



**Abstract**

Symmetry has long been considered a configurational cue, but we failed to find evidence for this claim in previous experiments using brief exposures. In our displays, symmetric regions with rectilinear stepped contours alternated with same-area asymmetric regions with the same contour type. Similar results were obtained with curved contour displays. In the present experiments, we examined whether our previous results reflect the failure of the weak cue of symmetry to dominate perception of highly regular displays within a brief exposure. In Experiments 1 & 2 we reduced the regularity of displays with rectilinear edges by adding one curved edge; this allowed bilateral symmetry to determine perception on more than 60% of the trials. In Experiment 3 we investigated whether these effects were due to bilateral symmetry, as we supposed, by replacing the symmetric regions with asymmetric regions. Subjects were no more likely to report seeing the asymmetric region as figure than would be expected on the basis of chance alone. In Exp. 4, we examined perception of the highly regular displays under longer display durations. We found that in highly regular displays, symmetric regions could be seen as figure more often than expected on the basis of chance if displays were exposed for 380 ms. Thus, the strength of the configurational cue of bilateral symmetry varies with both the display characteristics, which affect the number of interpretations that might compete prior to perception, and the exposure duration, and therefore whether the competition has been resolved when a response is required.

**Background**

Bilateral symmetry is known a Gestalt configurational cue. Yet, in briefly exposed (100 ms.) displays, observers were no more likely to report a bilaterally symmetric region as figure than its adjacent asymmetric region (Kim & Peterson, 2003).



% symmetric regions = figure 52 (s.e. = 1)      52 (s.e. = 1)

**Why was symmetry ineffective in 100 ms exposures?**

Symmetry is a weak configurational cue (Kaniza & Gerbino, 1976; Pomerantz & Kubovy, 1986). Before the figure is perceived, a number of interpretations may compete. Symmetry may be too weak to win the competition within 100 ms.

**Potential competing interpretations?**

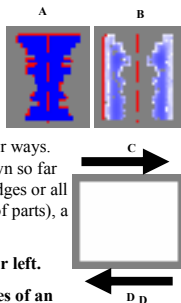
**A. Symmetric shape**

**B. Two shapes whose edges are reflectively symmetric around the space between them.**

The edges may group together in a variety of other ways. Given that the edges in the displays we have shown so far all have the same properties (e.g., all rectilinear edges or all curvilinear edges with approx. the same number of parts), a variety of other regularities are possible, such as:

**C & D. Three overlapping surfaces facing right or left.**

**E. The two leftmost edges group as the boundaries of an asymmetric shape; the rightward boundary forms the visible border of a similar asymmetric shape, etc.**



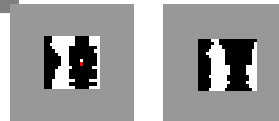
**Hypothesis**

If we reduce the regularity of the displays, the number of competing interpretations may be reduced. With less competition, the weak cue of symmetry may win the competition within 100 ms.

**Experiment**

**To test the competing interpretations hypothesis**

**Experimental displays** with two rectilinear edges and one curved edge



Exp. (n = 60)      Control (n = 60)

**Control displays** with three rectilinear edges

**Method**

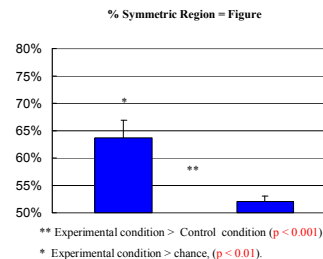
100 ms exposure; contrast & symmetry not confounded

Red probe on one of the two regions closest to fixation.

Observers pressed an "on" or "off" key to indicate whether the probe was located on or off the figure.

% "on" when probe on symmetric region + % "off" when probe on asymmetric region)

= % symmetric region = figure



**Two Potential Explanations:**

1. The curved edge reduced the number of competing interpretations by reducing the regularity of the displays.
2. Experiment 1 results due to convexity which can operate in 100 ms (Kim & Peterson, 2003). If the convex region was seen as figure, and the region between it and the symmetric region was seen as ground, choices of the symmetric region as figure may reflect the effects of convexity rather than of symmetry.

**Experiment 2**

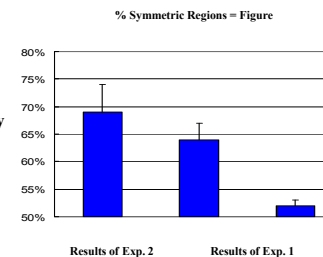
**We reversed the facing direction of the curved edge.**

21 Subjects; 100 ms exposures; 60 displays; on/off task.



**Explanation 1:** the symmetric region should be figure more often than chance.

**Explanation 2:** the symmetric region might be seen as figure less often than chance.



**Discussion**

Reducing the regularity of the displays by introducing a curved edge may have decreased the number of competing interpretations thereby allowing bilateral symmetry to win the competition.

**Question**

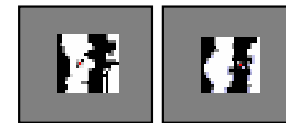
Can we be sure that subjects' figure reports reflect the effectiveness of bilateral symmetry?

Or might subjects simply be more likely to see the region bounded by rectilinear edges as a figure under these conditions?

**Experiment 3**

**We replaced the bilaterally symmetric region with an asymmetric region.**

Tested both curved edge conditions with different groups of subjects (N = 42).



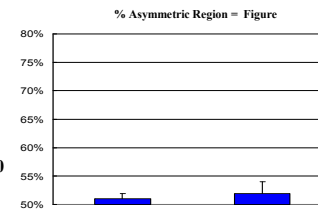
100 ms exposure; 60 displays; on/off task

**Results**

Chance reports of asymmetric region as figure.

**Discussion**

Expts. 1, 2, & 3 show that the weak cue of symmetry can dominate in 100 ms if the regularity of the displays is reduced.



**Experiment 4**

**Given more time, can symmetry dominate in displays with a high degree of regularity?**

60 displays with three rectilinear stepped edges; color not confounded with symmetry; On/off task.



Exposure conditions grouped (100 ms; 250 ms; or 380 ms) Mask: 530 ms

**Results & Discussion**

250 ms was not long enough for the symmetric region to be reliably seen as figure in highly regular displays.

380 ms was sufficient: The symmetric region was reported to be figure more often than expected by chance (p < 0.01).

Thus, symmetry can dominate in highly regular displays if more time is allowed to resolve the competition.

**General Discussion**

The strength of the configurational cue of bilateral symmetry varies with both

- the display characteristics, and therefore the number of competing interpretations for the display, and
- the exposure duration, and therefore whether the competition has been resolved when a response is required.

**References**

Kanizsa, G., & Gelman, W. (1976). Convexity and asymmetry in figure-ground organization. In M. Hesse (Ed.), *Vision and artifact*. New York: Springer Publishing Co. Keirker Kim, J. H., & Peterson, M. A. (2003, November). *Long range interactions among local competitors for figural status* (OPAM, Vancouver, B.C.)  
Pomerantz, J. R., & Kubovy, M. (1986). Theoretical approaches to perceptual organization. In Boff, K. R., Kaufman, L., and Thomas, J. P., editors, *Handbook of Perception and Human Performance*, pp 36-1 - 36-46. Wiley, NY.