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Gestalt Perception

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Gestalt perception addresses the question of how a visual input is transformed into percepts. A major tenet of the Gestalt approach is, “The whole is different from the sum of its parts.” An early illustration was *apparent motion*, whereby an object that is located on the left in one frame of a movie and on the right in the next frame can be perceived to move from left to right without moving through intermediate positions; that is, motion is perceived where there is no stimulation. Another early example is that the same melody is perceived when played in different keys; thus, whole melodies transcend their components. A second major tenet of the Gestalt approach is that sensory stimulation is organized by factors that serve to *group* some points of stimulation and *segregate* others early in perception before memories are activated. The Gestalt view was revolutionary at the turn of the 20th century. Although Gestalt ideas can be applied to input from all senses, much of the research has focused on vision.

History

The Gestalt view ([Koffka, 1935](#); [Köhler, 1940](#); [Wertheimer, 1923/1938](#)) was a reaction against structuralism that prevailed at the beginning of the 20th century and held that independent points of retinal stimulation are assembled into representations of objects by matching stored representations of previously seen objects in memory [see [Visual Memory](#)]. The Gestaltists argued that identifying the correct memory match for the myriad points of retinal stimulation would be difficult and unrealistically time consuming and that novel objects can be readily perceived despite not having a match to previously seen objects.

The Gestalt view is that retinal input is organized into larger units before object memories are accessed; in other words, perception occurs in stages. *Perceptual organization* is accomplished through innate responsiveness to a set of factors that are readily available in the input. The factors are of two types: *grouping* and *segregation* factors. Grouping factors cause portions of the stimulation to cohere (see [Figure 1](#)). Segregation factors cause abutting regions in the input to differentiate into shaped entities (figures) and locally shapeless backgrounds.

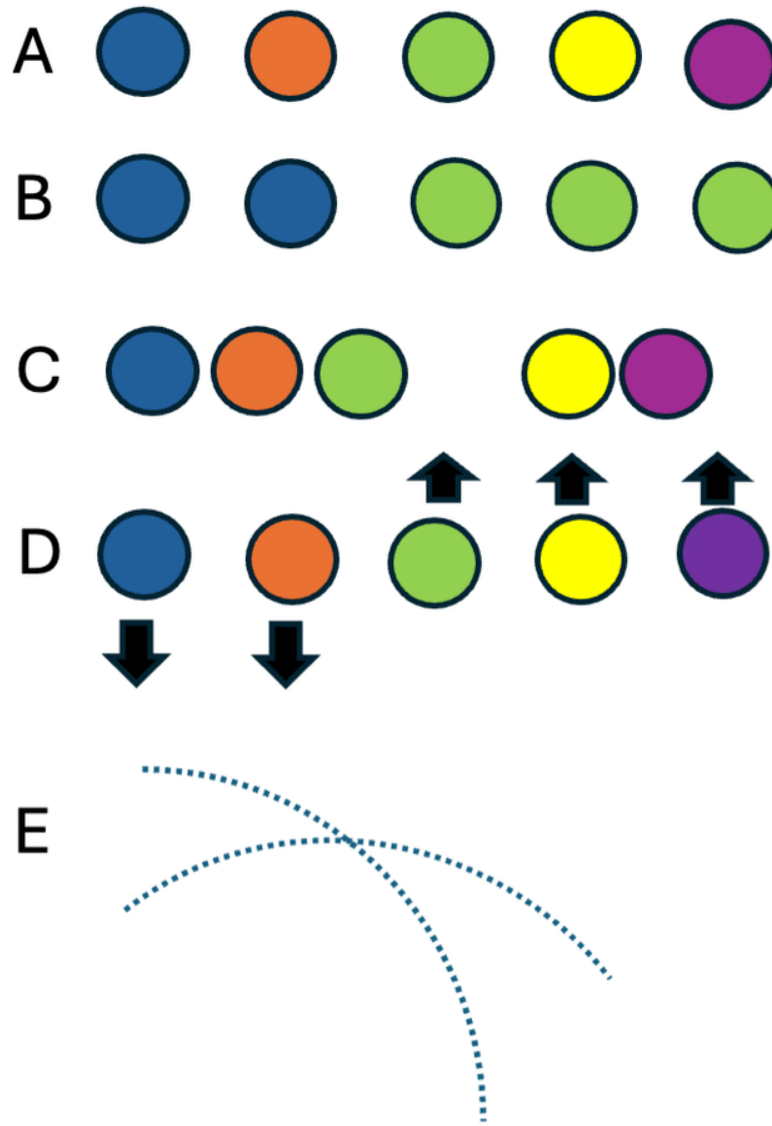


Figure 1

(A) Five equally spaced dots of different colors in a row. (B) The first two dots from the left are the same color (blue), and the next three dots are a different color (green); hence, even though the spacing between the dots is the same as in line A, two subunits are grouped by similarity of color.

(C) The first three dots and the last two dots are closer to each other than in line A, and a larger space separates the third and fourth dots; hence, even though the colors are the same as in line A, two subunits are grouped by proximity.

(D) The arrows imply direction of motion; hence, even though the dot colors and spacing are the same as in line A, the first and second dots are grouped because they move along a common path—they have a common fate—and the third, fourth, and fifth dots are grouped because they move along a different common path—have a different common fate. (E) The small dots are grouped into two intersecting curved lines by good continuation, the tendency to perceive smoothly curving rather than abruptly changing paths.

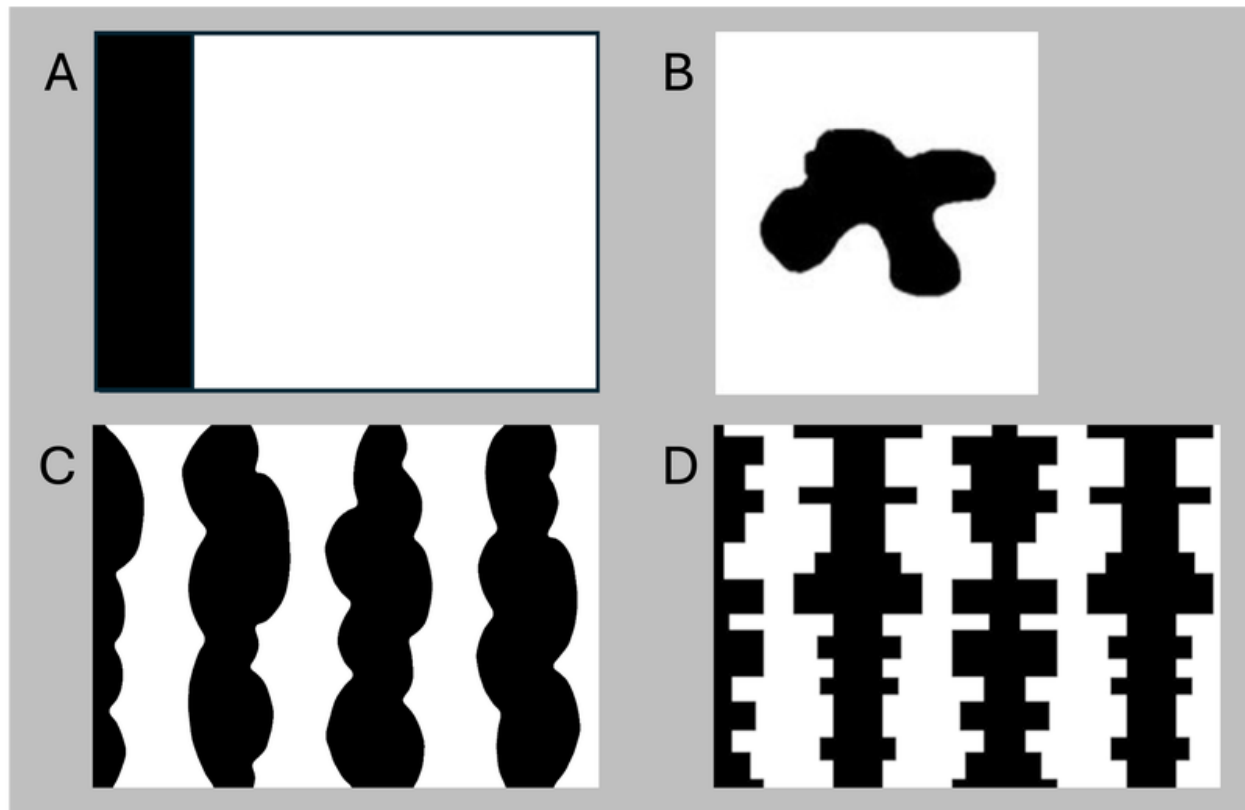


Figure 2

(A-D) The black regions tend to be perceived as figures and the white regions as grounds. The segregation factors illustrated are (A) small area, (B) enclosure, (C) convexity, and (D) symmetry. The larger area and surrounding, concave, and asymmetric white regions, respectively, abutting the black regions tend to be perceived as locally shapeless grounds to the black figures.

Gestalt psychologists showed that a large majority of observers (albeit not all) who viewed displays like those in [Figure 1](#) and [Figure 2](#) reported perceiving them in accordance with grouping and segregation factors, later called laws of organization or simply cues. Such reports were taken as strong evidence that these factors were sufficient for perceptual organization and, hence, that memory does not play a role. Other image-based grouping and segregation principles have been identified since, including the grouping factors of *synchrony* (items that change state simultaneously are grouped even if they change into different states), *element connectedness* (connected elements are grouped), and *common region* (elements enclosed within a larger region are grouped) and the segregation factors of *lower region* (the lower of two vertically oriented regions sharing a border is likely to be perceived as the figure) and *top-bottom polarity* (regions that are wider at the bottom than at the top are more likely to be perceived as figures than regions that are wider at the top than the bottom (for review, see [Wagemans et al., 2012](#)).

Another important Gestalt principle is that of *Prägnanz*, which holds that the resultant percept is the best, or the simplest, that might be seen. This is particularly true when grouping and segregation factors are in opposition.

Core concepts

The central concept of Gestalt perception—that the whole is different from the sum of its parts—was transformative and opened the field to go beyond responses to local elements to consider the roles of context and global factors. A compelling example is *subjective contour stimuli* (which are *illusions*; [Kanizsa, 1979](#); [Figure 3](#)). Subjective contour stimuli are also an excellent example of *Prägnanz*.

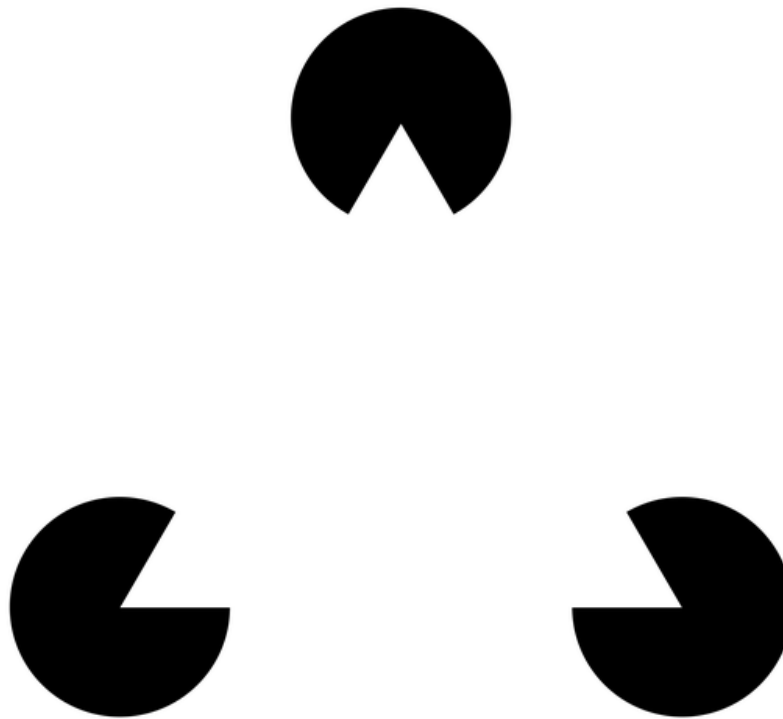


Figure 3

A subjective contour triangle. The three black shapes taken independently do not depict a triangle.

Nor do they depict full disks; they depict incomplete disks. However, a white triangle occluding three black disks is perceived when the whole array is presented simultaneously. The triangle and its contours are “subjective”; they are generated by the perceiver. This is compelling evidence that the whole percept is different from what can be predicted by simply summing the parts.

Perceptual organization, with its emphasis on grouping and segregation, is another core concept of Gestalt perception. The focus on figure–ground perception made clear that the region abutting the contour of an object (i.e., a figure) lacks shape and simply appears to continue behind it, as illustrated by the Rubin vase/face stimulus ([Figure 4](#)). To support the claim that perceptual organization necessarily precedes memory, theorists pointed to the fact that the vase interpretation was perceived only when the central region was perceived as a figure, and face profiles were perceived only when the regions on the left and right sides were perceived as figures. Their claim that perceptual organization necessarily precedes memory was not tested, however (see the section “Questions, controversies, and new developments”).

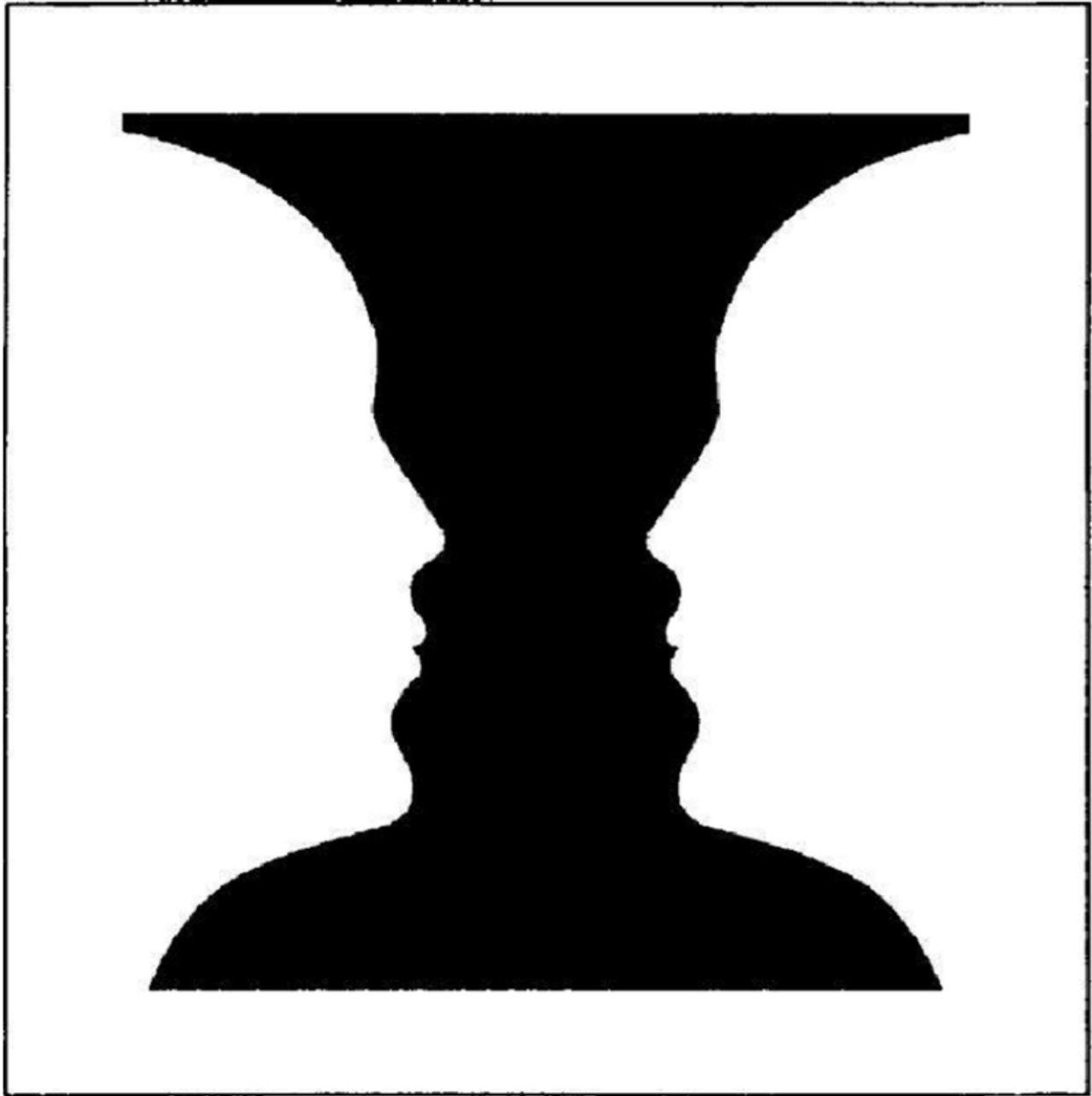


Figure 4

The Rubin stimulus is perceived to depict a vase when the central black region is perceived as a figure. In that case, the white region appears shapeless near the contours of the vase and appears to continue behind the vase. Alternatively, when the white regions at the left and right borders they share with the black region are perceived as figures, they are perceived to depict two face profiles. In that case, the black region appears shapeless near the contours of the profile faces; it appears to continue behind the faces.

Questions, controversies, and new developments

The theoretical pendulum swung away from the wholistic Gestalt view back toward a more atomistic view after the discovery of simple, complex, and hypercomplex cells in vision ([Marr, 1982](#)). Models were published that built line drawings of stimuli using putative responses of those cells (e.g., [Serre et al., 2007](#)). However, these models proved inadequate. Another reason for reduced enthusiasm for Gestalt ideas was that direct reports of what observers perceived were considered insufficiently quantitative. Interest was rekindled when indirect measures replicated the direct reports and provided quantitative measures of grouping and segregation (e.g., [Kubovy & Wagemans, 1995](#); [Palmer & Beck, 2007](#); [Pomerantz et al., 1977](#)).

The Gestaltists did not test whether, in addition to the grouping and segregation cues they identified, memory also played a role in perceptual organization. Instead, memory was ruled out in part because it did not seem efficient or even possible to find a memory that could integrate unconnected points of stimulation. Evidence that memories of previously seen objects serve as grouping and segregation cues accumulated, however (e.g., [Peterson, 2019](#) for review; [Wagemans et al., 2012](#)). This evidence did not require a reversion to structuralism, both because configurations larger than individual object parts mediated these memory effects and because memory was shown to be one of many factors relevant to figure–ground perception, not the dominant factor. Finally, although some still espouse the view that perception occurs in stages, as entailed by the Gestalt view that perceptual organization necessarily precedes access to memories, evidence supporting the claim that dynamical brain activation involving feedforward as well as feedback determines perceptual organization is accumulating (cf. [Peterson, 2025](#)). In fact, the idea that perception is produced by dynamic brain processes was introduced while Gestalt psychology was ascendant ([Köhler, 1940](#)). Then, the idea was far ahead of its time; the methods and vocabulary available were insufficient to convey and test it. Its specific claims were disproved, and the idea fell out of fashion.

Recent research has shown that Gestalt cues are present in natural scenes (e.g., [Burge et al., 2010](#); [Geissler et al., 2001](#)), supporting the view that they are apt for the ecological niche animals occupy on earth ([Palmer, 2003](#)) [see [Scene Perception](#)]. Indeed, the Gestaltists had identified the cues as *autochthonous*, that is, of the locale in which they are expressed. Grouping and segregation cues are now referred to as *priors*—that is, expectations of what will be perceived based on prior experience—and are understood within a *Bayesian framework* in which more than one interpretation of the visual input is considered before the best fitting interpretation is perceived (e.g., [Peterson, 2025](#)) [see [Unconscious Inference](#)].

Broader connections

The theoretical ideas introduced by Gestalt psychologists were dominant into the 21st century but are less central today. After it was clear that previous experience with specific objects was a prior for figures, further research showed that the semantics of those objects was also activated before perceptual organization occurred ([Cacciamani et al., 2014](#); [Sanguinetti et al., 2014](#)). The divide between perception and cognition was breached by this research and by research with brain-damaged individuals (e.g.,

[Barense et al., 2012](#)). The dynamical approach broadens connections further, to research on music and speech perception that unfold over time (e.g., [Stephens et al., 2013](#)). In addition, Gestalt grouping and figure-ground concepts continue to be instrumental in design and advertising.

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