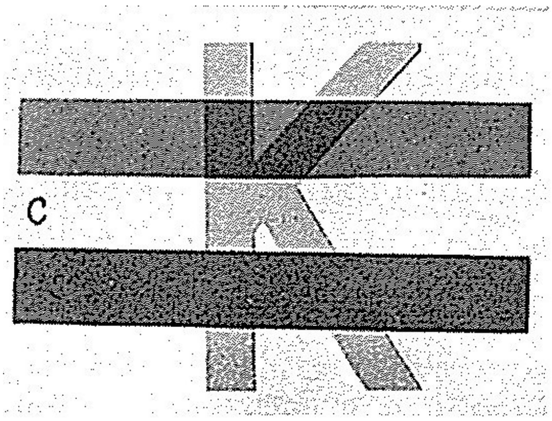


Figure 130c

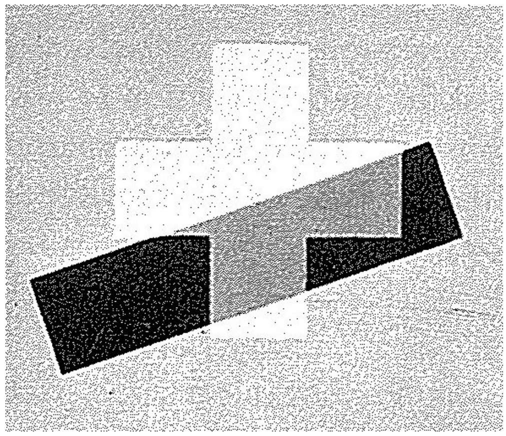


Figure131a

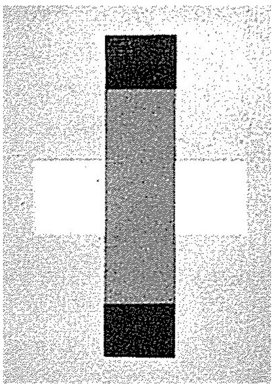


Figure131b

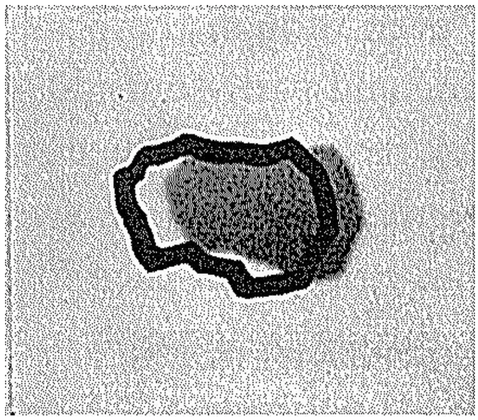


Figure132b

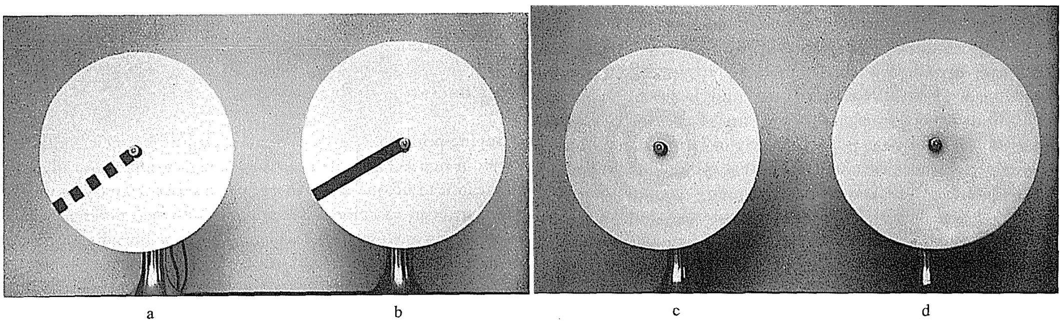


Figure133a Figure133b Figure133c Figure133d

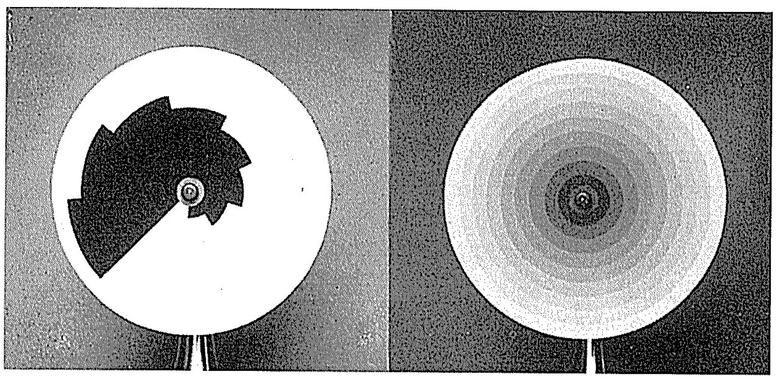


Figure136

Wolfgang Metzger: Laws of Seeing

Chapter 8. Form and substance of seen things—the Praegnanz tendency

Speakers: Yu Shu Liang (DongDong)
Chia Wei Lui (Bingo), December 1, 2009

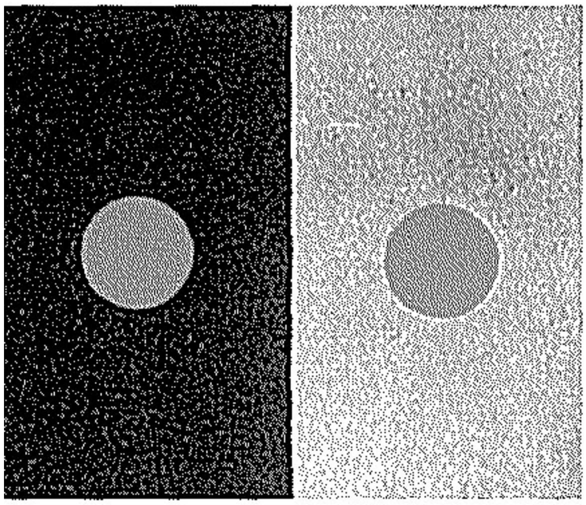
This chapter discusses the *Praegnanz* principle, which implies that a perceived figure looks more regular, more symmetrical, more unified, and better balanced than warranted by the stimulus.

The first example is apparent transparency. Figure 130c shows the letter "K" covered by two horizontal stripes. The upper one is semitransparent, the lower one opaque. Yet, Figure 131a demonstrates that an opaque (mid-grey) stripe overlying a (white) cross can also look transparent, provided it is darker than the (light-grey) background, which in turn is darker than the occluded figure (see Metelli's article in *Scientific American*). The decomposition of an inhomogeneous surface into two layers (white behind black or black behind white) is called *scission* and renders the overlying stripe more uniform (Gestalt factor of *similarity*). In Figure 131b, the vertical stripe looks opaque, but will change to semitransparent, when the dark gray sections above and below the intersection are transformed to black. The question was raised, why we see transparency if, in fact, the occluding object is nontransparent. Could Mother Nature have endowed us with this ability so that disrupted parts that belong together are also seen together?

Decomposition into two layers would also be required when we need to distinguish between a dirt spot, such as caused by a dark stain, and a deep shadow cast by a spot light. This distinction is not trivial and requires that the surface be moved. If the spot moves along, it is a stain; if not, it is a shadow (Figure 132b).

Another example demonstrating the Gestalt factor of *similarity* in surface perception is shown in Figure 133. When disk (a) with a radius of individual black squares is rotated at high speed, grey rings are seen that become progressively lighter to the edge (c). In comparison, when disk (b) is rotated, it appears perfectly uniform (d), although the black continuous bar should also produce a brightness gradient. According to Metzger, the disk owes its apparent uniformity to the absence of borders, which favors the tendency to a more *unified Gestalt* and brightness assimilation.

An increase in brightness with distance from the center is indeed seen in Figure 136, where each ring not only looks brighter than the previous one, but also slightly brighter on the inside and darker on the outside. This is a *border contrast* effect and is known as *Mach bands,* after the Austrian physicist and philosopher Ernst Mach. The bands can be explained by lateral inhibition (see Werner & Spillmann**:** Floyd Ratliff**:**



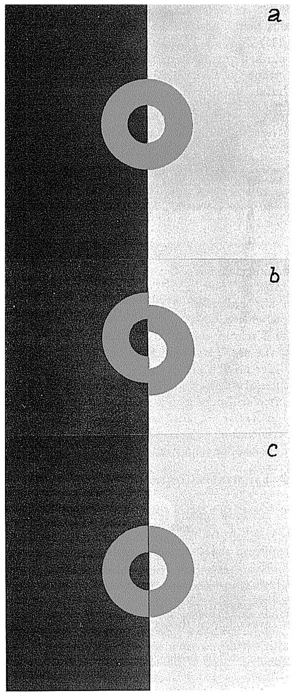


Figure134

Figure135

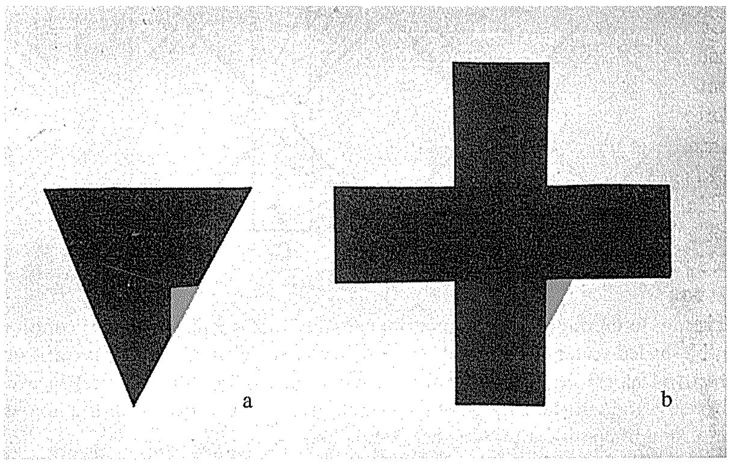


Figure137a

Figure137b

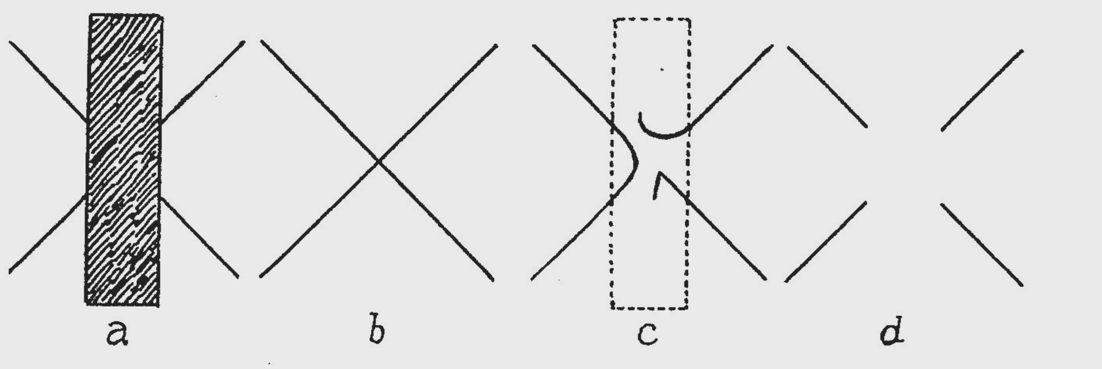


Figure 138

The neural foundations of perception. In: Kimble, G. and Wertheimer, M. (Eds.): Portraits of Pioneers in Psychology). It is reminiscent of Marr's *primal sketch* of a scene by edge extraction and Grossberg's *boundary contour system*. Edge enhancement helps us to better differentiate between subtle shades of grey, but is lacking surfaces. Its biological significance is evident from the fact that it has been shown in animals as low as the horse-shoe crab.

Figures 134 and 135, demonstrating simultaneous contrast on a bipartite field and Koffka's ring, were already demonstrated and discussed in the last class.

Simultaneous contrast depends not only on a luminance step, but also on the figural context. A classical example is *Benary's cross*. The small triangle in Figure 137 looks brighter, when it is part of a larger triangle (a), and darker, when it is an accidental appendage of a cross (b). This difference may be interpreted in terms of *belongingness*. However, should one not expect assimilation, rather than contrast? The effect of context on perceived brightness has been beautifully demonstrated by Ted Adelson in his snake and corrugated plaid illusions. See also White's illusion and the Craik-O'Brien- Cornsweet Effect in Michael Bach's collection of visual illusions.

If a figure is occluded by a vertical bar, we perceptually complete the missing part according to the Gestalt factor of *good continuation*. This is illustrated in Figure 138. Although the center of the cross is distorted or missing (c, d), we nevertheless perceive the figure as complete (b). Experience plays a role, but so do alignment and *good continuation*. Most objects in our world are partially occluded. Yet, we "see" the occluded parts *amodally* as *invisibly present*. Or would we attribute the upper and lower halves of each person in the photograph below to different people? Experience, of course, contributes here. (Test with a zigzagging occluding strip)

Torso and legs – one person?

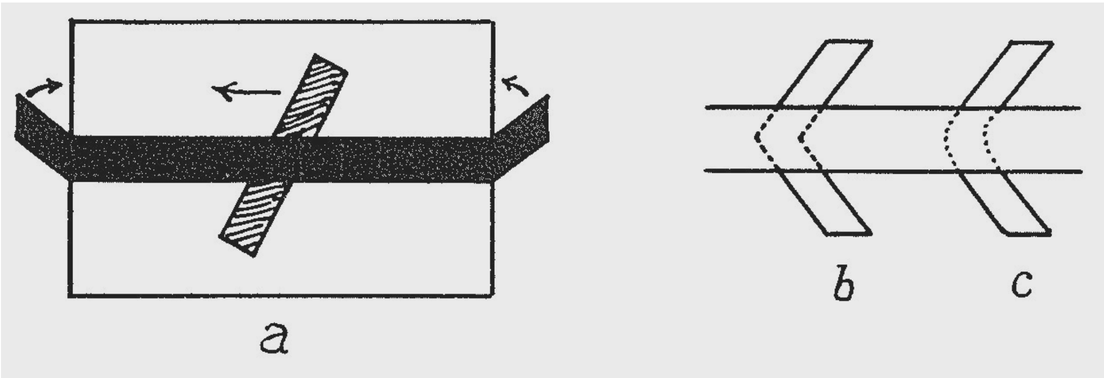


Figure 141

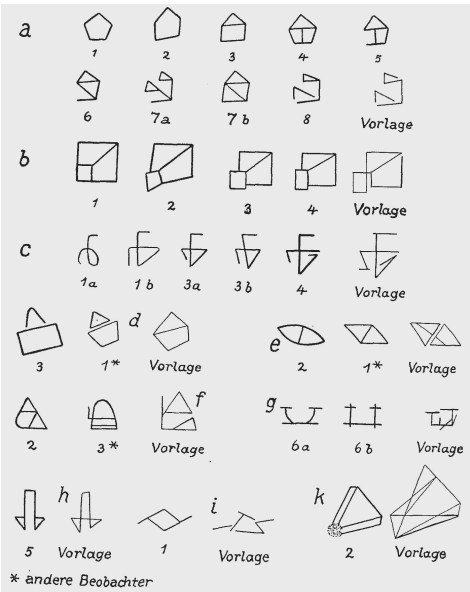


Figure 142

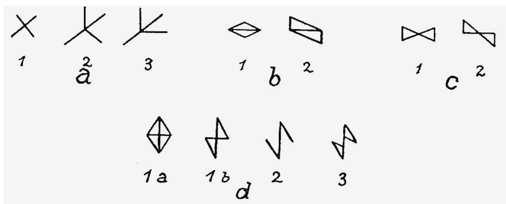
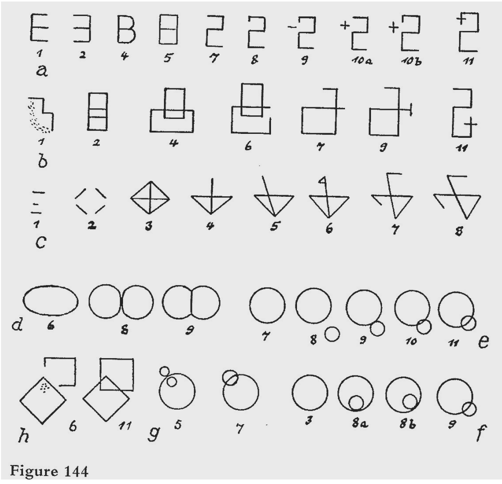


Figure 143

Figure142

Figure143



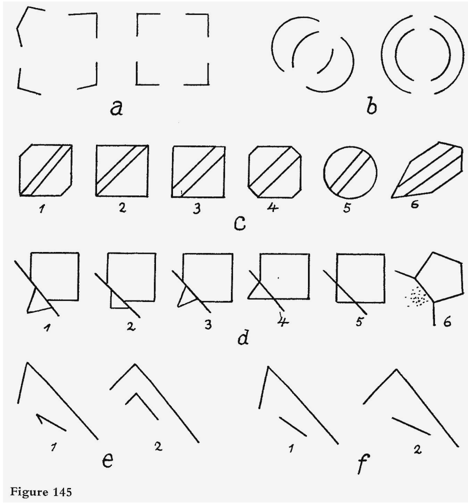


Figure144 Figure145

Figural completion across a gap was demonstrated in Figure 141 under dynamic conditions. When an occluded yellow bar was moved behind a black horizontal stripe, a yellow ghost image or *phantom* could faintly be seen connecting the upper and lower sections. There are limits, of course, when the two sections become perceptually “unrelatable”. (Try it by widening the gap or deviating from collinearity.) A tendency towards a better Gestalt is apparent in Figure 141 (right), where the arrow head will be seen as round, even if we know that is pointed. Phantom motion has first been described by Bob Sekuler and Naomi Weisstein.

Up to now, the various Gestalt factors have been demonstrated in the fully differentiated percept. How about the power of the *Praegnanz* principle on a percept during its emergence from the undifferentiated early stages (*microgenesis*)? Such observations require great patience and are very difficult to do. To find out, three unfavorable viewing conditions were used (Figures 142-144): smallest stimuli, low-contrast stimuli, and peripheral stimuli. Under all these conditions, the perceived Gestalten appeared simplified in accordance with the factors of *closure* and *symmetry*. They are therefore called *Vorgestalten* or *pre-Gestalten*. The same tendency can be observed in touch (Figure 145), when embroidered figures are probed with a finger (as in Braille). Tactile perception has been regarded as a primitive stage of vision.

Figures perceived under degraded viewing conditions are generally more regular and better balanced than the stimuli by which they are elicited (see the various examples on pp. 139-141). This tendency testifies to the *Praegnanz principle* (see above). In order for these stimuli to be seen veridically, they need to be made larger, presented at higher contrast, and shown closer to the fovea. Here, we discussed the point- and line-spread functions (PSF) as limiting cases of spatial resolution on the retina. No matter, how small the visual angle of an object, i.e., a star at a great distance; if its PSF is sufficiently high to exceed the contrast threshold, it will be seen. A poor PSF is the reason for low visual acuity in cataract patients.

A remarkable contrast illusion by Wim van de Grind was shown. It consists of a rotating windmill with grey blades on a yellow background. With fixation in the center, we first observed purple color at the leading and outer edge of each blade, gradually filling in the entire blade. The complementary color took at least 5 seconds to reach maximum, longer than any other color induction phenomenon known to us.

We are planning to measure the time for maximum induction of the induced color in our next class. Please bring your stop watch along. Also, be prepared for an experiment on variants of Kitaoka's rotating snakes, using magnitude estimation.

Thank you, DongDong, for the four beautiful animations and the photograph showing apparent completion across the three persons split in half by a white occluder. Thank you also, Mei-Chen, for inquiring with Prof. Westheimer about the spider web.

Ehrenstein illusion (DongDong and Bingo)

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