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Pictorial Resemblance

The theories holding that pictures depict in virtue of resembling their subject matter are the oldest of the general kinds of approaches to explaining depiction. Plato gave an example of such a theory in his dialogue, *Cratylus*, and C. S. Peirce also endorsed a theory of this kind.[1] Such theories have recently been revived and given a more sophisticated presentation. John Hyman and John V. Kulvicki both make this claim in their (otherwise very different) theories of depiction, and a range of other philosophers have supported, and continue to argue for, theories of this kind.[2]

This article develops a new account of the role of resemblance in depiction that is critical of such theories. Of course, I am not the first to aim criticism in this direction. Nelson Goodman is the most famous critic of resemblance theories. In a series of arguments in *Languages of Art*, he showed that no resemblance can be sufficient for depiction.[3] This point is now generally accepted, but as many have since pointed out, it does not in itself disprove resemblance theories. Rather, it could equally indicate that other conditions, together with resemblance, are sufficient for picturehood.[4] A more effective way of disproving resemblance theories would be to argue that resemblance is not *necessary* for depiction. This approach, which Goodman and others have largely ignored, is the strategy I take.[5]

My approach is also unusual in another way, for while I argue that pictures do not necessarily resemble their subject matter, I do not reject the importance of resemblance in depiction. Most pictures, I allow, do resemble their subject matter in specifiable respects, and this fact does play an important, although not necessary, role in establishing depiction.

I begin by clarifying the notion of resemblance and discussing John Hyman's account of the ways in which pictures resemble their subject matter. Hyman's account is the most extensive and carefully considered of those currently available and is a useful foil for my own account. The article is then devoted to two general arguments that support my position. First, I argue that pictures usually do resemble their subject matter, but that these resemblances are often different from those proposed by Hyman. By identifying and analyzing ways in which pictures do resemble their subject matter, I show that the character of pictorial resemblance depends on the constitution of our visual recognitional abilities. Since the particular constitution of these abilities is an empirical matter, these resemblances cannot be regarded as necessary for depiction. Second, I argue that there also exist instances of depiction that do not depend on any resemblance. These instances of depiction without resemblance are exceptions to the pictorial resemblances I identify, and they show that resemblance *of any kind* is not necessary for depiction. These too find their explanation in facts about our visual recognitional abilities. I conclude by discussing the positive consequences of my arguments for theories of depiction.

I. KINDS OF RESEMBLANCE

I will call all theories that hold that a viewer-independent resemblance between a picture and its referent is necessary for depiction resemblance theories. I will say what I mean by 'viewer-independent resemblance' in a moment; first

though, I should note that this definition of a resemblance theory is broader than is traditionally made, for it encompasses a range of sophisticated, post-Goodman, theories, including Hyman's and Kulvicki's, that see other conditions as also necessary for depiction. Hyman, for instance, holds that it is necessary that pictures resemble their subject matter in certain respects, but also sees experience as having a crucial role.[6]

It is important to specify that our interest here is in viewer-independent resemblances. These are resemblances that involve a sharing of viewer-independent properties. Such properties may be an object's intrinsic properties, such as its geometrical shape, or they may be properties that are not intrinsic to the object, but are nevertheless viewer independent. Occlusion shape, which I discuss below, is one such property. The shape an object occludes is not an intrinsic property, for it depends on how it is positioned relative to a particular viewpoint X. But neither is it viewer-dependent, for it can be specified without reference to a particular viewer (it is the solid angle the object subtends at X).

The concept of viewer-independent resemblance corresponds at least roughly with our everyday notion of resemblance. Viewer-dependent resemblance, by contrast, does not. A viewer-dependent resemblance involves the sharing of viewer-dependent properties. These properties are abilities to generate the same or a similar response in the viewer. Viewer-dependent properties may often be explained by the presence of viewer-independent properties, but they are not necessarily accompanied by such properties. Viewer-dependent resemblance is therefore no guarantee of viewer-independent resemblance.[7]

When resemblance theorists speak of resemblance, it is viewer-independent resemblance that they mean; and when I speak of resemblance below, that is also what I mean. I should also add a word about color here, for there is dispute over whether it is a viewer-independent or viewer-dependent property. Resemblance theorists usually speak of color properties as viewer independent (Hyman has developed this position most explicitly).[8] I will begin by giving resemblance theorists the benefit of the doubt on this point, but the issue of the subjectivity of some kinds of colors will arise later in this article.

II. OCCLUSION SHAPE AND APERTURE COLOR

Hyman proposes that pictures resemble their subject matter with respect to occlusion shape and aperture color.[9] Let me treat occlusion shape first. Pictures use configurations of two-dimensional shapes (usually delimited by lines or variations in tone or color) to depict three-dimensional forms. For a resemblance theorist, this poses a question: what is the salient resemblance between the two-dimensional shapes on the picture's surface and the three-dimensional forms they depict? We might simply say, "shape," but this response only elides the differences between the two-dimensional shapes on the picture's surface and the depicted forms; it identifies no common, shared property. Responding to this problem, Hyman proposes that pictures resemble their subject matter with respect to occlusion shape.

An object's occlusion shape is the solid angle that the object subtends at the point occupied by the viewer's eye.[10] An easy way to grasp what occlusion shape is to take a pane of glass and place it between oneself and the object. One then looks through the glass at the object and traces the object's outline on the glass. The resultant outline, from that point of view, will have the same occlusion shape as the traced object. If this outlined shape were to be filled in with an opaque material such as paint, provided one's point of view had not moved, it would precisely occlude the outlined object.[11] Hyman proposes that for a picture to depict an object, X, it is necessary that the particular part of the surface that depicts the object has the same occlusion shape as X. Hyman calls this the 'occlusion shape principle.'

Now to Hyman's account of color resemblance.[12] Many (although of course not all) pictures employ color to convey part of their depictive content. Red is typically used to depict a fire engine's hue, white to depict the brightness of the moon, and so on. I call those pictures that use color to convey depictive content 'color pictures.' Note that I include tone or brightness as a color property, as well as hue and saturation.

Hyman's reasons for introducing the notion of aperture color are similar to those that prompt him to introduce occlusion shape. He begins by considering some problems encountered in trying to formulate simple accounts of color resemblance. Perhaps the simplest interpretation we can give

resemblance theories as they apply to color will hold that picture and subject matter share local or surface color. Visually indiscriminable samples of color have the same local color—samples of paint out of the same pot, for instance, will share local color. This interpretation cannot be right for many color pictures, however. Many color pictures deviate from simply reproducing the local colors of their subject matter in order to depict changes in shadowing and illumination over a surface, reflective surfaces, textured surfaces, aerial perspective, and other factors that can change our perception of an object's local color. Pictures that depict shadowing and illumination, for instance, will typically use a darker color than the subject matter's local color to depict the shaded part of the surface and will use a brighter color than the local color to depict the illuminated portion of the surface.

In response to such concerns, Hyman proposes that while some simple color pictures do share local colors with their subject matter, others must share other kinds of color properties—properties that are not intrinsic but still viewer independent.[13] In particular, he thinks, "when shading is used, the aperture colors of the various parts of a painting's surface are the same as the aperture colors of the various surface colors they depict, as long as the painting is suitably lit."[14] Aperture color is the color that a part of a surface appears to have when it is viewed in isolation, through an aperture such as a small hole in a piece of gray card. Viewing colors in this way cuts out environmental influences, such as contrast and constancy effects, that ordinarily affect our perception of color.

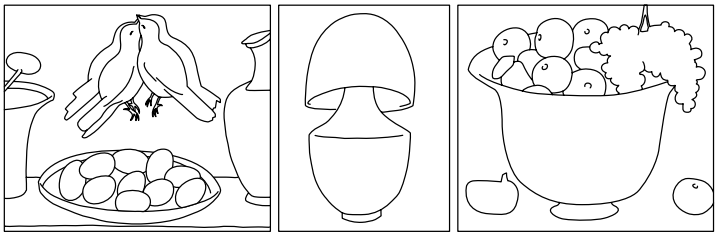
Occlusion shape and aperture color are not intrinsic properties of things, but they are viewer-independent properties. As one moves about an object, its occlusion shape and aperture colors will change, but note that both can be determined without reference to a viewer. To do this, one only needs to specify a particular geometrical point, coinciding with the point from which the object is viewed. As I have said, this point, in conjunction with intrinsic facts about the shape of the object, will be enough to determine occlusion shape. If we know facts about the object's textural and reflective properties, how it is illuminated, and other features affecting the transmission of light from the object to the point of view, we can also determine the object's aperture colors. In short, the object's aperture colors are the colors that the rays of light reflected from the object have where they intersect the point of view.

Certainly, aspects of shape and color play an important role in depiction. But why should it be occlusion shape and aperture color? Hyman's idea is that two objects with the same occlusion shapes and aperture colors will cause the eye to receive the same stimulus, so explaining the similarity of our response. Since light travels in straight lines, the lines projected from an object to the pupil of a viewer will correspond to rays of light reflecting from the object and projecting into the viewer's eye. Similarly, the lines projected from the picture to the pupil will correspond to rays of light reflecting from the two-dimensional figure to the viewer's eye. In either case the light rays reflecting from the solid body or the picture will deliver the same pattern of light to the eye. The stimulation is thus the same, whether caused by the presence of the solid body or the picture.

III. RESEMBLANCE AND RECOGNITION

It may seem that there are straightforward counterexamples to the occlusion shape principle. While it will apply to perspective pictures and ordinary photographs that preserve occlusion shapes, it may appear that other pictures do not preserve the occlusion shapes of their subject matter. Prior to the invention of perspective in Europe, and at most times in cultures outside Europe, occlusion shapes have not been preserved in pictures. But Hyman has a reply to this. He makes a distinction between a picture's "internal" and "external" subject matter. The internal subject matter is that which the picture occasions an experience of, and the external subject matter is the actual object from which the picture was painted. Hyman intends his claims about resemblance to apply to a picture's internal subject matter. They might also apply to the external subject matter, but only insofar as the picture represents that external subject matter faithfully. So it will not concern him that the occlusion shapes and aperture colors of a picture do not correspond to any real thing. Rather, he claims, they correspond to the occlusion shapes and colors of the items that the picture occasions an experience of.[15]

An awkward conclusion follows from this reply, for it implies that a nonperspectival picture will occasion an experience of its subject matter



Newall fig. 1. Line drawings after (from left to right) *Still-Life with Eggs and Game* (detail), from the House of Julia Felix, Pompeii, first century A.D., Museo Nazionale, Naples; *Still Life with Water-Fowl and Flask of Water* (detail), from Herculaneum, first century A.D., Naples Archaeological Museum; *Bowls of Fruit and Amphora* (detail), from the House of Julia Felix, Pompeii, first century A.D., Museo Nazionale, Naples.

as having the spatial properties associated with the occlusion shapes used to depict it, rather than having the spatial properties associated with its actual occlusion shape. That is, it will occasion an experience of a distorted version of its subject matter. This might be an acceptable conclusion in the case of intentional pictorial misrepresentation, such as caricature.[16] But where misrepresentation is not intended it is less plausible, for it implies that every such picture produced without the benefits of perspective techniques will occasion experiences that differ from those intended by the picture maker. On this account, every picture made before the invention of perspective is in various respects a failure, for the experiences of seeing that they occasion fail to match the intentions of the picture makers.

I make two responses to this. First, pictorial experience can be noncommittal with respect to certain kinds of properties. One kind of spatial property to which this is an attractive response is detail. When, say, an impressionist painter eschews the intricate occlusion shapes that would depict a van Eyck-like level of detail, it does not mean that he occasions an experience of his subject matter as lacking detail. A viewer habituated to this way of picture making will have an experience of the subject matter that is noncommittal about detail at that level (much as we veridically have such experiences when our vision is blurry, in conditions of low illumination, and so on). A viewer unfamiliar with impressionism might experience the subject matter's surface as lacking detail, but that only serves to remind us that most pictures can support experiences that vary from that intended by the picture maker.

I will spend more time on the second response, for it illuminates some underlying issues about pictorial resemblance. It points out that a form's occlusion shape is not the only two-dimensional shape that can occasion experiences of that form: other kinds of resemblances can be used for this purpose. I shall focus on one example, the depiction in Greco-Roman painting of tilted circles. Perspective stipulates that tilted circles are depicted using ellipses (since a circle viewed from an angle occludes an elliptical shape). Greco-Roman painting typically uses another shape for this purpose, one I call a 'pointed ellipse.' This can be seen in the line drawings in Newall fig. 1, drawn after details of Roman still-life paintings from Pompeii and Herculaneum. Pointed ellipses are used to depict the dish of eggs in the first picture, the flask in the second picture, and the bowl's rim in the third picture.[17] Even taking into account the loose brushwork of some of these painters, it is clear that none of these rims is depicted using an ellipse. Rather, they use a pointed ellipse—an upper and a lower curve that meet in pointed vertices. Usually these vertices are slightly rounded, and the upper curve projects further from the horizontal axis than does the lower curve.

Now, it is true that we can see these pictures as depicting distorted rims. Indeed, coming to these pictures for the first time, it may be hard not to see them this way—the vessels themselves can seem to have a pointed elliptical cross section rather than a circular one. But I think we have to acknowledge that the ancient Greeks and Romans did not see them this way. How can we know this? The Greco-Roman tradition of pictorial realism, by which I mean the pursuit of a lifelike effect, is a long and continuous one. Its major advances had mostly been established in Greece by the fourth century B.C., about four hundred years before the examples I am discussing were produced. Much

as in European painting from the Renaissance to the nineteenth century, lifelike effects, even to the extent of illusion, were highly prized by artists and audiences alike.[18] But seeing the rims in these pictures as distorted detracts from these pictures' lifelike effects. It is reasonable to think that if ancient viewers perceived these pictures in this way, they would have decisively redressed the deficiency of the pointed ellipse schema at some point. The Greeks and Romans would hardly have put up with such a prevalent (and readily fixed or hidden) flaw in pictures that aimed at realism—and so, I think we must acknowledge that this was no flaw at all. That is, ancient audiences were able to see circular rims in such pictures without the occlusion shapes of those rims being preserved in the marks on the picture surface.

Another factor that makes me think this conclusion is right is that in working with these images, I have found that the sense of distortion does indeed wane and disappear after studying them for some time. This accords with other anecdotal reports of introduction to novel systems of depiction. In particular, those unused to perspective pictures can report an analogous effect, until they become habituated to them. Gombrich's quotation of Yoshio Markino, a London-based Japanese artist writing early last century, makes this point well.

> When I got a book of the drawing lessons at my grammar school there was a drawing of a square box in the correct perspective. My father saw it and said, "What? This box is surely not square, it seems to me very much crooked." About nine years later he was looking at the same book and he called me and said, "How strange it is! You know I used to think this square box looked crooked, but now I see this is perfectly right."[19]

The point I draw here is that having the correct experience in front of a picture does not necessarily happen automatically if it is in an unfamiliar style. Note that this position does not entail conventionalism. It shows only that we sometimes require habituation to new systems of depiction before we can fully understand them. There still exist constraints on the configuration of marks that can occasion a particular experience. These constraints are not as restrictive as those stipulated by the occlusion shape principle, but they still exist. There are, for instance, many shapes that surely cannot be used to depict a circular rim (rectangles, triangles, and so on).

What then are these constraints, and why is depiction so constrained? To answer these questions, we shall need to consider recognitional mechanisms that mediate visual perception—in this case, it is the mechanisms governing the recognition of volumetric form. I shall make use of Irving Biederman's theory of volumetric form perception.[20]

In the interests of speed of processing, visual recognition is based not on the entire array of light entering the eye, but on salient features of that array. In the case of the perception of volumetric form, recognition is based primarily on certain features of the edge information encoded by an early stage for processing called the primal sketch. Not all features of this edge information are made use of in recognition, only those that are "non-accidental": those that, over a variety of viewpoints, tend to be reliable (although not infallible) indexes of real spatial relations. It is combinations of these that form the grounds for recognition of simple three-dimensional forms such as cylinders, blocks, wedges, and spheres.

The case that concerns us is that of the cylinder (including variant forms with a circular cross section, such as a dish or bowl shape). Biederman proposes that the visible circular "top" of a cylinder is indicated in the primal sketch by a figure, symmetrical around two axes, comprised of curved edges coterminating in Y vertices on the long axis.[21] An ellipse, of course, satisfies these constraints, as one would expect. But what is of interest here is that other shapes—in particular pointed ellipses—also do so. The particular curvature that distinguishes a true ellipse from a pointed ellipse is not taken into consideration on Biederman's account. Indeed, he stresses that the recognition process cannot "be dependent on absolute judgements of quantitative detail," as such judgments would be slow and unreliable.[22] "For example, distinguishing among just several levels of the degree of curvature . . . typically requires more than that required for the identification of the object itself."[23]

If Beiderman's account is right, it would give us an explanation of why Greco-Roman still lifes do successfully depict the rims of bowls, dishes, and other vessels as circular. For while the pointed ellipse and true ellipse produce different patterns of light on the retina, and so generate correspondingly different primal sketch representations, the ensuing process in which recognition of

volumetric form occurs is not sensitive to these differences and so recognizes both as tilted circles.[24]

This analysis in terms of recognitional abilities implies that, while occlusion shape need not be preserved, particular *features* of occlusion shape will be preserved. In our example, to depict a rim as a tilted circle, a picture must preserve the following properties of the rim's occlusion shape: the properties of being a figure comprised of an upper and lower curve, each curving out from, and roughly symmetrical around, an axis. As will now be clear, these properties may be instantiated by a pointed ellipse, as in the Greco-Roman pictures I have discussed, just as well as the true ellipse stipulated by perspective.

I have argued that the occlusion principle does not hold in all cases. But assuming Biederman's theory is correct, we have in this case identified *another*, more generic viewer-independent respect of resemblance: the features of occlusion shape that are salient to recognition of a tilted circle. Further analysis could be made in the same vein, using Biederman's theory to identify a range of resemblances between pictures and other forms. Could these new resemblances be used to support a resemblance theory? They cannot. One reason why they cannot is that such resemblances will only be recognitionally relevant because our visual system is sensitive to resemblances in those respects. If our recognitional abilities were sensitive to different features, then picture makers would need to preserve different features in order to depict their subject matter. We can certainly imagine a visual system (and perhaps Hyman does imagine such a system) in which recognition is responsive to all features of occlusion shape, so that pictures must reproduce an object's occlusion shape precisely if they are to successfully depict that object.[25] Thus, if resemblances with respect to shape can be found, they will not be necessary for depiction; rather, their role in depiction will be determined by the constitution of the human visual system.

A similar argument can be made about color. I will not go into depth about this here, as I have made such an argument in detailed form elsewhere.[26] The salient points can be briefly stated. Most painters usually make no attempt to reproduce the aperture colors of their subject matter. Indeed, this task is often impossible anyway, since the brightest colors observable in nature will be much brighter than those that a painting, viewed under normal gallery lighting, can reproduce.[27] So, instead of reproducing the absolute lightnesses and darknesses of a scene, a painter will aim to preserve in the picture the *relations* of lightness and darkness. A white pigment need not be anywhere near as bright as, say, a glowing streetlight in order to depict it; it need only be brighter than its surrounding pigments. To take another case, a painter need not reproduce the precise hue of something in order to faithfully depict it. Rather, she may use a hue that a viewer may still recognize as being somewhat of the subject matter's hue. So, a blue car can be depicted using a range of bluish hues, and not just those of the car's aperture colors. Here it is a relation of similarity that is preserved. These are instances in which aperture colors are not preserved, but *features* of aperture colors—relative tone and similarity of hue—are. Again, though, this does not provide a basis for a resemblance theory, for these resemblances prove to be contingent upon the constitution of our recognitional abilities. Our recognitional abilities have evolved to be sensitive to these properties of aperture color because they are especially salient—and more so than precise aperture colors—to recognition. Since conditions of illumination under which objects can be seen typically vary, an object's aperture colors can vary in a range of ways. This makes the precise aperture colors of an object an unreliable basis for recognition.

Similarity of hue and relative brightness give a more useful basis on which visual recognition can be made, for these properties are preserved under a wide range of conditions. If the brightness of the illumination under which an object is seen is reduced, it reduces correspondingly the absolute brightnesses of that object's colors but tends to preserve the relative brightnesses of those colors. If one color is brighter than another, this relation will typically be preserved regardless of their light source's dimming or brightening. Changing illumination also has effects on hue, but these are usually more limited. A blue surface, for instance, will typically retain at least a bluish appearance under most variations in illumination. So responding to similarity of hue is usually a preferable basis for recognition than responding to a precise hue.[28]

The color properties that color pictures preserve are thus those that are salient to visual recognition. But, again, we can readily imagine a visual system that is sensitive to different color

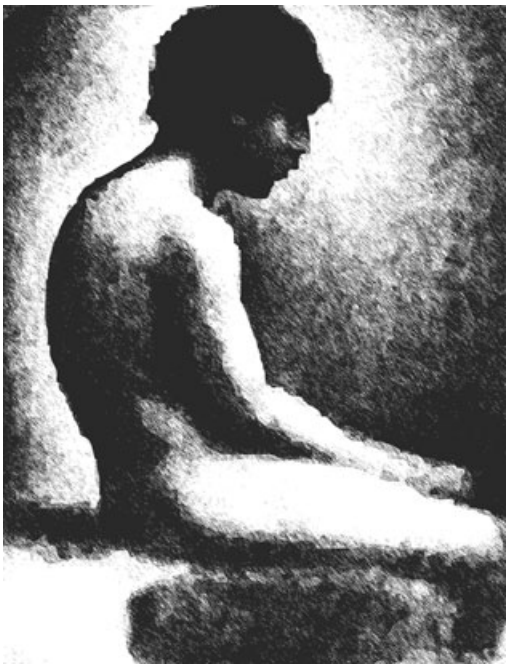
properties. If we could perceive ultraviolet light, as some animals can, our pictures would reproduce correspondingly different color properties. So, again, we find that these resemblances are not necessary for depiction, for they depend on contingent facts about the human visual system.

IV. DEPICTION WITHOUT RESEMBLANCE: DEPICTION OF SUBJECTIVE EFFECTS

The other reason why these resemblances do not support a resemblance theory is that we can also identify instances of depiction of form that do not depend on *any* viewer-independent resemblance. I will consider two general kinds of example. The first, which I briefly consider an example of in this section, involves the depiction of subjective effects. The second, which I treat more extensively in the following section, involves the use of subjective effects in depiction.

My first kind of example is drawn from a well-known art-historical source: the Pointillist paintings and drawings of Georges Seurat. One of Seurat's aims was to depict the subjective effect of simultaneous contrast. This is most readily seen in the "haloes" of contrasting color and tone with which he silhouettes figures in his paintings and drawings. Newall fig. 2, a digital rendering after a Seurat drawing, shows the subtle effect in slightly exaggerated form. Simultaneous contrast occurs when areas of differing tone or areas of differing hue are placed so that their edges touch. In such cases the perception of each tone or hue, around the edge where they meet, is heightened. When a dark tone is placed next to a light tone, the dark tone appears darker then it otherwise would, and the light tone appears brighter than it otherwise would. Similarly, when differing hues are placed next to one another, they appear more different in hue than they in fact are. Orange placed next to gray will make the gray appear bluish, for example.[29] As I have said, Seurat depicted this effect by heightening the contrasts of hue and tone around the edges of the objects he depicts.[30]

It has on occasion been said that Seurat's depiction of simultaneous contrast stems from a misunderstanding of the phenomenon.[31] This line of thought points out that if two colors are placed side by side on a canvas, they can be expected to generate the same effect of simultaneous contrast they would produce if they appeared in nature. Thus, to reproduce the effect of simultaneous contrast between, say, an object and the background against which it appears, it should suffice to reproduce the local colors of the object and the background, for once these colors are reproduced on the canvas, their proximity will generate a simultaneous contrast identical to that produced by the subject matter.



Newall fig. 2. Digital drawing after Georges Seurat, *Seated Nude: Study for* Une Baignade, 1883, conté crayon on paper, National Galleries of Scotland, Edinburgh.

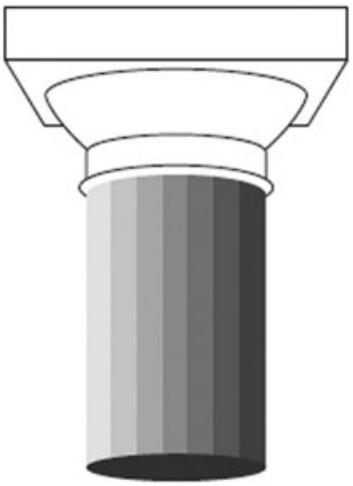
Such arguments are not convincing and have not convinced art historians. John Gage and Georges Roque have observed that a plausible rationale does exist for the depiction of simultaneous contrast and was available to Seurat and his contemporaries in Hermann von Helmholtz's well-known essay, "The Relation of Optics to Painting."[32] We have already seen that Helmholtz pointed out that it is impossible to recreate in a painting the brightness of many colors that appear in nature. But since contrast effects are "produced more strongly by bright light and brilliantly saturated colors than by faint light and duller colors," Helmholtz suggests a way of partially overcoming this:

> An artist [who] wishes to reproduce as strikingly as possible, with the pigments at his command, the impression

which real objects produce . . . must indicate with paint the contrasts which the real objects naturally display. . . If the colors in a painting were as strong and brilliant as those of actual objects, the contrasts which appear in reality would appear automatically in a painting. Here . . . subjective visual phenomena must be introduced objectively into a painting, since the colors and light intensities in it are different from reality.[33]

The depiction of contrast effects can therefore compensate for the inability of painting to reproduce the bright and saturated colors of a sunlit scene. Bright and saturated colors generate strong contrast effects, and while the brightness and saturation of these colors may not be reproducible in a painting, the hues of their associated contrast effects can be reproduced. Helmholtz gives a number of examples that make it clear he includes the depiction of simultaneous contrast, giving examples of contrast with respect to both brightness and hue: "Painters and draftsmen generally make a plain, uniformly lighted surface brighter where it meets a dark object and darker where it meets a light one. You will find that uniformly grey surfaces are given a yellowish tint at the edge where there is a background of blue and a rose-red tint where there is green."[34] Helmholtz was writing before Seurat depicted the effects he describes, and his remarks are a useful reminder that while Seurat's paintings are the most prominent examples of depicting these effects, many artists before him had more subtly incorporated them into their pictures. One prominent example that Helmholtz may have had in mind are those paintings by Velázquez in which his subjects appear against a blank ground with the dark edges of their bodies clearly "haloed," such as *The Buffoon Sebastian de Morra* (c. 1646, Museo Nacional del Prado, Madrid) and *Juan de Pareja* (1650, Metropolitan Museum of Art, New York).

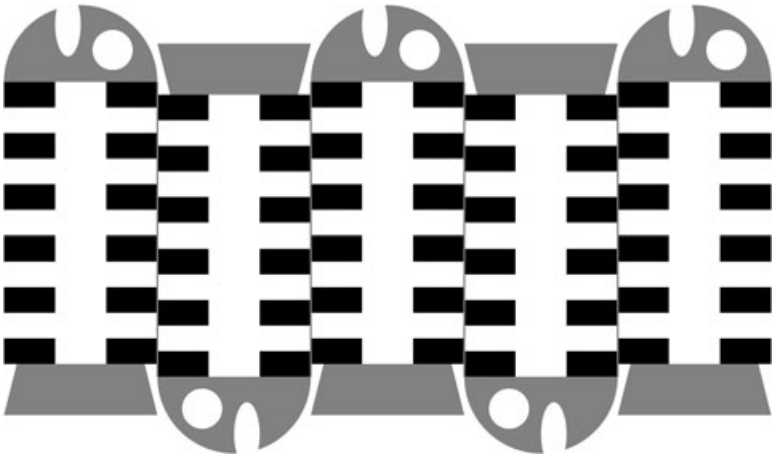
Now, considering Seurat's, and others', use of painted-in haloes to depict simultaneous contrast, we may challenge the resemblance theorist to find a resemblance between picture and referent on which this depiction depends. Clearly, we will find nothing corresponding to aperture colors of the painted-in halo in the referent's aperture colors, for in the latter case it is a subjective, viewer-dependent effect. Indeed, for the same reason there can be no viewer-independent resemblance whatsoever between the painted-in halo and the referent. Nor can there be a resemblance between the painted halo that depicts this effect and the features in life that give rise to it, for in life the perceived halo is a response of our visual system to the intense illumination and saturated colors that, as we have seen, painting is unable to reproduce. In short, there is no resemblance on which this instance of depiction depends.



Newall fig. 3.

V. DEPICTION WITHOUT RESEMBLANCE: USE OF SUBJECTIVE EFFECTS IN DEPICTION

This section considers examples in which subjective effects are used to depict properties of tone, hue, and shape.[35] I begin with an example of the depiction of tonal properties. Newall fig. 3 depicts the uppermost part of a Doric column. The vertical bands of tone on the shaft that depict its fluting are each a single, homogenous tone—a fact that can be readily confirmed by looking at each area of tone separately through a reduction screen. However, due to simultaneous contrast of tone, the bands of tone appear darker on the sides where they abut a lighter band and lighter where they abut a darker band. This subjective effect allows the picture to depict a feature of the column that it otherwise would not. On account of this effect each section of fluting is depicted as having one edge in shadow and one more brightly illuminated; that is to say, each section is depicted as being a concave surface.[36]



Newall fig. 4. Akiyoshi Kitaoka, *Fish*, 2003 (www.ritsumei.ac.jp/~akitaoka/cafewalle.html).

Again there can be no viewer-independent resemblance on which this depends. The concave facets of an actual column are perceived as such because they are shaded on one edge and more brightly illuminated on the other. Here, the simultaneous contrast, used to depict the variations in illumination and thus the concavity, is a subjective effect. Nor can a salient resemblance be found between concave fluting and the features of the figure that generate the effect, for while the former are recognized as concave by distinctive variations in shade and illumination, the latter are simply stripes of single, undifferentiated shades.

The next example is a color image and so does not lend itself to reproduction in the print version of this journal. A description will suffice here (the image itself is included as supporting information in the electronic version of this article).[37] Consider a picture of red apples against a background of green foliage. However, rather than using red pigment or light to depict the apples as red, the areas depicting the apples are in fact gray or slightly greenish (which can be confirmed by viewing these areas through a reduction screen). The depiction of the apples as red depends on simultaneous contrast of hue: because a bright green is used to depict the surrounding foliage, the patches that depict the apples appear to have a distinct red tinge, an effect that allows the viewer to see red apples in the picture surface and so allows the picture to depict the apples as red.

The situation is much the same as the previous example. The depiction of the apples as red cannot depend on a viewer-independent resemblance, because simultaneous contrast is a subjective effect. Nor can a salient resemblance be found between the hue of the depicted apples and the hue of the areas of the picture that depict them, for as we can see using the reduction screen, these areas are not in fact red or in any degree reddish.

I now turn to an example of the use of a subjective effect to depict shape. Akiyoshi Kitaoka's *Fish* (Newall fig. 4) depicts an arrangement of fish as having bodies that taper toward their tails. However, the shapes used to depict their tapering bodies are in fact rectangles; their sides are all straight lines, parallel to one another. The impression that these shapes taper is a strong one, and it may be necessary to take a ruler to the picture to demonstrate to oneself that the lines are indeed parallel.

Kitaoka exploits the café wall illusion, so named because it was first noticed in a tiled café wall.[38] Across narrow areas of intermediate tone, bright tones "lock," appearing to extend into the intermediately toned area. R. L. Gregory and Priscilla Heard suggest that border locking ordinarily functions to ensure that edges are correctly "locked" together—that is, that the borders of contiguous regions of contrasting tone (and color) are recognized as edges. Here it "malfunctions" so that where the gray lines lie between black and white areas, the white appears to extend into the gray, so that the white areas appear to angle out at this point.[39] Our visual system makes sense of this by seeing the gray lines as tilted at a corresponding

angle, so giving rise to the perception of the fish's bodies as interlocking wedges.

Here we will be unable to identify any viewer-independent features shared by the occlusion shapes of the picture and the depicted fish on which this instance of depiction could depend. It might be objected that, as with the examples of Greco-Roman painting I discussed, some salient common features might yet be identified. But this is not so. The depicted edges of the fish tilt, but the lines that depict those edges do not. Could verticality share some feature of orientation with an angle somewhat off the vertical? It can rightly be pointed out that these two orientations are more like one another than vertical is like horizontal, for instance—so do they not share something? They do, but what they share is merely extension along a particular dimension—let us call it y. The vertical line extends across y only, while the tilted line also extends across a perpendicular dimension, x. But extension across y is not the critical feature of Kitaoka's picture that affects misrecognition of the lines in the building as tilted. For as we have seen in the account of the café wall illusion, it is the particular configuration of shapes, tones, and lines that gives rise to the effect.[40] There is then no resemblance on which this instance of depiction could depend.

One could readily construct a wide range of similar counterexamples using other optical illusions that involve a misperception of shape or relative size.[41] But this example is enough to establish my conclusion—that there are instances of depiction of shape that do not depend on viewer-independent resemblance.

Let me consider a possible objection. It might be asked whether the flat bands of tone really do depict the fluting as concave, whether the neutrally hued patches really do depict the apples as red, and whether Kitaoka really does depict his fish with tapering bodies. In particular, it might be objected that the interpretation of the fluting as concave, the apples as red, and the fish as tapering involves a misinterpretation of these pictures. On this account, the pictures are properly seen as, and really depict, a column whose shaft is comprised of flat planes, not concave flutes; neutrally hued apples, rather than red apples; and rectangular rather than tapering fish. After all, a real shaft faced with flat planes will produce the same subjective effect and could readily be mistaken for a fluted column. Neutrally hued apples, seen amid an abundance of bright green foliage, could be mistaken for riper fruit. If we did happen to come across a fishmonger selling rectangular fish arrayed and patterned as they are in Kitaoka's picture, we might well mistake them for tapered fish. Moreover, normative systems of depiction, such as photography, will not rely on these effects. They will depict the fluting using light and dark tones, the red surface of apples using red pigments, and the strangely patterned fish using rectangular shapes. A critic might say that it is significant that a photograph of a column that has flat facets will feature flat bands of color, as does my picture of the column; a photograph of neutrally hued apples amid bright green leaves will feature the same hues as the image of apples (in the supplementary information); and that a photograph of the strange fish will feature rectangular shapes, as does Kitaoka's picture. If we happen to interpret such photographs as depicting a fluted column, red apples, or tapered fish, we would clearly be mistaken.

To defend my account, it will help here to draw on Richard Wollheim's insights about pictures. Wollheim held that when we understand a picture, we *see* the picture's subject *in* the picture; hence, his term 'seeing-in,' which has become a widespread shorthand for pictorial experience. While it is disputed whether the conditions Wollheim lays out are, as he claimed, both necessary and sufficient for an object to depict X—it is widely accepted that the conditions he gives are *sufficient* for an object to depict X. That is, it is widely accepted that a surface, Y, depicts subject matter, X, if (i) X can be seen in Y by a standard viewer, and (ii) Y's maker intends X to be seen in Y.[42] Thus, if we can see X in a surface and its maker intended us to see X in that surface, then the surface is a picture of X. Now, as we have seen, we are quite capable of having an experience of seeing-in concave fluting, red apples, and tapered fish in figures. And it will be equally clear that the maker of these pictures intended viewers to have this experience. This is the whole point of Kitaoka's picture, and I can be even surer that intention exists in the cases of the pictures of the column and the apples, since I designed them. It is beside the point that this is an unusual way of depicting the column's fluting, an apple's color, or a fish's shape and that photography and other forms of picture making would depict these things in a different way, and even that we can also see-in other features, such

as flat facets, neutrally hued apples, and rectangular fish, if we try. If we can reliably see fluting in bands of flat tone, red in neutrally hued patches, and wedges in rectangular shapes, that opens the way for a picture maker to use these effects to depictive ends.

VI. CONCLUSION

We have found that while pictures often do not share their occlusion shapes and aperture colors with their subject matter, we can, for the most part, expect *properties* of a subject's occlusion shapes and aperture colors to be preserved. The particular properties they share are determined not wholly by the geometry of vision (which determines the relevance of occlusion shape and aperture color), but also by the processes of visual recognition that underlie seeing in the rest of the visual system. These processes determine which features of occlusion shape and aperture color are relevant to recognition and seeing and thus determine which properties typically need to be preserved by a depiction. While I have only touched upon the relevant recognitional processes, I hope I have said enough to show that it is the processes of visual recognition that often hold the key to resolving questions about the particular nature of pictorial resemblances.

As I have argued, these particular resemblances are therefore not necessary for depiction; rather, they are contingent on characteristics of our visual systems. If our visual processing happened to be sensitive to different properties of occlusion shape and aperture color, then pictorial resemblances would differ correspondingly. It follows that we should prefer theories of depiction that, rather than affirming that pictures depict their subject matter partly in virtue of sharing certain properties, hold that these pictures depict partly in virtue of engaging visual recognitional abilities engaged by their subject matter.

This conclusion is further supported by the examples of depiction without resemblance. For while we have seen that most instances of depiction will involve resemblance, it is clear from these examples that not all do. Not only is resemblance dependent on recognition, but also recognition may occur in the absence of resemblance. Again this tells us that resemblance should not play a part in a definition of depiction; rather it suggests that recognition instead forms a necessary condition for depiction.

It might be wondered at this point why it is that if resemblance theories are false, pictures still in many respects resemble their subject matter. The examples of depiction without resemblance that I have presented are no doubt unusual instances of depiction—usually picture makers use a red hue to depict a red subject, darker tones to depict darker areas, lighter tones to depict illumination, and so on. An answer can be found when we consider our recognitional abilities as a product of evolution. One of the general, evolutionarily advantageous purposes these abilities have evolved to meet is the recognition of viewer-independent resemblances in our environment. It can obviously be useful to be able to recognize objects as having certain familiar properties or being of some familiar kind. It is for this reason that our visual systems are so responsive to viewer-independent resemblances. However, because our recognitional abilities are fallible—that is to say, because misrecognition can occur—we should not be surprised that they can sometimes be engaged by objects without these resemblances. Thus we can appreciate why, despite the fact that pictures do not necessarily resemble their subject matter, fashioning viewer-independent resemblances is still a relatively straightforward, effective, and thus popular strategy for making pictures.[43]

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1. Plato, *Cratylus*, in *Plato: Complete Works*, ed. John M. Cooper, trans. C. D. C. Reeve (Indianapolis: Hackett, 1997), pp. 102–156; Charles Saunders Peirce, *Writings of Charles S. Peirce: A Chronological Edition*, ed. Max H. Fisch (Indiana University Press, 1982–2000). Peirce touches on pictures at many points in his discussions of signs; see, for instance, vol. 5, p. 379.

2. John Hyman, "Pictorial Art and Visual Experience," *The British Journal of Aesthetics* 40 (1999): 21–45, and John Hyman, *The Objective Eye: Color, Form and Reality in the Theory of Art* (University of Chicago Press, 2006); John V. Kulvicki, *On Images: Their Structure and Content* (Oxford University Press, 2006). See also James W. Manns, "Representation, Relativism and Resemblance," *The British Journal of Aesthetics* 11 (1971): 281–287; Karen Neander,

"Pictorial Representation: A Matter of Resemblance," *The British Journal of Aesthetics* 27 (1987): 213–226; Douglas Arrell, "What Goodman Should Have Said about Representation," *The Journal of Aesthetics and Art Criticism* 46 (1987): 41–49; Craig Files, "Goodman's Rejection of Resemblance," *The British Journal of Aesthetics* 36 (1996): 398–412; Tony Skillen, "Passing Likeness," *Philosophical Papers* 25 (1996): 73–93; Randall R. Dipert, "Reflections on Iconicity, Representation, and Resemblance: Peirce's Theory of Signs, Goodman on Resemblance, and Modern Philosophies of Language and Mind," *Synthese* 106 (1996): 373–397; and Catharine Abell, "Canny Resemblance," *Philosophical Review* 118 (2009): 183–223.

3. Nelson Goodman, *Languages of Art: An Approach to a Theory of Symbols* (Indianapolis: Bobbs-Merrill, 1968), pp. 3–5.

4. See, for instance, Files, "Goodman's Rejection of Resemblance," for this point.

5. Goodman does make this claim, but he supports it only by saying that "almost anything may stand for almost anything else" (*Languages of Art*, p. 5). It is clear that this remark is impossible to defend in the case of pictures. As Richard Wollheim has pointed out, a picture in which colors are replaced by their complementaries or which is cut up and rearranged cannot have the same depictive content as the original picture (Richard Wollheim, *On Art and the Mind* [Harvard University Press, 1974], p. 25).

6. In particular, Hyman holds that "the experience of looking at a picture is the only decisive test of what it depicts" ("Pictorial Art and Visual Experience," p. 44).

7. There are a range of theories that allow these kinds of resemblances, including those that propose that picture and subject matter elicit a similar experience in the viewer (including Robert Hopkins, *Picture, Image and Experience: A Philosophical Inquiry* [Cambridge University Press, 1998]), and those that hold that pictures and subject matter engage overlapping recognitional abilities (such as Dominic McIver Lopes, *Understanding Pictures* [Oxford University Press, 1996]). While I reject resemblance theories, I agree with these theories that a viable theory of depiction will allow viewer-dependent resemblances.

8. Hyman, *The Objective Eye*, chaps. 1–3.

9. He also proposes a third respect of resemblance—occlusion size—that I leave out of this discussion (Hyman, *The Objective Eye*, pp. 98–99).

10. Hyman, *The Objective Eye*, pp. 75–99. See also Hyman, "Pictorial Art and Visual Experience," pp. 24–29, and John Hyman, *The Imitation of Nature* (Oxford: Basil Blackwell, 1989), chap. 3.

11. The idea of using a pane of glass to determine outline shape derives from advice Leonardo da Vinci gives to painters (Leonardo da Vinci, *Treatise on Painting*, trans. A. Philip McMahon [Princeton University Press, 1956], vol. 1, p. 65).

12. Hyman, *The Objective Eye*, pp. 99–104.

13. Hyman, *The Objective Eye*, p. 111.

14. Hyman, *The Objective Eye*, pp. 101–102.

15. Hyman, "Pictorial Art and Visual Experience," p. 25; *The Objective Eye*, pp. 71, 80, 99, 100. Unless I state otherwise, when I speak of a picture's subject matter, I mean its external subject, and assume that the picture does not misrepresent it.

16. Although his "experienced resemblance" view is not a resemblance theory, Hopkins has a position similar to that of Hyman here, but focuses on the example of caricature (*Picture, Image and Experience*, chap. 5). Caricatures, as he puts it, exhibit a "resemblance to the . . . [subject] *as it is depicted as being*" (p. 104).

17. There are exceptions to the use of the pointed ellipse. For example, in the painting of the abduction of Persephone, from the Tomb of Persephone in Vergina (late fourth century B.C.), the wheels of Hades' chariot are painted using shapes closer to ellipses. Some scholars have also argued that perspective was developed in ancient times. John White, *The Birth and Rebirth of Pictorial Space* (New York: Harper & Row, 1972), to take a prominent example, holds this view. White's evidence is slight; for instance, he presents only a single example of the use of a vanishing point to support his position. However, the mainstream position is that perspective was unknown in ancient times. See, for instance, Erwin Panofsky, *Perspective as Symbolic Form*, trans. C. S. Wood (New York: Zone, 1991 [1927]).

18. Aside from the artworks themselves, the major documentary evidence for this claim is found in Pliny the Elder's *Natural History*, trans. H. Rackham (London: William Heinemann, 1952), books 35–36, which collects its art-historical data from a range of older sources.

19. E. H. Gombrich, *Art and Illusion: A Study in the Psychology of Pictorial Representation* (London: Phaidon Press, 1960), p. 227. Gombrich quotes Yoshio Markino, *When I Was a Child* (Boston, New York, and London: Houghton Mifflin, 1912), pp. 272–274.

20. Irving Biederman, "Recognition-by-Components: A Theory of Human Image Understanding," *Psychological Review* 94 (1987): 115–147. This theory is a well-established view within the scientific literature on vision, although it is not uncontested.

21. Biederman, "Recognition-by-Components," pp. 120–121, fig. 5. In the case of a cylinder, "[t]he termination of one segment in the curved Y is tangent to the other segment" (p. 120).

22. Biederman, "Recognition-by-Components," p. 117.

23. Biederman, "Recognition-by-Components," p. 117.

24. There will need to be more to this account. Perhaps habituation produces further constraints on recognition ruling out, to eyes habituated to perspective, the interpretation of pointed ellipses (but not true ellipses) as tilted circles. Or this distinction between circles and distorted forms may be part of a later, more fine-grained visual processing. (Some of Biederman's comments suggest the latter.)

25. Such a system, Biederman would point out, would sacrifice speed for accuracy and so would be an unlikely outcome of evolution.

26. Michael Newall, "Pictures, Colour and Resemblance," *Philosophical Quarterly* 56 (2006): 587–595.

27. Hermann von Helmholtz, "The Relation of Optics to Painting" (1871), in *Selected Writings of Hermann von Helmholtz*, ed. Russel Kahl (Wesleyan University Press, 1971), p. 308.

28. Perceptual psychologists Kathy Mullen and Frederick Kingdom, in "Color Contrast in Form Perception," in *The Perception of Color*, ed. Peter Gouras (Boca Raton, FL: CRC, 1991), pp. 198–217, make similar observations: "The most dramatic changes in natural lighting occur as a result of the diurnal cycle where the intensity of sunlight illumination can vary over a range of 10 log units. The spectral content of sunlight also varies to some extent, for example when measured under a blue sky, clouds, a red sunset or the

canopy of a rain forest. This variation is due to the different absorbance properties of atmospheres, or due to absorbance or reflectance by surfaces. The differences however will be small" (p. 198).

29. Michel-Eugène Chevreul, *The Principles of Harmony and Contrast of Colors, and Their Applications to the Arts*, trans. Charles Martel (London: Bell & Daldy, 1872 [1839]). Peter Gouras discusses the neurophysiological basis of simultaneous contrast in "Cortical Mechanisms of Color," in Gouras, *The Perception of Color*, pp. 179–197.

30. Seurat's use of dots and optical mixture plays an important role in his system of depiction, but for our purposes it can be set aside here.

31. Alan Lee, "Seurat and Science," *Art History* 10 (1987): 203–226, at p. 218.

32. Helmholtz, "The Relation of Optics to Painting"; John Gage, "Seurat's Silence," in his *Color and Meaning: Art, Science and Symbolism* (London: Thames & Hudson, 1999), p. 221; Georges Roque, "Chevreul and Impressionism: A Reappraisal," *Art Bulletin* 78 (1996): 26–39, at p. 38.

33. Helmholtz, "The Relation of Optics to Painting," p. 221. In what may appear to be a contradiction of this passage, earlier in "The Relation of Optics to Painting," Helmholtz mentions "Chevreul's simultaneous contrast," which is, unlike successive contrast, "independent of the movements of the eyes" and should not be depicted because the color changes associated with it "do not produce any differences between a painting and reality" (p. 317). Helmholtz's analysis of simultaneous contrast was complex; he identified what he believed were two different phenomena by that name. See Hermann von Helmholtz, *Physiological Optics*, 3 vols., ed. James P. C. Southall (New York: Dover, 1962 [1866]), vol. 2, pp. 265–269). Chevreul, however, does not make such a distinction.

34. Helmholtz, "The Relation of Optics to Painting," p. 221.

35. It would not affect my argument to instead say that it is the features of a picture surface that *produces* the subjective effects that does the depiction here. This way of putting it is perhaps more intuitively attractive; I only avoid it because of its more complex phrasing.

36. Psychologists may recognize the shaft as the column as made up of Mach bands. My use of this effect to depictive ends was inspired by Josef Albers, who likened it to the fluting of a Doric column in his *Interaction of Color*, revised ed. (Yale University Press, 1975), p. 57.

37. The online version of this article can be found at http://www3.interscience.wiley.com/.

38. Richard L. Gregory, "The Confounded Eye," in *Illusion in Nature and Art*, ed. Richard L. Gregory and E. H. Gombrich (London: Duckworth, 1973), pp. 49–95.

39. R. L. Gregory and Priscilla Heard, "Border Locking and the Café Wall Illusion," *Perception* 8 (1979): 365–380.

40. At most the extension along y of the lines in the picture can explain how the picture depicts the sides of the fish as extending along y. This, however, is trivial.

41. The Ponzo, Zollner, Ebbinghausen, and Muller–Lyer illusions and the Fraser Spiral, to mention some well-known examples, could all lend themselves to such treatment. David Topper, in "The Poggendorff Illusion in *Descent from the Cross* by Rubens," *Perception* 13 (1984): 655–658, explains how Rubens uses a subjective effect related to the Poggendorff illusion to depict the ladder in his *Descent from the Cross* (c. 1611–1614, Cathedral of Our Lady, Antwerp).

42. Richard Wollheim, *Painting as an Art* (Princeton University Press, 1987), pp. 46–51. It is increasingly recognized that certain things that do not satisfy these conditions are also pictures. See, for example, Martin Kelly, "Richard Wollheim's 'Seeing-In' and 'Representation,'" in *Visual Theory,* ed. Norman Bryson, Michael Ann Holly, and Keith Moxey (Cambridge: Polity, 1991), p. 161.

43. I am grateful to the audience and organizers of Depiction: A Conference on the Nature and Value of Pictorial Representation (University of Manchester, 2007), where part of this article was presented. Comments and criticism I received there from Catharine Abell, Katerina Bantinaki, Dominic Lopes, John Hyman, and Bence Nanay were especially helpful. Thanks too to anonymous reviewers for this journal for valuable and generous advice. I am grateful to Akiyoshi Kitaoka for permission to reproduce his work, and to John Newall for assistance with the other images. Thanks also to Alan Lee for getting me to think about color and contrast effects.

Supporting Information

Additional supporting information may be found in the online version of this article.

Figure S1:

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