

Body, head, and gaze orientation in portraits: effects of artistic medium, date of execution, and
gender

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Abstract

Studies have found a tendency for heads in portraits to be oriented so that more of the left side than the right side of the face is visible, though it is stronger in female than in male portraits. Two studies are reported that set head orientation in the context of body and gaze orientation, and additionally look at effects of artistic medium (paintings, photographs, and drawings) and changes in the tendency over time. There was strong congruency between body, head, and gaze orientation. In particular, body and head had the same orientation in more than three-quarters of the portraits in both samples. Gender differences were found only for paintings and only in Study 1. There were several strong effects of artistic medium; for example, frontal orientation of gaze was much less common in drawings than in paintings and photographs. There were also several changes over time; for example, frontal orientation of body and head tended to increase going into the twentieth century. The results show that body, head, and gaze direction need to be considered together, and hypotheses concerned only with head orientation cannot provide a complete explanation for posing orientation. Four possible approaches to explanations are briefly discussed.

Keywords: Left side bias; perception; emotion; lateral asymmetry; art; portraits.

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In portraits, other than self-portraits, the head of the sitter may be facing directly forwards or oriented either to the viewer's right, showing more of the right side of the face, or to the viewer's left, showing more of the left side of the face. The two lateral orientations will be called right side and left side orientation, respectively. A compilation of data from published studies of head orientation is shown in Table 1. It can be seen that, overall, left side orientation occurs more commonly than right side orientation (Frimer & Sinclair, 2016; Gordon, 1974; Grüsser, Selke, & Zynda 1988; Labar, 1973; Lindell, 2013, 2017; McManus & Humphrey, 1973; Nicholls, Clode, Wood, & Wood, 1999; Nicholls, Wolfgang, Clode, & Lindell, 2002; Powell & Schirillo, 2009). The left side preference is not universal and some studies have found either no significant difference (Churches, Feuerriegel, Callahan, Wells, Keage, Keage, Kohler, Thomas, & Nicholls, 2014; González, 2012; Manovich, Ferrari, & Bruno, 2017) or a significant right side preference (Burkitt, Saucier, Thomas, & Ehresman, 2006; Churches, Callahan, Michalski, Brewer, Turner, Keage, Thomas, & Nicholls, 2012; Frimer & Sinclair, 2016; Nicholls et al., 1999; ten Cate, 2002; Uhrbrock, 1973). Overall, the left side tendency for the data in Table 1 was statistically significant, $\chi^2(1) = 28.40, p < .001$. Table 2 summarises results of studies that investigated gender differences. The totals show a substantial left side preference for female sitters, $\chi^2(1) = 199.70, p < .01$. The total for males appears to show a right side preference, but it falls just short of statistical significance, $\chi^2(1) = 3.74$; in any case, there is clearly no left side preference overall for male sitters.

Many hypotheses have been put forward in attempts to explain the overall left side preference (Chatterjee, 2002; Lindell, 2013; McManus & Humphrey, 1973; Nicholls et al., 1999;

Powell & Schirillo, 2009; Manovich et al., 2017; Frimer & Sinclair, 2016; Tosun & Vaid, 2014).

For example, most artists are right-handed and it has been suggested that the left side tendency could occur because right-handed artists find it easier to draw a profile towards the left side of the surface (McManus & Humphrey, 1973). That hypothesis is disconfirmed by evidence for the left side tendency in the work of left-handed artists (Nicholls et al., 1999), and also by the strong gender difference described in the previous paragraph. The hypothesis that has the strongest support from research evidence is that the left side of the face shows more emotional expressiveness than the right side does, and that artists or sitters might want to portray more of a sitter's emotionality (Lindell, 2013; Nicholls et al., 2002; Powell & Schirillo, 2009). Some findings of right side preferences are consistent with this hypothesis. For example, the gender difference could be explained as due to male sitters (or their artists) being less inclined than female sitters to want to express emotionality in a portrait. Consistent with this, ten Cate (2002) found a strong right side preference in a sample of portraits of male university professors (see Table 2), where expression of emotion might be regarded as inappropriate in a formal institutional portrait. The lateralisation of emotional expression in the face is not straightforward, however. For example, negative emotions are expressed more on the left side of the face and positive emotions more on the right side (Schirillo, 2000). A left side tendency would therefore result in a tendency for the sitter's negative emotions to be displayed more than their positive emotions, a tendency that would not be consistent with the common tendency for portraits to flatter the sitter (Campbell, 1990; Costa & Corazza, 2006).

It can never be more than a matter of conjecture whether the hypothesis about lateralisation of emotional expression accounts for the tendencies observed in portraits not produced under controlled experimental conditions. Head orientation in portraits is subject to influence from a host of cultural and art historical factors that are thoroughly confounded with

each other and hard to ascertain in historical perspective (Campbell, 1990). One reason for thinking that such factors might be important in this context is evidence for historical trends in head orientation. Two studies have found evidence that the left side orientation was strongest in the earliest period of European portraiture, declined to the seventeenth century, where it was either absent or reversed, and possibly slightly recovered after that (Grüsser et al., 1988; White, 2019). In addition, White (2019) found that the tendency was strongest in Italian portraits, and either weak or absent in portraits from other parts of Europe. Of course, a concern with emotional expressiveness might interact with cultural factors and could therefore still partly explain these tendencies. But there is no rigorous way to test that possibility.

Having said that, progress can be made by investigating the association between head orientation and other features of portraits. Head orientation has mostly been studied in isolation. The orientation of the sitter's body has not been investigated at all, and gaze direction has been subject to just one study, by Morin (2013). If there are left or right side preferences in body and gaze orientation, then explanations that focus just on head orientation are ignoring two-thirds of the relevant data.

In view of that, the present paper reports two studies of the relationship between body, head, and gaze orientation in single-figure portraits. It also looks at historical trends in all three, and effects of artistic medium and gender of the sitter. The studies were not designed to test hypotheses about head orientation, but to set the head orientation evidence in the context of other factors that need to be taken into account, in order to move towards a more complete understanding of pose and orientation of the sitter in portraits. The aim was to compile a body of data that would facilitate the development of hypotheses taking account of body and gaze as well as head.

Study 1

Method

The data source for Study 1 was the complete illustrated catalogue of the National Portrait Gallery, London (Saywell & Simon, 2004). Using a complete gallery catalogue has the advantage that portraits in the published collection have not been subject to editorial decisions (Morin, 2013). All art collections may be subject to biases in acquisition and bestowal, and all art is subject to biases in and accidents of survival. In general, the likelihood of survival decreases with age, but it is not clear how that might affect the investigation of historical trends. For those reasons one can never be certain that a given collection is representative of all Western art. The sample in this study is large enough (2287 paintings, 1147 photographs, and 1169 drawings) for the association with gender and historical trends to be assessed. If these replicate those found in other studies, then confidence in the representativeness and generalisability of the findings is increased. In this case the corpus also affords the opportunity to assess differences in tendencies in different media, specifically paintings, drawings, and photographs.

For each portrait, body, head, and gaze orientation were recorded as left, right, or frontal, along with gender and date. Orientation was recorded relative to the plane of the picture, not that of any part of the sitter. For example, if the head is turned so that more of the right side than the left side of the face is visible, gaze directed at the (hypothetical) viewer is frontal in relation to the picture plane but rightward in relation to the sitter's head. For this study such a portrait would be recorded as having frontal gaze direction. Portraits were excluded if: (i) either body, head, or gaze orientation could not be unambiguously ascertained; (ii) the date of the portrait either was unknown or had a range of possible dates that crossed the fifty-year category boundaries used in

this study; (iii) there was more than one sitter; (iv) the portrait was a copy, because the date of the copy is not a guide to the date of the original. Also excluded were self-portraits, equestrian portraits, and portraits executed after the death of the sitter (which included conjectural portraits of early monarchs executed long after their death).

Results

The interest in the present study was the degree of empirical association between variables, and the non-parametric test of association, the chi-square test, was the most appropriate for that. The drawback of the test is that it cannot handle more than two factors, so this necessitated a large number of analyses. Effect sizes were calculated using the ϕ statistic.

Reliability

For the paintings, reliability checks were carried out for each of the judgments of body, head, and gaze. For each a different random sample of 100 works was selected. Page numbers were chosen by generation of a random sequence of numbers from 1 to 700 (the number of pages of single figure portraits in the book), and the first 100 of these were used for the reliability check. A further set of numbers randomly generated from the numbers 1 to 10 was used to identify the portrait to be checked within the page. If there was no painting meeting the criteria for inclusion in the study at the corresponding number, the nearest one to it was chosen. Three judges, each blind to the aims of the study and the author's judgments, coded the samples, one coder each for body, head, and gaze. Written guidance was provided for the reliability checks, as follows.

Body. "It is important not to allow a body orientation judgment to be influenced by the following factors:

1. Head orientation. Head and body are often not aligned, so do not be influenced by the orientation of the head.

2. Lighting. Lighting cues are often oblique in portraits, which can create an impression of asymmetry in body position. For example, one side of the body may be more in shadow than the other. Take care not to be influenced by this.

3. Tilt. The body of the sitter is not always perfectly vertical and may be tilted to one side, resulting in one shoulder being higher than the other. Take care to distinguish tilt from turn.

Clothes can be a cue to body orientation. For example, the centre of a collar may be displaced in the direction of the body's turn. However, clothes can sometimes be represented as sitting askew on a body, so take care with this.

If the upper and lower halves of the body have different orientations, record the orientation of the upper half."

Head. "The following criteria should be used:

1. Ears. If only one ear is visible and there is nothing obscuring the other ear (other than the sitter's head), then that is the side that should be chosen. If there is an obvious difference in the amount of each ear that is visible, the more visible ear is the side that should be chosen.

2. If one or both ears are obscured by hat or hair, look at the area of skin visible on each side of the face. If more is visible on the left side then the judgment should be left, and vice versa if more is visible on the right.

3. Visible displacement of features to one side or the other - this includes angle of nose, displacement of chin, mouth, and/or eyes to one side."

Gaze. "If a sitter seems to be gazing directly at you, then that is sufficient for the frontal judgment to be made. If they do not seem to be gazing at you, then they are probably not, and you record whichever side they seem to be looking towards. Ignore the orientation of the head: head and gaze are often not aligned, so head orientation is not a valid cue to gaze direction."

For body orientation judgments, the blind coder and the author agreed on 97 out of 100 paintings. The three disagreements were all figures that were close to frontal, and in each case the author had coded them as left and the blind coder as frontal. The author's codings were used in the analyses. For head orientation judgments, the blind coder and the author agreed on all 100 paintings. For gaze orientation judgments, the blind coder and the author agreed on 93 out of 100 paintings. There was no evident pattern in the disagreements; for example, no tendency for one coder to judge frontal and the other to judge left or right. The main problem is that the reproductions in the book are quite small, and the eyes are a small feature within the paintings, so the difference between a frontal orientation and one that is slightly off to one side can be hard to ascertain. Unfortunately the blind coder was not available for discussion of the disagreements so the author's codings were entered into the analyses.

Paintings

Paintings included works executed in oil paint, watercolour, pastels, and acrylic. The sample that survived the application of the exclusion criteria comprised 2287 portraits, with 2011 (87.9%) male sitters and 276 (12.1%) female. This differs from the sample of portraits in European galleries in White (2019), where 68.7% were male, and from the data in Table 2, where 69.5% were male. The only sample with a more unbalanced sex ratio is that in the study by ten Cate (2002), where 99.5% were male. Table 3 summarises the data on orientation for each

of body, head, and gaze. Supplementary Tables 1, 2, and 3 (tables in the supplementary materials) present data for body, head, and gaze, respectively, broken down by gender and historical period.

Left v. right side orientation. Overall, considering just left versus right orientation for the body component in question, left side orientation was more common than right for head, $\chi^2(1) = 20.66, p < .01, \phi = .10$ and for gaze, $\chi^2(1) = 21.20, p < .01, \phi = .14$, but the difference for body was not significant, $\chi^2(1) = 1.48$. For female sitters there were significant left side tendencies for body, $\chi^2(1) = 3.98, \phi = .14, p < .05$, head, $\chi^2(1) = 40.78, p < .01, \phi = .42$, and gaze, $\chi^2(1) = 22.72, p < .01, \phi = .41$. For male sitters there were significant left side tendencies for head, $\chi^2(1) = 6.52, p < .05, \phi = .06$, and gaze, $\chi^2(1) = 9.90, p < .01, \phi = .10$ but not for body, $\chi^2(1) = 0.34$.

Direct comparisons between the genders showed no significant difference in body orientation tendency, $\chi^2(1) = 2.84$. For head orientation, the left side tendency was more pronounced for female than for male sitters, $\chi^2(1) = 26.91, p < .01, \phi = .12$ and this was also the case for gaze, $\chi^2(1) = 11.63, p < .01, \phi = .10$.

Historical trends. Historical trends in orientation are shown in Figure 1(a). Because of the small sample size of female sitters, all figures showing historical trends combine data for male and female sitters, and readers should be mindful of the gender imbalance in the data. The figure shows percentages of left side orientation only for portraits where orientation is either left or right; that is, frontal orientation data are not included. Thus, the percentage right side orientations would be the inverse of the percentages shown in the figure.

The historical trend for head orientation in Figure 1(a) is similar to those reported in Grüsser et al. (1988) and White (2019): strong left side preference in earliest times, dipping

below 50% in the latter seventeenth century, and slowly increasing from then on. This indicates that this particular trend is a pan-European phenomenon in portraiture: the sample in Grüsser et al. (1988) was paintings in central European collections, and that in White (2019) was drawn from the Louvre, Florence, the National Gallery London, and the Prado. It should be noted that the trend as described above was found for male portraits only in the study by White (2019): the left side tendency for females was maintained without obvious change across the entire historical period. That may be the case in the present sample as well (see Supplementary Table 2), but there are too few female sitters for statistical analysis.

Correlations between pairs of body components over historical periods were computed using the Pearson correlation coefficient, which was used for all correlations reported in this paper. The historical trends for body, head, and gaze orientation are highly correlated with each other. For body and head, $r = +.96$; for body and gaze, $r = +.86$, and for head and gaze, $r = +.96$, $p < .001$ in all cases. The data for these analyses do not include portraits with frontal orientations and, as Table 3 shows, frontal orientation is common for gaze. Despite that, body, head, and gaze clearly share the same trend over a period of centuries when left side orientation is compared with right. These high correlations show that lateral tendencies in body, head, and gaze must be considered together: whatever the explanation for the left side head orientation tendency may be, it must involve and account for the similar tendencies in body and gaze orientation as well. Representation of emotion in the face could be part of the story, but cannot be the whole of it.

The historical trends for frontal orientation are shown in Figure 1(b). This plots frontal orientation as a percentage of the total portraits for each historical period. It is readily apparent that changes in gaze orientation run independently of changes in body and head orientation over time. This is confirmed by correlations between pairs of body components over historical periods. For body and head, $r = +.78$, $p < .05$; for body and gaze, $r = -.61$, $p < .05$, and for head

and gaze, $r = -.21$, ns. Thus, there is a negative correlation between frontal gaze orientation and frontal orientation of body, and certainly no positive correlation between gaze and head. This suggests a tendency to avoid poses in which everything is frontal.

As Figure 1(b) shows, at earliest times frontal orientation is rarely found for gaze. This rapidly changes to approximately 80% during the period 1551-1700, and then declines to around 40% up to 1900 before increasing again in the twentieth century. This pattern resembles that found by Morin (2013). Morin found a rapid increase in frontal gaze between 1500 and 1599, reaching a peak in the period 1640 - 1739, and then falling off. He did not find a recovery period in more recent times, but this may be explained by the fact that his data sample terminated at 1939, whereas the present sample terminated at 2000. Also, his sample was small, with only 25 portraits in each of five one-hundred year blocks. Morin's sample came from five different European countries, so the resemblance in findings suggests that this too may be a pan-European tendency.

Data for frontal body and head orientation show that both are rare in early times, but undergo a steady increase commencing around 1750 and continuing to the present. If the typical seventeenth century portrait can be characterised as having lateral body and head orientation and frontal gaze, the typical twentieth century portrait shows a shift towards the front for body and head, but with gaze more likely to be averted.

Relationships between body, head, and gaze orientation. What the analyses carried out so far do not show is the relationship between body, head, and gaze at the level of individual portraits. For example, if body and head are both frontal in any given portrait, how likely is it that gaze is frontal as well? The next set of analyses will be concerned with questions of that

sort. Table 4 shows the association between body, head, and gaze orientation for the entire sample, disregarding gender and date.

Body and head share the same orientation in 75.4% of portraits. Body and gaze share the same orientation in 40.1% of portraits. Head and gaze share the same orientation in 59.6% of portraits. When body and head are both oriented frontally, gaze is also frontal in 91.3% of portraits. However, when body and head are both oriented to the same side, gaze has the same orientation in only 47.8% of portraits. This is almost entirely accounted for by the tendency for gaze to be frontal. In fact, although there are 27 possible combinations of orientations, just 4 account for 68.5% of portraits. These are body and head left with either left or frontal gaze, and body and head right with either right or frontal gaze.

When body and head both have right side orientation, gaze is more likely to be frontal than to the right, $\chi^2(1) = 7.96, p < .01, \phi = .10$, but when body and head both have left side orientation, there is no significant difference between the incidence of frontal and left gaze, $\chi^2(1) = 0.08$. Most importantly, when gaze is frontal, the difference between left and right head orientation is not statistically significant, $\chi^2(1) = 2.38$, nor is the difference between left and right body orientation, $\chi^2(1) = 0.18$. When gaze is left-oriented, in 97.5% of portraits the head is left-oriented as well and, when gaze is right-oriented, in 96.6% of portraits the head is right-oriented as well.

Gaze is oriented to the left more often than to the right, and head orientation is almost always oriented the same way as gaze when gaze is not frontal. When gaze is frontal the difference between left and right head orientation is not significant: that is, the left side tendency in head orientation only occurs when gaze is not frontal. ~~This means that the overall left side preference in head orientation is being driven by the left side preference for gaze direction. If gaze direction was not influencing head orientation, one would expect a left side preference in~~

~~head orientation when gaze was frontal, but this was not found. This does not mean that head orientation does not affect gaze direction. If the head is oriented to one side, it is not easy to turn the gaze in the opposite direction. There are only 9 paintings in this sample in which that was done, and they tend to look contrived and awkward. So a decision to orient the head one way would tend to constrain gaze direction. It is very likely that the overall pose is determined by consideration of body, head, and gaze, and that none of those components has overall dominance in determining the pose. As far as I am aware, nobody has yet considered how gaze direction and body orientation impact on head orientation, or indeed how gaze, head, and body enter the decision process when the sitter's pose is being set up. But the close association between all three indicates that all three should be treated together, and as of equal importance.~~

Photographs

The sample that survived the exclusion criteria comprised 1147 portraits, with 951 (82.9%) male sitters and 196 (17.1%) female sitters. Although the proportion of female sitters is higher than in the sample of paintings, it is still considerably lower than that in the sample in White (2019). Table 3 summarises the data on orientation for each of body, head, and gaze. Supplementary Tables 4, 5, and 6 present data for body, head, and gaze, respectively, broken down by gender and historical period. Photographs have a shorter history than paintings and very few in the sample date from before 1850, so just three date categories were used.

Left v. right side orientation. Overall, considering just left versus right orientation for the body component in question, left side orientation was more common than right for all three with statistically significant effects in all cases. For body, $\chi^2(1) = 5.28, p < .05, \phi = .08$. For head, χ^2

(1) = 6.58, $p < .05$, $\phi = .09$. For gaze, $\chi^2(1) = 8.28$, $p < .01$, $\phi = .12$. There were no significant gender differences. For body, $\chi^2(1) = 0.01$; for head, $\chi^2(1) = 0.39$; and for gaze, $\chi^2(1) = 0.89$.

Historical trends. Historical trends in left side tendency are shown in Figure 1(c). The figure shows percentages of left side orientation only for portraits where orientation is either left or right, and can be compared with the corresponding time periods in Figure 1(a). It is readily apparent that there is little if any difference between body, head, and gaze, and little if any change over time.

The historical trends for frontal orientation are shown in Figure 1(d). This plots frontal orientation as a percentage of the total portraits for each historical period, and can be compared with the last three time periods in Figure 1(b). Figure 1(d) shows a striking increase in frontal orientation for body, head, and gaze in the latter half of the twentieth century. A similar though less extreme increase is apparent in paintings, as shown in Figure 1(b).

Relationships between body, head, and gaze orientation. The next set of analyses is concerned with the relationship between body, head, and gaze orientation at the level of individual photographs. Table 5 shows the association between body, head, and gaze orientation for the entire sample, disregarding gender and date.

Body and head share the same orientation in 73.1% of photographs. This is similar to the value of 75.4% found in the paintings. When body and head are oriented frontally, gaze is also frontal in 93.7% of photographs, again similar to the result for paintings. When body and head are both oriented to the same side, gaze has the same direction in 69.7% of photographs. This is markedly higher than the 47.8% found for paintings. The overall percentage of frontal gaze orientation in the photographs was 48.4%, similar to the 45.4% found for paintings.

When body and head both have right side orientation, gaze is more likely to be right than frontal, $\chi^2(1) = 36.98, p < .01, \phi = .37$. This is opposite to the tendency found with paintings.

When body and head both have left side orientation, gaze is more likely to be left than frontal, $\chi^2(1) = 57.86, p < .01, \phi = .43$. This contrasts with the lack of significant difference found for paintings. As with paintings, when gaze is frontal, the difference between left and right head orientation is not statistically significant, $\chi^2(1) = 0.42$. Also similar to what was found for paintings, when gaze is left-oriented, in 95.2% of portraits the head is left-oriented as well and, when gaze is right-oriented, in 96.2% of portraits the head is right-oriented as well. ~~As with paintings, then, gaze direction is driving head orientation.~~

Drawings

Drawings included works executed in pencil, graphite, charcoal, chalk, and metalpoint. Engravings and any other media in which the image was generated by printing were excluded because the printing process laterally inverts the image. Other exclusion criteria were as in the painting sample. The sample that survived application of the exclusion criteria comprised 1169 portraits, with 1083 (92.6%) male sitters and 86 (7.4%) female. Table 3 summarises the data on orientation for each of body, head, and gaze. Supplementary Tables 7, 8, and 9 present data for body, head, and gaze, respectively, broken down by gender and historical period.

Left v. right side orientation. Overall, considering just left versus right orientation for the body component in question, left side orientation was significantly more common than right for all three. For body, $\chi^2(1) = 56.62, p < .01, \phi = .23$. For head, $\chi^2(1) = 46.32, p < .01, \phi = .21$. For gaze, $\chi^2(1) = 43.72, p < .01, \phi = .21$. For female sitters there was a significant left side tendency

for head, $\chi^2(1) = 3.88, p < .05, \phi = .24$ but not for body, $\chi^2(1) = 2.12$, or gaze, $\chi^2(1) = 3.36$.

The small sample size for females could be a factor in this. For males there were significant left side tendencies in all cases. For body, $\chi^2(1) = 54.72, p < .01, \phi = .24$. For head, $\chi^2(1) = 42.52, p < .01, \phi = .21$. For gaze, $\chi^2(1) = 43.06, p < .01, \phi = .22$. Comparisons between the genders show no significant effects. For body, $\chi^2(1) = 0.25$. For head, $\chi^2(1) = 0.08$. For gaze, $\chi^2(1) = 0.44$.

Historical trends. Historical trends in left side tendency are shown in Figure 1(e). The trends for body, head, and gaze are all in the opposite direction to the corresponding trends in paintings over the same historical period, shown in Figure 1(a). In all three cases, the left side tendency was most pronounced in the earliest period and declined slightly over time, whereas a slight increase in left side tendency for paintings over the same period is observable in Figure 1(a), as it is for a different sample of paintings in White (2019). The trends for body, head, and gaze are again strongly correlated. For body and head, $r = +.99$; for body and gaze, $r = +.99$, and for head and gaze, $r = +.999, p < .001$ in all cases.

Historical trends for frontal orientation are shown in Figure 1(f). Comparison with Figure 1(b) shows that paintings and drawings are not similar in this respect. Frontal gaze does not dominate in drawings and there is no sign of the pronounced tendency to favour frontal gaze orientation found in paintings in most of the historical periods. Frontal orientation is consistently infrequent in drawings for both body, head, and gaze.

Relationships between body, head, and gaze orientation. Table 6 shows the overall association between body, head, and gaze orientation. Body and head share the same orientation in 91.8% of drawings. Body and gaze share the same orientation in 80.1% of drawings. Head and gaze share the same orientation in 90.8% of drawings. All of these are considerably higher than

the corresponding percentages for paintings. When body and head are both oriented frontally, gaze is also frontal in 82.1% of portraits, about 10% less than was found for paintings. The very strong degree of congruency between body, head, and gaze in drawings is shown by the fact that just two of the twenty-seven possible orientations, all three to the left and all three to the right, account for 75.0% of all portrait drawings. This compares to just 32.8% in the paintings. When gaze is oriented to the left, 98.8% of drawings have a left-oriented head; when gaze is oriented to the right, 97.9% of drawings have a right-oriented head. When gaze is frontal, there is no significant left side tendency, $\chi^2(1) = 1.80$. These results are similar to those for paintings and photographs.

Comparisons between paintings, photographs, and drawings

Paired comparisons of overall frequency of left versus right orientation were carried out for the three media. Starting with body orientation, there was a stronger left side tendency in drawings than in paintings, $\chi^2(1) = 28.53, p < .01, \phi = .10$, and photographs, $\chi^2(1) = 10.04, p < .01, \phi = .07$, and there was no significant difference between paintings and photographs, $\chi^2(1) = 1.67$. There was a similar pattern for head orientation: for drawings versus paintings, $\chi^2(1) = 8.19, p < .01, \phi = .05$; for drawings versus photographs, $\chi^2(1) = 6.16, p < .05, \phi = .06$; and for paintings versus photographs, $\chi^2(1) = 0.05$. For gaze direction there were no significant differences: for drawings versus paintings, $\chi^2(1) = 3.31$; for drawings versus photographs, $\chi^2(1) = 3.47$; and for paintings versus photographs, $\chi^2(1) = 0.13$.

Figures 2a, 2b, and 2c present direct comparisons between the three media for body, head, and gaze orientation, respectively, over time, for proportion of the sample with left side orientation (out of right and left orientation only). There is little evidence of any difference

between the three media except that, for body, head, and gaze, the proportion of left side orientation in the earliest sample of drawings (pre-1800) is noticeably higher than that for paintings in the same period. Too much should not be read into this. The pre-1800 sample is only 92 drawings, and they are dominated by sets of preparatory drawings (sketches made in preparation for painting or sculpture) by two artists, who appear to have habitually used left profile orientation for that purpose.

Paired comparisons of frontal versus non-frontal orientation were carried out for the three media. Starting with body, frontal orientation was proportionately more common in photographs than in paintings, $\chi^2(1) = 125.15, p < .01, \phi = .19$, and in drawings, $\chi^2(1) = 184.76, p < .01, \phi = .28$, and also more common in paintings than in drawings, $\chi^2(1) = 25.78, p < .01, \phi = .09$. Frontal orientation of the head was proportionately more common in photographs than in paintings, $\chi^2(1) = 222.78, p < .01, \phi = .25$, and drawings, $\chi^2(1) = 169.39, p < .01, \phi = .27$, but there was no significant difference between paintings and drawings, $\chi^2(1) = 1.01$. Frontal orientation of gaze was proportionately less common in drawings than in paintings, $\chi^2(1) = 316.67, p < .01, \phi = .30$, and photographs, $\chi^2(1) = 231.74, p < .01, \phi = .32$, but there was no significant difference between paintings and photographs, $\chi^2(1) = 0.61$.

It is worth pausing briefly to summarise that complex set of findings. Frontal orientation of the body was proportionately more common in photographs than in paintings and drawings, and more common in paintings than in drawings. Frontal orientation of the head was also more common in photographs than in paintings and drawings, but there was no significant difference between paintings and drawings. Frontal gaze was more common in photographs and paintings than in drawings. The chi-square values show that the significant differences are substantial. The results for left side orientation given above were for the proportion of left side orientation out of left and right side orientation only. If we reconsider those findings in the context of the

differences in frontal orientation, things look rather different. As a proportion of all portraits, left side orientation of body and head is more common in paintings than in photographs; this is not so for gaze. Both paintings and photographs are more oriented to the front than drawings are: that is, both left side and right side orientation are more common in drawings than in the other media.

Given the subdivision of the sitter into body, head, and gaze, it is possible to assess the proportions of portraits in which all are oriented the same way. The data for this are shown in Table 7. The table compares frequencies for portraits where all three are left oriented, all three are right oriented, and all three are frontal (collectively "unmixed") with the remainder, comprising all mixed orientations. There are striking contrasts between the three media: mixed orientations constitute 61.3% of paintings, 43.8% of photographs, and 21.9% of drawings. In paired comparisons, all differences are statistically significant: for paintings versus photographs, $\chi^2(1) = 94.61, p < .01, \phi = .17$; for paintings versus drawings, $\chi^2(1) = 480.18, p < .01, \phi = .37$; for photographs versus drawings, $\chi^2(1) = 125.73, p < .01, \phi = .23$.

If the fully frontal orientation (i.e. frontal for all three components) is singled out, a different pattern emerges. Fully frontal orientation makes up a significantly higher proportion of photographs than of paintings, $\chi^2(1) = 171.08, p < .01, \phi = .22$, and of drawings, $\chi^2(1) = 134.86, p < .01, \phi = .24$. There is no significant difference between paintings and drawings, $\chi^2(1) = 2.44$.

Figures 2d, 2e, and 2f present direct comparisons between the three media for body, head, and gaze orientation, respectively, over time for proportion of the sample with frontal orientation. It is evident that frontal orientation in all three has been consistently lower in drawings than in the other media. It is also evident that there has been a general increase in frontal orientation in all three media during the twentieth century.

The final set of comparisons concerns gender differences. For each orientation of each component, males and females were compared across media. Results of chi-square tests are shown in Table 8. The results for body and head share the same pattern: a higher proportion of males have left orientation in drawings than in the other media, and a higher proportion of females have right orientation in drawings than in the other media. The pattern for gaze is more complex. A higher proportion of males have left oriented gaze in drawings than in the other media, consonant with the results for body and head orientation. A higher proportion of females have right gaze orientation in photographs than in the other media. A higher proportion of males have frontal gaze in paintings than in photographs, with drawings falling in between.

Discussion

A comprehensive review of the results will be saved for the general discussion but some highlights will be briefly mentioned here. Just four combinations of orientations, left body and head with left or frontal gaze and right body and head with right or frontal gaze, account for almost three-quarters of all portraits. Although some comparisons were not significant, all significant differences in analyses of orientation favoured the left side. There were left side tendencies for body, head, and gaze. ~~Gaze direction appears to be driving the left side tendency in head orientation: w~~When gaze was frontal, there was no left side tendency in head orientation. Considering just portraits with either left or right orientation, the historical trend in paintings replicated that found in previous studies (Grüsser et al., 1988; White, 2019). And the historical trends for body, head, and gaze were highly correlated with each other. Clearly, it is the whole of the sitter's pose that needs to be explained, not just the head position. For frontal orientation, however, the historical trend for gaze runs independently of the trends for body and head. There

were some quite substantial differences between the three media, notably the low proportion of mixed orientations in drawings, the low proportion of frontal gaze in drawings, and the gender-specific differences described in the previous paragraph. Any comprehensive explanatory account of orientation in portraits needs to take these differences between the media into account.

Study 1 has taken advantage of the complete (up to 2000) collection of the National Portrait Gallery, London, to obtain samples that are unaffected by editorial decisions. Of course, accidents of survival and gallery acquisition policies and opportunities affect the content of the collection, and the effect of such factors on the results of the present study are a matter of guesswork. The most notable factor is that almost all of the portraits are of British sitters and by British artists. A second study was therefore carried out on a large sample of a different nationality.

Study 2: Portraits of historical American figures

Method

Study 2 utilised a large corpus of American portraits (Cirker & Cirker, 1968). The criterion for inclusion in the corpus was historical importance of the sitters, not artistic merit. The selection is, of course, subject to accidents of survival and the editors included a list of individuals who would have been included but for whom no portrait could be found.

Images were cropped in some cases to show the face most clearly, but in almost all cases enough of the torso was visible for a judgment about body orientation to be made. Where more than one portrait of an individual had been available, the editors had favoured three-quarter

views, by which they meant views in which the head is oriented to one side but not full profile, so it is likely that frontal head orientations are under-represented in the sample because of that editorial policy. The investigation of historical trends was limited by different factors at either end of the historical spectrum. Very few portraits dated from before 1750, so the earliest historical category in the analyses reported here was pre-1750. The editors decided to include only portraits of people who were historically important before 1905, except for presidents and their spouses, so the latest historical category was post-1850. These restrictions meant that there were only four historical categories.

Some potentially important information is missing in many cases. One of these is date of creation of the portrait. In all cases the sitter's birth and death years (where known) were given, and these, combined with an estimate of the sitter's age in the portrait, give enough information that the date can be pinned down to one of the four 50-year periods in most cases. There is unresolvable uncertainty in a few cases, but uncertainty of a few years is unlikely to be consequential, given the broad historical categories used in the study. Given the choice of historical time periods, portraits executed in 1849 and 1851 would fall on different sides of a category boundary, whereas portraits executed in 1801 and 1849 would fall into the same category. In view of that, a small number of errors of categorisation are unlikely to have a major impact on historical trends, other than adding a small amount of noise to the data.

The other major problem with the published information is the medium in which the portrait was executed. In some cases the portrait is identified as a painting or an engraving, but in the majority of cases it is down to the viewer to decide whether a portrait is a painting, a drawing, an engraving, or a photograph. In the case of engravings, it is usually possible to detect the mark of the engraving tool, which produces characteristic hatching or linear features of varying coarseness. There is, however, another problem with engravings. The term "engraving"

is used here to cover all processes in which a surface is either etched or excavated with a tool such as a burin, which includes metal engravings, woodcuts, and linotypes. The common feature of these processes is that the finished portrait is produced by a printing process in which the image is reversed. Thus, what would be a left side tendency in a set of paintings would appear as a right side tendency in a set of printed engravings. This could be addressed by reversing the orientation of engravings in data recording. The problem is that sampling of engravings from the earliest historical period without reversing the visible orientation revealed a strong right side tendency, similar to the tendency in the rest of the sample for that period (paintings and drawings). This raises the possibility that, in the publishing process, the engravings were once more reversed so that the proper image of the sitter was published. The editors did not say whether this was done or not. However, since there is no way to rule this possibility out, a decision was made to exclude engravings from the sample. The sample, therefore, comprises paintings, photographs, and drawings. Because it was often not possible to tell whether an image was a painting or a photograph (partly due to the poor quality of some reproductions), it was also decided not to analyse different media separately in this study.

For each portrait, body, head, and gaze orientation were recorded as left, right, or frontal, along with gender and estimated date. The same exclusion criteria as in Study 1 were used, except that dates were estimated from the information about the birth and death dates of the sitters and the apparent age of the sitter in the portrait.

Results

The sample that survived the application of the exclusion criteria comprised 2667 portraits, with 2394 (89.8%) male sitters and 273 (10.2%) female. This is similar to the overall

proportions of the sample in Study 1. Table 3 summarises the data on orientation for each of body, head, and gaze. Supplementary Tables 10, 11, and 12 present data for body, head, and gaze, respectively, broken down by gender and historical period.

Left v. right side orientation. Overall, considering just left versus right orientation for the body component in question, left side orientation was more common than right for body, $\chi^2(1) = 28.02, p < .01, \phi = .11$ and for head, $\chi^2(1) = 18.92, p < .01, \phi = .09$ but the difference for gaze was not significant, $\chi^2(1) = 2.80$. For male sitters there were significant left side tendencies for body, $\chi^2(1) = 25.54, p < .001, \phi = .11$, and head, $\chi^2(1) = 17.74, p < .001, \phi = .09$ but not for gaze, $\chi^2(1) = 2.36$. For female sitters there were no significant left side tendencies: for body, $\chi^2(1) = 2.50$; for head, $\chi^2(1) = 1.22$; and for gaze, $\chi^2(1) = 0.44$. The lack of significant differences among female sitters may be partly due to the small sample size. The strength of the left side tendency did not differ significantly between the genders for either body, $\chi^2(1) = 0.03$, head, $\chi^2(1) = 0.05$, or for gaze, $\chi^2(1) = 0.02$. The small χ^2 values in each case show that the proportions portraits that are left side (out of left side and right side orientation only) are almost exactly the same for male and female sitters in all cases.

Historical trends. Historical trends in orientation are shown in Figure 3a. As in Study 1, the figure combines data for male and female sitters. The figure shows percentages of left side orientation only for portraits where orientation is either left or right; that is, frontal orientation data are not included. Thus, the percentage right side orientations would be the inverse of the percentages shown in the figure.

The results show little if any change over time. For head orientation, there seems to be a right side tendency in the pre-1750 category, but it was not statistically significant, $\chi^2(1) = 0.86$.

Nor was there a significant difference in 1751-1800, $\chi^2(1) = 1.30$, or 1801-1850, $\chi^2(1) = 0.96$. There was, however, a significant left side tendency in the post-1850 period, $\chi^2(1) = 18.80$, $p < .001$, $\phi = .10$. Results for body orientation showed a similar pattern. There was no significant difference in the pre-1750 period, $\chi^2(1) = 1.14$, 1751-1800, $\chi^2(1) = 2.04$, and 1801-1850, $\chi^2(1) = 1.86$, and there was a significant left side tendency in the post-1850 period, $\chi^2(1) = 27.22$, $p < .001$, $\phi = .13$. For gaze, there was a significant left side tendency in 1751-1800, $\chi^2(1) = 6.68$, $p < .05$, $\phi = .25$ but no other differences were significant. For pre-1750, $\chi^2(1) = 1.64$; for 1801-1850, $\chi^2(1) = 0.30$; for post-1850, $\chi^2(1) = 2.16$.

Historical trends for frontal orientation are shown in Figure 3b. For body and head, frontal orientation was at a consistently low level but possibly increased slightly over time. It should be borne in mind that the editorial selection policy described above could have played a part in this: it could, for example, have levelled out any historical fluctuations in orientation that might otherwise have been present. For gaze, however, there was a marked decrease from frontal orientation in 63% of portraits in the earliest period, declining to 30% in the most recent period.

Relationships between body, head, and gaze orientation. The next set of analyses concern the relationship between body, head, and gaze at the level of individual portraits. Table 9 shows the association between body, head, and gaze orientation for the entire sample, disregarding gender and date. Body and head share the same orientation in 77.1% of portraits. Body and gaze share the same orientation in 48.3% of portraits. Head and gaze share the same orientation in 68.2% of portraits. Overall, just four of the possible 27 combinations of orientation account for 73.8% of portraits. These are body and head left with either left or frontal gaze, and body and head right with either right or frontal gaze.

When body and head both have right side orientation, gaze is more likely to be right than frontal, $\chi^2(1) = 64.28, p < .001$. When body and head both have left orientation, gaze is more likely to be left than frontal, $\chi^2(1) = 40.56, p < .001, \phi = .27$. When gaze is frontal, body orientation is more likely to be left than right, $\chi^2(1) = 23.34, p < .001, \phi = .17$, and head orientation also is more likely to be left than right, $\chi^2(1) = 27.66, p < .001, \phi = .19$. When gaze is to the left, in 97.1% of portraits the head is also left-oriented and, when gaze is to the right, in 96.6% of portraits the head is to the right as well.

Discussion

Different media were not considered separately in this study because of the difficulty of identifying the medium used in some cases. However, the proportion of drawings in the sample appeared to be very small and engravings were excluded, so almost all of the sample comprised paintings and photographs. This would be subject to a historical trend because there were no photographs prior to 1800 and few in the period 1801-1850, probably all of which would date to the 1840s. The possibility that the historical trends found in this study reflect changing proportions of paintings to photographs in the sample, therefore, cannot be ruled out.

There were significant left side tendencies for body and head but not for gaze. These tendencies were only evident for male sitters. That could reflect the small sample size for female sitters, but the sample of 273 female sitters was only 3 fewer than the sample of 276 in paintings in Study 1, and significant left side tendencies were found there for body, head, and gaze. In addition there were no significant gender differences. There is, therefore, no evidence for a left side tendency for female sitters in either body, head, or gaze.

This corpus of portraits was previously the subject of an investigation by Conesa et al. (1995). The authors studied only head orientation and distinguished half-left and half-right poses from full profile views. Apparently all of the portraits in the book were included, because no exclusion criteria were mentioned. They reported a significant left side preference consistent with the present results. In their sample, combining data for full profile and half-profile poses and omitting frontal poses, 53.4% of the portraits had left side head orientation, compared to 55.1% in the sample selected for inclusion in the present study. The greatest number of exclusions from the present sample was for engravings. The similarity in the results of the two studies suggests that that exclusion had little effect on the results.

Analysis of historical trends revealed that the left side tendencies for body and head were statistically significant only in the most recent period. Sample size could be a relevant factor in that. The results for frontal orientation are probably not meaningful because of the editorial selection policy.

Nearly three-quarters of the portraits fell into just four of the 27 combinations of body, head, and gaze orientation: left body and head with left or frontal gaze, and right body and head with right or frontal gaze. In Study 1, head orientation appeared to be driven by gaze direction, because the left side tendency in head orientation did not occur in portraits with frontal gaze direction. In Study 2, however, that was not the case, and the left side tendency was found regardless of whether gaze was frontal or not.

General discussion

Summary of findings

Previous studies have mostly investigated head orientation in portraits in isolation, except for looking at the association with gender of the sitter. The main aim of the present study was to set head orientation in the context of other factors, specifically body orientation, gaze direction, artistic medium, and historical period. Two major sources of portraits were used: the complete (up to the year 2000) collection of the National Portrait Gallery, London (Saywell & Simon, 2004), and a published corpus of 4,000 portraits of historically significant Americans (Cirker & Cirker, 1968). Artistic medium could only be investigated in the former sample.

The aim of integrating head orientation among other factors entailed considerable detail in the results. The main findings can be summarised quite straightforwardly, however. Overall, there was strong congruency between body, head, and gaze orientation. Table 10 shows the proportions of portraits in each sample, divided by artistic medium in Study 1, that fell into the four most popular orientation combinations: left body and head orientation with left or frontal gaze direction, and right body and head orientation with right or frontal gaze direction. Overall those four, which are just 15% of the number of possible combinations, accounted for 70.1% of the portraits.

Portraits in which body and head had the same orientation accounted for 75.4% of NPG paintings, 73.1% of NPG photographs, 91.8% of NPG drawings, and 77.1% of American portraits. Congruency of both body and head with gaze was lower, mainly because frontal gaze direction was more common than frontal body and head orientation. In all, 18.6% of the portraits had frontal body orientation, 12.6% had frontal head orientation, and 38.8% had frontal gaze direction. The last of these is lower than the percentage in the sample studied by Morin (2013), inferring from data in Figure 1 in that paper. One possible explanation for that is that frontal gaze was much less common in drawings than in the other media studied, and Morin's sample included only paintings. Another possible explanation is the aforementioned editorial decision to

favour three-quarter poses in the American sample: given the tendency for gaze direction to be congruent with body and head orientation, this might have had the effect of reducing the proportion of poses with frontal gaze in that sample. Having said that, an important question for further research is to investigate why frontal orientation is so much more common for gaze than for body and head, and indeed why the head is less likely to be frontally oriented than the body.

The tendencies described so far vary to some extent depending on artistic medium. Results discussed here are drawn from Study 1 because artistic media could not be reliably separated in Study 2. The data in Table 10 would suggest that frontal gaze orientation was less common in photographs than in paintings. That, however, is because the combination of frontal body, head, and gaze was more common in photographs (20.7% of the total) than in paintings (6.0%) and drawings (4.7%). In fact, frontal orientation of gaze was much less common in drawings (18.6%) than in paintings (49.8%) and photographs (48.4%). 73.4% of drawings showed either left orientation for all three components or right orientation for all three components, compared to 32.7% for paintings and 35.5% for photographs. The drawings often convey a sense of lack of engagement by the sitter, as if the sitter was unaware of being drawn. Frontal orientation is unlikely to occur by chance, so its occurrence suggests some degree of engagement by the sitter with either the artist or the (hypothetical) viewer. Paintings and photographs tend to present the sitter self-consciously to the world in a way that drawings, usually, do not. The finding that frontal orientation was more common for gaze than for body or head may have something to do with this presentation of engagement, because the eyes signal the direction of attention more than any other part of the body.

Some previous studies have found evidence that the left side tendency in head orientation is stronger with female than with male sitters. In Study 1, with paintings, there were significant left side tendencies in body, head, and gaze for female sitters, and in head and gaze for male

sitters. The left side tendency was more pronounced for females than for males in head and gaze. In photographs, there were left side tendencies for all three, and no significant gender differences. In drawings, there were significant left side tendencies for all three for males, but only for head for females, and there were no significant gender differences. In Study 2, there were significant left side tendencies for body and head for males, but none for females, and there were no significant gender differences. In the present samples, therefore, gender differences were only found for paintings in the NPG sample. Overall, where significant differences occurred, they were always in the direction of a left side tendency, but the evidence suggests that the tendency is not universal. Also, there was no clear evidence that the tendency was any stronger for the head than for body or gaze.

Because of the small sample of female sitters in both studies, historical trends could not be analysed separately by gender. In paintings, the historical record extends back to the sixteenth century in the National Portrait Gallery. The trend found there in head orientation was similar to that found in previous studies (Grüsser et al., 1988; White, 2019), with a strong left side tendency in earliest times, dipping below 50% in the seventeenth century, and recovering somewhat up to 2000. In photographs and drawings, and in the American sample, the historical record does not extend back so far. There was no compelling evidence for change over time in photographs. Drawings showed a marked decrease in left side tendency over time, opposite to the trend found for paintings. The left side tendency appeared to increase over time in the American sample, but the sample size for the earliest periods is small and the change was not great. Changes over time in left side tendency in body and gaze orientation tended to match changes in head orientation quite closely. Clearly, the highly correlated changes in all three are in need of explanation.

The proportions of portraits with frontal orientation also showed changes over time. The most striking of these is the one shown in Figure 1b. In paintings in the National Portrait Gallery, gaze became markedly frontal in the seventeenth century, peaking at about 80%, and rapidly declined to below 40% in the nineteenth century. Frontal orientation of body and head both showed a tendency to increase, particularly in the twentieth century. A similar increase in frontal orientation was found for body, head, and gaze in photographs. In drawings, however, frontal orientation remained at a low level throughout the available history. The American sample matched the paintings from Study 1 in showing a considerable decline in frontal gaze from the eighteenth century to the most recent period, but little change in either body or head orientation.

~~Finally, the results of Study 1 suggested that the left side tendency in head orientation was driven by gaze direction: when gaze was frontal, there was no left side tendency. This was found for each of the three artistic media. It was not found, however, in Study 2, where there was a significant left side tendency in portraits when gaze was frontal.~~

Perspective

The results have shown significant effects of all the factors investigated. Body, head, and gaze all tended to be oriented to the left more than to the right. Those three tendencies all varied, however, depending on artistic medium, nationality of sitter, historical period, and gender. The left side tendency in head orientation has been interpreted in psychological terms, as related to hemispheric differences in expression of emotion in the face (Lindell, 2013; Nicholls et al, 2002; Powell & Schirillo, 2009). The present results do not disconfirm that hypothesis. However, the left side tendency in head orientation can only be fully explained in the context of its association with other factors. The most obviously relevant of these is body orientation. The present research

has shown a left side tendency in body orientation as well as in head orientation, and head and body orientation were highly correlated over time and highly congruent across portraits. The facial expression of emotion hypothesis could account for that result if the decision about head orientation was determining the decision about body orientation. There is no evidence for that, however. In fact, in Study 1, ~~gaze direction appeared to be the main determining factor.~~ When gaze direction was to the left or right, the head had the same orientation almost without exception. If head orientation was determined independently of gaze direction, then a left side tendency should have been found when gaze was frontal. In fact no such tendency was found in any of the three media studied in Study 1. This was not found in Study 2, however, which suggests that gaze direction cannot be assumed to be always the dominant consideration in posing the sitter.

It is possible that gallery samples exhibit a bias towards left side orientation because that is the pictorial preference of the viewers or buyers. Under that possibility, there would be no left side tendency in portraits as a whole, but the tendency arises when portraits are selected for gallery acquisition, or preferred by visitors to the gallery and therefore more likely to be retained in the collection. Some influence of sampling bias cannot be ruled out. However, Study 2 drew on a sample of portraits that were selected not on the basis of aesthetic criteria but on the basis of the judged historical importance of the sitter; in many cases, only one portrait of an individual was available, so there was no possibility of a selection bias towards left side portraits in those cases. In some of the studies of head orientation listed in Table 1, no aesthetic selection bias could have operated. This applies particularly to the sample of school yearbook photographs studied by LaBar (1973), where a strong left side tendency was found, and it also applies to the academic portraits studied by ten Cate (2002), where a strong right side tendency was found. It is likely, therefore, though not certain, that the tendencies found in samples of portraits, both here

and in the studies listed in Table 1, are representative of the population from which portraits entered galleries.

Given the multitude of cultural, historical, and artistic factors and the interplay between them that must be involved in determining poses in portraits, the question for research in psychology is whether there is any room left for psychological factors. The overriding problem is the impossibility of experimental investigations of actual portrait painting. It is certainly possible to test psychological hypotheses under rigorous experimental conditions, and evidence from such research is the main reason for thinking that lateralised expression of emotion could be a significant factor in portrait poses. There is no way to test its influence in the history of art, however.

As an illustration of that, in the sixteenth century Bronzino painted a series of portraits of Florentine noblewomen. In all of the portraits, which can be seen reproduced in Brock (2002), body and head have left side orientation and gaze is frontal. Those tendencies might suggest a concern with expression of emotionality, and indeed engagement with the viewer by gazing out of the painting. That possibility is contradicted, however, by the emotionless, statuesque faces of the sitters. The sitters, perhaps in collaboration with the artist, had established a set of norms for pose and expression that were appropriate for a noblewoman in a permanent image meant for public display: acknowledging the existence of the citizens of Florence who were the presumed audience for the painting, but remote, dignified, and indeed noble. In those portraits, whatever the reason for the consistent left side orientation, it had nothing to do with expression of emotion. There are at least four other possibilities that may be worthy of investigation in application to portraits.

Engagement with the viewer

Morin (2013) found that direct gaze is associated more with anonymous or non-famous sitters than with famous sitters. He commented, "Arguably, paintings whose sitters are famous enough to have left a name in history do not need to attract the viewer's attention quite as much as others" (p. 224). This suggests a hypothesis that gaze direction is used to manipulate the viewer's attention. Direct gaze suggests interaction between sitter and viewer, indeed acknowledgement by the sitter of the viewer's existence, which the viewer may find engaging or flattering. Averted gaze may suggest that it is beneath the sitter's dignity to acknowledge the viewer's presence, or that the sitter is engaged with something or someone other than the viewer.

That is a hypothesis that may be worthy of further investigation. The Bronzino portraits show that things cannot be that simple, because the sitters were far from anonymous for their presumed audience at the time, and their direct gaze is more dominating or condescending than engaging. Nevertheless, engagement or lack of engagement with the intended viewers may be a significant determinant of pose. Viewing a portrait cannot be described as a kind of social interaction, but the relationship between the viewer and the sitter may still evoke social cognitions and emotions in the viewer, and portraits may be designed to manipulate that.

Another relevant and neglected dimension is head canting: Costa et al. (2001) found relatively pronounced head canting in religious and mythological figures and almost none in military and noble portraits. Costa and Corazza (2006) said, "It appears, therefore, that painters have exploited the relationship between head canting and expression of submission, appeal for protection, adoration, and ingratiation when depicting religious and mythological figures" (p. 231). This time the Bronzino portraits are consonant with that hypothesis because the sitters are invariably depicted with upright, uncanted heads. So far there has been no research that would

link engagement with the viewer to the left side tendency in portraits, but it remains possible that factors connected with engagement have some relevance.

Reading images from left to right (or not)

Several factors may be involved in determining how paintings are read. Chatterjee, Maher, and Heilman (1995) asked participants to draw stick figures in agent-recipient relations and found a tendency to locate the agent on the left and the recipient to the right. Chatterjee (2001, 2002) has argued that the research evidence supports a general agency bias according to which right-handers tend to locate agents to the left of recipients of actions, and that the tendency has its origins in hemispheric specialisation, specifically the role of the left hemisphere in both encoding actions and deploying attention with a left to right vector.

Subsequent research has shown that the tendency is influenced by script direction. Maass and Russo (2003) replicated the study by Chatterjee et al. (1995) with Italian and Arabic participants. The participants read simple sentences involving an agent and a recipient, such as "A pushes B", and drew a stick figure picture of it. Italians tended to locate the agent to the left and the recipient to the right and Arabs did the opposite. In cultures where the direction of reading is left to right, artistic images seem to be oriented so that action can be read from left to right: agents of action tend to be on the left and recipients on the right (Maass, Suitner, & Nadhmi, 2014). Maass et al. found evidence that both script direction and the order in which agent and recipient are mentioned in sentences are involved in that tendency, by looking at cultures where one or both of these was reversed from the standard orders in Western cultures.

Other studies have found more mixed results. Altmann, Saleem, Kendall, Heilman, and Rothi (2006) presented sentences written in either active or passive mode to English and Arab

participants. They found no script direction effect and no preference for locating agents on the left side. In fact there was a tendency in the opposite direction, though with English participants this was significant only with passive verbs. Döbel, Diesendruck, and Böhle (2007) presented sentences in which the order of agent and recipient was varied. German participants showed a tendency to put the agent on the left, and this was reversed for Hebrew participants. The effect was stronger for adults than for children, suggesting an effect of culture. However, this pattern held only when the agent was mentioned first. When the recipient was mentioned first, both groups tended to put the agent on the right. So it is likely that there is a separate tendency to put the first-named person on the left. The most recent study, by Stroustrup and Wallentin (2018) manipulated the first-named character, the agent of the action, and the grammatical subject orthogonally and found effects of all three, with tendencies to locate the first-named character, the agent, and the grammatical subject to the left.

Sitters in portraits are rarely depicted as engaging in any kind of action. Nevertheless, one study has found evidence that the composition of portraits is affected by script direction. Pérez González (2012) looked at nineteenth century studio photographs taken in Iran, where script direction is right to left, and in Spain, where it is left to right. She found a significant left side tendency in poses in the Spanish photographs but no significant tendency either way in the Iranian ones. There were other asymmetries in portraits with props and group portraits. For example, where a chair was used as a prop, it was placed to the left of the sitter more often than to the right in the Spanish photographs, but was more likely to be the other way round in the Iranian photographs. Chahboun, Flumini, Pérez González, McManus, and Santiago (2017) suggested that gaze direction of the sitter determines the direction of scanning of the portrait. It is more natural to scan in the direction of one's native handwriting so, for left-to-right readers, a pose with the left side of the face more exposed yields a scanning direction that is consonant

with the reading direction and, for right-to-left readers, the opposite is the case. Assuming that gaze and face orientation are consonant, the scanning hypothesis would predict a left-side tendency in portraits in cultures with left-to-right reading and a right-side tendency in portraits in cultures with right-to-left reading. The results of the study by Pérez González (2012) support the former but not the latter. Chahboun et al. (2017) found indirect support for both propositions in a study of aesthetic preferences. Spanish (left-to-right) readers had an aesthetic preference for left-side over right-side directionality in photographs and the reverse was found for Arabic (right-to-left) readers, but only when a photograph and its mirror reversal were presented together. Also, the photographs in their study were not confined to single figure portraits but included mostly images with multiple people in them. Overall, their results provided only weak support for the scanning hypothesis. More research would be needed to settle the matter.

The mental timeline

A considerable body of research has shown that time tends to be represented as moving from left (past) to right (future) (Bonato, Zorzi, & Umiltà, 2012; Ulrich & Maienborn, 2010; Tillman, Tulagan, Fukuda, & Barner, 2018). This tendency to represent a mental timeline develops during childhood (Tillman et al., 2018) and is associated with script direction (Ouellet, Santiago, Israeli, & Gabay, 2010). Walker (2015) sampled Google images and found that moving people, animals, and inanimate moving objects such as cars were presented moving from left to right more than from right to left. The faster the movement, the stronger the tendency was.

What relevance would these studies have to portraits? There has been little investigation of the way in which the mental timeline might impact on portraits. However, the mental timeline hypothesis implies that left is the direction of retrospection and right is the direction of

prospection. In that case, choices of poses by artists and sitters may be influenced by thoughts about whether the sitter should appear reflective or forward-looking.

Space and valence

Glaser and Hellmann (2017) found an association between left and right and moral judgment: in three studies the right side was associated with harsher moral judgments than the left side. They did not use pictures as stimuli, but there is a clear implication for portraits. Sitters (or their painters) might want to be represented as morally gentler or sterner and their pose may be oriented accordingly. This would be consistent with the evidence that the left side tendency is stronger in female than in male sitters, if it is accepted that women, historically at least, might want to be portrayed as gentler more than men would. It might also be consistent with the right side tendency found by ten Cate (2002) in academic portraits because academics, at least in past times, might have wanted to come across as more stern, authoritarian, or morally upright, or indeed their painters might have wanted to portray them that way.

Things are not that simple, however. According to Casasanto (2009), "[r]ight-handers tended to associate rightward space with positive ideas and leftward space with negative ideas, but left-handers showed the opposite pattern, associating rightward space with negative ideas and leftward with positive ideas" (p. 351). He proposed that there are "body-specific associations between space and valence" (p. 353). People in general are more expert with the dominant hand than with the non-dominant hand and Casasanto suggested that the association of positive with the dominant hand side is due to the relative ease of doing things on that side. Supportive evidence came from a drawing task where people tended to locate good things on their dominant hand side and bad things on the other side. It also happened when they only indicated orally

where they would put things. The participants seemed to have no awareness of this. Whether this factor would influence orientation of the sitter or just the side of the painted space in which the sitter was located is not clear. But the relationship between visual space and valence could be worthy of further consideration as an influence on orientation.

Conclusion

There is a need to understand the entire orientation of the sitter, not just that of the sitter's head. It has been shown that orientation of body, head, and gaze are highly correlated, and also that tendencies in orientation vary depending on artistic medium, historical period, and nationality. Exactly how psychological factors such as the mental timeline and the valenced interpretation of visual space might impact on these tendencies is not clear at present, but hopefully the present study has opened the door to many possibilities for future research. The fact that there are consistent tendencies in portrait poses, and discernible changes in those tendencies across time, artistic medium, and culture is quite remarkable: one would have imagined that individual portrait poses are the subject of individual decisions, and yet there are clearly factors that influence those decisions in such a way as to generate the observed consistencies over large samples. In this topic, psychology and the study of culture and art history come together and the confluence enriches the appreciation of both.

Footnote

1. Results of a study by Conesa, Brunold-Conesa, and Miron (1995) were excluded from Table 1 because Study 2 in this paper drew on one of the two sources used by Conesa et al. (1998).

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Figure captions

Figure 1. Historical trends in orientation, Study 1: (a) left side orientation over time in paintings; (b) frontal orientation over time in paintings; (c) left side orientation over time in photographs; (d) Frontal orientation over time in photographs; (e) left side orientation over time in drawings; (f) Frontal orientation over time in drawings.

Figure 2. Comparisons between artistic media in historical trends, Study 1: (a) Left side body orientation over time; (b) left side head orientation over time; (c) left side gaze orientation over time; (d) frontal body orientation over time; (e) frontal head orientation over time; (f) frontal gaze orientation over time.

Figure 3. Historical trends in orientation, Study 2: (a) left side orientation over time; (b) frontal gaze orientation over time.