5.07%; Levene test,  $F_{1, 783} = 0.584$ ,  $p = 0.445$ ). However, considering just the portraits from the seven artists identified above, there were highly significant differences in variance (Levene test,  $F_{6, 384} = 14.6$ ,  $p < 0.001$ ); SDs in order from least to

<sup>(2)</sup>To avoid the need for mental rotation while coding we recorded left and right from the viewer's perspective and not from the subject's (sitter's). We use that convention throughout this paper.



**Figure 2.** Results of the analysis of eye position in 785 painted portraits. (a) and (b) are as in figure 1, except that in (a) measurements were not taken of the extreme positions of the head.

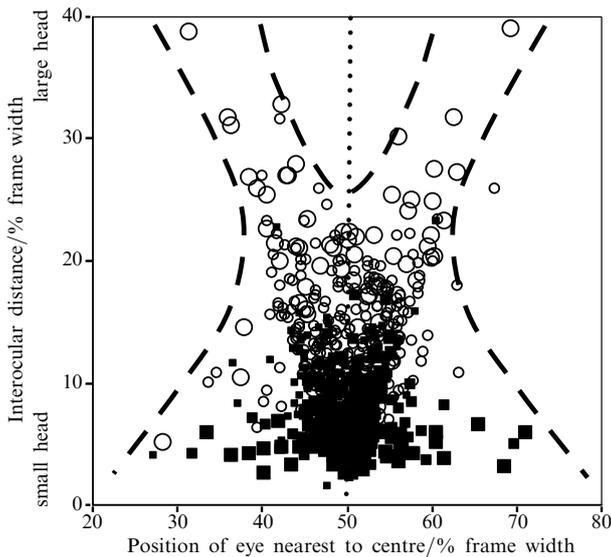


**Figure 3.** Boxplot of the position of the centred eye (ordinate) in relation to the century in which the portrait was painted. The solid horizontal line indicates the median, the box indicates the interquartile range (IQR), the line with bars is  $\pm 3$  IQRs from the median, and beyond that individual points are plotted.

greatest, Velázquez (2.75%), Rembrandt (3.52%), Titian (3.63%), Augustus John (5.25%), van Gogh (5.66%), David Hockney (6.94%), and Lucian Freud (8.72%). It is noteworthy that the four artists with the highest variance are all from the modern period.

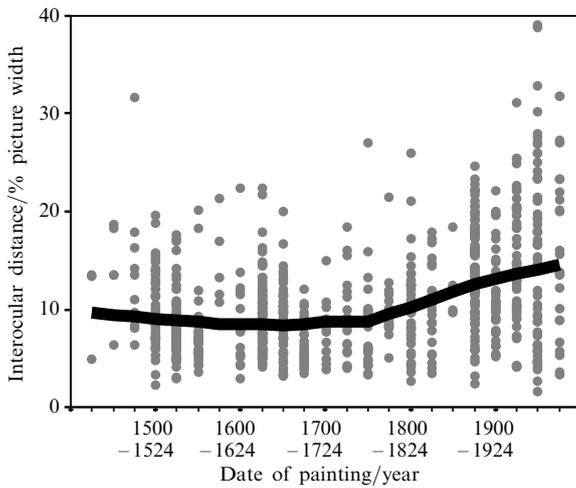
The size of the head in a portrait can vary, and we have estimated this by calculating the interocular distance as a percentage of frame width. On average, the interocular distance was 10.9% of frame width ( $SD = 5.68\%$ ; range = 1.63% – 39.11%). Although we did not measure head width as such—it is not easy to assess it accurately because of hair and clothing—in general, in a portrait the interocular distance is about one third to one half of total head width, and large interocular distances indicate portraits which are head-only, with smaller values indicating progressively head-and-shoulders, torso, and whole-body portraits.

Figure 4 shows the position of the centred eye in relation to interocular distance (a similar plot has been provided by Tyler, 2000). There is a complex relationship, which is best indicated by the free-hand lines sketched onto the figure. In the middle of figure 4, which mainly corresponds to head-and-shoulders or torso portraits, the distribution is unimodal and relatively narrow. However, at the bottom of figure 4, which corresponds to portraits showing the whole body, there is much greater variation, but the distribution is still unimodal. In contrast, at the top of figure 4 (where there are relatively few portraits), which corresponds to head-and-shoulders or just head-only portraits, the head being relatively large, the distribution is more obviously bimodal, with no portraits having the centred eye at the pictorial centre.



**Figure 4.** The position of the centred eye (abscissa) in relation to the interocular distance (ordinate), expressed as a percentage of the total frame width. Symbols indicate the approximate amount of the body visible in the portrait: ○ head-only; ◯ head and shoulders; ■ head, shoulders, and chest; ■ head and body down to waist; ■ whole body (legs at least partially visible). The dotted line shows the pictorial midline, and the dashed lines indicate a freehand drawing of the approximate envelope around the data.

Interocular distance shows a correlation with date of production of a portrait ( $r = 0.361$ ,  $p < 0.001$ ). The scattergram in figure 5 shows that, until the middle of the 18th century, the distance between the eyes is typically about 10% of picture width, after which it rises steadily; hence, pictures in which the interocular distance is 20% or more of frame width are, with rare exceptions, only really occurring in the modern period, from about 1875 onwards.



**Figure 5.** The historical trend of interocular distance in portraits in relation to the date of painting, with date plotted to the nearest quarter of a century. The solid line is a fitted lowess curve.

### 3.3 Discussion

Our data confirm that the average position of the centred eye is very close to the vertical midline of a picture, being 49.8% of the distance from the left-hand to the right-hand frame. However, this would also be true of any set of objects placed at random within a frame, and therefore shows the need for a null hypothesis for testing the eye-centring hypothesis. The very accuracy, on average, of the central placing of an eye, can also be used to argue that psychological processes are not involved, because when humans bisect a line, or place an object in the middle of a space, the process of pseudoneglect means that the placement is somewhat to the left of the true centre (Nicholls et al 1999; Jewell and McCourt 2000; McCourt et al 2001). Rueckert et al (2006) show the midpoint for line bisection of a 16 cm line was 49.06% of the distance between the left and the right-hand ends of the line (with the effect being largest in the longest line presented). In the present study, the 95% confidence interval for the position of the centred eye in the painted portraits was 49.48%–50.18%, including the precise midpoint of 50% but excluding a typical effect size for pseudoneglect. If unconscious psychological factors are involved in eye centring, as Tyler has suggested, then pseudoneglect should be an inescapable component of those factors. Of course, if one eye is centred by measurement then the effect is not unconscious, it should be mentioned in textbooks on pictorial composition and known to artists, and the standard deviation should be far narrower than that found here, essentially to within the accuracy of using a ruler.

Tyler emphasises that the distribution of the position of centred eyes is “narrow” and cites an overall value of 5.6%, which is compatible with our value of 5.05%. Tyler (1998b) also states that his sample was of portraits “that depicted only one person, *from above the waist*” (emphasis added). Since portraits purely showing the head are relatively rare (as can be inferred from our figure 4), this means the majority of Tyler’s portraits would have been in the middle range of our figure 4, where the variance is least and the distribution is unimodal. Inclusion of portraits that show the legs or the whole body would have resulted in a greater variance than reported by Tyler, and inclusion of a greater number of head-only portraits would have demonstrated a bimodal distribution with a high variance.

Figure 4 implies that there are strong constraints on the placing of a head in a portrait. These are seen best when a portrait shows the head filling most of the picture space, with an interocular distance of perhaps 25% to 40% of the frame width (and a head width of ~50% to 100% of the frame width). The outcome is that it is difficult

in such a portrait, particularly if full frontal, to arrange the composition so that one eye is centred. The result is the bimodal distribution seen at the top of figure 4. In contrast, if the head is relatively small, as in a portrait involving the whole of the body, with an interocular distance of perhaps 5% or less of the frame width, then a myriad of compositions is available (standing, sitting, lying etc) and the centred eye can be far removed from the frame midline. Tyler's narrow, unimodal distribution therefore results to a large extent from him concentrating on pictures which are mainly of the head and shoulders, or of the head and torso.

Because our analysis contains portraits taken both from general reviews of art history and also from monographs on particular artists, it can be seen that there are not only historical changes in the placement of the centred eye but also differences between individual artists, as in the case of the three more-classical artists—Titian, Velázquez, and Rembrandt—and of the four modern artists—Van Gogh, Augustus John, David Hockney, and Lucian Freud. Those differences between artists argue against any general compositional principle. In part, the increased variance in position of the centred eye shown by later artists is explained by differences in choice of composition of the portraits, with more modern portraits concentrating to a greater extent on the head and face. The reason for that is not clear but may itself be in part an influence of the development of portrait photography, with its emphasis on the face.

#### 4 Experimental analysis

Tyler makes clear that the principle of eye centring is not merely something carried out by artists, whatever their reasons, but also is a general principle for viewers of such works, “suggesting that hidden principles are operating in *our* aesthetic judgments” (emphasis added). If that is the case, then there is a clear prediction that, when presented with a choice of two pictures—one with a precisely centred eye and the other not centred—subjects will prefer the portrait with the centred eye. Our experiment was designed to test that hypothesis with both painted portraits and photographic portraits.

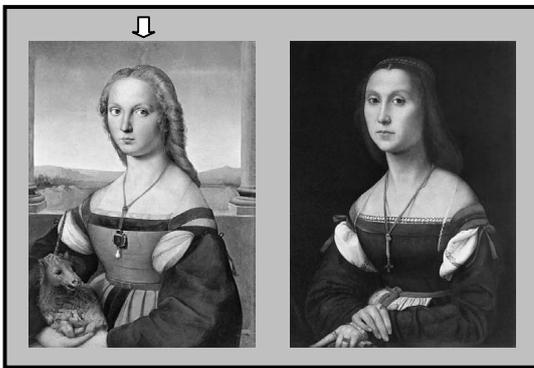
In designing our study we were aware of the possibility, based on previous studies, that some subjects may be more sensitive than others to cues such as eye centring (McManus et al 1993; McManus and Kitson 1995; McManus and Weatherby 1997), that individuals might differ in their knowledge and experience of the arts (McManus 2006; McManus and Furnham 2006), and that personality might correlate with judgments. We designed the experiment therefore so that the results of individual subjects could be assessed against a strict null hypothesis of randomness under a binomial distribution, both for individual subjects and individual pictures, and background measures of personality and art experience were obtained.

##### 4.1 Method

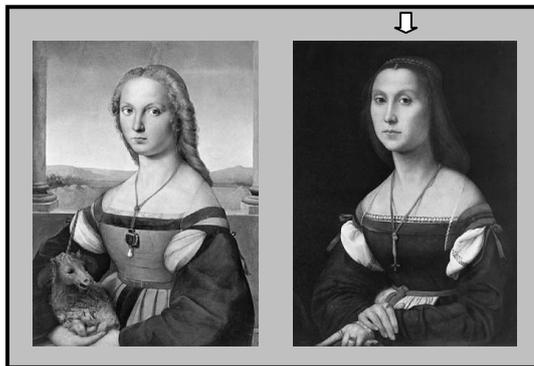
4.1.1 *Subjects.* The experiment was carried out by fifty subjects, who were mainly undergraduates and postgraduates at University College London. 60% were female, and the mean age was 21.1 years ( $SD = 1.5$  years; range 19 to 26 years). Subjects were unaware of the purpose of the experiment, and were debriefed afterwards as to its purpose.

4.1.2 *Experimental design.* Each subject first made preference judgments on a series of 20 pairs of painted portraits, and then on a series of 40 pairs of photographic portraits. The design of the study was different for the paintings and for the photographs, and will be described separately.

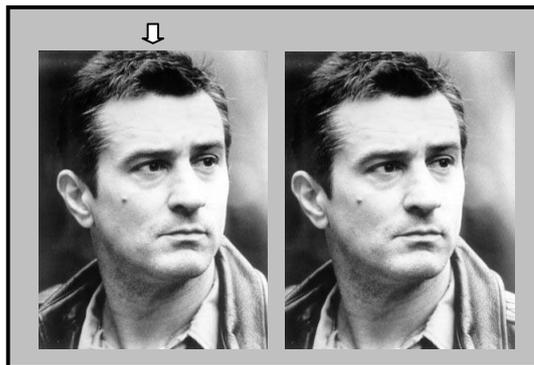
4.1.3 *Painted portraits.* 20 pairs of portraits were used, in each of which the 2 portraits were broadly matched for artist, style, and subject. An example is shown in figure 6.



(a)



(b)



(c)



(d)

**Figure 6.** Examples of the stimuli used in the experimental study. In each of the 4 pairs, one of the pictures had one eye centred precisely (indicated here with an arrow, although the arrow was not, of course, visible in the stimuli shown to subjects). (a) and (b) show a matched pair of stimuli used in the between-subjects experiment on painted portraits, subjects either seeing (a) or (b) but not both. The portraits are by Raphael (left: *Portrait of a Lady with a Unicorn*, Rome; right: *Portrait of a Lady, La Muta*, Urbino). (c) and (d) are examples of photographic portraits used in the second part of the experiment (Robert de Niro and Frank Sinatra, respectively).

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All portraits were shown in colour using a Microsoft Powerpoint projection system. Portraits were placed randomly to the right or left side, with the same orientation for all subjects. Both portraits in a pair were cropped slightly, either to the right or left, so that one of the portraits showed the centred eye exactly at the pictorial midline, whereas in the other portrait the centred eye was not at the midline. A between-subjects design was used. Let the two portraits be A and B, with  $A^m$  being the cropped version of A in which the centred eye is at the midline and  $A^o$  is the cropped version in which the centred eye is off-centre. Half of the subjects saw  $A^m$  paired with  $B^o$ , whereas the other half of the subjects saw  $A^o$  paired with  $B^m$  (see figures 6a and 6b for examples). Differences in preference for artist, style, or subject are therefore balanced out across the experiment.

4.1.4 *Photographic portraits.* 40 high-quality, black-and-white photographic portraits of celebrities and stars were obtained from the Internet. All subjects saw the same set of portrait pairs, in each of which a photographic portrait P was chopped slightly to right or left so that subjects saw  $P^m$  paired with  $P^o$ , the portrait with the centred eye being placed randomly to the right or left in each of the 40 pairs (see figures 6c and 6d). It should be emphasised that each picture in a pair was slightly cropped from the original so that subjects could not infer that one version was uncropped and must therefore be the original and hence implicitly preferable.

4.1.5 *Judgments.* Subjects were told that they would be seeing a series of pairs of pictures and that their task was to indicate which of the 2 pictures they thought looked nicer, better, or more attractive. The task was purposely left somewhat vague, although, as in most studies in experimental aesthetics, subjects seemed to have no difficulty in understanding it. Subjects made their answers in a response booklet by means of a six-point preference scale (strong, moderate, or weak preference for the left-hand stimulus, and weak, moderate, or strong preference for the right-hand stimulus).

4.1.6 *Statistical analysis.* For statistical analysis the six-point scale was reduced to a two-point scale (preference for right-hand stimulus versus preference for left-hand stimulus), and then recoded as 'preference for eye-centred stimulus' versus 'preference for non-eye-centred stimulus'. Null hypothesis distributions were calculated with the binomial distribution.

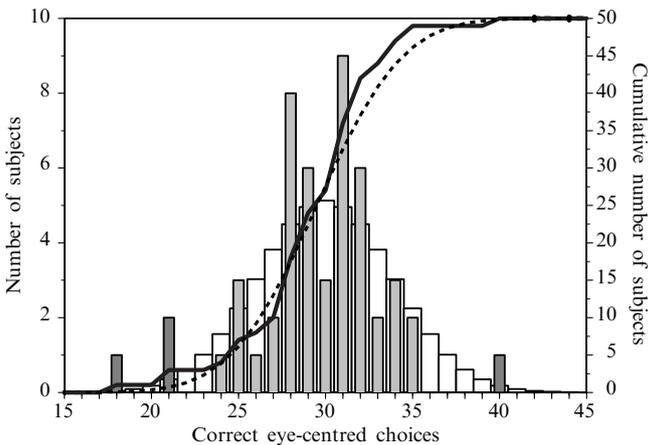
4.1.7 *Background measures.* Subjects completed a brief questionnaire at the end of the experiment which contained a number of background measures, including a brief version of the Big Five personality measure used in a number of previous studies (Furnham et al 2003; Furnham and McManus 2004; McManus et al 2004; McManus 2006), and a 17-item measure of involvement in a range of different aesthetic activities (Furnham et al 2004; McManus and Furnham 2006).

## 4.2 Results

Each subject made a total of 60 preference judgments, 20 for painted portraits and 40 for photographic portraits. Overall, the fifty subjects made an average of 10.16 ( $SD = 1.898$ ) preferences for the eye-centred-painted portrait in the 20 pairs, and a one-sample *t*-test against a chance expectation of 10 was nonsignificant ( $p = 0.522$ ). For the 40 photographic portraits, the fifty subjects made an average of 19.36 ( $SD = 3.49$ ) preferences for the eye-centred portrait, which is also nonsignificant against the chance expectation of 20 ( $p = 0.201$ ). Combining the painted and photographic portraits, subjects made an average of 29.52 ( $SD = 3.85$ ) preferences for the eye-centred portrait, which is nonsignificant against an expectation of 30 ( $t = 0.382$ ).

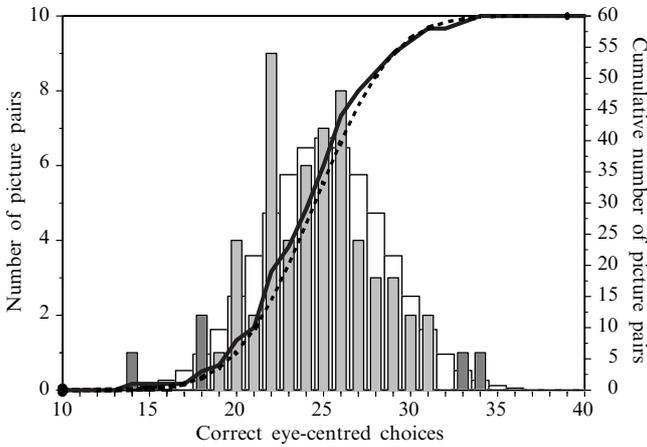
**4.2.1 Intersubject differences.** Figure 7 shows the distribution of the number of eye-centred choices for the fifty subjects across all 60 portraits, compared with a binomial distribution. The dark-grey bars indicate the results of the four individual subjects that were significant, with  $p \leq 0.05$ . However, with fifty subjects there is a chance expectation that two and a half of the fifty subjects will achieve a conventional 5% significance level. Bonferroni correction of the significance levels of the two most extreme subjects, who have uncorrected significance levels of 0.0011 and 0.0062, results in probabilities of 0.0532 and 0.301, respectively. There is therefore no evidence for a subset of subjects who particularly prefer eye-centred portraits.

**4.2.2 Background factors.** The 17 measures of aesthetic activity were combined into a single overall measure of aesthetic activity. This measure showed no significant correlation with the number of eye-centred pictures which were preferred ( $r = -0.202$ ,  $n = 50$ , ns), and neither did the subscale of visual-arts-related activities correlate with the number of eye-centred pictures that were preferred ( $r = -0.115$ ,  $n = 50$ , ns). The Big Five personality measures of neuroticism, extraversion, openness to experience, agreeableness, and conscientiousness also showed no correlation with number of eye-centred portraits preferred ( $r = -0.165, 0.095, -0.154, -0.058, \text{ and } -0.087$ , respectively;  $n = 50$ , all ns).

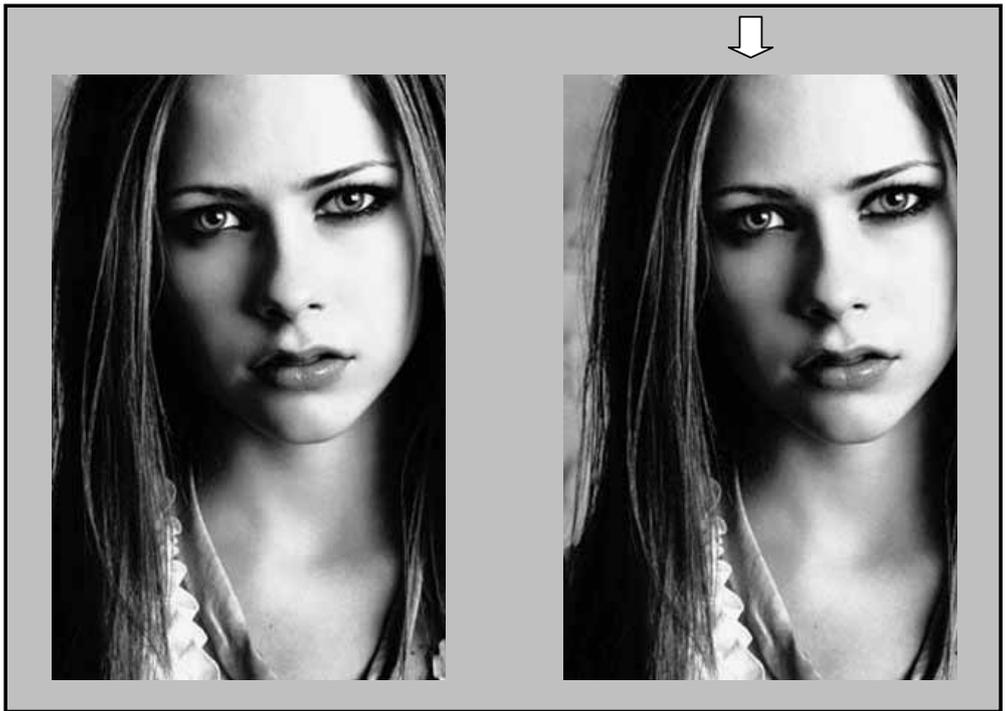


**Figure 7.** Histograms of the number of eye-centred choices out of 60 made by each of the fifty subjects. The white bars show the expected distribution under a binomial distribution, with grey bars indicating the number of subjects (light gray:  $p < 0.05$ ; dark grey:  $p \geq 0.05$ ). The left-hand axis shows the number of subjects in each histogram bin. The right-hand axis shows the cumulative numbers, with the solid black line indicating the actual cumulative distribution, and the dashed black line indicating the expected cumulative distribution for a binomial distribution.

**4.2.3 Interstimulus differences.** Figure 8 shows the distribution of eye-centred preferences made for each of the 60 stimulus pairs, compared with a binomial distribution. 5 of the pairs were individually significant with  $p < 0.05$ , although with 60 pairs, 3 such pairs would be expected by chance alone. The raw probabilities of the 2 most extreme pairs were 0.0000122 and 0.0066. The latter is not significant after Bonferroni correction ( $p = 0.3296$ ), whereas the former is still significant ( $p = 0.0007$ ). Figure 9 shows the significant stimulus pair, in which it should be noted that, although the image on the right is the eye-centred image, only fourteen out of fifty subjects preferred it, the remaining thirty-six subjects preferring the non-eye-centred image on the left.



**Figure 8.** Histogram of the number of eye-centred choices out of 50 for each of the 60 picture pairs. The white bars show the expected distribution under a binomial distribution, with grey bars indicating the number of subjects (light grey:  $p < 0.05$ ; dark grey:  $p \geq 0.05$ ). The left-hand axis shows the number of picture pairs in each histogram bin. The right-hand axis shows the cumulative numbers, with the solid black line indicating the actual cumulative distribution, and the dashed black line indicating the expected cumulative distribution for a binomial distribution.



**Figure 9.** The single portrait pair which achieved statistical significance (after Bonferroni correction). The portrait is a picture of Avril Lavigne (pop singer). The right-hand image is the version in which the eye is centred (indicated by the white arrow), whereas the left-hand image was preferred by a majority of subjects.

4.3 Discussion

In this experimental study of the aesthetics of eye-centring we find no evidence that subjects show a preference for portraits in which the eye is centred over equivalent

images in which the eye is not centred. Neither is there any evidence that there is a subset of subjects who particularly prefer portraits with a centred eye, and there is no evidence that subjects with a particular personality or with a greater experience of the arts in general, or of the visual arts in particular, prefer portraits with a centred eye.

Of the 60 pairs of images we used in the experiment, only 1 showed a significant difference in the preference of the eye-centred and the non-eye-centred version, and that was actually a preference for a non-eye-centred portrait. Interestingly this picture (figure 9) has a relatively high interocular distance (35%), putting it near the top of figure 4, where the distribution is bimodal, and it becomes difficult to centre an eye without cropping some of the head.

## 5 General discussion

Tyler (1998b) presented an interesting hypothesis, that in general one eye in portraits is centred, as a result of a general but unconscious aesthetic preference. Here we have described three different approaches to testing the hypothesis, but none provides any support for it.

The Monte Carlo study emphasises the absence of a clear null hypothesis, and the difficulty of assessing whether or not a distribution with a standard deviation of 5.6% is 'narrow'. Our simulation suggests that a very general generating process, in essence saying that heads have to be roughly in the centre of portraits, will produce similar results to those found by Tyler.

Our survey of eye position in painted portraits of the past six centuries produces a very similar overall result to that found by Tyler, and replicates that finding. However, our larger and somewhat more extensive analysis suggests two problems with Tyler's interpretation in addition to the absence of evidence for a pseudoneglect effect, described earlier.

First, our analysis by historical period suggests that the variance of the position of the centred eye was *higher* in the 19th and 20th centuries in comparison with the previous four centuries. Tyler argues that the unconscious process of eye centring is not just restricted to artists, but is broader, applying also to ordinary viewers looking at portraits. The implication is that all individuals prefer portraits in which an eye is centred, and that preference manifests itself in painters who unconsciously express it when designing a composition, and also in viewers who prefer those portraits painted by artists in which the eye is centred, thereby reinforcing the unconscious choices of artists. Such a mechanism implies that the variance in position of the centred eye should decrease over time, whereas figure 4 suggests the opposite.

Second, our survey of paintings shows a complex relationship of the position of the centred eye to the size of the head, expressed as the interocular distance. The position of the centred eye shows the narrowest distribution in portraits which are best described as head and shoulders, down to head and body (torso), and these happen to be the portraits which are particularly used by Tyler. Portraits in which the head is smaller show a much greater variability in the position of the centred eye, reflecting the greater compositional freedom in such pictures. In contrast, portraits of the head-only show a bimodal distribution, reflecting the constraints on putting the entire head within the frame, and the subsequent difficulty of also getting one eye at the centre. Overall, these results suggest that a centred eye is at the centre not because of any overriding aesthetic principle, but because of geometric and compositional constraints inherent in the nature of portrait painting.

Our third study is a direct experimental test of the hypothesis that subjects have an aesthetic preference for portraits with a centred eye. Our results are clear, finding no evidence that subjects prefer portraits with a precisely centred eye, no evidence for a subset of subjects who have such preferences, and no evidence that those with more

experience of the arts or the visual arts have such a preference. Analysis of individual portrait pairs found only a single case in which there was a significant preference in relation to the position of the centred eye, and that was for the version in which the centred eye was not central.

Taking our results overall, we can find no evidence to support the hypothesis of Tyler. On average, one eye does tend to be at the centre of portraits, but the distribution is relatively wide, is readily generated by a Monte Carlo process, shows no evidence of an expected 'pseudoneglect effect', is not present in head-only portraits or whole-body portraits, and the variance does not become less over historical time. The strongest evidence against the hypothesis, though, is the lack of a preference of subjects for portraits in which the centred eye is at the pictorial midline. We conclude that there is nothing special about the positioning of the eye in Western portraits, beyond the inevitable and obvious constraints of a portrait having to show the subject's head and eyes somewhere within a frame.

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