Testing the attentional model of brightness contrast with relative area and figure-ground organization unconfounded

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Using gray-white metric patterns, for which figure-ground relationships had been previously determined, several features of an attentional theory of brightness contrast were investigated. Experiment I, involving three subjects and the method of constant stimuli, showed that ground, the unattended area, could be reliably perceived as brighter; responses were affected by both the type of pattern and level of contrast ratio. Experiment II, involving 40 subjects and the method of magnitude estimation, used metric patterns for which attentional factors were not confounded with relative area. The results supported the first study and further indicated the primary involvement of relative area rather than focus of attention in brightness contrast.

Several studies have indicated a relationship between figure-ground organization and figure brightness (Coren, 1969; Graham, 1929; Wever, 1927); area which is organized as figure tends to be perceived as phenomenally brighter (Coren, 1969; Wever, 1927). It has also been shown that when an area is increased in brightness it tends to dominate as figure (Graham, 1929).

Coren (1969) had subjects perform a brightness match on the ambiguous woman-rabbit pattern and on patterns where figure stereoscopically resided in the front of ground. While the study involving the woman-rabbit pattern suffered from order effects, it and the second study with a stereoscopic annulus did tend to show the relationship between perceived brightness and organization. A third study, using a stereoscopic Benary figure, tended to show that the brightness effects of the Benary design were explainable in terms of figure-ground organization and the increased brightness of the area perceived as figure.

Fry and Robertson (1935) had previously examined Coren's explanation for the brightness effects of a two-dimensional Benary figure. Subjects matched the brightness of a test triangle to a standard while the standard was surrounded with a black field abutting it at various angles. An inverted U-shaped relationship was found between brightness and angle of surround, with the maximum brightness needed to match occurring when the angle of the surround was continuous with the hypotenuse of the test triangle, a characteristic of the brighter triangle in the Benary design. However, in their design, amount of surrounding area was confounded with the angle of

surround, with the brightest triangle being found when the surround was neither at a maximum nor at a minimum. The lack of a linear relationship led Fry and Robertson to conclude that it was spatial position and not mode of perception which affected brightness.

The results of Fry and Robertson (1935) and Coren (1969) need not be contradictory if depth information is processed at a different neural level (cf. Julesz, 1971); however, the nonlinearity found by Fry and Robertson would suggest caution in interpreting the results of a study where only one type of pattern has been used, particularly if the amount of black and white in the pattern has not been varied.

Coren's (1969) hypothesis was reinterpreted by Festinger, Coren, and Rivers (1970) who suggested that figure was meant to denote only that part of the visual field which captures the attention of the observer, the observer attending more to figure than to ground. Festinger et al. (1970) proposed a model of visual information transmission that assumed that the system computes an overall average level of luminance of the visual field with attended areas overweighted in determining apparent brightness. Brussell (1973) showed that relative area must be considered in the overweighted average. Under dichoptic viewing of a spot and annulus, U-shaped relationships were observed between spot brightness and spot size: a black (white) spot darkened (lightened) as the diameter of the spot increased but lightened (darkened) with continued increases in size. The maximum darkness (lightness) occurred when a spot 90 min in diam was centered on a 180-min disk. Brussell's (1973) dichoptic data compare favorably with the binocular of Fry and Robertson (1935),

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although Brussell failed to find similar relationships under binocular conditions.

The effects of attention are assumed to operate in addition to those of retinal inhibition (Brussell, 1973; Brussell & Festinger, 1973). Attentional and retinal inhibitory influences are assumed to be working in the same direction if the portion of a visual display which captures attention is also the portion where brightness is being measured and in opposite directions if the brightness of this attentional portion is not being measured. However, the attentional model assumes that the visual system transmits little information about retinal steady states; it interpolates between contours and assumes uniformity of stimulation across such areas (Festinger et al., 1970). An implication of these assumptions is that an attentional variable, such as perceived figure-ground relationship, should cause a constant increase in the magnitude of apparent brightness independent of the real level of luminance differences between the figure and ground areas. If the visual display consists of white and gray areas, darkening the gray area should change the average luminance but not how the average is weighted by the attended portions of the display.

Previous studies that have been used to support the attentional model of brightness contrast (Brussell, 1973; Coren, 1969; Festinger et al., 1970) have not used visual displays which varied the level of luminance between different attentional areas. Furthermore, these studies did not independently determine the attentional characteristics of their stimuli but sought to achieve figure-ground relationships through manipulation of stimulus variables. The two experiments reported here sought to validate the model at varied levels of luminance between experimentally determined attentional areas.

EXPERIMENT I

The first experiment sought to determine if the brightness of an area which captured attention (figure) would be of greater magnitude than an area which did not (ground). Three gray-white metric patterns with experimentally known figure-ground relationships were used as stimuli. The white area of each pattern was responded to as either figure, ground, or ambiguous. If the hypothesis were correct, the brightness of the white area of the pattern where white is figure should be greater than the white of the pattern where white is ground. Additionally, this hypothesis was tested when the gray area of each pattern was reproduced at different luminance levels with that of the white area held constant. If the hypothesis were correct, the brightness effects should occur independent of luminance relationships.

Method

Stimuli. Sixty gray-white metric patterns, each of which 160 subjects had previously judged to be a "gray figure residing on a white ground" (Catano, 1972), were categorized into three sets on the frequency of such judgments. Set A contained all patterns judged as a gray figure on a white ground by more than 75% of the subjects; Set B, those patterns judged so by more than 45% but less than 55%; and Set C, those judged so by less than 25%. One pattern was randomly chosen from each of these three sets; the selected patterns were No. 1, No. 33, and No. 60, respectively (Figure 1). As can be seen, one variable which characterizes these three patterns is the number of gray cells.

Slide transparencies of each pattern were produced at four levels of contrast ratio¹ (Catano, 1972). For all 12 patterns, the brightness of the white area, as measured with a Macbeth illuminometer from the subject's viewpoint, was a constant 0.133 mL. The brightness of the gray area was 0.0156, 0.0414, 0.0719, or 0.0907 mL, which corresponded, respectively, to contrast ratios of 88.2%, 68.9%, 45.9%, and 31.8%.

Subjects. Two male and one female, experimentally naive, undergraduates at Lehigh University were paid \$1.50/h to perform in the study.

Apparatus. Each pattern which subtended an angle of 4.5 deg was projected by a GAF 980 slide projector onto the rear of a 19-deg translucent screen attached to one channel of a two-channel Gerbrands tachistoscope, which had been modified to have bright pre- and postexposure fields and a dark exposure field. A second projector was aligned such that a 2.5-deg circular spot of light fell to the subject's left of the projected pattern; the circumference of the spot was tangential to an imaginary projection from the upper border of the pattern. There was a separation of 2 deg between the pattern and nearest portion of the spot. The brightness of the spot was varied through the use of a system of Wratten neutral density filters.

Procedure. The method of constant stimuli was used to compare the brightness of the white area of each pattern to six values of spot brightness. The constant stimuli were brightnesses of 0.22, 0.17, 0.14, 0.11, 0.09, and 0.07 mL.

Each subject was run individually in a darkened, sound-protected room on 4 consecutive days. At each session, 3 patterns were randomly selected without replacement from the 12 patterns used. There were 50 presentations of each of the six constant stimuli for each of the 12 patterns. The target pattern and the test spot were exposed simultaneously for a duration of 600 msec on each trial by darkening the lights in the T-scope chamber. The 600-msec exposure time had been shown previously to be effective for figure-ground organization (Catano, 1972). Each trial was initiated 3 sec after the subject made his decision. The subject was to decide if the test spot was brighter than the white area of the pattern. The patterns were never referred to by the experimenter in terms of figure-ground. After the subject had completed the experiment, he was asked to describe each of the three types of patterns; it was noted whether the subject used figure-ground relationships in his description.

Results

Psychophysical analysis. Traditional psychophysical curves were plotted showing the relationship between the probability of judging the circle of light brighter than the white area of the pattern as a function of the constant stimuli. Straight line curves were fitted to each set of points by the least squares method; the 50% point of subjective equality (PSE) as determined for each curve is presented in Table 1. There were no apparent trends over pattern and contrast for a comparison of PSEs and the standard figural brightness (0.133 mL) of each pattern.

Figure 1. Three metric patterns with different, experimentally determined figure-ground organization tendencies.

In the postexperimental interviews, all three subjects described pattern No. 1 as a black figure on a white ground, No. 60 as a white figure on a black ground, and No. 33 ambiguously by referring to various areas of that pattern. The average PSE, taken over the four values of contrast, indicated that Subject 2 and Subject 3 perceived the white area of No. 1 as phenomenally brighter; this result should have occurred, according to the hypothesis, only if the white area was perceived as figure. Similarly, the average thresholds for these two subjects for No. 60 were less than the standard, where the hypothesis would predict they would be greater. Directional difference tests compared the thresholds for Patterns 1 and 60 at the four levels of contrast for each of the subjects. The one-tailed difference test was significant for Subject 3 [$t(3) = 2.83$, $p < .05$] but not for Subject 2 [$t(3) = 0.88$]. While Subject 1's average PSE for No. 60 is not greater than the standard, it is greater than No. 1; however, this directional difference was not significant [$t(3) = 0.18$].

Although there were inconsistencies at particular levels of contrast, it appeared that Subjects 2 and 3, on the basis of average PSE, viewed No. 33 in the

same manner as they did No. 60 while Subject 1 perceived it differently from both No. 60 and No. 1. Examining the effects of contrast on threshold, it appeared that the greatest amount of relative contrast affected threshold behavior least, while lesser amounts may affect threshold uniquely for each subject.

Analysis of variance. In an attempt to gain a clearer understanding of the variables which might have affected subjects' responding, a 3 by 4 by 6 (Pattern by Contrast by Spot Brightness) analysis of variance was performed on the frequency that the spot was judged brighter. Since the psychophysical data had indicated strong individual differences, the data for each subject were considered to be an independent replication and three separate analyses were performed.

As expected, the spot brightness, a "dummy variable" for the purpose of the analysis, was significant at the .001 level for all three replications. The nontrivial results were also consistent, the only discrepancy being that for Subject 1 the pattern effect was marginally significant [$F(2,30) = 3.02$, $p < .07$], while it met a reliable level for both Subject 2 [$F(2,30) = 4.35$, $p < .05$] and Subject 3 [$F(2,30) = 4.33$, $p < .05$]. Contrast was significant over the three replications [Subject 1, $F(3,40) = 5.52$, $p < .01$; Subject 2, $F(3,30) = 5.01$, $p < .01$; Subject 3, $F(3,30) = 6.99$, $p < .01$], as was the Contrast by Pattern interaction [Subject 1, $F(6,30) = 5.49$, $p < .01$; Subject 2, $F(6,30) = 2.87$, $p < .05$; Subject 3, $F(6,30) = 5.48$, $p < .01$]. The nature of the Contrast by Pattern interaction was not consistent over subjects; each subject's response varied uniquely, depending on pattern and contrast ratio.

Discussion

The hypothesis that the brightness of an area which captured attention (figure) would be of greater magnitude than an area which did not (ground) received no support; results showed that an area experimentally known to be responded to as ground could be perceived reliably as brighter. While threshold data did vary with mode of perception, it did so in an inconsistent and unsystematic manner. The results cannot be explained by the attention

Table 1
The 50% PSE (in Millilamberts) to a White Area of Standard Brightness (.133 mL) and Varying Configuration

Contrast Ratio (%)	Pattern		
	1	33	60
Subject 1			
31.8	.107	.130	.135
45.9	.139	.082	.115
68.9	.140	.129	.140
88.2	.131	.133	.136
Mean	.129	.118	.132
Subject 2			
31.8	.139	.133	.133
45.9	.144	.129	.126
68.9	.128	.121	.112
88.2	.132	.121	.144
Mean	.136	.126	.129
Subject 3			
31.8	.141	.117	.098
45.9	.125	.142	.164
68.9	.162	.103	.094
88.2	.138	.143	.134
Mean	.142	.126	.122

model of brightness contrast (Festinger et al., 1970). While the method of constant stimuli did in fact require the subject to attend to the white area of each pattern, the separate attentional and retinal factors (Brussell & Festinger, 1973; Brussell, 1973) should be working in the same direction in pattern No. 60, where white is figure, and in opposite directions in pattern No. 1, where white is ground. The attentional model would predict that the white area of No. 60 would be perceived as brighter than that of No. 1; the results do not support this prediction.

The effects of contrast ratio, as seen in Table 1 and verified by the analysis of variance, showed that changes in the perceived brightness of the white area did not occur independently of the luminance level of the gray area. The attentional model makes no provision for this result.

As can be seen in Figure 1, in addition to figure-ground response probabilities varying over the three patterns, the amount of area seen as figure or ground changes. The results of Fry and Robertson (1935) and Brussell (1973), in conjunction with those of this study give rise to the possibility that the effects were due to relative size itself.

EXPERIMENT II

The second experiment was designed to investigate the effects of relative area on brightness contrast for patterns with known figure-ground relationships. In figure-ground organization, a smaller area is generally responded to as figure (Goldhamer, 1934; Graham, 1929; Oyama, 1960; Wever, 1927); this relationship holds for the patterns used in Experiment I. Therefore, it is generally assumed that the focus of attention will shift to the smaller of two areas comprising a visual stimulus. This assumption is used by Brussell (1973) to explain the U-shaped relations he found between brightness and spot size: as the area of a spot increases, its impact on the luminance of a surrounding annulus increases as long as the spot is the focus of attention; once the area of the spot becomes greater than that of the annulus, the annulus captures attention and the impact of the spot decreases with continued increases in spot size. A corollary of this hypothesis is that the greatest impact will occur when the two areas are equal; the impact of the area under attention has increased to its maximum and the unattended area does not yet attract attention since it is not smaller.

It is not always the case that the smaller of two areas will be responded to as figure. Catano (1972) verified this assumption in general for metric patterns, but he also found that there were individual differences between patterns with corresponding physical dimensions such that a smaller area could be responded to as ground. This second study sought to

make use of these experimental differences to provide a set of patterns over which relative area changed but figure-ground response probability was constant. This set of patterns would provide a control for the effects of area itself when compared to a set of patterns where figure-ground response probability was confounded with area.

Method

Stimuli. Two sets of stimuli, each consisting of five gray-white, random metric patterns were formed from those used by Catano (1972). The number of gray cells in each 36-cell pattern was 6, 12, 18, 24, or 30, with one pattern in each of the two sets at each of these relationships. These five areal relationships will be designated Patterns A, B, C, D, and E, respectively. Set I consisted of patterns for which figure-ground responses were known to vary with change in areal relationships. Set II consisted of patterns for which figure-ground responses remained relatively constant with change in area. With respect to the number of gray cells given above the percentage of "gray figure-white ground" responses for Set I were 82%, 65%, 52%, 36%, and 16%, while for Set II they were 46%, 51%, 52%, 51%, and 39%. While the response rates for Patterns A and E of Set II were lower than the other three patterns, they most nearly approximated the 50% response rate for patterns at those areal relationships that were investigated. Only Pattern C was common to both sets; Set I included Patterns 1 and 60 of Figure 1. Each pattern was produced at the four contrast ratios given in Experiment I.

Subjects. Forty undergraduate volunteers, 21 females and 19 males, from the introductory psychology course at Saint Mary's University served as subjects.

Apparatus. An Iconix tachistoscope, Model 6137-3, was programmed to operate as in Experiment I through an Iconix timebase, Model 6255, and preset controller, Model 6010. Each pattern was centered and projected onto a translucent screen which replaced one exposure field.

Procedure. Subjects were assigned randomly in an equal number to either Group I or Group II. Subjects in Group I were presented with patterns from Set I, and Group II, Set II. Subjects were required to judge the brightness of the white or gray areas of the patterns through the method of free modulus magnitude estimation.

Each subject was presented with 20 patterns, 5 patterns at each of the four contrast ratios; two brightness estimates each were made for the gray and white areas of a pattern, a total of 80 observations per subject. The brightness estimates were counterbalanced over gray and white according to an ABBA design, with one-half of the estimates first being given to white. The order of pattern presentation was randomized over subjects.

The duration of each pattern presentation was 600 msec, with an interval of 9 sec between pattern presentations. Subjects were instructed to respond verbally immediately after viewing a pattern.

Results

Regression lines were fitted between the average log magnitude estimate and the log probability of a "gray figure-white ground" response for Set I at each contrast ratio. The patterns of Set II were treated as though each had a response probability identical to a pattern in Set I of equal areal relationship. For Set II, regression lines were fitted between the average log magnitude estimate and the "yoked" log probability of "gray figure-white ground" responses. The slopes, intercepts, and correlation coefficients for these regression lines are presented in Table 2. Significant

Table 2

Characteristics of Regression Lines Fitted to Magnitude Estimates of White and Gray Area Brightness at Each Level of Contrast Ratio

Contrast Ratio (%)	White Estimates						Black Estimates					
	Set I			Set II			Set I			Set II		
	Slope	Intercept	r	Slope	Intercept	r	Slope	Intercept	r	Slope	Intercept	r
31.8	-.04	.14	.11	.21	.09	.86	-.27	.84	-.43	.42	.16	.96†
45.9	.28	-.09	.95**	.22	.30	.81	-.02	.53	-.07	-.02	.80	-.07
68.9	.23	.10	.88*	.02	.74	.67	-.07	.82	-.51	-.10	1.05	-.40
88.2	-.01	.58	-.15	-.02	1.31	-.15	-.22	1.12	-.83	-.14	1.15	-.79

* $p < .05$ ** $p < .02$ † $p < .01$

nonzero slopes were obtained for estimates of the white areas of Set I patterns at the 68.9% contrast ratio ($t = 3.20$, $df = 3$, $p < .05$) and at the 45.9% contrast ratio ($t = 5.21$, $df = 3$, $p < .02$); for Set II patterns, a nonzero slope was found for estimates of gray area at 31.8% contrast ratio ($t = 6.12$, $df = 3$, $p < .01$). The direction of the significant nonzero slopes was the same in all cases: for Set I, the brightness estimates of the white area increased as the probability of the white area being responded to as ground increased; for Set II, the brightness estimates of the black area increased as if the probability of the black area being responded to as figure increased.

Figure 2 presents the log magnitude estimates for the gray and white judgments averaged over the four contrast ratios at each areal relationship. The higher the scale value, the brighter the area under judgment appeared. An inspection of this graph reveals that magnitude estimates of Set I and Set II patterns resulted in similar, inverted U-shaped curves. Magnitude estimates of the white areas show that brightness increased with increasing amounts of white area but then decreased with continued increases in the amount of white area. For Set I, the figure-ground patterns, the maximum brightness occurred when the white area comprised 67% of the total, in Set II the maximum occurred at 50%; however, the frequency distributions of maximum brightness estimates for these two sets did not differ significantly (Kolmogorov-Smirnoff: $K_d = 4$, $n = 20$, $p > .05$, two-tailed). Since the greatest amount of contrast should have occurred when both areas were of equal amount, comparisons were made between each subject's magnitude estimates of Pattern C, where gray-white area is equal, and those of Pattern A, where white is maximum, and Pattern E, where white is minimum through Wilcoxon signed rank tests. Group I judged the white area of Pattern C to be significantly brighter than that of Pattern A ($T = 48$, $n = 20$, $p < .05$, two-tailed) but not of Pattern E ($T = 81$, $n = 20$, $p > .05$, two-tailed). Group II judged the white area of Pattern C to be significantly brighter than that of Pattern A ($T = 50$, $n = 20$, $p < .05$, two-tailed) and also of Pattern E ($T = 5$, $n = 20$, $p < .01$, two-tailed).

Magnitude estimates for the brightness of the gray areas resulted in relationships very similar to those for the white judgments. Magnitude estimates of the gray areas show that brightness increased with increasing amounts of gray area but then decreased with continued increases in the amount of gray area. For Set I, the maximum brightness occurred when gray comprised 67% of the total area, and for Set II it occurred at 50%; however, the frequency distributions of maximum brightness estimates did not differ significantly (Kolmogorov-Smirnoff: $K_d = 5$, $n = 20$, $p > .05$, two-tailed). Wilcoxon signed-ranks tests were used to compare the magnitude estimates of the gray area of Pattern C, where gray and white areas were equal, to Pattern A, where gray area was a minimum, and to Pattern E, where gray area was a maximum. Group I judged the

Figure 2. Log magnitude estimates averaged over contrast ratios as a function of pattern areal relationships.

gray of Pattern C to be significantly brighter than that of Pattern A ($T = 3$, $n = 20$, $p < .01$, two-tailed) but not of Pattern E ($T = 61$, $n = 20$, $p > .05$, two-tailed). Group II judged Pattern C to be significantly brighter than Pattern A ($T = 29.5$, $n = 20$, $p < .01$, two-tailed) and also of Pattern E ($T = 18$, $n = 20$, $p < .01$, two-tailed).

The 20 patterns in each set were rank ordered with respect to average luminance. The average magnitude estimate was obtained for each pattern for both gray and white estimates. The estimates were rank ordered and correlated with average pattern luminance. Spearman rank correlation coefficients were significant for Set II for white area magnitude estimates ($\rho = 0.52$, $df = 18$, $p < .02$) and also for gray area estimates ($\rho = 0.67$, $df = 18$, $p < .01$). For Set I, the correlation was significant for estimates of gray area ($\rho = 0.69$, $df = 18$, $p < .01$) but not for estimates of the white area ($\rho = 0.39$, $df = 18$, $p > .05$).

Discussion

The results of Experiment II confirm Brussell's (1973) finding concerning the role of relative area in brightness contrast; however, his explanation, based on the attentional model of Festinger et al. (1970), was not supported. In Figure 2, it is evident that the greatest amount of contrast occurs as the gray and white areas approach equality, with the least amount of contrast when one area dominates the other. Brussell found this result, using a spot and annulus rather than metric patterns, consistently under dichoptic viewing conditions, while in Experiment II normal viewing occurred. Brussell's assumption that a change in focus of attention occurred with change in relative area was not supported; the same type of brightness relationships were found for Group I and Group II. Set I and Set II patterns had identical gray-white areal relationships but different figure-ground response probabilities. For Group II, the probability that either the white or gray area would capture the subject's attention was relatively constant at 50% and unrelated to the size of the gray and white areas; the drop in contrast that occurred when one area was at a minimum, Patterns A and E, cannot be attributed to the smaller area being seen as figure and causing a change in focus of attention. More appropriately, it appears that relative area, itself, is involved in brightness contrast.

The results of Experiment II further support the findings of Experiment I; Table 2 shows that an attentional variable, the perceived figure-ground relationship, does not affect brightness judgments in a constant manner for identical patterns which have different levels of contrast between the figure and ground areas. The effect of the attentional variable is dependent of that level of contrast. The attentional

effect found in Experiment II was similar to that of Experiment I; brightness estimates of a white area increased as the probability of that white area being seen as ground with respect to a gray background increased. This result is in contradiction to that of Coren (1969); Brussell (1973), however, did find under binocular viewing that a white spot surrounded by a gray annulus became lighter with increases in the diameter of the spot. Since the effect did occur over Set I patterns, it could be argued that the increase in brightness was due to figure-ground organization; however, the occurrence of brightness increases to the gray area found at the 31.8% contrast ratio for Set II patterns, where figure-ground relationship was constant, suggests that the composition of the pattern, the relative area, and the contrast relationship between the pattern elements should be considered as influences of brightness contrast.

Festinger et al. (1970) proposed that absolute brightness levels were arrived at by averaging over the entire visual field with those areas to which an observer attended being overweighted. The significant rank-order correlations found between the average brightness estimates and average pattern luminance suggests that an averaging process occurred: the estimates of the gray or white area were influenced by the nonestimated area. Whether an attended area overweights the average is uncertain. Similar significant correlations were found for gray estimates for Set I and Set II, where figure-ground response probabilities differed; the attentional model does not indicate whether the same absolute brightness level should be obtained for patterns of equal luminance but different attentional characteristics. It should also be noted that the only nonsignificant correlation occurred for the condition where there were strong figure-ground influences.

GENERAL DISCUSSION

The results presented in the above experiments suggest that Festinger et al.'s (1970) model of processing information in the visual system be modified.

The role of attention might be more useful if looked upon instead as a preattentive process (Neisser, 1967) which segregates the visual stimulus into areas related through a common characteristic, e.g., grayness or whiteness. Whether an area is responded to as figure or ground, or is likely to capture attention, is irrelevant. The brightness of each area would be integrated separately and the absolute brightness would be an average of area brightness normally weighted by relative area. In view of Baker and Loeb's (1973) recent finding that for two-dimensional black-white forms the number of changes in eye fixations represented individual differences and that

location of the fixations were related to position preferences and the configuration of the form, duration of the integrating process might also be an appropriate weighting factor.

While the visual system may interpolate between contours and assume uniformity of stimulation between boundaries, it is wrong to assume that little or no information is transmitted about steady state areas; the contrast ratio effects found in this study suggest otherwise. Brussell (1973) minimized the involvement of lateral inhibition through dichoptic viewing and obtained results which were very similar to those found in Experiment II under normal viewing conditions. Since Brussell's results may be specific only to the contrast ratio he used, it would be premature to discard lateral inhibition as the primary influence of brightness contrast.

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NOTES

1. Contrast ratio = $(1 - I_f/I)100$, where I_f is the intensity of the darker area; I , the whiter (Luckiesh, 1944, p. 108).
2. The complete sets of patterns used in Experiment II may be obtained upon request from the author.

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