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Asymmetrical facial expressions in portraits and hemispheric laterality: A literature review

W. R. Powell ^a; J. A. Schirillo ^a

^a Wake Forest University, Winston-Salem, NC, USA

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Asymmetrical facial expressions in portraits and hemispheric laterality: A literature review

W. R. Powell and J. A. Schirillo

Wake Forest University, Winston-Salem, NC, USA

Studies of facial asymmetry have revealed that the left and the right sides of the face differ in emotional attributes. This paper reviews many of these distinctions to determine how these asymmetries influence portrait paintings. It does so by relating research involving emotional expression to aesthetic pleasantness in portraits. For example, facial expressions are often asymmetrical—the left side of the face is more emotionally expressive and more often connotes negative emotions than the right side. Interestingly, artists tend to expose more of their poser's left cheek than their right. This is significant, in that artists also portray more females than males with their left cheek exposed. Reasons for these psychological findings lead to explanations for the aesthetic leftward bias in portraiture.

Keywords: Affective hemispheric laterality; Facial expressions; Aesthetic judgements; Portraiture.

There is an asymmetry in portraiture to depict more of the left side of a poser's face than their right side (Gordon, 1974a; Grüsser, Selke, & Zynda, 1988; McManus & Humphrey, 1973; Zaidel & Fitzgerald, 1994). However, there is little agreement as to why portrait asymmetry exists. This article will explore this aesthetic phenomenon by discussing a potential cause—cerebral hemispheric lateralisation—paying particular attention to the distinction between spontaneous and posed expressions. This article will also discuss left/right asymmetries in portraiture and potential explanations for their existence by covering the relationship between attraction and asymmetry and the use of mirror-reversed images to disassociate an aesthetic leftward bias from potential perceiver left visual field bias.

Address correspondence to: Jim Schirillo, Psychology Department, Wake Forest University, Winston-Salem, NC 27109, USA. E-mail: schirija@wfu.edu

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FACIAL ASYMMETRIES IN PORTRAITURE

The use and ultimate failure of facial physiognomy

For centuries the pseudoscience of facial physiognomy, or face reading, has been used to deduce an individual's character (Brandt, 1980). An example would be inferring that an individual is conscientious because their nose is long and straight. Face reading dates back to Plato and Aristotle and was used by physicians well into the Middle Ages, while astrologers used physiognomy to predict the future. However, by the nineteenth century face reading faded from popularity only to be replaced by phrenology, which proposed to deduce character by analysing the bumps on the skull. Yet face reading resurfaced after phrenology declined, and exhibited its greatest popularity in the 1920s and 1930s. As popular appeal has waned researchers finally agree that facial physiognomy is no longer viable (Brandt, 1980). For example, Squier and Mew's (1981) exploration of facial height (by measuring jaw angle) and personality characteristics suggested that long, angular-faced individuals differed from small, square-faced individuals on a variety of personality characteristics. Yet they found it impossible to infer *specific* personality characteristics for a *specific* individual based on their face length. Although physiognomy is spurious, many researchers have proposed that transitory changes (e.g., emotions) instead of permanent facial structures can be used to categorise unique characteristics of each side of the face.

Darwin (1872) was the first to observe facial asymmetries during emotional expressions, such as when humans reveal their canine tooth on only one side of their face while sneering. Wolff (1933) followed up on these observations when he created chimerical faces by photographing a forward-looking face and splitting it in half to create composite faces, taking one original side and combining it with its mirror-reversed side. Wolff (1933) found that right face composites resemble the entire face more than left face composites. Moreover, he observed qualitative asymmetries and claimed that a right-side composite face reflected one's "public side", expressing qualities of vitality and power, while a left-side composite reflected one's "private side", containing unconscious qualities (Kowner, 1995). Although these terms are vague, they point to other studies suggesting that the right side of the face is an individual's social side while the left side of the face is their introspective side (Hallervorden, 1902). Experiments by Stringer and May (1981) supported Wolff's qualitative categorisations of facial asymmetry. They used a bipolar rating scale to show that the right side of the face was considered outgoing, active, thinking, and strong while the left side of the face was considered receptive, intuitive, feeling, pleasant, and happy. Likewise, Karch and Grant's (1978) work on facial asymmetries had

observers rate (left or right) male facial composite images on nine adjective scales. Their observers described left facial composites as healthier, stronger, harder, more active, more excitable, and in the direction of bad on the good–bad scale. Right facial composites were judged to be more sickly, weaker, more feminine, softer, more passive, calmer, and in the good direction on the good–bad scale.

Facial expressions, emotion, and facial physiognomy

The above-mentioned studies suggest there may be inherent qualities differentiating the two sides of the face. However, these studies also suggest little consistency as to what these qualities are. Consequently, determining personality factors from facial physiognomy has lost favour, but research devoted to emotional expression continues to hold promise. Pushing the field forward, Ekman and Friesen (1976) found several universal emotions depicted in facial expressions that can be discriminated reliably: happiness, surprise, sadness, anger, disgust, contempt, and fear. How these emotions may be asymmetrically displayed has been studied extensively (Borod, Haywood, & Koff, 1997), with the majority of research examining posed (voluntary) emotional expression.

Multiple laboratories have found the left side of the face to be more emotionally expressive (Borod, Kent, Koff, Martin, & Alpert, 1988; Borod, Koff, & White, 1983; Campbell, 1978, 1986; Sackeim & Gur, 1978; Sackeim, Gur, & Saucy, 1978). The conclusions of the current paper are consistent with previous literature reviews in regard to facial asymmetry during emotional expression (e.g., Borod et al., 1997; Campbell, 1986; Skinner & Mullen, 1991). In this section we sample the literature in more detail regarding the important studies concerning facial asymmetries of spontaneous and posed expressions.

Using chimeric faces has been the most common methodology to produce such findings (Skinner & Mullen, 1991). These stimuli were used by Sackeim and colleagues (Sackeim & Gur, 1978; Sackeim et al., 1978) to first report that the left side of the face is more dominant in emotional expression. They conclude that their findings reflect right cerebral hemispheric superiority in the control of voluntary emotional displays since the contralateral cerebral hemisphere governs the lower two-thirds of the facial musculature (Brodal, 1965; for a review see Rinn, 1984).

Posed (voluntary) facial expression. The results of Sackeim et al. (1978) have been replicated in studies examining posed facial expressions (Sackeim & Gur, 1983) which suggest marked differences between the left and right sides of the face. In a meta-analysis of 14 studies, Skinner and Mullen (1991)

conclude that the left side of the face is judged to have greater emotional expression than the right side. Borod and Caron (1980) concur that the left side of the face differs from the right side in affective qualities. They videotaped people who posed with various emotions expressions and had observers rate the intensity of emotion on the two sides the poser's face. Observers rated the left side as more intense in emotional expression. Importantly, this was true regardless of the type of emotion displayed (i.e., positive or negative).

Regarding just positive emotions, Campbell (1978) had participants specifically examine smiles. In her first experiment observers viewed two chimeric faces and were asked which of the pair looked happier. The chimeric faces had a normal orientation with a half smile on the left side; or a normal orientation with a half smile on the right side; or a mirror orientation with a half smile on the left side; or a mirror orientation with a half smile on right side. She found that participants judged faces as happier when the smile was made on the left side of the face, regardless of whether the image was shown in its original or mirror-reversed orientation. In her second experiment Campbell concurred with previous researchers by showing that participants judge facial expressions as more extreme when they were exhibited on the left side of the face.

Kowner (1995) examined asymmetry as it relates to a neutral expression, which occurred when posers were asked to "present a neutral expression, devoid of any emotion" (p. 545). Using a slightly more advanced and realistic technique than Wolff's (1933) to create facial composites, he examined attributions made to right-handers' neutral faces. Findings from multiple experiments led Kowner to conclude that there are no consistent differences between the right and left hemiface for both emotions and personality attributions. That is, he found only 3 significant main effects out of a possible 54. However, later experiments were consistent with the finding that right-handers' left hemifaces are more intense in posed emotional expression.

To provide further support for the left-side dominance in emotional expression, Borod et al. (1997) reviewed the findings from 26 studies (on 4 of which this paper elaborates) on emotional asymmetry of posed facial expressions. Despite varying techniques and methodologies implemented in these studies, Borod et al. (1997) ultimately concluded that the left side of the face has greater involvement than the right side of the face during emotional expression.

While the aforementioned findings provide convincing evidence for a left side of the face dominance for posed emotional expressions, a similar conclusion for studies using spontaneous expression is doubtful since these studies often use imprecise methodologies and have conflicting results.

Spontaneous (involuntary) facial expression. Ekman (1980) criticised Sackeim et al. (1978) for not making a distinction between spontaneous and posed expressions (i.e., Sackeim et al.'s facial expressions were posed), a methodological concern reiterated by many researchers. Ekman explored this matter by examining the differences between spontaneous and posed emotional expressions. Ekman, Hager, and Friesen (1981) claimed that spontaneous (i.e., involuntary) facial expressions are more symmetrical while voluntary expressions are asymmetrical. In their first study, Ekman, et al. (1981) videotaped children making a spontaneous happy face that was elicited by jokes and encouragement, which they compared to a posed happy face. The researchers found that only 6% of the 78 spontaneous happy faces were asymmetrical while posed happy faces were asymmetrical for 24% of 114 expressions.

Complicating matters, Cacioppo and Petty (1981) found that participants judged the right side of the face to be more expressive in posed photographs. However, they found the opposite result for spontaneous pictures, in which case participants judged the left side as being more expressive. However, Bryden and Ley (1983) reviewed a number of relevant studies, including Cacioppo and Petty's (1981), and concluded that the left side of face was more intense and expressive for *both* spontaneous and posed emotion. They questioned Cacioppo and Petty's conclusion because their effect size was weak and because Cacioppo and Petty examined only one emotion (i.e., sadness), limiting the generalisability of their findings.

Sackeim and Gur (1983) also concluded that in voluntary displays the left side of the face is more intense. They reasoned that this was because posed and spontaneous facial expressions involve separate neural controls, where extrapyramidal influences are believed to be an important contributor of spontaneous emotion expression (Ekman, Matsumoto, & Friesen, 1997). Sackeim and Gur hypothesised that the left side of the face is more intense in spontaneous negative emotion displays, yet the right side of the face is more intense in positive emotion displays. Additional support for this hypothesis comes from Schwartz, Ahern, and Brown (1979), who found greater electromyograph activity in the right side of the face during positive emotional questions while activity was greater in the left side of the face during negative emotional questions.

Schiff and MacDonald (1990) also concluded that the face is bifurcated by emotional states. They tested this hypothesis by having participants produce antonyms to incite different levels of emotional arousal. In essence, harder versions of the task produced frustration while easy versions were performed with no difficulty. Participants were then photographed and right-right and left-left facial composite chimeric photos were generated and given to a separate group of people. These participants judged the right side of the face as changing more than the left side of the face for easy tasks (i.e., the positive

emotional state). However, when the task was difficult (i.e., the negative emotional state), the left side of the face was judged as changing more than the right side of the face. This indicates that left and right sides of the face differ, depending on the emotional attribute being elicited.

Schiff and MacDonald's (1990) finding contradicts a series of earlier field and laboratory studies by Moscovitch and Olds (1982) who concluded that spontaneous emotional expression is associated with unilateral facial movement on the left side of the face. They found that the majority of their participants could wink only with their left eye (Study 1), and that unilateral expressions were present more often on the left side of face (Study 2). They also showed that there were more left-sided unilateral expressions of restaurant diners (Study 3); and there was a left-sided dominance of expression when participants related a sad, funny, or frightening experience to a camera (Study 4).

Borod et al. (1983) also examined facial asymmetry for both spontaneous and posed emotional expressions. In their spontaneous emotion condition participants viewed slides designed to elicit the expression of either negative or positive emotions. In the posed condition participants were given a verbal command to pose with either one of two pleasant or two unpleasant facial expressions, or they were shown slides (e.g., a child picking flowers) and asked to make the appropriate facial expression associated with the image. Judges then rated the asymmetry, intensity, and emotional category of the facial expressions. Borod et al. found no significant difference in facial asymmetry for positive posed and spontaneous expressions of emotion, yet they found that left-sided faces were more strongly associated with negative emotions.

Likewise, Mandal, Asthana, Madan, and Pandey (1992) prepared original images, along with left and right composites, from neutral expressive photographs. They presented these images and their mirror reversals to participants, who rated the degree of pleasantness in the neutral expressions. The researchers found that the left-side composites were judged to be more emotional than both the right-side composite and the original face images.

In an excellent review of 49 experiments in the literature Borod, Koff, Yecker, Santschi, and Schmidt (1998) came to several conclusions. First, they found that posed and spontaneous expressions did not differ in the direction of facial asymmetry, unlike clinical observations (which indicate that spontaneous expressions show more bilaterality). Second, overall there was no support for a facial asymmetry differences as a function of gender. That is, although single-gender experiments have suggested that males may be more strongly lateralised (left hemiface/right hemisphere), studies involving both genders have failed to yield significant differences or have found that lateralised differences (i.e., left-facedness) were randomly distributed across males and females. There were however, 7 of 47

observations in which posers showed right-facedness of positive emotions (none showed negative emotions). Lastly, in studies that involved trained judges and muscle quantification there were left-sided emotional asymmetries (just as with unilaterally brain-damaged individuals). This suggests that the right hemisphere has a dominant role in mediating emotional expression; however in studies using self-report measures there was some degree of support for the valence hypothesis.

In summary, studies on spontaneous and posed emotion expressions are somewhat inconclusive, in that clinical observations report dissociation between these two types of expressions. These observations come from patients with facial paralysis (Monrad-Krohn, 1924) and commisurotomies (Gazzaniga & Smylie, 1990). However, the non-clinical studies reported above suggest that there is facial asymmetry, with emotions being expressed more on the left side of the face than on the right for both spontaneous and posed expressions (e.g., see Borod et al., 1997).

Facial musculature reflects hemispheric lateralisation of emotion

The aforementioned studies provide convincing evidence that the left and right sides of the face differ in the extent they display emotional expressions. One popular explanation posited for these findings is that emotional expressions are tied to cerebral hemispheric laterality. Specifically, the right hemisphere plays a superior role in emotional processing. Since the right hemisphere controls the contralateral lower two-thirds of the left side of the face (Brodal, 1965; Rinn, 1984) emotional expression should be more intense on this side. Support for right hemisphere superiority in emotional processing is found in studies examining asymmetries of emotional expression, lesion studies, face recognition studies, dichotic listening tasks, priming experiments, and tachistoscopic studies, among many other paradigms (Bryden & Ley, 1983).

For example, Borod et al. (1988) videotaped participants making eight facial expressions (three positive and five negative expressions) in two conditions. The first condition contained an oral command (e.g., "look happy"), while in the second condition participants saw slides of an adult male posing in a prototypical facial emotional expression and were instructed to look like that person. In both conditions the emotional expressions generated were more intense on the left side of the face for both negative and positive emotions.

Another line of evidence has revealed that right cerebral hemisphere damaged participants performed worse than left damaged and non-damaged participants on how well they could determine the emotional expressions of

various stimuli (Bowers, Bauer, Coslett, & Heilman, 1985). Thus, both the production and evaluation of emotions is thought to be focused predominantly in the right hemisphere.

Positive and negative emotions are expressed on the right and left side of the face, respectively

Research conducted over the past 20 years overwhelmingly suggests that the right and left brain hemispheres differ in the processing of emotional tone. Known as the valence hypothesis, it suggests that the left brain hemisphere is specialised for positive emotions and the right brain hemisphere is specialised for negative emotions (Davidson, 1984; Fridlund & Izard, 1983; Sackeim et al., 1982; Schiff & Lamon, 1989; Silberman & Weingartner, 1986). Neurological evidence obtained through various methods has provided strong support for this proposition.

One of the first studies that suggested an emotive hemispheric difference involved the administration of the Wada test, which consists of intracarotid injections of barbiturates to one hemisphere without interrupting the other hemisphere (Rossi & Rosadini, 1967). A total of 68% of left hemisphere injections produced depression while only 32% produced euphoria. In contrast, 84% of right hemisphere injections produced euphoria while only 16% were associated with depression. These findings suggest that, when active, the right hemisphere primarily regulates negative emotions while the left hemisphere primarily regulates positive emotions.

Unilateral lesion studies also support a valence hypothesis. Gainotti (1969, 1972) reported that patients with left hemisphere damage (i.e., they had only an active right hemisphere) were tearful, withdrawn, and depressed. However, right hemisphere damaged patients (i.e., they had only an active left hemisphere) were described as having flatness of tone and inappropriate jollity.

Sackeim et al. (1982) provide other substantive neurological evidence for hemispheric laterality by examining patients with cerebral damage. They found that pathological laughing (i.e., enduring, spontaneous, uncontrollable displays of emoting that are uncorrelated with objective changes in their surrounding) was associated with right-sided cerebral damage. They also found pathological crying associated with left-sided cerebral damage. In a second study, 12 of 14 right hemispherectomy patients were judged as having euphoric mood, and that patients with pathological laughing were three times more likely to have right-sided hemisphere damage, whereas patients with pathological crying were twice as likely to have left-sided hemisphere damage.

Along similar lines, Mandal, Tandon and Asthana (1991) studied right-brain-damaged, left-brain-damaged, and normal participants' responses to various emotional stimuli during matching and verbal labelling tasks. In the matching task, participants viewed an image of a certain male facial expression and were asked to find that expression from a series of female images. In the verbal task participants verbally labelled the emotional expression they saw in various images. Right hemisphere damaged patients had more trouble recognising negative arousal emotions compared to left hemisphere damaged and non-damaged patients. Furthermore, left hemisphere damaged patients performed better than right hemisphere damaged patients in judging negative, but not positive, emotions.

In an interesting set of effects related to emotional musculature, Schiff and Lamon (1989) found that unilateral right and left face contractions produce different emotions (for a counter-argument see Fogel & Harris, 2001). They found that left face contractions (i.e., right hemisphere driven) produced negative changes to participants' emotional state, while the opposite was found for right face contractions.

Besides feeling lateralised emotions, emotional expressions can be perceived by even slight turns of the head. For example, a study by Nicholls and colleagues (Nicholls, Ellis, Clement, & Yoshino, 2004) used relatively realistic faces generated via 3-D imaging techniques. The faces were rotated 35 degrees to the right or left. Participants perceived the right side of the faces to be happier and they perceived the left side of the faces to be sadder. This was independent of whether the image was in its original or mirror-reversed orientation, suggesting that it is the side of the face that carries specific emotional expressions, not necessarily the side exposed to the viewer. Furthermore, a related study by Nicholls, Wolfgang, Clode and Lindell (2002b) showed that the left side of the face is more emotionally expressive even in photographs that include head turns of just 15 degrees. Using six models, they showed that left and midline images were judged to be more emotionally expressive than right-cheeked images. As in Nicholls' et al. (2004) later study they got the same effect for mirror-reverse images, suggesting that the asymmetry is tied to the physiognomy of the model's face rather than an aesthetic preference or perceptual bias of the observer.

Jansari, Tranel and Adolphs (2000) also found that observers discriminated negative emotions more effectively when expressed on the left side of the face, whereas the opposite was true for discriminating positive expressions (where the emotional expression on the right side was better discriminated).

While the valence hypothesis has used a positive/negative emotional distinction to categorise each brain hemisphere, a more recent argument is that an approach/withdrawal model may provide a more appropriate fit to human emotional expressions (Demaree, Everhart, Youngstrom, & Harrison, 2005).

Davidson's and others' interpretation of the left/right differences in emotion valence is that the right cerebral hemisphere regulates withdrawal behaviours, and therefore the emotional expressions that may coincide with withdrawal, whereas the left cerebral hemisphere regulates approach behaviours and their corresponding emotional expressions (Davidson, 1984, 1992; Davidson, Ekman, Saron, Senulis, & Friesen, 1990; Fox, 1991; Kinsbourne, 1982). Davidson (1992) garnished support for this claim by collecting electroencephalogram (EEG) data revealing that anterior regions in the left hemisphere are specialised for approach (e.g., happy) while anterior regions in the right hemisphere are specialised for emotions related to withdrawal (e.g., disgust). In addition, Davidson, Schwartz, Saron, Bennett, and Goleman (1979) found a difference in activation in frontal brain regions for emotion. They had participants view video clips intended to evoke negative or positive emotions, during which time they pressed a pressure-sensitive knob to represent how much they disliked the clip. Comparing the pressure knob data with EEG recordings, the researchers found greater left hemisphere activation in frontal brain regions for positive emotion-evoking conditions, whereas greater frontal right hemisphere activation was associated with negative emotion-evoking conditions.

Taken together, these studies support the conjecture that certain emotions may be lateralised and regulated by separate cerebral hemispheres. The left hemisphere dominates in regulating positive emotions while the right hemisphere dominates in regulating negative emotions. Furthermore, the dimension of approach and withdrawal has been suggested as a more appropriate global classification underlying emotion. Studies involving unilateral injections of barbiturates (Wada test), neurological and neuro-imaging, and unilateral cerebral lesion studies all confirm this proposition.

How perceptual asymmetries relate to visual field studies

The discovery of laterality raises two questions: Does laterality create leftward bias? And does it also create perceptual differences in an observer? For example, it has been argued that an observer's left visual field (LVF) processes emotional content faster than the right visual field because the right hemisphere is superior at recognising emotional stimuli. This creates a bias towards the left visual field (Gilbert & Bakan, 1973). The following studies are consistent with findings that the right cerebral hemisphere is superior in processing emotional content and emotional facial expression (via a LVF advantage) compared to the left cerebral hemisphere.

In one study Suberi and McKeever (1977) had participants view neutral, happy, sad, and angry faces. In comparison to neutral faces presented separately to each visual field, they found that participants' left visual field

was faster than their right visual field in discriminating all emotions. Furthermore, participants who memorised emotional faces showed faster reaction times in their left visual field than participants who memorised neutral expression faces. As expected, in participants who memorised emotional faces, sad faces produced the greatest left visual field advantage (i.e., faster reaction times to stimuli).

In another measure of visual field advantage Reuter-Lorenz and Davidson (1981) used an affective discrimination task, where participants were briefly presented a face on either side of a central fixation point. Participants' reaction time was recorded as they identified the side that contained the more emotional face. Reaction times were faster when happy faces were presented in the right visual field, compared to when sad faces were presented. Conversely, reaction times were faster for negative faces presented in the left visual field compared to positive faces. These results suggest that positive and negative emotions are processed primarily by left and right cerebral hemispheres, respectively. Likewise, Heilman and Van den Abell (1979) presented threatening stimuli to the left visual field and found reduced reaction times (albeit a very small effect size) compared to threatening stimuli presented to the right visual field. Consistent with Suberi and McKeever (1977) and Reuter-Lorenz and Davidson (1981), this implies that the right hemisphere (LVF) is dominant in processing negative stimuli.

Heller and Levy (1981) found that right-handers showed a LVF bias for judging facial emotions. They photographed individuals expressing spontaneous neutral and smiling poses. Participants were shown the poser's facial composites (mirror-reversed and original images) with one side of the face smiling and the other side with a neutral expression. Participants sequentially viewed two images (one with a smile on the left side of the face and the other with a smile on the right side) and were asked which of the pair looked happier. All participants judged faces to be happier when the left half of the face was smiling. This was found for both original and mirror-reversed images. Sackeim and Grega (1987) also showed a greater left visual field bias. Posers were instructed to make happy and sad expressions that accentuated either the right or left side of their face. Afterwards, different participants rated the emotional intensity of the original posed and mirror-reversed images. The researchers found that participants rated expressions as more intense when the accentuated side was to their left, independent of mirror reversals.

Levy, Heller, Banich, and Burton (1983) found a LVF bias. Their study examined visual field bias in emotional and neutral expressions of chimeric faces. They had participants examine 36 pairs of chimeric and their mirror-reversed faces that consisted of one side smiling and the other side with a neutral expression. When participants were asked which chimeric face

looked happier, the researchers found that right-handers had a consistent LVF bias. Likewise, Ley and Bryden (1979) found greater LVF accuracy in judging emotional expression of five emotional expressions of five cartoon faces. Based on their numerous studies of tachistoscopic presentation of cartoon faces, Bryden and Ley (1983) concluded that the LVF effect for emotional recognition is a robust one.

Both perceptual and poser asymmetry was examined by Borod, St. Clair, Koff, and Alpert (1990) as they studied expressions of asymmetries in normal, right-brain-damaged, and left-brain-damaged posers. The posers were instructed to pose with either happy or angry expressions. Participants were presented with both original and mirror-reversed faces and asked to rate the degree of asymmetry for each face. The researchers found that participants rated expressions as asymmetrical when presented in the left visual field more than when the same expression was presented in the right visual field. Reversed images of the posers were rated as more left-sided than the original orientation. Together, these results suggest a LVF bias. Also, expressions were rated more intense for the left side of the face of left-brain-damaged and normal posers. This result is expected because the right cerebral hemisphere, which is dominant in emotional expression, is intact. However, expressions for right-brain-damaged posers were not significantly lateralised, implying that the left hemisphere does not play as vital a role in emotional expression.

Thus, a vast literature had been developed by researchers to show that while determining personality factors from facial physiognomy has been ruled out, facial structure may be relevant for perceiving emotion. Marked differences exist between the two sides of the face. Studies have consistently shown that the left side of the face portrays more emotional expression than the right side. The most probable reason for this finding is that expressive emotional differences reflect cerebral hemispheric laterality. This manifests itself in two ways. First, the right hemisphere is superior in processing emotion overall, leaving the left side of the face more expressive. Second, the right hemisphere is dominant for processing negative emotions, whereas the left hemisphere regulates positive emotions. A further distinction has been made between spontaneous (involuntary) and posed (voluntary) facial expression. Studies of posed facial expression have been consistent with the findings stated above, whereas studies concerned with spontaneous facial expression have produced mixed results and are thereby less conclusive. Caution must also be taken in interpreting the results of emotional facial expression studies because of potential left field perceiver bias, which would cause greater right hemisphere activation to emotional stimuli presented to the left visual field.

LEFT/RIGHT ASYMMETRIES IN PORTRAITS

Artists typically wish to convey some sort of emotion in depicting expressions, making them intuitive psychologists. A study by Erdos, Harvey, and Tan (2001) had participants make judgements of faces alone as well as judgement of whole images (full-length body images). They looked at emotions such as happiness, triumph, fear sadness, shock, disgust, love anticipation, anger, suspicion, illness, and surprise. As expected, whole pictures matched the predicted responses for both artists and non-artist participants. However, both groups were more variable in their responses with whole images compared to when just faces were viewed. This suggests that artists use portraits to capture specific emotions that become less distinct when whole pictures are used.

This raises an interesting question. Do facial emotional asymmetries underlie why portraits are often asymmetrical (Gordon, 1974a; McManus & Humphrey, 1973; Zaidel & Fitzgerald, 1994)—where one side of the face is more exposed than the other? In fact, artists portray the left side of the poser's face more often than the right side (Conesa, Brunhold-Conesa, & Miron, 1995; Gordon, 1974a; McManus & Humphrey, 1973; Nicholls, Clode, Wood, & Wood, 1999). This is most interesting in that, as stated above, it is the left side of the face that more often depicts negative emotions; a finding that is more conclusive for posed individuals (i.e., voluntarily expressing emotions). The seminal work of McManus and Humphrey (1973) examined portraits from Western Europe created from the fourteenth to the twentieth century. Of 1474 portraits examined, 891 (approximately 60%) of posers were depicted with the left side of their face more exposed, whereas 583 (approximately 40%) were shown with more of their right side portrayed.

A subsequent, more extensive, study conducted by Conesa et al. (1995) consisted of examining asymmetries in portraits in various media, including paintings, drawings, daguerreotypes, etchings, and photographs. Conesa et al. categorised 4180 single-subject portraits and found that the majority of profiles were left facing and this pose was significantly greater than right-face profiles. That is, two judges determined that 1990 were left-half profiles (47.61%), 172 were left profiles (4.11%), 185 were full-faced (4.43%), 1702 were right-half profile (40.72%), and 131 were right profiles (3.13%).

What might account for this leftward bias? Over the last 30 years numerous hypotheses for the leftward bias in portraiture have been postulated. The first explanation put forth was also the simplest. Art historians postulated that the leftward bias exists because of an imposed mechanical bias of the artists. That is, right-handed artists find it easier to draw a leftward-facing pose (leaving the face uncovered by their hand as they draw), resulting in more left-faced portraits. Although this explanation is

simple, a number of researchers have found considerable evidence contradicting it.

One way to see if an artist's handedness causes the left-face bias is to examine the works of left-handed artists in addition to right-handed artists. Nicholls et al. (1999) found that the leftward bias also applies to left-handers. For example, they found that left-handed painters, including Raphael, were just as likely to portray the poser with their left side exposed to the viewer. However, the most significant finding against the artist's handedness explanation is that several studies with a leftward bias have also found that a gender difference exists, with artists portraying women left-cheeked more often than males (Gordon, 1974a; McManus & Humphrey, 1973). For example, of the left-face-dominant portraits found by McManus and Humphrey (1973), 68% of women were portrayed left-faced, while this was true of only 56% of men.

Nicholls, Clode, Lindell and Wood (2002a) claimed that this differentiation by gender asymmetry was the result of a desire to convey the emotive qualities on the left side of the face. They measured the emotional expressivity of 120 participants using the emotional expressivity scales (EES) devised by Kring, Smith, and Neale, (1994), and found that females were more emotionally expressive than males. Moreover there was a trend for left-cheeked posers to be more emotionally expressive than right-cheeked posers. Participants do not appear to be aware of any posing bias, nor do they offer any explanation for why they show the left or right cheek. This suggests that the posing bias is intuitive rather than conscious.

A second possible explanation of the gender difference is physiological. For example, Ellis (2006) discusses how females are more likely to smile than males. He argues that testosterone inhibits male smiling, since smiling interferes with males' ability to effectively intimidate rivals. This is necessary in that males often compete with other males for resources that are relatively scarce, and these capabilities are often enhanced through intimidation, bluffing, and engaging in dominance displays. Thus, Ellis claims that testosterone shifts the neocortex away from the left hemisphere (more prosocial and friendly) towards the right-hemisphere (less prosocial and friendly). Smiling has also been explained as an expression of submissiveness. Smiling appears to reflect nervousness, appeasement, and timidity at least as much as happiness and friendliness. Studies have indicated that gender differences in smiling are minimal prior to the onset of puberty, and since status striving follows the onset of puberty (not before), higher levels of circulating testosterone are associated with diminished social smiling. This theory ultimately fits within a Darwinian framework.

Although a gender bias exists for portraits painted, male and female viewers do not differ in their preference for portrait profile orientation. For example, McLaughlin and Murphy (1994) had 28 male and 36 female

participants view portraits and choose which version they preferred. They found that males and females both chose portraits with the expected right cheek showing rather than the left cheek for both male and female portraits. This is interesting since, citing various studies examining both verbal and nonverbal domains, Fairweather (1982) concluded that there were only a few studies in the non-verbal domain that support sex differences in cerebral lateralisation with females possibly excelling in tasks that involve facial recognition.

Moreover, the leftward bias has also been found when examining photographs, providing additional evidence that the mechanical bias hypothesis is untenable. In one particularly interesting study (Nicholls et al., 1999), participants had their photographs taken after being given specific instructions. One group of participants was instructed to pretend they were posing for a picture for their family before they went overseas for 1 year, and to “put as much real emotion and passion into the portrait as you can”. The other group of participants was to imagine “they were a scientist and were posing for the Royal Society because they had accepted you as a member and wanted a portrait for their gallery”. They were also instructed to “avoid depicting any emotion at all”. Nicholls et al. found that participants were more likely to turn their left cheek towards the camera if they were in the emotion group compared to if they were in the group that was instructed to avoid emotion. Conversely, participants who were told to avoid depicting emotion were more likely to turn their right cheek towards the camera than the participants in the emotion group. This implies that participants intuitively know which side of the face conveys certain emotive qualities.

A fascinating follow-up study by ten Cate (2002) wanted to explore why the left-cheeked bias is only consistent for females, while some male studies (like that of Nicholls et al., 1999) could obtain a right-cheeked bias. Ten Cate examined 1131 portraits of university professors in the Netherlands and Tubingen (Germany) over four centuries. He found that older portraits (pre-1820s) showed a clear right-cheeked bias (pre-1600s had a 90% rightward bias), which eventually shifted to a slight leftward bias by the 1900s. He then took a subset of these pictures—nine by Colasius (1710–1730) and nine by Quinkhard (1734–1760)—and showed them in their original and mirror-reversed orientations for 20 seconds each. Observers rated them on a 6-point scale where 1 indicated “non-scientific” and 6 indicated “scientific”. Ten Cate found that right-cheeked male university professors were more often judged as scientific, leading him to conclude that Nicholls et al. (1999) were correct, and that scientists are posed right-cheeked to communicate rationality and avoid portraying emotion.

There is other evidence that right-cheeked images may be preferred. Burkitt, Saucier, Thomas, and Ehresman (2006) examined posing bias in

full-page advertisements of magazines that reflect a variety of consumer groups. In magazines from 2002–2004 there was more rightward bias than leftward bias, with actually more central poses. Considering ten Cate's (2002) hypothesis that leftward bias would be stronger in earlier samples, Burkitt et al. looked at magazines from 1884–1955 (mode 1937). They found that central poses occurred least frequently, then leftward, and rightward slightly, but not statistically, more. It may be that rightward-biased images are rated as more attractive; and that this may be more powerful than emotional content in images used in advertising.

Another explanation for portraiture's leftward bias is that it may originate in the perceptual asymmetries of the viewer. As mentioned in a previous section, the right hemisphere is essential in perceiving emotional stimuli and is superior in face recognition. Thus the emotional and facial content in the left visual field would be preferred over the right visual field, making artists prefer to put the left side of the poser's face in the viewer's left visual field. However, the perceptual preference explanation fails to account for the enhanced leftward bias of female portraits. One way to resolve potential perceptual preference effects is to use mirror-reversed images. Mirror-reversal studies compare preference ratings between original and reversed orientations of portraits. Mirror-image studies have led to many important contributions in understanding portrait asymmetries, and will be discussed in detail later. For now, all that will be mentioned is that if there is a left visual field bias, it should be found when the left side of the face in both an original and mirror-reversed orientation is judged the same.

Another possible explanation for why artists paint more people with a left-face bias is to reflect the social distance of the poser from the artist. That is, some artists may use the posture of the poser to convey the social relationship between themselves and their subject. Humphrey and McManus (1973) explored this "perceived kinship" explanation by determining the relationship Rembrandt had to his subjects in 355 of his portraits. Male subjects that were closest to Rembrandt (e.g., himself, male-kin, and male-non-kin) were portrayed more left-cheeked than female kin and female non-kin. Overall, non-kin subjects were more likely to be right-cheeked than kin (e.g., his mother, father, sister, and wife). According to Humphrey and McManus's rationale, Rembrandt felt the groups most like himself were male-kin followed by male non-kin. Women were more remote to him, with female-kin farther away from all males but closer than female non-kin.

Although McManus and Humphrey proposed the most creative and interesting interpretation for leftward bias, their findings may be limited to Rembrandt. Gordon (1974b) tested Humphrey and McManus's social relationship theory by examining 295 portraits painting by the Spanish artist Francisco Goya. Consistent with other findings, Gordon found a left-side bias with a stronger bias for females, yet he did not find kin and non-kin

differences. As no other studies have found support consistent with Humphrey and McManus (Nichols et al., 1999) their explanation may only be applicable to certain artists.

Another hypothesis for the leftward bias is that the poser prefers to portray certain facial characteristics more evident on the left side of the face. This has been suggested since most portraits evoke emotional qualities, and since the right cerebral hemisphere expresses more emotion the left side of the face is more featured in portraits. Recall that observers judge the left side of the face as being more emotionally intense (Sackeim et al., 1978) and also perceive it to be more similar to the entire face (Wolff, 1933). This is especially important since the left side of the face is associated with negative displays of emotion, whereas the right side of the face is associated with positive emotional expressions (Davidson et al., 1990). It has been postulated that posers intuitively understand this notion, and instinctively present their left or right cheek according to the emotions they want to communicate (Nicholls et al., 1999).

Thus, unlike other theories, this hypothesis can also account for the sex difference observed in many studies. That is, males may not want to portray their emotive side as much as women, and may therefore present the right side of their face more often than females, while artists prefer to portray women as being more emotive than men, and thereby expose their left cheek more often. By examining portraits from the fifteenth to the twentieth century, Grüsser et al. (1988) suggest that this may be the case. Overall they found a left-cheek bias, which was always stronger for females than for males; however, the prevalence of the leftward bias changed over the years. They found the bias was the strongest from the fifteenth to the seventeenth centuries, which may reflect the zeitgeist of perceived sex differences for each time period. One may speculate that over time it has become more permissible for females to show their less emotive side.

In an effort to determine why the left side of the face is presented more often, Chatterjee (2002) and colleagues (Chatterjee, Maher & Heilman, 1995; Chatterjee, Southwood & Basilico, 1999) have successfully shown that participants are more likely to draw a circle to the left of a square when asked to draw events like "the circle pushes the square". These researchers use facts such as these to suggest that participants are more likely to conceptualise agents (those doing the action) on the left of recipients of action. Consequently, they claim that a participant on the left of the viewer would display more of their right cheek, which the data from the literature support. For example, it concurs with the notion that left cheeks are biased more for women (McManus & Humphrey, 1973) who are more often seen as passive. This has reduced from the fifteenth to the twentieth century as gender roles have become less stereotyped (Grüsser et al., 1988). Also, painters see themselves as agents, and thereby expose more of their right

cheek. This may be a more convincing argument than an explanation of social distance (Humphrey & McManus, 1973). For example, Chatterjee's findings also account for the fact that Da Vinci's right-cheeked images are perceived as active and potent (Benjafield & Segalowitz, 1993), and that McLaughlin and Murphy (1994) claim that a right cheek is preferred arguably because it is a more active agent.

Thus, while the cause of leftward bias in portraiture has yet to be identified definitively, many theories exist. The reason there have been many explanations for artistic bias is because it has not been related directly to affective laterality. Yet most theories support a shared mechanism for lateralised expression and aesthetic bias. It is to these issues that we turn our attention.

Facial asymmetry and attraction

Given the literature on lateralised portraiture, psychologists have sought to determine whether an observer finds one side of the face to be more pleasing than the other. Thus, a considerable research effort has examined the role aesthetics plays in portraiture. Numerous studies suggest that cerebral hemispheric laterality may influence aesthetic preference. For example, Benjafield and Segalowitz (1993) had participants rate eight portraits (four men and four women) by Leonardo da Vinci on a variety of bipolar scales (e.g., nice/awful, strong/weak, active/passive, beautiful/ugly, etc.). Participants viewed both left- and right-facing profiles as both original and mirror-reversed images. In general, female faces were rated more positively yet weaker than male portraits. However, there was also an interaction between the orientation of the face and whether the orientation was in the original orientation or a mirror image. The right side of the face, and the left face in mirror-reversed images, was rated as being more active and stronger than the left side of the face. This implies that the laterality effect is not due to a visual field bias, but instead the result of the facial characteristics Leonardo captured that mattered to observers.

To differentiate attractiveness from affect Zaidel, Chen, and German (1995) investigated judgements related to male and female faces for attractiveness (Experiment 1) and smiling expressions (Experiment 2). They found that attractiveness and smiling are asymmetrically represented on the face. In Experiment 1 participants had to judge whether left–left or right–right facial composites were more attractive. For female faces, right–right facial composites were rated as more attractive than left–left facial composites. However, for male faces, Zaidel et al. found no differences in judgements between the right–right and left–left facial composites. In Experiment 2 participants were asked which composite had a more

pronounced smile. Unexpectedly, left–left facial composites for both men and women were judged as having a more pronounced smile than right–right composites.

Complementing Zaidel et al.'s (1995) findings, Schirillo (2000) found that left-cheeked portraits by Rembrandt are evaluated more negatively than right-cheeked images, whereas right-cheeked portraits are evaluated more positively. Schirillo had participants rate original and mirror-reversed Rembrandt portraits on personality and emotion traits that clustered into four factors using multidimensional scaling (e.g., pleasingness, social appeal, dominance, and agreeableness). Left-cheeked females were evaluated as containing more negative qualities (e.g., lower pleasantness, lower appealingness) compared to right-cheeked females. Similarly, the right-cheeked male posers were rated more positively than left-cheeked males. These findings are consistent with Davidson's (1984, 1992) suggestion that the left side of the face reflects approach expressive qualities, whereas the right side reflects more withdrawn qualities.

Investigating hemispheric laterality and perceiver bias can also help explain how aesthetic judgements are made about portraits. Towards that end, Chen, German, and Zaidel (1997) specifically examined whether facial beauty is a stable characteristic (due to facial physiognomy) or is caused by the perceptual asymmetries of the viewer. In their first experiment, participants viewed right–right, left–left, and normal facial composites. Participants were split into original and mirror-reversed image groups in which they simultaneously viewed the three types of images. They rated which of the two composites looked more like the normal face. Chen et al. found a perceiver left visual field bias, because whichever side of the face was in the left visual field of the normal face determined which composite participants said most resembled the normal face. In their second experiment beauty was assessed on a 5-point scale. Participants again were divided into original and mirror-reversed image groups. In this case, orientation had no effect on their judgements. Since Chen and colleagues found no perceptual bias effect they concluded that participants used the poser's facial physiognomy to make their aesthetic ratings.

This is an interesting finding in that Zaidel and Fitzgerald (1994) and Schirillo (2000) reported that women are depicted in portraits with the less-attractive side of their face showing. Zaidel and Fitzgerald's first experiment investigated participants' liking of portraits. Two groups of participants viewed portraits in either their original orientation or their mirror-reversed orientation. Participants liked the right side more than the left side of the face of portraits. Consistent with findings of their previous research, Zaidel and Fitzgerald found that women's right side of the face was preferred more than men's right side. However, they found no difference between a woman's left side and a man's left side. In their second experiment participants rated

each portrait on attractiveness. Not surprisingly, right-cheeked portraits were favoured over left-cheeked portraits with higher ratings for females than males. For males, right- or left-cheeked portraits did not differ in attraction ratings.

In contrast to these studies, Schirillo and Fox (2006) showed observers all 373 of Rembrandt's portraits and found that observers rated left-cheeked females as more approachable than right-cheeked females, while males (for both sides of the face) were assessed as preferably avoided. Moreover, observers were more likely, overall, to want to approach female rather than male Rembrandt portraits. Unfortunately it is possible Rembrandt had an idiosyncratic way of making portraits, and hence his paintings need not be representative of portraits in general. Future studies that cover portraits from a large number of artists may therefore be more informative to trace general properties.

Cultural factors have also been thought to influence the aesthetic preference of profiles. For example, Nachson, Argaman, and Luria (1999) showed that a culture's reading and writing habits affect preference for profiles. They presented Arabic, Hebrew, and Russian participants with pairs of 29 facial and body profiles (9 were faces only, 20 were of entire bodies) and asked them to rate which profile was more beautiful. The pairs were presented in original profile or as reversals, and these pairs consisted of either inward- or outward-facing pairs. Arabic and Hebrew participants (who read from right to left) preferred facial and body profiles that were facing right, whereas Russian participants (who read from left to right) preferred profiles facing left.

Not only cultural differences need to be considered when explaining a leftward bias, in that an Internet search using "Google Images" revealed that pictures of dogs, fish, lizards, and infants under 1 year of age also exhibit a leftward bias (Thomas, Burkitt, & Saucier, 2006). This suggests that something quite primitive may underlie our aesthetic preferences.

Taken together, these findings support a shared mechanism for lateralised expressions and leftward bias. That is, research on portraits suggests that hemispheric laterality may be a significant factor that influences aesthetic preferences. The majority of studies have shown that participants attend to the poser's actual facial characteristics, which may reflect underlying cerebral lateralisation. For women, it seems that the right side of the face is more aesthetically pleasing than the left side. This is fascinating, since it is not the way they are most often portrayed! Yet Schirillo and Fox (2006) found that left-cheeked females were assessed as more approachable than right-cheeked females. For men, the conclusions do not favour either side as being more aesthetically pleasing.

Mirror image effects

The fact that participants judge the left side of the face as less pleasant than the right side may occur for two different reasons. First, it may be explained by the hemispheric laterality of emotion, where the left side is judged as being more negative because it is viewed more by the right hemisphere (i.e., left visual field) of the perceiver which is superior in processing negative emotional stimuli. Second, the biased judgements may be due to the actual physiognomy of the poser's left side of the face, caused by the poser's right hemisphere's superior role in generating a negative emotional display.

Exploring mirror image effects of portraits may help to confirm the hemispheric laterality hypothesis of portrait asymmetries, while simultaneously controlling for potential visual field effects. According to the hemispheric laterality hypothesis each hemisphere may produce specific emotions, which will be expressed in the musculature of the portrait being viewed. To the extent that this is the case, the emotional content on each side of the face will remain constant even when the portrait is mirror-reversed. This means that perceiver bias can be ruled out if participants are shown both original and mirror-reversed portraits and they judge each image to be aesthetically equivalent. In other words, a poser's exposed left cheek would be judged as more negative than their right cheek in original images, whereas the right would be judged more negative in mirror-reversal images. Mirror images are therefore useful in dissociating hemispheric laterality from visual field bias.

Mirror image effects have been examined since the mid-twentieth century. In an informal analysis of paintings, Keller (1942) reported that the effect produced by a mirror image of a picture is very different from the effect of the original picture; yet what qualified as an effect was not made explicit. Wölfflin (1941) suggested that pictures (including portraits) are viewed from left to right and that this tendency is found in, at least, European pictures. Wölfflin suggested that this occurred because the composition of the left side of the picture is "closed" whereas the right side is "open". This viewpoint has been widely adopted by the artistic community. For example, Hoffman (1986) reported that advertising firms have adopted this viewpoint, leading them to alter their advertisement layouts to accommodate a left-to-right method of viewing.

The theory of a glance curve of left-to-right viewing of a picture was further developed by Gaffron (1950). He stated that the curve begins in the left foreground, penetrates in depth, and then turns towards the right where all objects within the range of the glance curve path are recognised spontaneously. Since the glance curve is the way viewers examine pictures in a fixed scan path, mirror-reversing a picture should result in a loss of aesthetic quality.

The idea that reversing an image changes its effect on the perceiver led to subsequent criticisms. For example, Gordon (1974a) argued that while mirror reversals change the appearance of a painting, they do not cause severe loss of meaning or pleasantness. Reporting on a number of experimental studies, he concluded that choosing the original orientation from a selection of original and mirror reversals was unlikely. Furthermore, he pointed out major flaws in numerous studies that site the glance curve explanation and ultimately concluded that there is little or weak support for the glance curve theory.

Further evidence against the glance curve theory comes from an interesting study by Mita, Dermer, and Knight (1977). They argued that if reversed images alter aesthetic qualities, then reversed images should be less preferred and pleasing than when in their original orientation. In their first experiment, participants viewed two faces but were exposed to the mirror-reversed image more than the original photograph. In addition, the participants' friends were exposed more to the original photograph than the mirror-reversed print. Both participants and their friends were then asked which photograph (original or mirror-reversed) they liked better. Mita et al. (1977) found that participants preferred the mirror-reversed print while the friends preferred the original photograph. This was found to be related to what Zajonc (1968) called the mere exposure effect, where the more an observer is exposed to something, the more they come to like it. In a second experiment, participants and their friends were exposed to both original and mirror-reversed photographs of the participant. They found participants preferred the mirror-reversed image of themselves (probably because they view their own face always as mirror-reversed), whereas their friends preferred the original orientation photograph (because they typically view the participant's face in this original orientation).

Gross and Bornstein (1977) offer an evolutionary explanation for the mirror-reversal effect of images. They propose that only mirror images that occur in the natural world need not be distinguished (since they occur so rarely), and therefore mirror image confusion developed as an adaptive mode of processing visual stimuli. That is, the visual system seldom processes mirror images and therefore the ability never developed. Evidence that supports their explanation stems from the findings that non-literate adults show the same types of confusion (e.g., problems distinguishing the letter d from the letter b) as children. They explain that literate people learn to overcome the natural mode of processing.

To appreciate the implication of such an evolutionary explanation, Blount, Holmes, Rodger, Coltheart, and McManus (1975) investigated if participants could detect whether a picture was an original or mirror image. They simultaneously presented participants mirror-reversed and original paintings (still-lives and portraits) and asked them to determine which was in

the original orientation, which one they preferred, and how confident they were that they had seen the painting before. They found that participants could only detect the original version of a picture from its mirror image when they were confident they had seen the picture before. Moreover, participants preferred original paintings only when they were certain that they had seen the picture before.

Thus, while it may seem that mirror-reversing paintings changes their balance, little evidence has been found to support that this affects their aesthetic value. Yet an important advantage of mirror-reversal studies is to allow researchers to examine if facial asymmetry is caused by perceptual asymmetries or hemispheric emotional asymmetries. Most research suggests the right side of the face is more attractive, but interestingly, this side is less often depicted in portraits. Studies of portraits reveal a general leftward bias, with this bias being more prevalent in women. Many explanations for this have been proposed, but the only consistent finding is that the leftward bias seems to be related to the hemispheric laterality of emotion that is reflected in the poser's facial physiognomy.

CONCLUSIONS

Artists tend to portray posers with their left cheek more often exposed than their right. Several suggestions have been proposed to explain this phenomenon. Exploring hemispheric laterality and perceiver bias can facilitate understanding of the leftward bias. It seems that each side of the face conveys unique characteristics during emotional expression. Facial asymmetry of emotional content may be tied to differences in the cerebral hemispheric laterality of emotion, and may help explain the leftward-facing bias in portraits. Perceiver asymmetries may also play an important role in judging emotional facial expression. Studies that examine mirror image effects of portraits may effectively control for perceptual asymmetries that result in the visual field effect of a viewer, while also permitting the hemispheric laterality hypothesis to be tested. It seems most plausible that the leftward bias may be due to the preference for posers to portray certain facial characteristics, and this occurs because the poser and artist may intuitively know which side of the face conveys certain meanings. The leftward bias could also occur because artists have preferred to portray women as being more emotive than men, and thereby expose their left cheek more often.

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