Notes and Comment

Further difficulties for the filtered-components approach to illusory visual contours

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Ginsburg (1975) and Becker and Knopp (1978) promoted the intriguing hypothesis that illusory visual figures such as the famous illusory triangle of Kanizsa (1955) arise from long-wavelength components within the inducing patterns which correspond in locale to the resulting illusory contours. It has since become clear, however, that such components are not necessary, because it has now been shown that illusory contours can occur in a pattern which, when suitably filtered, reveals no such long-wavelength counterparts (Parks & Pendergrass, 1982). On the other hand, that conclusion leaves open the important possibility that such long-wave components, when they *are* present, do have the capacity to initiate and sustain corresponding illusory contours. On the contrary, the present observations indicate that they do not, thus rendering even this more limited version of the Ginsburg/Becker thesis untenable.

The Stimulus Patterns

Frisby and Clatworthy (1975) pointed out that a pattern in which the inducing elements consist of areas of scattered dots yields weak, "if any," illusory contours. Similarly, each element of the first of the present patterns (Figure 1a) consists of a collection of small squares placed randomly but with the restriction that across any row or column their average density be the same and that the part of any row or column that borders on a "notch" have a lower density than the corresponding parts of rows or columns that are more removed from the notches. This latter restriction stands in contrast to the tendency, in Frisby and Clatworthy's example, for density to be slightly higher (rather than lower) along the borders of their notches, and yet, as can be seen, the present pattern is equally ineffective.

Similarly, the second stimulus is based upon a previous observation. That is, it has been argued that the occurrence of an illusory figure depends, to some extent at least, on the ease with which inducing elements on opposite sides of the potential figure can be seen as the visible parts of a larger, continuous, but partially occluded, element (e.g., Parks, 1980).

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Figure 1. The present stimuli (see text for derivation).

As can be seen, the various elements of Figure 1b are designed so as to render such a perceptual result difficult and, as expected, the pattern is not an effective inducer of illusory contours.

Finally, the third of the present stimuli (Figure 1c) is based to some extent upon the prior observation that an area that is partially delineated solely by a set of thin-line corner elements will not take on the appearance of an illusory figure (e.g., Gregory, 1972).

Figure 2. A system for filtering in the spatial domain. Lenses L_1 , L_2 , and L_3 and the object holder are all part of a standard Ektographic slide projector from which the projection lens assembly has been removed.

In the present case, even though such elements have been supplemented in a manner which drastically augments the supposedly important frequency components (see below), they, too, are ineffective.

Filtration

A slide transparency of each of the present three patterns was prepared and masked so as to allow for the filtration of one corner element and its surround at a time. This procedure is legitimate, because the only information in the pattern that can contribute to long-wavelength differences between areas inside of and outside of a line connecting the corner elements (i.e., along the locale of each potential illusory contour) must reside individually in each of these regions. At the same time, if filtration is performed one axis at a time, this procedure has the advantage of ensuring a balance of reflectance from the projection screen to either side of the locale of the potential contour.

Filtration was accomplished in the spatial domain (and the results photographed) by means of the apparatus shown in Figure 2 into which was inserted a 90×1 mm slit filter. As Becker and Knopp explain (1978, p. 523), essentially identical results would be obtained were these patterns to be subjected to the more troublesome and less photographable process of filtration and reconstitution in the frequency domain or, for that matter, to any reasonable digital algorithm for such filtration and reconstruction.

It should be noted that special care must be taken in filtering Figure 1a, because each square transparent area in the slide (each small white square as presented here) tends to act as a "pin-hole" lens that focuses the elements of the projection lamp onto the screen. Before inserting the slit filter, it was, therefore, necessary to examine the screen for an area that was free of such aberrations and was, therefore, a suit-

able place to project the filtered image (the latter placement being a function of the exact placement of the slit filter on a line orthogonal to the line of projection).

As can be seen in Figure 3, filtration of Figures 1a, 1b, and 1c revealed striking evidence of strong long-wavelength components of the exact sort that have been claimed to produce illusory contours. Yet, as noted before, they do not in any of these cases.

Discussion

Clearly, the presence of (or, in the case of the modification made in Figure 1c, the introduction of) ap-

Figure 3. The result of filtering any corner (and its surround) of Figures 1a, 1b, and 1c, respectively. In each case, part of the original pattern has been added to the results of filtration to indicate the locale of the long-wavelength components relative to the pattern elements. In the case of Figure 1a, the maximum extent of the rows and columns that compose an element are blacked solidly here for convenience.

appropriately located long-wavelength components within the Fourier transform of a pattern is not sufficient to elevate a merely suggested form to the status of an illusory figure. The argument could, of course, be made that such components, although they may never be sufficient in themselves, will contribute to such an effect given only that certain other requirements having to do with structural factors within the design are satisfied. However, since such factors (i.e., the presence of certain details that can be interpreted as consistent with the presence of interposition; Coren, 1972) would be expected, themselves, to invoke instances of more generally demonstrable lightness effects (Kanizsa, 1975; Parks, Rock, & Anson, in press), even this weakest possible version of the Ginsburg/Becker hypothesis is unacceptably unparsimonious.

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