Aesthetic judgement of orientation in modern art

George Mather

School of Psychology, University of Sussex, Falmer, Brighton BN1 9QH, UK [Present address: School of Psychology, University of Lincoln, Lincoln, UK]; e-mail: gmather@lincoln.ac.uk;

Abstract. When creating an artwork, the artist makes a decision regarding the orientation at which the work is to be hung based on their aesthetic judgement and the message conveyed by the piece. Is the impact or aesthetic appeal of a work diminished when it is hung at an incorrect orientation? To investigate this question, Experiment 1 asked whether naïve observers can appreciate the correct orientation (as defined by the artist) of 40 modern artworks, some of which are entirely abstract. Eighteen participants were shown 40 paintings in a series of trials. Each trial presented all four cardinal orientations on a computer screen, and the participant was asked to select the orientation that was most attractive or meaningful. Results showed that the correct orientation was selected in 48% of trials on average, significantly above the 25% chance level, but well below perfect performance. A second experiment investigated the extent to which the 40 paintings contained recognisable content, which may have mediated orientation judgements. Recognition rates varied from 0% for seven of the paintings to 100% for five paintings. Orientation judgements in Experiment 1 correlated significantly with "meaningful" content judgements in Experiment 2: 42% of the variance in orientation judgements in Experiment 1 was shared with recognition of meaningful content in Experiment 2. For the seven paintings in which no meaningful content at all was detected, 41% of the variance in orientation judgements was shared with variance in a physical measure of image content, Fourier amplitude spectrum slope. For some paintings, orientation judgements were quite consistent, despite a lack of meaningful content. The origin of these orientation judgements remains to be identified.

Keywords: aesthetics, visual art, abstract art, orientation.

1 Introduction

Two paintings by the American abstract artist Mark Rothko from his Black on Maroon series contain broad black stripes across the canvas defining hazy maroon rectangles. The paintings were donated to the Tate Modern Gallery in London in 1968, which hung them for many years with the stripes running horizontally. The paintings were then rotated so that they were hung with the stripes running vertically for a time, before being returned to the horizontal orientation for an exhibition of Rothko's work. Controversy has surrounded the question of the correct orientation in which to hang the paintings. Rothko's signature indicates a horizontal orientation (see Jamieson 2008), but the works are currently hung vertically. The artist himself may have been unsure; paint dribbles run in both directions on the canvas. Art historians have debated the relative aesthetic merits of the two orientations. There are anecdotal reports of other disputes about the correct orientation of other paintings, including work by Matisse, Rauschenberg, van Gogh, and O'Keeffe. But does orientation really matter in an abstract or semiabstract painting, at least to the untrained eye?

Modern art often contains little or no recognisable representation of real-world objects or scenes. Abstraction allows the artist to focus on composition and medium rather than on subject matter. In the process of creating a modern artwork, an artist may make an aesthetic decision regarding the orientation at which the work should be hung, based on their intended message. The correct orientation is often specified on the back of the canvas. However, this intended orientation is not always obvious to others viewing the work, especially if there is no recognisable content at all, which raises questions about aesthetics. Is there sufficient information in a modern artwork for a naïve viewer's judgement to align with the correct

orientation? Is the impact or aesthetic value of a work diminished by viewing at an incorrect orientation? Relatively few studies have addressed such questions, but answers to them should throw some light on the cognitive processes underlying visual aesthetic judgement. Lindauer (1969) asked participants to indicate their preferred orientation for 54 abstract paintings and found that half were in agreement with the artist's intended orientation. On the other hand, Swartz and Hewitt (1970) showed their participants a series of abstract paintings, either in the original format or rotated or mirror-reversed, and asked participants to rate each image aesthetically. Aesthetic ratings were not affected by rotation or mirror reversal. Latto et al (2000) were primarily interested in preferences for vertical and horizontal orientations over oblique orientations in Mondrian paintings, though they did report slightly higher aesthetic ratings for paintings presented at the intended orientation. Plumhoff and Schirillo (2009) more recently found some evidence of higher aesthetic ratings for Mondrian's paintings presented at the correct orientation. In Johnson et al's (2010) study of the same Mondrian paintings, pupil size was significantly higher for the correct orientation than for other orientations.

The present study aims to build on previous studies by (i) systematically investigating the relevance of recognisable content in preferences for orientation (a potential confounding factor in previous studies employing a range of abstract artworks) and (ii) assessing whether a commonly used statistical measure of information content in images has any bearing on orientation-dependent judgements. Recent work suggests that the Fourier amplitude spectrum slope plays a role in aesthetic judgements of art (Graham and Field 2008; Redies 2007; Redies et al 2007). It may also play a role in orientation judgements.

In the first experiment, participants were shown four versions of each artwork, oriented at 0, 90, 180, and 270 degrees clockwise with respect to the intended orientation, and asked to select the most pleasing or meaningful image. Was the correct orientation chosen more often than would be expected on the basis of chance?

2 Experiment 1

2.1 Method
2.1.1 *Participants*

Eighteen naïve participants were recruited from the student body at Sussex University, none of whom had any previous formal training in art.

2.1.2 *Visual materials*

Forty modern artworks were selected from three art books (Gerhardus and Gerhardus 1979; Gibson 1997; Hunter 1997), scanned electronically, and rescaled so that the longer dimension of each image was 300 pixels (to allow all four versions to be visible simultaneously on a computer monitor). Fifteen images had a vertical "portrait" aspect ratio, and twenty-two had a horizontal "landscape" aspect ratio. The remaining three were square. The criteria for inclusion of paintings were that (i) there was a clear intended or "correct" orientation, (ii) the work was produced by an artist of international renown, and therefore of high aesthetic quality, (iii) the set as a whole represented a sample of modern art from the early to mid 20th century, and (iv) paintings varied in the extent to which they exhibited recognisably representational content. Figure 1 shows three of the paintings in the set. A full list of artists and titles for all 40 paintings is available as supplementary material.

Figure 1. Three of the paintings used in the experiments. (a) Kasimir Malevich (1878–1935) *Suprematist Composition: Airplane Flying*, 1914–15. (b) Piet Mondrian (1872–1944) *Composition*, 1933. (c) Jackson Pollock (1912–56) *One*, Number 31, 1950. All digital images © 2011, The Museum of Modern Art, New York/Scala, Florence.

2.1.3 *Apparatus and procedure*

The experiment was controlled by a Flash application running on a Dell desktop PC. Stimuli appeared on the screen of a Sony Trinitron Multiscan G400 monitor (resolution 1024 × 768). A single trial involved presentation of one of the 40 artworks (order randomised across participants). All four cardinal orientations were shown on-screen (0, 90, 180, 270 deg clockwise with respect to the correct orientation as defined in the source book; oblique frame orientations were not used because they occur much less frequently in true artworks, and only a few orientations could be presented on the screen at an acceptable resolution). The screen was divided virtually into four quarters, with one image in each quarter. The on-screen ordering of the four orientations varied randomly from trial to trial and between participants. The centre-to-centre separation of the images was 17 deg horizontally and 12 deg vertically at the 57-cm viewing distance. The longer dimension of each image subtended 10.3 deg. Images were presented against a uniform dark grey background (2.3 cd/m^2); the mean image luminance varied from image to image between approximately 3.7 and 38 cd/m^2.

Participants were given an unrestricted time to view each set of four on-screen images and used a mouse to click an on-screen button next to each image according to the following instruction: "Select the orientation which is the most pleasing or meaningful." Given that participants may detect some meaningful content in a given painting (even if none was intended by the artist), this instruction acknowledged the possibility that they may use that information in their judgement. Successive trials were separated by a 0.5-s interval during

which the screen remained blank. Responses were recorded by the Flash application and transferred to an Excel spreadsheet at the end of the session.

2.1.4 *Spectral slope*

The amplitude spectrum slope was estimated for each image using a script written in MATLAB® as follows. Each image was converted to grey-scale using a standard YIQ transform ($L = 0.2989 \times R + 0.5870 \times G + 0.1140 \times B$). A two-dimensional discrete Fourier transform was performed on the largest central square section of the image. The slope of the best-fit line to the rotationally averaged amplitude spectrum (plotted on log–log coordinates) was calculated. In order to avoid spatial frequency artefacts owing to image sampling and nonlinearities, line fitting was restricted to the middle range of frequencies between 0.25× and 0.5× the maximum spatial frequency available in the Fourier transform (cf Redies et al 2007). To assess possible orientational anisotropies in the images, the ratios of horizontal to vertical (*H*:*V*) power and oblique to cardinal power (*O*:*C*, where *C* = ([*H* + *V*] / *2*)) were also calculated.

2.2 Results and discussion

Each participant provided four scores that correspond to the proportion of responses at each of the four available orientations (0, 90, 180, 270 deg clockwise) across the 40 images. Figure 2 shows the mean scores across the 18 participants (±1 *SE*). Since there were four orientations, chance performance falls at 25%. Observers reliably selected the correct orientation over the other three available orientations in almost 50% of trials, a figure which is close to that reported by Lindauer (1969). One-factor ANOVA revealed a highly significant effect of orientation, $F(3, 51) = 85.06$; $p < .0001$. Pairwise comparisons showed that responses at the correct orientation (0 deg) were significantly higher than responses at each other orientation.

Notice that all the other available orientations were selected much less frequently and at about the same rate of 16–18% or so each. This result indicates that participants were not generally prone to confuse upright with inverted versions of the images consistently; they either selected the correct orientation or chose one of the others equally often overall.
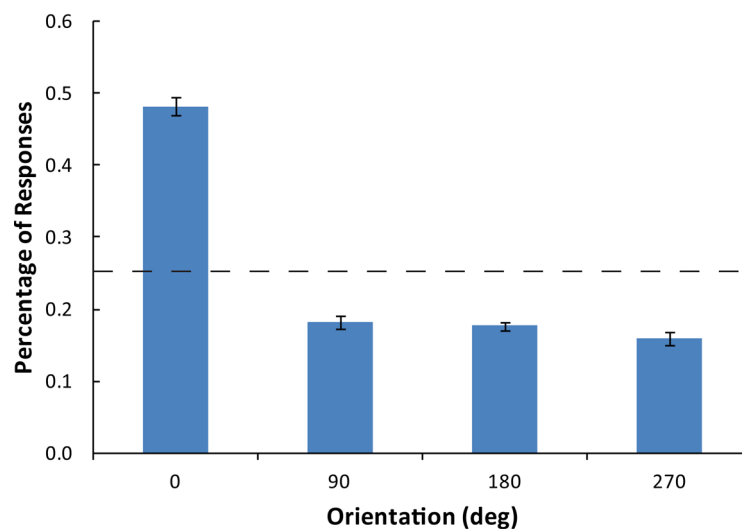

Figure 2. Mean percentage responses at each orientation across the 18 participants (±1 *SE*). The correct orientation corresponds to 0 deg; other orientations are expressed in degrees clockwise relative to this orientation. The dotted line corresponds to chance performance.

The mean spectral slope of the 40 images was –1.248 (*SD* 0.221), close to the value cited in a previously published study of abstract art (–1.13; Graham and Field 2008). There was no significant correlation between image spectral slope and the percentage of correct orientation judgements (r = 0.0124, *ns*). Correlations of orientation judgements with measures of anisotropy were higher but nonsignificant: for *O*:*C* (oblique to cardinal power), r = 0.171; for *H*:*V* (horizontal to vertical power), r = –0.181.

On inspection of the data for individual images, it is clear that the correct orientation was judged quite consistently in some cases but not in others. For certain images, it is possible to discern a pictorial element in the image that may have facilitated a decision. For example, a tree shape may be seen on careful viewing of Braque's *House at Estague* (88.9% correct). In other cases, it is not clear how participants were able to infer the correct orientation. Miro's *Birth of the World* is quite abstract, as is von Wiegand's *City Lights*, but both supported reliable performance (55.6% and 77.8%, respectively).

Responses in Experiment 1 may have been influenced by detection of meaningful content in some paintings, rather than by aesthetic pleasure alone, and this factor may have masked any effect of spectral slope. A second experiment assessed the extent to which recognisable content in the form of a meaningful object or scene was detected in the experimental stimuli.

3 Experiment 2

3.1 Method
3.1.1 *Participants*

Eight naïve participants were recruited from the student body at Sussex University, none of whom had taken part in Experiment 1.

3.1.2 *Materials, apparatus, and procedure*

The same 40 modern artworks were used as for Experiment 1. The equipment was identical to that in Experiment 1. The experimental task was also almost identical to that in Experiment 1; all four orientations were displayed for each painting, but in this experiment the on-screen instruction read: "Does each painting contain recognisable or meaningful content?" Two on-screen response buttons were available, labelled "Abstract" and "Recognisable." Observers were instructed to click on "Recognisable" if they saw any meaningful content in the painting, otherwise to click on "Abstract". They were also instructed to base their answer on any of the four orientations presented and were given an unlimited time to make a judgement.

3.2 Results and discussion
The mean percentage of "meaningful" responses was calculated for each of the 40 paintings and ranged from 0% for seven paintings such as Kasimir Malevich's *Suprematist Composition* to 100% for five paintings such as Fernand Leger's *Two Women with Still Life*. Across the 40 paintings, the correlation between correct orientation judgements in Experiment 1 and "meaningful" responses in Experiment 2 was 0.65 (p < .0001); thus, recognisable content clearly did have a significant relation to orientation judgements, though only 42% of the variance in orientation judgements in Experiment 1 can be attributed to recognition of meaningful content.

A partial correlation was performed across the 40 paintings to assess whether spectral slope played a role in orientation judgements independently of "meaningful" judgements. The correlation was 0.157 (*ns*), so across the full image set, orientation judgements were dominated by recognition of meaningful content. The seven paintings in which no partici-pant reported any meaningful content at all had a mean spectral slope of –1.26, and a mean

percentage of correct orientation judgements of 23.02% (range 0–55.6%). In these purely abstract paintings the correlation between percentage correct and spectral slope was 0.64 ($r^2 = 0.41$), so there is a hint that purely abstract images with the shallowest spectral slope are easiest to judge, though the sample size is very small. One painting in this abstract set, Jackson Pollock's *One*, was judged correctly in 55.6% of responses and has a spectral slope of –0.768.

There are other intriguing variations between individual paintings. The three paintings in Figure 1 are particularly interesting. In the case of Kasimir Malevich's *Suprematist Composition*, 72% of responses selected an incorrect orientation rotated 90 deg anticlockwise from the correct orientation, and none of the 18 observers selected the correct orientation. No observer discerned any meaningful content in this painting, which has a very steep spectral slope of –1.56. All observers also agreed that Piet Mondrian's *Composition* contained no meaningful content, and only 5.6% of them selected the correct orientation (the other three orientations were chosen equally often by observers). The painting's spectral slope is –1.58. Only one participant saw anything meaningful in Joan Miro's *The Birth of the World*, yet over half of the participants in Experiment 1 selected the correct orientation. The painting's spectral slope is –1.38.

A limitation of the present study was that there was no systematic attempt to assess the degree to which participants were familiar with any of the artworks, though participants did not report any familiarity during informal debriefing. For example, Pollock's *One* (see Figure 1) is famous and should therefore arguably be quite familiar to some participants. However, given the abstract nature of the work, it seems unlikely that untrained participants would have retained such detail in memory that they were able to judge its orientation correctly.

4 Conclusions

In agreement with anecdotal reports from galleries, the judgements of nonexpert viewers accord with the intended orientation for abstract or semiabstract art at levels well above chance. However, performance is far from perfect, consistent with results in previous studies. The most important new result is that orientation judgements are mediated at least in part by some appreciation of meaningful content in the image. However, in a minority of paintings, a consistent orientation effect was obtained, even when no meaningful content was apparent. The origin of these orientation judgements remains to be identified conclusively, but image spectral slope may play a role.

References

Gerhardus M, Gerhardus D, 1979 *Cubism to Futurism: The Evolution of the Self-Sufficient Picture* (Oxford: Phaidon) ◄
Gibson A E, 1997 *Abstract Expressionism: Other Politics* (London: Yale University Press) ◄
Graham D, Field D, 2008 "Variations in intensity statistics for representational and abstract art, and for art from the Eastern and Western hemispheres" *Perception* **37** 1341–1352 doi:10.1068/p5971 ◄
Hunter S, 1997 *The Museum of Modern Art, New York: The History and the Collection* (New York, NY: Abrams) ◄
Jamieson A, 2008 "Rothko hung 'wrong way round' in exhibition" *Daily Telegraph* 9 November ◄
Johnson M G, Muday J A, Schirillo J A, 2010 "When viewing variations in paintings by Mondrian aesthetic preferences correlate with pupil size" *Psychology of Aesthetics, Creativity, and the Arts* **4** 161–167 doi:10.1037/a0018155 ◄

Latto R, Brain D, Kelly B, 2000 "An oblique effect in aesthetics: Homage to Mondrian (1872–1944)" *Perception* **29** 981–987 doi:10.1068/p2352 ◄

Lindauer MS, 1969 "The orientation of form in abstract art" *Proceedings of the American Psychological Association* **4** 475–476

Plumhoff J, Schirillo J A, 2009 "Mondrian, eye movements, and the oblique effect" *Perception* **38** 719–731 doi:10.1068/p6160 ◄

Redies C, 2007 "A universal model of esthetic perception based on the sensory coding of natural stimuli" *Spatial Vision* **21** 97–117 doi:10.1163/156856807782753886 ◄

Redies C, Hasenstein J, Denzler J, 2007 "Fractal-like image statistics in visual art: similarity to natural scenes" *Spatial Vision* **21** 137–148 doi:10.1163/156856807782753921 ◄

Swartz P, Hewitt D, 1970 "Lateral organization in pictures and aesthetic preference" *Perceptual and Motor Skills* **30** 991–1007 doi:10.2466/pms.1970.30.3.991 ◄