

Do we like what we see?

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Shapes have an aesthetic value even in the absence of meaning. This observation underlay the move to abstraction in 20th century art. It also raises the question of why some abstract shapes are more attractive than others. One possibility is that we find pleasing those forms most closely tuned to the properties of our visual system. An example of differential tuning is the oblique effect in orientation perception: horizontal and vertical lines have privileged access, predicting that they should also be preferred. The effect of rotating Mondrian's paintings on their aesthetic appeal was examined, controlling for frame orientation by using paintings with either oblique or horizontal/vertical frames. There was a preference for pictures when their component lines were horizontal/vertical rather than oblique and, independently of this, for the original orientation, perhaps because rotation changes the painting's balance as well as the orientation of component lines. There was no overall preference for either frame orientation, but there was an interaction between frame orientation and component orientation, resulting in a preference for paintings where the components were parallel to the frame. A follow-up study analysing a representative sample of paintings found a greater use of horizontal/vertical contours in a wide range of styles, including representational paintings. Together these findings suggest that there is an aesthetic oblique effect paralleling the psychophysical oblique effect, both of which reflect the structure of our visual environment.

1. INTRODUCTION

Humans find it remarkably easy to make aesthetic judgements about shapes and forms. We clearly prefer some shapes to others, and these aesthetic judgments occur even in the absence of any narrative or semantic association. We find some abstract patterns very attractive: Matisse's *The Snail*, 1963*, an abstract pattern despite its title, is consistently at or near the top of postcard and poster sales at London's Tate Modern.

The move away from realism towards abstraction that happened in Western art at the beginning of the twentieth century was a recognition of this ability to appreciate form for its own sake (something of course that other cultures and fabric and wallpaper designers have long known). It was also perhaps, more aggressively, an assertion of the dominance of form over narrative content. In purely abstract painting, as with much music, form is all we have. Artists were quite consciously trying to identify the primary features of stimuli that were aesthetically rewarding: sometimes, like Kandinsky (*Cossacks*, 1910-11) and Mondrian (*Composition No 10*

* Most of the paintings discussed in this chapter can be viewed on the Web using a search engine such as Google™ in Images mode.

Pier and Ocean, 1915), starting with a representational subject and simplifying it down into its dominant components to create an abstract pattern; sometimes, like Malevich (*Supremus No 50*, 1915) and the other Constructivists, starting with a blank canvas and arranging ('constructing') shapes and colours in a way they found pleasing. Contemporary critics like Clive Bell and Roger Fry were soon talking about 'significant forms' (Bell, 1914, p.8) which made up 'a purely abstract language of forms - a visual music' (Fry, 1912/1981b, p.167).

The question then arises as to *why* some abstract forms are aesthetically more effective than others. Roger Fry, who read science as a student at Cambridge before becoming an artist and art critic and therefore perhaps had a rather broader perspective than most, invoked natural selection to suggest that some representational forms, like a charging bull, might elicit what he called 'instinctive reactions to sensible objects, and their accompanying emotions' (Fry, 1909/1981a, p.13), but he did not extend this discussion to abstract forms.

The most common speculation though, from Wundt (1905) through Berlyne (1971) and Martindale (1988) to, most recently, Zeki (1999) and Livingstone (2002) is that aesthetic pleasure is linked in some general way to neural activity, or more specifically that a form is effective because it relates to the processing properties of the human visual system. To capture this concept, a few years ago I coined the term 'aesthetic primitive' (Latto, 1995) which, using primitive in the sense of primary or fundamental, was defined as a stimulus or property of a stimulus which is intrinsically interesting, even in the absence of narrative meaning, because it resonates with the mechanisms of the visual system processing it. Examples of aesthetic primitives which have arisen in the exploration of visual perception by both artists and scientists include: certain patterns of lines and geometrical shapes, of the kind explored by the gestalt psychologists, the aesthetic appeal of symmetry is a good example; stylised organic forms, for example, the biomorphs of the surrealists; the human body, the human face, and the human hand, which we know now have specialised mechanisms in the visual system for processing them (Kanwisher et al., 1997; Downing et al., 2001); and even possibly, it has been argued, certain kinds of biologically important landscape features (Balling and Falk, 1982; Kellert and Wilson, 1993). The suggestion is that it is these aesthetic primitives that provide the vocabulary of Roger Fry's language of forms. Purely abstract works can consist of isolated aesthetic primitives with no intrinsic semantic or affective overtones.

So the techniques used by artists and the forms they select succeed because they exploit the properties of the visual system and, through their work, artists have indirectly been defining the nature of these visual processes, often before these have been investigated scientifically. Particular forms are aesthetically moving not because they reflect the properties of the world but because they reflect the properties of visual systems that have evolved and developed to look at that world. We like looking at what we are good at seeing.

This seems, to me at least, to be a neat theory, but the problem is that, apart from the circumstantial evidence that has been collected together from examples of similarities between the workings of the visual system and the work of visual artists, there is little direct evidence that we prefer stimuli that have preferential access to our visual systems.

One possible idea for generating some direct evidence came from putting together the oblique effect (or orientational anisotropy) in visual psychophysics (the preferential access which horizontal and vertical lines have over oblique ones in a wide variety of situations and tasks) with the obsession which the artist Mondrian had with horizontal and vertical and the strong and persistent appeal which Mondrian's paintings have.

The oblique effect is extraordinarily robust. As far as I can discover, it was first reported in Wisconsin by Jastrow (1892) at the end of the 19th Century and in almost every situation that has been looked at since, observers with normal optics are better at perceiving, discriminating

and manipulating horizontal and vertical lines than oblique lines (see review by Appelle (1972)). For example, Furmanski and Engel (2000) demonstrated it by measuring the effect of varying the orientation of a grating on contrast detection sensitivity, on orientation discrimination, and on the activity generated in VI in human visual cortex as measured by fMRI (Figure 1).

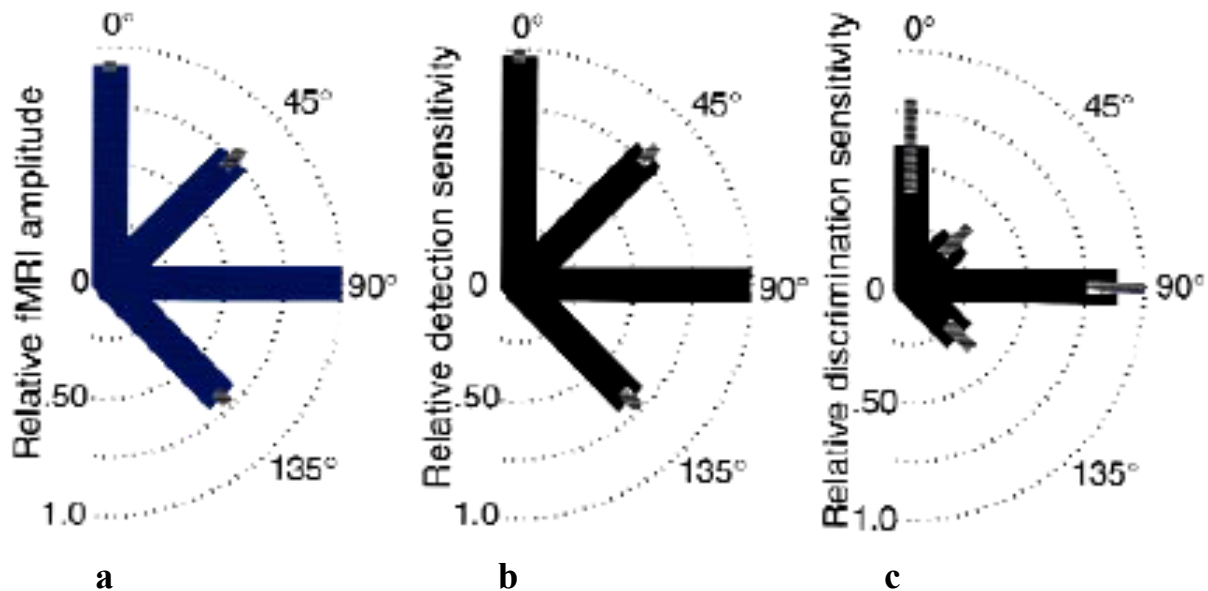


Figure 1. The effect of the orientation of a grating on: **(a)** Mean fMRI response amplitudes in Area V1 of occipital cortex; **(b)** Contrast detection sensitivity; **(c)** Orientation discrimination sensitivity. (From Furmanski & Engel, 2000).

Mondrian's commitment to the horizontal and vertical was equally robust. So strong was it that when in 1925 another artist in the De Stijl group which Mondrian had founded, van Doesburg, insisted on using obliques in his paintings (for example, *Simultaneous Counter Composition*, 1929-30), Mondrian formally left the group (Jaffe, 1970).

The oblique effect suggests that horizontal and vertical lines are perceptually primary, but was Mondrian right in believing that they are also aesthetically primary? Do people prefer horizontal and vertical lines to oblique lines?

2. IS THERE AN AESTHETIC OBLIQUE EFFECT?

We answered this question (Latto et al., 2000) by measuring the effect on aesthetic judgements of rotating Mondrian's paintings so that the component lines became oblique, exploiting his use of canvases with oblique frames (usually referred to as lozenge paintings) to control for possible effects of frame orientation.

2.1 Method

Eight paintings by Mondrian were used. All had sides of equal lengths and consisted of only horizontal and vertical lines. Four paintings had traditional horizontal and vertical frames:

Composition in a Square (1929). Oil on canvas, 52 x 52 cm.

Broadway Boogie-Woogie (1942-43). Oil on canvas, 127 x 127 cm.

Composition with Red, Blue and Yellow (1930). Oil on canvas, 51 x 51 cm.

Composition with Red, Yellow and Blue (1921). Oil on canvas, 48 x 48 cm.

And four had oblique frames:

Composition I with Blue and Yellow (Lozenge) (1925). Oil on canvas, 79 x 79 cm.

Composition with Two Lines (1931). Oil on canvas, 80 x 80 cm.

Victory Boogie-Woogie (1943-44 Unfinished). Oil on canvas, 126 x 126 cm.

Composition in a Lozenge (1925). Oil on canvas, 77 x 77 cm.

Eight slides were made of each painting at eight different orientations 45° apart, in each case producing four pictures with only horizontal/vertical components (original and 90°, 180° and 270° rotation) and four with only oblique components (45°, 135°, 225° and 315° rotation).

There was therefore a total of 64 stimuli, with 8 in each of 8 degrees of rotation. Each block of eight slides contained one example of each picture and one example of each orientation. The order of the eight pictures was counterbalanced with a Latin Square and the 64 stimuli were divided into four blocks of sixteen (two complete sequences of eight) whose order of presentation was itself varied in a counterbalanced sequence between participants.

Slides were made to a standard size which when projected onto a screen 3 m in front of the participant formed an image 58 cm square and subtended an angle of approximately 11°. Room lights were turned off during the experiment and each slide was exposed for 5 seconds.

30 undergraduate participants were used, tested individually. They were first shown four practice slides of two Mondrian's not included in the experimental set and asked to rate each picture for aesthetic pleasingness on a 7-point scale, numbered 1 to 7 and labelled 'Lowest' at 1 and 'Highest' at 7.

The sixty-four experimental stimuli were then presented in a counterbalanced order and rated in a continuous sequence.

All effects presented here were statistically significant at the 5% level or better. Full details of the statistical analyses in Sections 2.2 and 3.2 are given in Latta et al. (2000) and Latta and Russell-Duff (2002), respectively. Asterisks on the figures indicate the probability level of the differences (* = 5%, ** = 1% and *** = 0.1%).

2.2 Results

The overall mean ratings given to pictures with horizontal/vertical or oblique components show that the pictures composed of horizontal/vertical components were rated as more aesthetically pleasing than those composed of oblique components (Figure 2).

Figure 3 shows the mean ratings for each orientation of the paintings. As would be expected from the overall data in Figure 2, the original orientation (0°) was preferred to all rotations generating oblique components, but not to those generating horizontal/vertical components with the exception of the inverted pictures (180°).

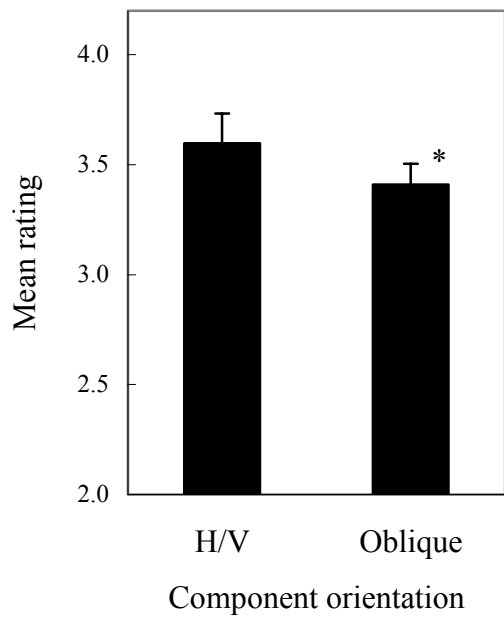


Figure 2. The effect of the orientation of the component lines on ratings of Mondrian's paintings.

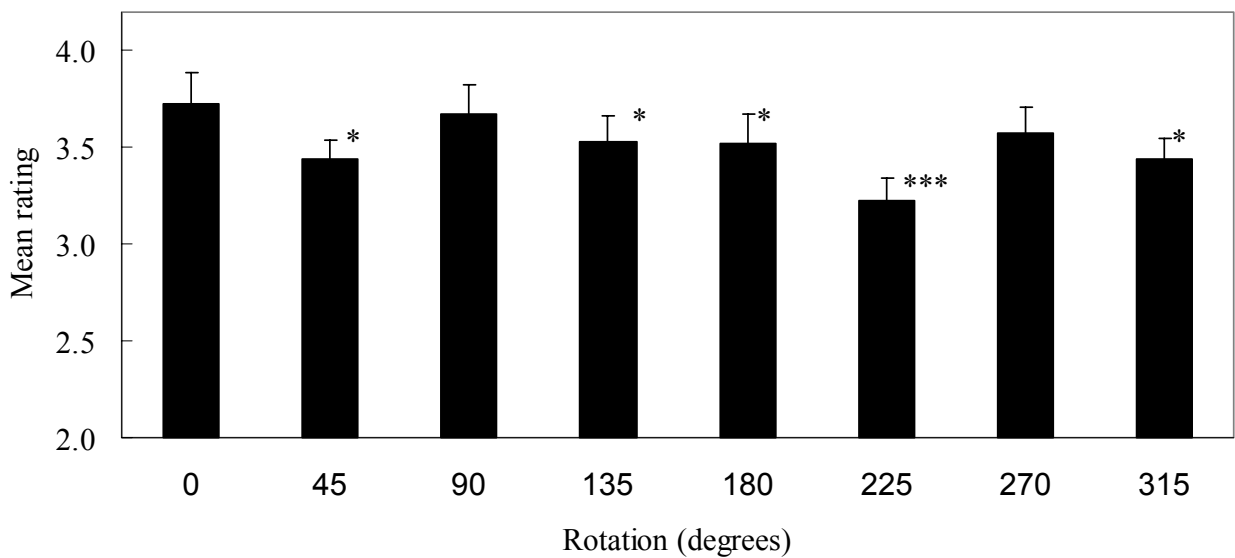


Figure 3. The effect of clockwise rotation on ratings of Mondrian's paintings. (Asterisks indicate the significance of the difference from the original orientation.)

Interestingly, an overall comparison of the original paintings with the average of all the rotated versions showed a higher rating for the originals (Figure 4). This might have been due solely to the presence of obliquely oriented components in four of the seven orientations in the rotated pictures. However, this was not the case since comparing ratings for the original paintings with those for paintings rotated through 90° , 180° and 270° which contain

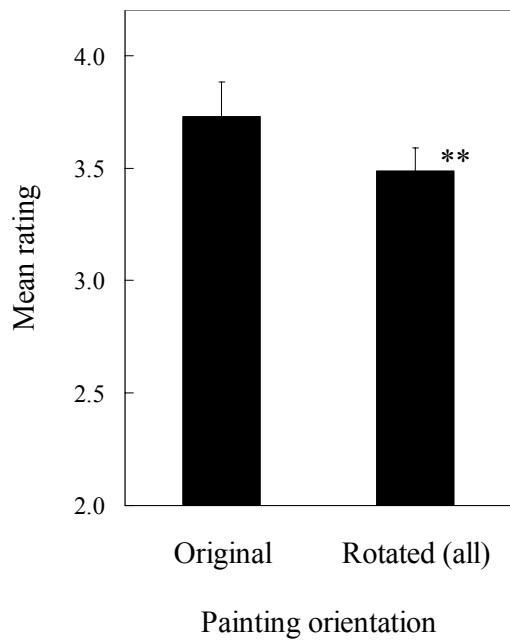


Figure 4. A comparison of the mean ratings of Mondrian's paintings in their original orientation and when rotated.

only horizontal and vertical components still shows a preference for the original orientation, though this was significantly smaller than the preference for original paintings over rotated paintings containing only oblique components (Figure 5).

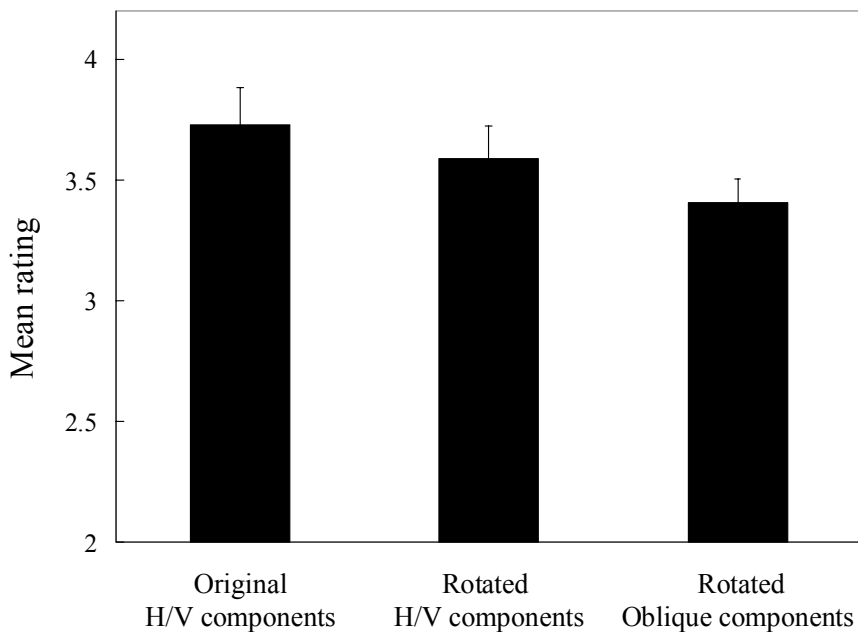


Figure 5. The effect of rotating Mondrian's paintings to give *either* horizontal and vertical components *or* oblique components.

This pattern of results suggests that there are two factors reducing the appeal of the Mondrians when they are rotated: one due to the introduction of obliquely oriented components, and one due to rotation *per se*. Rotation upsets the balance of the pictures, a property which a number of studies have shown also affects aesthetic judgements (Gordon and Gardner, 1974; McManus et al., 1993; Freimuth and Wapner, 1979; Levy, 1988; Banich et al., 1989). Significantly, nearly all these studies have used mirror-imaging to reverse the left-right balance of the paintings and in the present study the only rotated paintings with horizontal/vertical components which produced a significantly lower preference than the original orientation were those rotated through 180° , also giving a left-right reversal of the dominant features in the paintings (Figure 3).

Figure 6 shows the overall effect of frame orientation on aesthetic judgements. There was no difference between horizontal/vertical frames and oblique frames. There was however an interaction between component orientation and frame orientation with the preference for horizontal/vertical components being partially balanced by a preference for components which are parallel to the surrounding frame. This resulted in a preference among the *original* paintings for those with horizontal/vertical frames over those with oblique frames, the lozenge paintings (Figure 7). Participants were therefore preferring paintings where the components were parallel to the orientation of the frame. The orientation of the visual frame in which a line is perceived contributes substantially to the perceived orientation of that line. An oblique

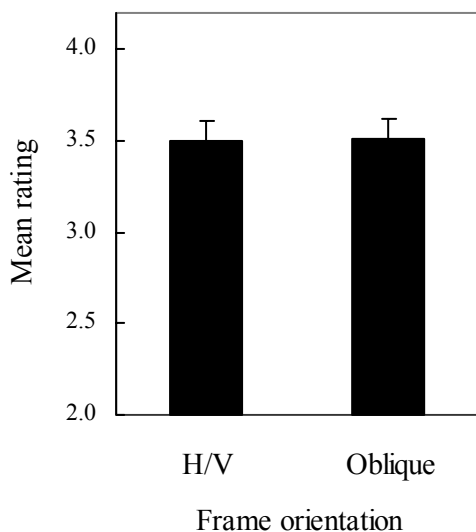


Figure 6. The effect of the orientation of the frame on ratings of Mondrian's paintings (Original and rotated paintings combined)

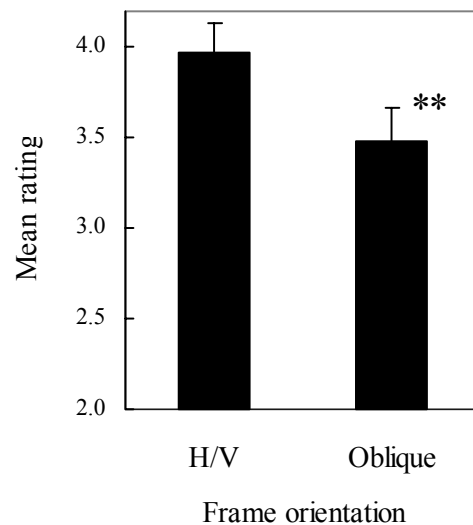


Figure 7. A comparison of the mean ratings of Mondrian's *original* paintings using horizontal/vertical frames or oblique (lozenge) frames.

frame tends to make vertical and horizontal lines look oblique (Witkin and Asch, 1948; Curran and Lane, 1962; Howard, 1978; McAfee and Proffitt, 1991). The effect of manipulating a frame on the psychophysical oblique effect has not been investigated, but it has been shown that tilting the head does not alter the absolute orientation of the sine-wave

grating for which we have the best orientation acuity (Buchanan-Smith and Heeley, 1993). The favoured orientation is modified by head and body posture. The psychophysical oblique effect must therefore depend on relatively high level processes in the visual system driven by information not only from the retino-topic information but also from other sources such as the vestibular system and the visual context. If there is a causal link between the psychophysical oblique effect and the aesthetic oblique effect, then the latter too would be subject to these non-retino-topic influences.

So, returning to the central finding (Figure 2), Mondrian was right and van Doesburg was wrong. There is something special about horizontal and vertical lines, and the fact that this aesthetic oblique effect is matched by a psychophysical oblique effect provides a possible explanation for why Mondrian was right: we prefer horizontal and vertical lines because they are perceptually more powerful.

3. THE DISTRIBUTION OF LINE ORIENTATION IN PAINTINGS

The aesthetic oblique effect would be particularly important in abstract paintings like Mondrian's where the aesthetic power depends entirely on the strength of the sensation produced by the form, but it could apply to some extent to all the visual arts. So a follow-up question is to ask whether artists generally make use of this phenomenon.

3.1 Method

We have looked at this (Latto and Russell-Duff, 2002) by analysing the proportions of lines of different orientations in the 88 paintings in the catalogue of an exhibition of twentieth century paintings held at the Israeli Museum, Jerusalem (Perry-Lehmann, 1990). This provided a reasonably representative sample and one that was usefully sub-divided by the curators into seven different artistic styles. All lines and contours in the paintings were classified as either horizontal, vertical or oblique, using a circular protractor that allocated 120° to each orientation. They were then measured and the proportion of line length in each orientation was calculated.

3.2 Results

There was a significant difference between the proportions, in descending order, of vertical, horizontal and oblique contours (Figure 8).

Analysing the proportions of lines in the three orientations broken down according to the seven categories of paintings identified by the curators of the exhibition, surprisingly found no significant difference between the different categories (Figure 9). If, for example, the most abstract category (*The form is the message*) is compared with a purely representational category (*Landscape and nature*), both show a clear oblique effect. Nor was there a significant interaction between category and orientation.

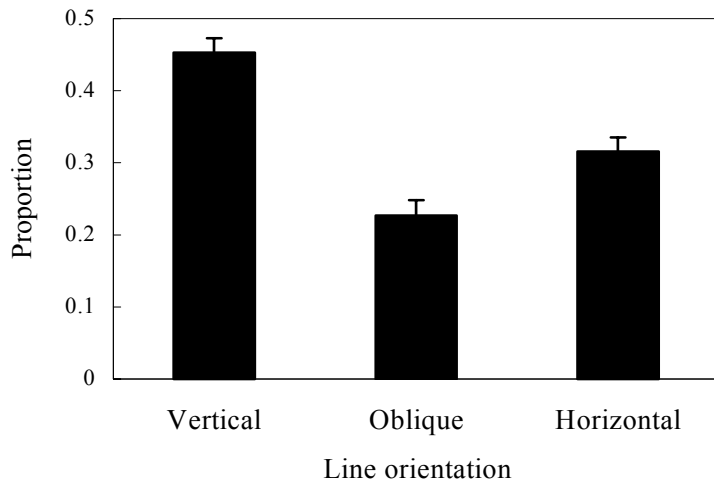


Figure 8. The proportions (by length) of lines in each of three orientations over a sample of twentieth century paintings.

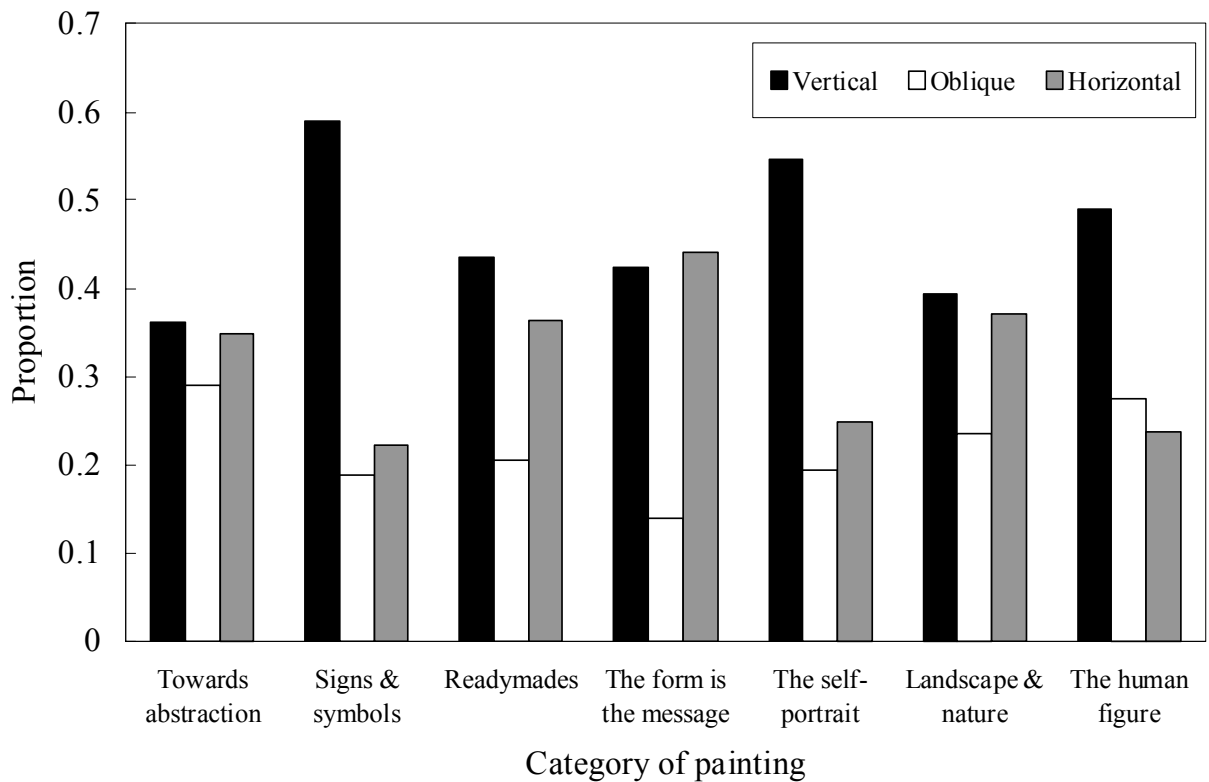


Figure 9. The proportions of lines in each of three orientations over a sample of twentieth century paintings, sub-divided according to the style of the painting.

4. DISCUSSION, AN ANECDOTE, AND SOME SPECULATION

Figure 9 suggests another possible explanations for the preponderance of horizontal and

vertical lines in paintings. Artists, even when painting abstract forms, may simply be reflecting the actual visual environments that we experience in our everyday lives. Since it has been shown by Switkes, et al. (1978) and, more recently, Coppola, et al. (1998) that the visual world contains more horizontal and vertical than oblique contours, even in pastoral environments, a painting that reflected the real world would do so as well.

This does not exclude the proposition that there is an aesthetic oblique effect. On the contrary, the two explanations are mutually supportive. Our visual systems have evolved and developed to represent the visual environment as efficiently as possible. So the oblique effect in perception is there *because* of the preponderance of horizontal and vertical in the visual environment. (Interestingly, a recent digital camera from Fuji apparently mimics this effect by arranging the sensor chips so that they respond preferentially to horizontal and vertical rather than oblique (Fox, 2000)). It is therefore because our visual systems are tuned to the particular visual environment in which we have evolved and developed that we find paintings whose form reflects that visual environment pleasing, even when they are abstract.

Not surprisingly therefore, horizontal and vertical also predominate in the designs of other categories of visual stimuli that are constructed to be as powerful as possible. This is certainly true of national flags. For example, as a representative sample, I looked at the flags of the eleven nationalities that it was possible to identify among participants of the conference of which this book is the proceedings. Of the eleven, nine (82%) had flags that were predominantly horizontal and vertical (Canada, England, Finland, Germany, Greece, Italy, Romania, U.S.A. and Wales), while only two (18%) were predominantly oblique (Scotland and Australia).

Apart from purists like Mondrian, Barnett Newman and Sean Scully, artists of course use plenty of oblique lines. The effect I have identified (the aesthetic oblique effect) is not an absolute one. One reason artists use oblique lines may derive from the fact that we are less good at seeing them. Just after we had done the original work on the aesthetic oblique effect, I was describing it to a friend who is a curator of Tate Modern in London and he said, perhaps a little condescendingly, "Of course it is well known among artists that horizontal and vertical lines are stable and peaceful while diagonals are restless and energetic." And he was right. Comparing the quiet, stability of, for example Mondrian's *Composition in Red, Blue and Yellow*, 1930 with the jazzy, restlessness of Malevich's *Supremus No. 50*, we can see clearly the different effects produced by the horizontal and vertical lines of the former and the oblique lines of the latter. This effect is also exploited in figurative art where painters use it, for example, to mimic the unstable, shimmering effect of water. The beautiful representation of the surface of the river in Berthe Morisot's *Summer's Day*, 1880 is achieved by a fine but clearly visible criss-cross of short oblique lines.

Returning to my main conclusion: the aesthetic oblique effect provides some direct evidence for the idea that we tend to prefer those shapes and arrangements of shapes which are most effectively processed by our visual systems. Horizontal and vertical edges are one, rather low level, example of an aesthetic primitive. Other components of our visual world to which we are highly tuned, like faces, hands and the human form in general, provide others.

At this stage, the reason for such a preference remains speculative. One possibility is that it is important for the visual system to be stimulated and sometimes pushed to the limit to function effectively, and so, as with other adaptive behaviours, we have evolved a mechanism for encouraging this. Perhaps we enjoy looking at faces, landscapes, Mondrians because it is good for us. Whatever the reason, artists, through their observation of the world or through trial-and-error, have been identifying these critical shapes and arrangements and exploiting

them in their paintings long before science began analysing the nature of perception and the geometry of our visual environment.

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