
Does left – right orientation matter in the perceived expressiveness of pictures? A study of Bewick’s animals (1753 – 1828)

Kate M Bennett, Richard Latto, Marco Bertamini, Ivana Bianchi¶, Sarah Minshull

School of Psychology, University of Liverpool, Eleanor Rathbone Building, Bedford Street South, Liverpool L69 7ZA, UK; e-mail: kmb@liv.ac.uk; ¶ Università degli Studi di Macerata, 62100 Macerata, Italy

Received 27 November 2009, in revised form 25 April 2010; published online 28 June 2010

Abstract. Strong claims have been made about the importance of orientation in visual art. Although there have been a few studies whether left or right oriented pictures are more aesthetically pleasing, there have been no empirical studies whether the meaning and expressiveness of pictures depend on orientation. Thomas Bewick (1753–1828) made explicit decisions about whether the main protagonist in his pictures should face left or right and did so to express particular meaning. In three experiments we examined whether orientation changes the expressiveness of an image. In experiment 1 participants viewed eight of Bewick’s animal wood engravings facing either in their original orientation or reversed, in a between-subjects design. They rated each print on ten characteristics, for example: docile–wild, clumsy–agile, and weak–strong. The original received more extreme ratings, across characteristics, than the reversal. Experiment 2 confirmed this result with participants from Italy. In experiment 3, using a within-subjects design, participants viewed ten wood engravings of dogs and rated them on characteristics specifically identified by Bewick. Again, the ratings of the original orientation were more extreme. Thus, in agreement with Bewick, we conclude that orientation affects expressiveness.

1 Introduction

Art historians and critics have argued that the balance of a picture is important for its aesthetic appeal and its meaning. Wölfflin (1941) compared Raphael’s tapestry *The Miraculous Draught of Fishes* with the cartoon from which it was prepared. He suggested that the picture changed both appearance and meaning when it was mirror-reversed, with the relative significance of the characters and the relationships between them altering. Rudolf Arnheim developed this idea further (1974, pages 33–36), observing that the balance of the figures is changed in a mirror-reversed version of Raphael’s *Sistine Madonna* so that “the whole composition seems to topple” (page 34).

The empirical study of aesthetics has a long history, and its roots can be found as far back as Gustav Fechner (1871; cited in McManus and Weatherby 1997). However, experiments on aesthetics are notoriously difficult, and some authors are skeptical about their feasibility (“there is little reason to expect rapid progress in this area”, Kubovy 2000, page 193). Nevertheless, the issue of balance and composition is probably the one that has received most attention. Our own contribution takes a novel approach: our analysis focuses on expressiveness ratings of images as defined by how far along a rating scale individuals place their responses (independently of the direction of the rating). Also novel is our selection of a series of images of animals from a single artist.

We will first introduce Bewick (1753–1828) as a case study, and explain why we chose him to study the expressiveness of pictures. We will then review the empirical evidence on the role of orientation in visual art.

1.1 *Thomas Bewick*

During the second half of the eighteenth century and the first half of the nineteenth century the wood engraver Thomas Bewick produced a large collection of prints depicting animals, and illustrations for Aesop’s *Fables* (Bewick 1790, 1797, 1818). The normal

process for producing a print was this: first the artist drew the picture; then the back of the drawing was blackened; this was fixed, blackened side-down, over a wooden block so that the main lines could be transferred by tracing the lines with a scribe; finally, these marks were used as guidance for the engraving process on the block (Bain 1981). Thus, the print would normally be a mirror image of the drawing. Note that, because of this process, orientation was an aspect of the image to which the artist's attention was drawn. In Bewick's case it is known that on occasion he went to the extra trouble of tracing the image again on the reverse side, so that the final image faced the same way as his original drawing, and that he did this to ensure that his intentions for the meaning of the picture were conveyed effectively. He traced again the image of a mastiff so that it would face right, and according to the text "he [the mastiff] seems every way formed for the important trust of guarding and securing the valuable property committed to his care" (1790, 1970 edition, page 336) (see also his *Shepherd's Dog*). Further evidence of Bewick's belief that picture orientation was important in conveying meaning comes from his version of Aesop's *Fables* (1818). He used Croxall's (1783) illustrated Aesop's *Fables* as the basis for his own version but in some cases changed the picture orientation and in some cases the text to express a certain meaning. Finally, we also know that Bewick was concerned about the transfer of the drawing to the block: "the first difficulty, I felt, as I proceeded was in getting the cuts I had done, printed to look anything like my drawings" (1982 edition, page 175). It is clear that he was aware of the differences between the drawing and the printed page. Presumably that may have dictated how the drawings were organised.

We studied a set of images in which an animal is the protagonist of the picture. These images are relatively uniform in size, contrast, and style. Another advantage of using images of animals is that we can ask direct questions about perceived traits, for instance how intelligent an animal appears.

From the data, after operationalising expressiveness, we will answer the question whether the expressiveness of an image depends on orientation. One possibility is that an animal appears more expressive when its head is to the right (or to the left). Another possibility is that expressiveness, however achieved by the artist, will decrease if the orientation is changed.

1.2 *Left – right asymmetries*

Let us now consider what is already known in the literature. Rudolf Arnheim (1974) suggested some theoretical reasons why orientation might be important. He suggested that objects looked heavier on the right, perhaps because the left hemisphere is dominant for vision as well as language. He also suggested that pictures, like text, are read from left to right, perhaps following the hypothetical glance curve proposed by Gaffron (1950). However, Arnheim's suggestions have not been confirmed either by neuropsychological studies which show a right hemisphere dominance for vision (Gazzaniga et al 2002), or by eye-movement recording which shows that eye movements when scanning pictures are guided more by top-down cognitive processes than by pre-programmed ballistic responses like a glance curve (Yarbus 1967; Zangemeister et al 1995).

Although there is no clear support for Arnheim's idea, it led to research into the spatial organisation of pictures and into the perceptual processes that might underlie them. There is evidence that right-handed participants overestimate the magnitude of the left side of a stimulus, and the left of two stimuli (pseudoneglect). Jewell and McCourt (2000) in a meta-analysis of line bisection studies reported that participants bisect lines to the left of the true centre. Nicholls et al (1999) found that, when participants had to judge brightness, numerosity, or size of pairs of mirror-reversed stimuli, they tended to select the stimulus with the relevant feature on the left-hand side as showing the dimension more strongly. Similarly, Charles et al (2007) found that,

when comparing two objects, participants tended to overestimate the size of the one on the left. Nicholls et al (1999) suggest that these effects are due to attentional biases, perhaps due to hemispheric differences, rather than scanning habits due to reading.

1.3 Orientation and preference

Other scholars have considered whether the orientation of a picture is important. In line with the dominant approach in experimental aesthetics, they have focused on measures of preference for a picture rather than on the meaning it conveys.

When right-handers are asked to choose between a pair of pictures in which one is the mirror-reversal of the other, there is a preference for the one with the greater interest on the right. This has been found for holiday photographs (Levy 1976), paintings (McLaughlin et al 1983), and drawings (Beaumont 1985). There is also evidence that right-handers prefer movement from left to right, rather than right to left, when choosing between mirror-reversed pictures. Freimuth and Wapner (1979) found this in paintings such as the *Hunters in the Snow* by Breugel the Elder (1525–1569). However, these effects may be cultural, because they are at least partially reversed in cultures that read from right to left (Chokron and De Agostini 2000; Nachson et al 1999).

In addition to evidence on aesthetic preference, there is evidence to suggest an asymmetry in the placing of emotionally significant content in drawings by both adults and children, with the figures in sad pictures being displaced toward the left compared to those in happy pictures (Heller 1994).

Note that the work on aesthetic preference does not test directly Wölfflin and Arnheim's original proposition that the meaning and content of pictures are influenced by their spatial organisation, and that their meaning will change when they are left–right reversed. In our study we will examine if this is the case, and whether Bewick was correct in believing that the orientation of the picture is important in conveying meaning.

2 Experiment 1

2.1 Method

2.1.1 Participants. 151 participants (118 females) took part. One group ($N = 76$) saw the images in the original orientation as intended by Bewick (hereafter referred to as original orientation), and another ($N = 75$) saw reversed images. Age varied between 14 and 69 years (mean = 31 years). 90% were right-handed.

2.1.2 Design and materials. Participants were presented with eight prints of woodcuts of mammals, taken from *Bewick's Animal Woodcuts* (2004; Dover Electronic Clip Art). These were: dog (mastiff); wolf; ass; lion; pig; sheep; horse; and elephant—see figure 1.

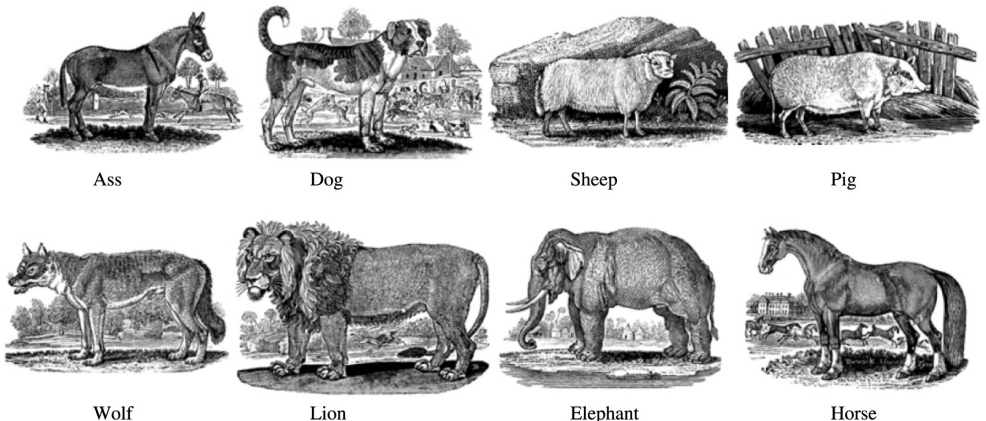


Figure 1. Images used in experiments 1 and 2, shown facing in the original orientation. Four were facing right (top), and four were facing left (bottom).

Importantly, half of the animals were facing right in the original and half were facing left. Each mammal was rated on ten dimensions (fierce–docile; lazy–energetic; agile–clumsy; unreliable–dependable; flexible–stubborn; sly–honest; tame–wild; stupid–intelligent; strong–weak; good–bad) on a 7-point Likert scale.

All participants rated each animal on all characteristics. However, half the participants saw the images in their original orientation and half saw them in the reverse: nobody saw the same animal twice.

2.2 Results

We coded each response so that 0 was the centre of the scale, and the extremes were, therefore, -3 and $+3$. As expected, the data show a different set of characters for each animal. For example, on the fierce–docile dimension the lion received a high score on fierceness (-2.5) and the sheep a high score on docility (2.2). Illustrations of the different profiles for each animal can be seen in figure 2.

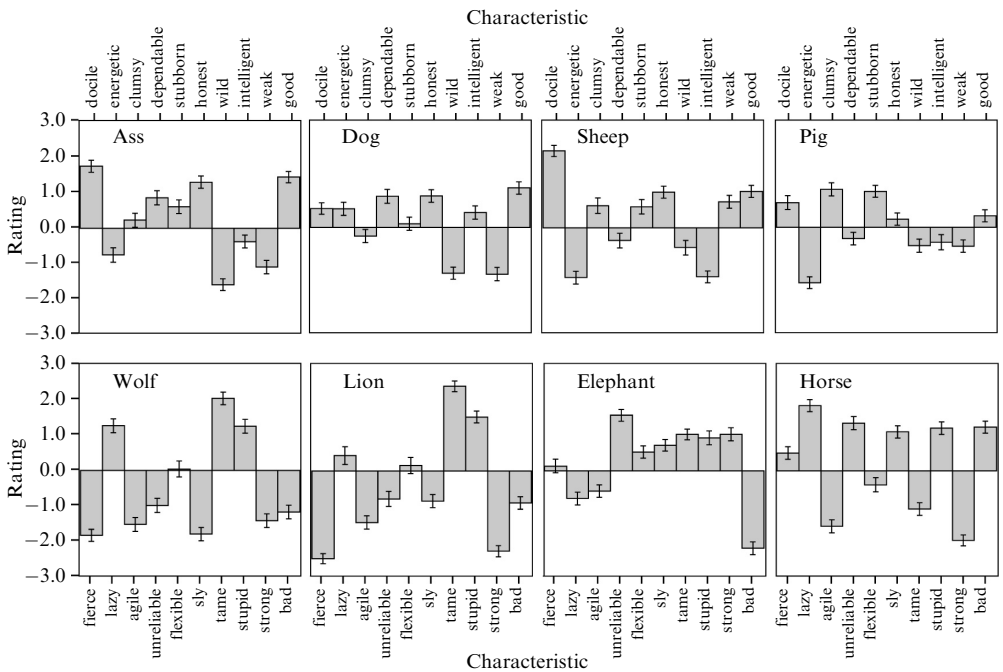


Figure 2. Data from experiment 1. Mean rating for each animal on each scale (characteristic). Each animal has a different profile, thus showing that participants discriminate the animals in terms of their perceived characteristics. Error bars are 95% confidence intervals.

We then created a data set which had one factor as the animal and one factor as the characteristic. This created a file with many cases, because for each participant there was a score per animal per characteristic ($n = 14560$). These scores ranged as before from -3 to $+3$. For each score we were able to say whether or not it was right- or left-facing in the original orientation. Next we calculated the mean score for each participant collapsing across animal and score, and therefore giving an N now of 151.

A histogram of age showed two distinct groups (17–26 years and 36–69 years). Thus, we chose a split at 30 years, one with a mode of age 18 years and one with a mode of age 45 years, representing younger and older adults. We conducted a mixed ANOVA on the following variables: sex of the observers (male–female), age-group (± 30 years), experimental group (images in the original or reversed orientation). In addition to these between-subjects variables, we also included the original orientation of the image (left–right).

There was no effect of sex, age-group, or experimental group, and these variables did not interact with each other. There was an effect of the original orientation ($F_{1,143} = 52.68, p < 0.001$). However, note that the animals that faced right or left in the original images are two distinct sets of animals. This effect may simply confirm the fact that different animals have different characteristics.

We repeated the ANOVA with the same design, but replacing the original orientation of the image with the actual orientation on the page (left-facing or right-facing). Again we found no effect of any of the between-subjects variables but a small effect of orientation on the page ($F_{1,143} = 5.19, p = 0.025$). This is interesting because, as all animals were shown in both orientations, the effect cannot simply be a difference between animals. However, the pattern of results is complex. Left-facing animals were judged more agile, energetic, and intelligent but also less fierce. Interpretation must take into account the interaction between the facing orientation and the kind of animal. For instance, both the lion and the wolf were found to be fiercer when facing left. However, on the same scale the sheep and the ass were found more docile (less fierce) when facing left.

To understand the role of orientation, we tested whether the orientation had an effect on how strong was the impression created by an image. To do so, we took the absolute values of the ratings. The advantage of this new measure is that we can ignore what particular preference participants have for the character of each animal. In general, we know that a lion is fierce and a sheep docile, but would their scores be more extreme on the rating scale depending on which way they faced? We call this measure ‘expressiveness’.

Using this measure of expressiveness, we conducted an ANOVA on the following variables: sex, age-group, and experimental group. We also included the original orientation of the image. We excluded left-handed participants, who amounted to approximately 9% of the sample.⁽¹⁾

Figure 3 shows the effects of sex, age, and original orientation in relationship to experimental group. There was no effect of sex or age-group. However, there was an effect of the original orientation ($F_{1,128} = 48.06, p < 0.001$) and a marginal interaction between original orientation and sex ($F_{1,128} = 5.0, p = 0.027$). In addition, higher absolute scores were given to images of animals facing left in the original image. However, as before, we note that these were two different sets of animals and there is no reason to expect that, for instance, a lion should be as expressive as a sheep. We can also say that the actual orientation on the page of the image was relatively unimportant. If it had been important, this would have created a strong interaction between original orientation and experimental group, because the images that were left-facing in the original were left-facing for one group and right-facing for another, and vice versa. There was no evidence of an interaction ($F_{1,128} = 0.14, ns$).

More interesting is the significant effect of experimental group ($F_{1,128} = 4.66, p = 0.033$). Higher scores were given to animals presented in the original orientation, as shown in figure 3.

2.3 Further analyses

As discussed in section 1, it has been suggested that the more important location for an object is to the right (eg Levy 1976). If so, one would expect artists, including Bewick, to place animals’ heads overwhelmingly on the right.

We therefore examined all the animals we used as our stimuli and counted the instances of each type in *Bewick’s Animal Woodcuts* (2004). Table 1 shows the frequency

⁽¹⁾The analyses of experiments 1 and 2 were restricted to right-handed participants following a suggestion from a reviewer. The effect of original orientation is the same in the full data set but the small percentage of left-handers does not allow a specific analysis of their data.

each animal faced left or right. Animals tend to face right (with the exception of the lion), but the deviations from 50% are small, eg Bewick portrays dogs as facing right more often, but only 67% of the time. Because these prints were meant for a printed publication, and Bewick was involved with its production, it is also interesting to note that the page (left or right in the book) does not predict the orientation of the animal (for the full analysis see Bertamini et al 2010).

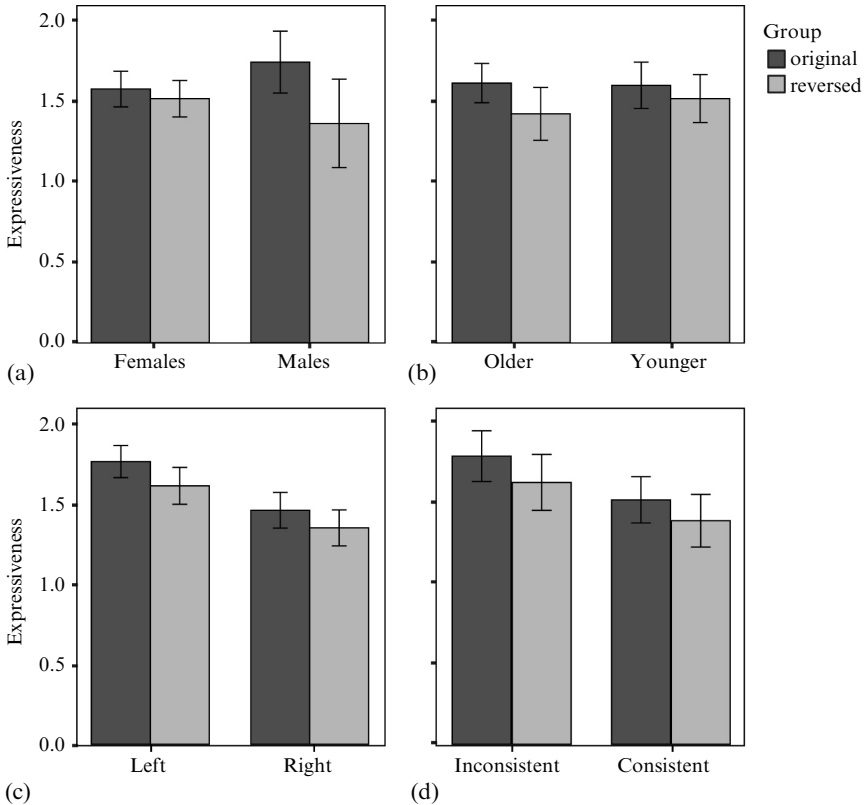


Figure 3. Data from experiment 1; error bars represent 95% confidence intervals. The effect of (a) sex, (b) original orientation, (c) age, and (d) whether the animal faces in the direction consistent with the more frequent direction for the type of animal on the perceived expressiveness in the original or reversed orientation (see section 2.3).

Table 1. For images found in *Bewick’s Animal Woodcuts* (2004), we counted the total number for each species facing left or right. The third column shows the orientation of the particular image (R = right, L = left) used in experiments 1 and 2, and the last whether this is consistent (C) or inconsistent (I) with the more common orientation in the book.

Animal	Number	Percentage facing right	Facing of stimulus in experiment 1 and 2	Consistency
Ass	4	75	R	C
Dog	30	67	R	C
Elephant	2	50	L	–
Horse	16	56	L	I
Lion	6	33	L	C
Pig	9	56	R	C
Sheep	20	60	R	C
Wolf	9	56	L	I

Because of the design of the study and because this hypothesis was an afterthought, it is not easy to fully test this idea. Nevertheless, we reanalysed the data by coding whether the orientation was consistent or inconsistent with the typical direction for that animal (figure 3d). Note that this new factor is confounded with group so instead of an observer-analysis we performed a characteristics analysis (ie the variability comes from the different characteristics). If typical orientation is important, we would expect an interaction between original orientation (original, or left–right reversed) and consistent or inconsistent orientation (with respect to the typical orientation) (note that we excluded the elephant since there were only two, one of which faced right and one left). There was not a significant interaction and, therefore, the results suggest that the original is rated more strongly than the reversed image regardless of whether the image is consistent or not with the typical direction of portrayal ($F_{1,9} = 0.54$, ns).

In a further analysis, we wanted to know whether participants were able to judge if the images were original or reversed, and the degree to which they were confident in that judgment. These data were collected in a separate study, testing second-year psychology students ($N = 79$, 87% female), the majority of whom (96%) were under 25 years of age (mean = 21.2 years). Participants were unable to distinguish between the original and the reversal and in both conditions more often than not believed the image was the original ($F_{1,76} = 0.88$, ns). Interestingly, there was no significant difference in the confidence with which they made their judgment ($F_{1,76} = 0.45$, ns). This may not be conclusive, given the relatively small sample, but suggests that there is no simple way for participants to guess whether an image has been reversed or not.

3 Experiment 2

The clear finding from experiment 1 is that animals appear more expressive when presented in the original orientation, as chosen by Bewick. This is a novel and surprising finding. Could this finding be replicated and extended to participants outside the UK? Experiment 2 was carried out with Italian students. The materials and procedure were identical but characteristics and instructions were translated into Italian.

In experiment 1 we also established that participants were not able to tell whether an image was in the original or reversed orientation. In experiment 2, we tested whether participants rated the spatial balance of a picture differently between the original and the reversal. After the images had been rated, participants were asked an additional question: “How balanced does the use of space in each image seem to you?”

3.1 Method

3.1.1 *Participants.* 103 participants (97 females) took part. Participants were undergraduate students at the University of Macerata. One group ($N = 50$) saw the images in the original orientation, and another ($N = 53$) saw reversed images. The age varied between 19 and 47 years (mean = 24 years). 96% were right-handed. As in experiment 1 we excluded left-handed students.

3.1.2 *Design and materials.* The design, procedure and materials were identical to those of experiment 1, except that the instructions and characteristics were translated into Italian.

3.2 Results

As before, we coded each response so that 0 was the centre of the scale, and the extremes were -3 and $+3$. As expected, the data show a different set of characters for each animal.

We then created the composite measure used in experiment 1 and took the absolute values of the scores. Using this measure of expressiveness, we conducted an ANOVA on the following between-subjects variables: sex, age-group, and experimental group.

A histogram of age showed that there were two distinct groups (≤ 21 and ≥ 22 years). Thus, we chose a split at 21 years, one with a mode of 19 and one with a mode of 27, to represent younger and older adults.

There was no effect of sex of age-group, but there was an effect of experimental group ($F_{1,91} = 4.91, p = 0.029$). Higher absolute scores were given to images of animals in the original orientation (see figure 4). Therefore, the results from experiment 2 were entirely consistent with those of experiment 1.

With respect to perceived balance, responses were on a 7-point scale, where 1 meant ‘not at all’ and 7 meant ‘very’. Participants did not rate the balance between images significantly differently ($F_{1,96} = 0.3, ns$). This suggests that our measure of expressiveness cannot be reduced to a measure of perceived balance.

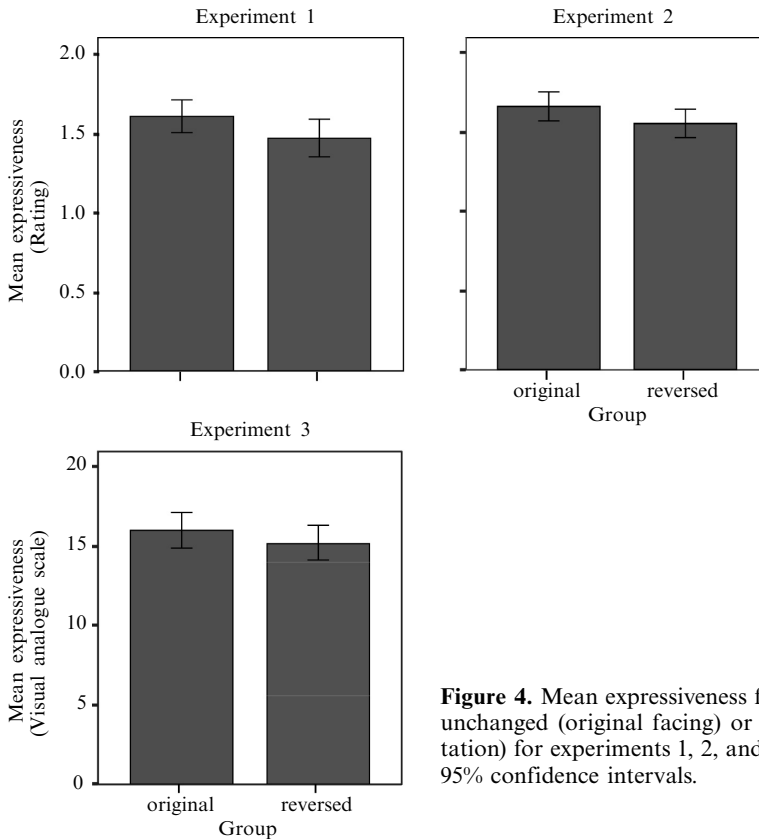


Figure 4. Mean expressiveness for the images that were unchanged (original facing) or changed (reverse orientation) for experiments 1, 2, and 3. Error bars represent 95% confidence intervals.

4 Experiment 3

In experiment 3 we aimed to extend our findings to new images and, additionally, to test directly whether the expressiveness of the characteristics Bewick wished to portray was influenced by orientation. We took ten pictures of dogs and their associated texts from *A General History of Quadrupeds* (1790). Note that our hypothesis is now tested within a single species (dogs). Each dog was judged on only one characteristic, and was seen only once, but one group of participants saw the first five dogs in the original orientation and the next five in the reversed orientation; the opposite was the case for another group. Orientation was, therefore, a within-subjects variable (unlike in experiments 1 and 2).

4.1 Method

4.1.1 Participants. 316 participants (202 females) took part. Age ranged between 17 and 88 years (mean = 32 years); 85% were right-handed.

4.1.2 *Design and materials.* We presented participants with a handout containing ten prints of woodcuts of dogs taken from *A General History of Quadrupeds* (1790). Each dog was rated on a single dimension (in italics), taken from the original text describing each dog. The direction they faced in the original is in square brackets: Shepherd's Dog (*faithful – disloyal*) [left]; Bulldog (*fierce – tame*) [right]; Greenland Dog (*savage – harmless*) [left]; Irish Greyhound (*gentle – rough*) [left]; Terrier (*courageous – cowardly*) [right]; Fox Hound (*strong – weak*) [right]; Spanish pointer (*fatigued – energetic*) [left]; English Setter (*speedy – slow*) [right]; Large Water-Spaniel (*docile – wild*) [right]; Lurcher (*cunning – guileless*) [left].

The images are shown in figure 5 in their original orientation. Of the ten dogs, half were facing right in the original and half were facing left. We know the print of the Shepherd's Dog was in the same direction as the original drawing, so Bewick must have taken the decision to trace it twice.

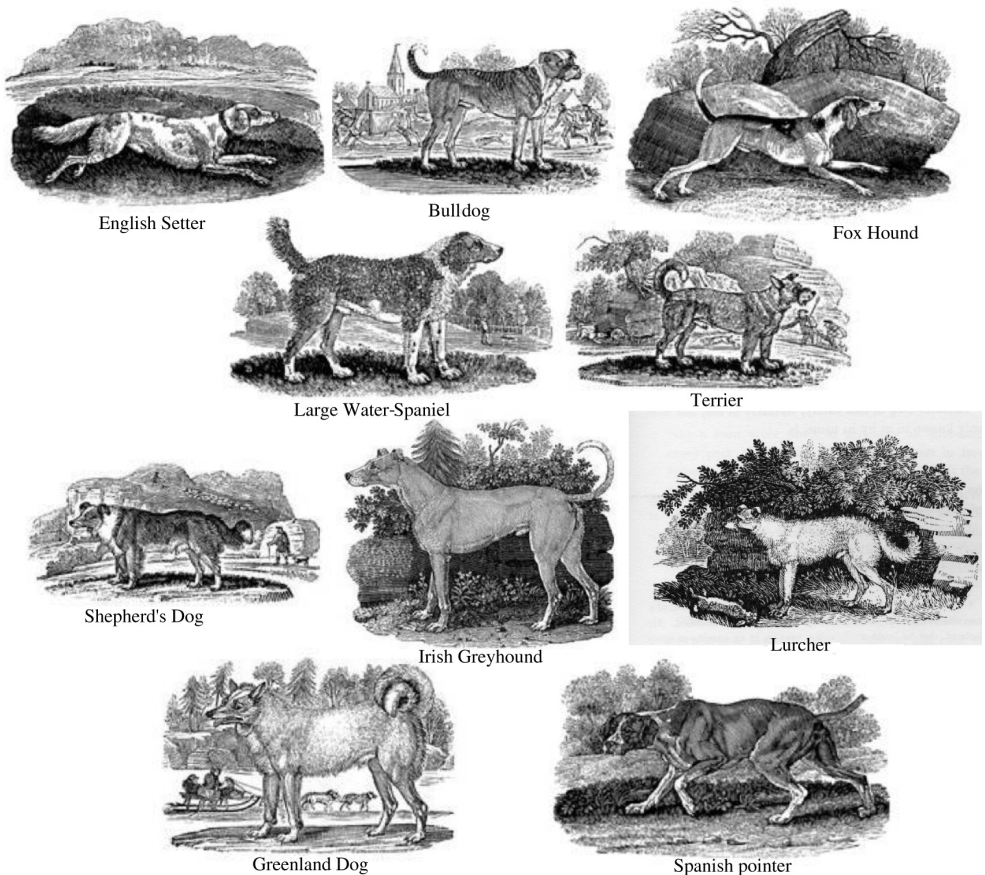


Figure 5. Images used in experiment 3. The dogs are shown facing in the original orientation. Five were facing right (top) and five were facing left (bottom).

The rating was done on a 100 mm visual analogue scale. The design was within-subjects. Each participant saw five animals in the original direction and five reversed. One group of participants saw the originals first (group A) and the second group saw the reversals first (group B). Participants also saw Bewick's chosen characteristic either on the right of the rating scale, or on the left of the rating scale, to control for biases in marking. Half of these participants were in group A and half in group B.

4.2 Results

We coded each rating so that 0 was the centre of the scale, and the extremes were therefore -50 and $+50$ mm. All but one of the animals was judged to express the characteristic proposed by Bewick, in both original and reversed conditions. The exception was the bulldog that was marginally judged to be more tame than fierce (a rating of $+2$ mm). We can conclude that, in general, Bewick's images were portraying the characteristics he wished to portray.

As before, we took the absolute value of these means to obtain a measure of expressiveness. Using this measure, we conducted an ANOVA on the following between-subjects variables: sex, age-group, and order (whether the original was seen first or second). The within-subjects variable was whether the images were in the original or reversed orientation. A histogram of age showed that there were two distinct groups (17–30 years and 31–88 years). Thus, we chose a split at 30 years, one with a mode of 20 and one with a mode of 47, to represent younger and older adults.

There was no effect of sex, handedness or age-group, but there was an effect of experimental group ($F_{1,307} = 133.9$, $p = 0.001$). Higher absolute scores were given to images of animals in the original orientation (see figure 4). In addition, there was an interaction with order: images seen later were rated more highly in the original orientation ($F_{1,307} = 171.7$, $p = 0.001$).

5 Discussion

Although previous research has suggested that observers have preferences for pictures where the focus of interest is on the right-hand side (Beaumont 1985; Levy 1976; McLaughlin et al 1983), it does not follow that artists should always orient the subjects of their pictures as facing to the right. In the specific case of Bewick's animals there was only a trend for the head to be placed more often on the right than on the left. His notions of what was more expressive were more sophisticated than simply placing the object of interest facing right. His images vary in orientation, even for a given species of animal, and we also know that in some cases Bewick chose a specific orientation to convey a particular meaning, or changed the text to correspond with the meaning suggested by a particular orientation. Ours is the first empirical investigation testing not aesthetic preferences but whether the expressiveness of an image is influenced by its left–right orientation. Our operational definition of expressiveness is based on how far along a rating scale the datapoints were located, across all the characteristics that were rated.

Our results tell an interesting story: images of animals did not change in expressiveness simply on the basis of whether they faced right or left. Instead, the images that scored higher on expressiveness were those seen in the original orientation, as chosen by the artist. This was confirmed in three studies. Experiments 1 and 3 were conducted in England, experiment 2 in Italy. Experiments 1 and 2 used a between-subjects design, while experiment 3 used a within-subjects manipulation. Finally, experiments 1 and 2 used a set of 8 animals, while experiment 3 used only images of dogs. These findings support those of McManus who found that it was cheek as originally painted which is related to meaning, and not cheek as shown to a subject (Humphrey and McManus 1973; McManus 1979, 2005).

The fact that there was no evidence that the orientation on the page, as seen by the observer, influenced expressiveness excludes any simple explanation in terms of asymmetries of attention due to the cerebral lateralisation of perceptual functions of the kind that have been used to explain orientation preferences (Levy 1976; Nicholls and Roberts 2002). Note also that our finding is not a function of typical orientation: for instance, Bewick's dogs do not always face right. As one possible mechanism underlying the perceived expressiveness, in experiment 2 we have examined whether

participants perceived the original as more spatially balanced than the reversal. We could not confirm this hypothesis from our data. We also conducted an analysis demonstrating that observers could not recognise whether they were presented with the original or the reversed orientation. This rules out conscious strategies of responding more positively to images recognised as originals.

We also found, though this is not perhaps surprising, that observers in experiment 3 perceived the dogs as expressing the traits that Bewick intended to portray. For example, the Spanish pointer was rated as fatigued.

In this paper we have analysed the work of one artist, Thomas Bewick. The findings prove that the methodology is viable and could be adapted to study other artists. One remarkable aspect of the images we have studied is that they are etchings. In most cases the original orientation is, therefore, not the same as the orientation in the original drawing. It is important to test whether our results replicate for paintings. Our hunch is that etchings are interesting exactly because of their image reversal, because this feature forces the artist to focus on the issue of left–right orientation. There is evidence from Bewick's writings that he was aware and interested in the issue of finding the best orientation for his pictures.

Another promising line of investigation would be to look at the lateralisation of the different dimensions in terms of expressiveness. Are some characteristics expressed more strongly when the image is facing to the left, others when the image is facing to the right? It might then be possible to link these to knowledge about lateralisation of emotional expressions (eg Christman and Hackworth 1993) or picture processing (eg Zaidel and Kasher 1989).

Much has been written about art and visual perception. Our findings, based on a new approach, provide empirical support for the idea that orientation does make a difference in terms of the perceived meaning and expressiveness of a picture. They also demonstrate that Thomas Bewick was aware of this difference and adjusted the orientation of his pictures accordingly.

Acknowledgments. We wish to thank Peter Osborne for posing the original question and Chris McManus and one anonymous reviewer for their valuable comments.

References

- Arnheim R, 1974 *Art and Visual Perception: A Psychology of the Creative Eye. The New Version* (Berkeley, CA: University of California Press)
- Bain I, 1981 *The Watercolours and Drawings of Thomas Bewick and His Workshop Apprentices* (London: Fraser)
- Beaumont J G, 1985 "Lateral organizational and aesthetic preference: The importance of peripheral visual asymmetries" *Neuropsychologia* **23** 103–113
- Bertamini M, Bennett K M, Bode C, 2010 "The anterior bias in visual art: The case of images of animals" *Laterality: Asymmetries of Body, Brain and Cognition* in press
- Bewick T, 1790 *General History of Quadrupeds* (Newcastle: Bewick and Son)
- Bewick T, 1797 *History of British Birds* (Newcastle: Bewick and Son)
- Bewick T, 1818 *The Fables of Aesop, and Others* with designs on wood by Thomas Bewick [and Robert Johnson] (Newcastle: Bewick and Son)
- Bewick T, 1970 *General History of Quadrupeds* Wardlock Reprints (Trowbridge, Wilts: Redwood Press)
- Bewick T, 1982 *Thomas Bewick: My Life* (edited and with an introduction by Ian Bain with numerous wood-engravings and watercolours by the author) (London: Folio Society)
- Bewick T, 2004 *Bewick's Animal Woodcuts* CD-ROM and Book (Electronic Clip Art) (New York: Dover)
- Charles J, Sahraie A, McGeorge P, 2007 "Hemispatial asymmetries in judgment of stimulus size" *Perception & Psychophysics* **69** 687–698
- Chokron S, De Agostini M, 2000 "Reading habits influence aesthetic preference" *Cognitive Brain Research* **10** 45–49
- Christman S D, Hackworth M D, 1993 "Equivalent perceptual asymmetries for free viewing of positive and negative emotional expressions in chimeric faces" *Neuropsychologia* **31** 621–624

- Croxall S, 1783 *The Fables of Aesop; with Instructive Applications* (London: J and R Tonson)
- Fechner G T, 1871 “Zur experimentalen Aesthetik” *Abhandlungen der Koeniglichen Saechsichen Gesellschaft der Wissenschaften*
- Freimuth M, Wapner S, 1979 “The influence of lateral organization on the evaluation of paintings” *British Journal of Psychology* **70** 211–218
- Gaffron M, 1950 “Left and right in pictures” *Art Quarterly* **13** 312–331
- Gazzaniga M S, Ivry R B, Mangan G R, 2002 *Cognitive Neuroscience: The Biology of the Mind* 2nd edition (New York: Norton)
- Heller W, 1994 “Cognitive and emotional organization of the brain: Influences on the creation and perception of art”, in *Neuropsychology* Ed. D W Zaidel (London: Academic Press) pp 271–292
- Humphrey N K, McManus I C, 1973 “Status and the left cheek” *New Scientist* **59** 437–439
- Jewell G, McCourt M E, 2000 “Pseudoneglect: A review and meta-analysis of performance factors in line bisection tasks” *Neuropsychologia* **38** 93–110
- Kubovy M, 2000 “Visual aesthetics”, in *Encyclopedia of Psychology* Ed. A E Kazdin (New York: Oxford University Press) pp 188–193
- Levy J, 1976 “Lateral dominance and aesthetic preference” *Neuropsychologia* **14** 431–445
- McLaughlin J P, Dean P, Stanley P, 1983 “Aesthetic preference in dextrals and sinistrals” *Neuropsychologia* **21** 147–153
- McManus I C, 1979 *Determinants of Laterality in Man* unpublished PhD thesis, University of Cambridge, <http://www.ucl.ac.uk/medical-education/publications/phd>
- McManus I C, 2005 “Symmetry and asymmetry in aesthetics and the arts” *European Review* **13**(S2) 157–180
- McManus I C, Weatherby P, 1997 “The golden section and the aesthetics of form and composition: a cognitive model” *Empirical Studies of the Arts* **15** 209–232
- Nachson I, Argaman E, Luria A, 1999 “Effects of directional habits and handedness on aesthetic preference for left and right profiles” *Journal of Cross-Cultural Psychology* **30** 106–114
- Nicholls M E R, Bradshaw D L, Mattingley J B, 1999 “Free-viewing perceptual asymmetries for the judgement of brightness, numerosity and size” *Neuropsychologia* **37** 307–314
- Nicholls M E R, Roberts G R, 2002 “Can free-viewing perceptual asymmetries be explained by scanning, pre-motor or attentional biases?” *Cortex* **38** 113–136
- Wölfflin H, 1941 “Über das Rechts und Links im Bilde”, in *Gedanken zur Kunstgeschichte: Gedrucktes und Ungedrucktes* 3rd edition, Ed. H Wölfflin (Basel: Schwabe)
- Yarbus A L, 1967 *Eye Movements and Vision* (New York: Plenum Press)
- Zaidel D W, Kasher A, 1989 “Hemispheric memory for surrealist versus realistic paintings” *Cortex* **25** 617–641
- Zangemeister W H, Sherman K, Stark L, 1995 “Evidence for a global scanpath strategy in viewing abstract compared with realistic images” *Neuropsychologia* **33** 1009–1025

ISSN 0301-0066 (print)

ISSN 1468-4233 (electronic)

PERCEPTION

VOLUME 39 2010

www.perceptionweb.com

Conditions of use. This article may be downloaded from the Perception website for personal research by members of subscribing organisations. Authors are entitled to distribute their own article (in printed form or by e-mail) to up to 50 people. This PDF may not be placed on any website (or other online distribution system) without permission of the publisher.