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From ScholarpediaPost-publishing activitiesCurator: Dejan Todorovich Gestalt principles, or gestalt laws, are the rules of the organization of the perception of the scene. When we look at the world, we usually perceive complex scenes consisting of many groups of objects on a certain background, with the objects themselves, consisting of parts that may consist of smaller parts, etc. How can we achieve such a remarkable perception of achievement, given that the visual contribution is, in a sense, simply the spatial distribution of different colored individual points? The beginning and direction of the response were provided by a group of researchers in the early twentieth century, known as gestalt psychologists. Gestalt is a German word meaning form or form. The principles of gestaltate are aimed at formulating patterns according to which perceptive contribution is organized into unitary forms, also called (sub)whole, groups, groups or gestalt (multiple form of gestalt). These principles are mainly applicable to vision, but there are similar aspects in auditory and somatosensic perception. In visual perception, such forms are regions of the field of view, parts of which are perceived as grouped or connected to each other, and are thus separated from the rest of the field of view. The principles of gestaltate were introduced in the founding work of Wertheimer (1923/1938), and were additionally developed by Koehler (1929), Kofka (1935) and Metzger (1936/2006; see todgy review of Todorovich, 2007). For a modern presentation of the textbook, including later contributions, see Palmer (1999). Figure-earth articulation Figure 1: Figure-ground articulation. If the field of view is homogeneous throughout, the situation is marked as Ganzfeld (German for the entire field), he does not have a consistent internal organization. A simple patch of a heterogeneous field is a display with a patch of the same color, surrounded by another color, as in Figure 1. In such cases, the field of view is perceived as formulated in two components, the figure (patch) on the ground (environment). This articulation in the picture may seem obvious, but it is not trivial. This type of field organization has a number of remarkable features, first described in Rubin's work (1915/1921), in the pre-published wertheimer. These two components are perceived as two segments of the field of vision, differing not only in color, but also in some other phenomenal characteristics. The figure has an object-like character, while the earth has less perception of saliency and appears as just a background. Areas of the shape and the earth usually do not seem to be juxtaposed in the general plane, as in the mosaic, but rather stratified in depth: there is a tendency to see the figure as located in front, and the ground at the further depth of the plane and continuing to expand behind the figure, as if closed by it. In addition, the boundary separating the two segments is perceived as belonging to a figure, not to the earth, and as a delineation of the shape of a figure, not its contour, while it is not related to the shape of the earth. Some displays are bi-stable, in that what is perceived as a figure can also be perceived as earth and vice versa. However, on structured displays such as Figure 1, where a smaller region is completely surrounded by a larger region, the first usually appears as a shape (although it can also be seen as a hole) and the second as a land. The described display organization into a shape and ground is not its only conceivable segmentation. To illustrate this, consider that Figure 1, presented on a computer screen, is a set consisting of a certain number of pixels, and that segmentation per shape and ground corresponds to a specific section of that set into two subsets. However, the same set can be divided into a huge number of other pairs of subsets (e.g., a subset of pixels in the left half of the shape and a subset in the right half, or a subset on one side of any arbitrary line wriggling through the display and subset on the other, or a subset consisting of even pixels in odd lines plus odd pixels in even rows and additional subsignms), or in any conceivable three subsms, or four subsms, etc. The section that is actually being considered is not a matter of geometric combinatory and attention to randomly selected subsignms: the natural, and often the only way we can perceive such a display, given the structure of visual input, is both segmented into shape and earth. This articulation, in which the virtual infinity of geometric possibilities is trimmed to one or only a couple of perceptive implementations, is a very basic feature of the visual system. Although perception on the ground is a fundamental aspect of the organization on the ground, it is usually not in itself referred to as the law of the gestaltut or the principle of grouping. Rather, these terms are mainly used to describe the rules of organizing slightly more complex visual fields. There is no definitive list of Gestaltut principles, but some of the most frequently discussed ones are listed and described below, illustrated by examples mainly based on Wertheimer (1923/1938) and Metzger (1936/2006). As these examples show, perception groups are in some cases strong and unambiguous, but in other cases better characterized as trends, especially when different factors compete with each other. Figure 2a's Proximity Principle contains six patches, each of which as a visual unit, a figure on common ground. However, they are also collectively elements of a higher order of visual visual horizontal row. According to gestaltate theory, the integration of individual components of this type into an extraordinary whole can be taken into account by the principle of proximity: elements are generally perceived as aggregated into groups if they are next to each other. Figure 2: The principle of intimacy. The effect of different proximity is illustrated in Figure 2b. Because of the change in distance between some components, here patches are perceived not only collectively as sextut, but also as subdivided into triple doublets, an organization that is designated as 12/34/56 in wertheimer's designation. Note that there are a number of other potential set sections in Figure 2b, such as in figure doublet (1234/56), or in a quartet and pair (1234/56), or even in a combination of non-dried elements. However, it is extremely difficult, if not impossible, to actually perceive groups of patches, except 12/34/56 in this figure. On the other hand, it is not impossible to see some units in Figure 2a. For example, with a focused effort and concentration, you can eventually achieve the mental separation of a number of patches into three pairs. However, such perceptions are usually only partially and locally successful (one clearly sees only one or two segregated pairs), appears far-fetched, and fleeting. In contrast, the perception of the same section in figure 2b is spontaneous and easy, and perception is global and stable. Attention may contribute to the perception of shapes, but, except in special cases, its role is usually limited: as a rule, it is not the attention that creates forms, but forms organized in accordance with the principles of gestaltit, which attract attention. With a different spatial distribution of six components, such as 2c, another naturally perceived section per subsections is identified as 12/34/5/6. Section 12/34/5/6, although perhaps simpler and more regular, is difficult to perceive in figure 2c: this would violate the principle of proximity, as it would involve grouping some elements at relatively long distances, but assigning others, relatively close elements, to different groups. The general principle of destiny is that elements are generally perceived as grouped together if they move together. Thus, if some elements in Figure 2 begin to be pushed out, they will be perceived as a group, even over long distances. This is shown in Figure 3, as follows. If you move the cursor in the area of this shape, some patches will move up some distance, and if you click on the left mouse button, they will move downwards. Repeatedly pressing and releasing the left mouse button provides a simple demonstration of the strength of the grouping of the general principle of destiny. Figure 3: General Principle The principle of similarity states that elements are usually integrated into groups if they are similar to each other. It is illustrated in figure 3a-e, where proximity is in a constant state, as individual shapes are at (approximately) the same distance from each other as in Figure 2a. However, they are perceptively divided into three adjacent pairs, due to the similarity of visual attributes such as lightness (figure 3a), color (figure 3b), size (figure 3c), orientation (figure 3d), or shape (figure 3e). Figure 3: The Principle of Similarity. Section 12/34/5/6 becomes more visible when intragroup similarities and differences between groups are exacerbated, making doublet similarity/different in more than one visual attribute (Figure 3f). An important manipulation, already studied wertheimer (1923), will change both similarity and intimacy, explore their joint influence on perceived groups. Note that by increasing the distance between elements 2 and 3, and elements 4 and 5 (as in figure 2b), salience 12/34/5/6 of the organization is strengthened (figure 3g), as similarities and intimacy cooperate in favor of the same organization. On the other hand, when the inter-distance element changes, as in Figure 2c, the resulting organization of perception, Figure 3h, is less clear because the similarity still stands for section 12/34/5/6, but proximity favors section 12/34/5/6. Thus, this type of manipulation can be used to quantify the consequences of the various principles of gestaltit and to compare their strength. The Principle of Continuity Display in Figure 4a can be described as consisting of a number of elements located in three sub-charge or branches converging in X. According to the principle of proximity, one would expect the BX branch to group with the CX branch, but instead it is grouped with the AX branch, forming a sub-total AXB. Figure 4: Continuity Principle. This grouping is an example of the principle of continuity: oriented units or groups tend to integrate into whole perceptions if they are aligned with each other. The principle applies in the same way to elements along the lines (Figure 4a) as well as to patterns constructed from the respective lines (Figure 4b). The balance between continuity and intimacy in the formation of basic sub-wholes can be shifted by different similarities, which can be achieved by coloring different branches in different ways. Thus, the coloration of the BX is the same as the AX, but differs from CX makes the AXB an even more visible block (figure 4c), while the coloration of BX is just like CX, but differs from the AX, usually increases the saliency of CXB (figure 4d). Figure 5a-b's closing principle is built by adding some relevant elements to Figure 4a-b. While in Figure 4a and Figure 4b, the BX component is grouped with AX, figure 5a and Figure 5b have a tendency to this component pretty group CX, both BX and CX are sides of the BCX form, which in itself makes up half the shape in the shape of a bow tie. This is an example of the principle of closure: items are usually grouped if they are parts of a closed figure. In this particular example, however, continuity remains relatively effective and is in strong competition with closures. Using similarities, BCX salience as visual sub-whole can be increased, as in figure 5c, or reduced, as in figure 5d. Figure 5: Closing principle. Note that the patterns in Figure 4a and Figure 4b, although physically contained in Figure 5a and Figure 5b, are hard to see there: they can be searched with directional attention, but do not appear spontaneously as a natural visual whole. The reason for this is not only that more items are added to the display. This is demonstrated in Figure 7, in which the pattern in a is easily distinguishable in b, despite the many added elements, but is virtually invisible in c, d and e, although geometrically it is also present there (and in the same place) as in a and b. The loss of visual identity of the pattern is due to the effectiveness of the principles of the hestaal, mainly continuity and closure, according to which its elements are significantly integrated with other elements. . a new visual whole. One way in which its visual identity can be restored is simply by changing its color to make it disposable with surround. To demonstrate the crucifying cursor anywhere in the area of Figure 7. Note also that when the cursor is removed from the shape and the pattern again takes the same color as the added elements, it quickly (though not necessarily instantly) disappears from view, and no effort of attention can restore it to a noticeable visual whole. For further demonstration, hold the left mouse button pressed while positioned in the shape area, which will remove the pattern and reveal only the added items. A classic study of such effects of the hidden figure was reported by Gotchalt (1926). These examples are examples of camouflage, a phenomenon in which objects are hidden from view, but not by occlusion: instead they are appreciably divided (broken internally) and re-involved, i.e. their parts are grouped with parts of the environment. As used by animals in the struggle for survival and humans in war, the power of the principles of gestaltate thus allows organisms and things that are in sight to become virtually invisible and therefore detect by enemies. Thus, whether there is a physical object that is optically present or does not exist visually depends on the interaction of the laws of perception. The good principle of the Gestalt Pattern in Figure 6a is easily divided into two components, a straight line and a wavy line, crosses each other. Other, perceptual decomposition is amplified by similarity (figure 6b). The alternative decomposition of Figure 6a into the two adjoining corners depicted in figure 6c does not appear spontaneously; this can be explained by the fact that it would violate the principle of continuity. However, the call for continuity does not explain why the section in figure 6d also does not appear spontaneously in Figure 6a, although both of its components are continuous lines. Figure 6: Good Gestaltit Principle 1. In another example related to this example, Figure 7 spontaneously decomposes on a half-wheel with curved cogs touching a rectangular snake. However, this result of perception actually violates the principle of continuity, because at the point at which the two components are concerned, this decomposition involves angles, instead of following the instructions of crossing continuous lines. Even clearer decomposition is achieved by introducing similarities as well (Figure 7b). However, similarities can also be used to enhance radically different decomposition into two intersections of twisted thread, favored by continuity, as indicated in Figure 7c. Figure 7: Good Principle of Gestalt 2. According to Gestalt's point of view, the dominant perceptions in figure 6a and figure 7a are examples of a good gestalt principle: elements are usually grouped if they are parts of a pattern that is a good gestalt, that is, as simple, orderly, balanced, unified, consistent, regular, etc., as is possible given the input. In this sense, the straight line and wavy line perceived in Figure 6a are better shapes than the pairs of lines in 6c and 6d, and in figure 7a the cog and snake wheel are better shapes than the hybrid shapes in figure 7c that will be generated in Figure 7a, in accordance with the principle of continuity at the point of intersection. In such cases, the global pattern takes precedence over local relations. This principle is also called the law of good form or The Law of the Przegnanza, a German word that translates roughly as salience, incisiveness, brevity, impressiveness or orderliness. Principle of past experience In some cases visual contribution is organized in accordance with the principle of past experience: elements are usually grouped together if they have been together often in the past experience of the observer. For example, we tend to think of the pattern in figure 8a as a meaningful word, built of strokes that are grouped into separate letters of the Roman alphabet (such as 'm', 'i', 'n', etc.). Note that individual letters are quite clearly and distinctly perceived as natural parts of a related shape, and only slightly easier to distinguish and distinguish if further individuated through separation (figure 8b) or coloring (figure 8c). However, in addition to this standard segmentation by letter, Figure 8a has many other alternative sections, sections. But unlike standard segmentation, the recognition and discrimination of these alternative components (some of which are non-letter) within Figure 8a is a cumbersome task, like the painstaking search for a hidden shape in 6c-e drawings; in addition, standard segmentation is perceived to some extent even in Figure 8e, where it competes with segmentation based on the principle of similarity. The spontaneity and lightness of the standard, the dominantly perceived organization of strokes in letters, is plausible mainly because of past experience, that is, our familiarity with the words written in the writing of the Roman alphabet. This particular organization may not occur for observers who do not have such acquaintances; in addition, the alternative section would probably be natural for observers accustomed to the alphabet, the letters of which would correspond to the subdivided in figure 8d and figure 8e. The importance of the gaps is indicative of the difficulty of wehavewhenreadingtextnotseparatedbyblanks ew henbl kspa cesap pems rinw onpl aces. Figure 8: Principle of past experience 1. Although this principle was recognized by the hestaalits, it was considered secondary to other principles based on incentives and easily dominated them. For example, in the 8f image, which adds a slightly overlapping upside-down version, the initial stimulus is much harder to see, due to the emergence of numerous new major sub-cases generated by continuity and closure. Hearing hestaalens are similar, as in vision, issues of organization, grouping and segmentation arise in the auditory sphere (Bregman, 1990; Dubovy and Van Valkenburg, 2001). Acoustic input is only a one-dimensionally temporarily modifiable wave form of air pressure, but on its basis we can perceive the auditory scene with multiple sources of human speech, vocal and instrumental music, animal sounds and other natural noises, sometimes occurring at the same time, each with its own subfiling and structure. Some of the visual principles of the gestaltate are directly applied in the acoustic area, but mostly in a temporal rather than spatial form. For example, silence or background noise interrupted by a loud sound, followed again by silence or noise, is the auditory analogue of a figure on earth. Similarly, a regular series of identical short clicks is analogous to Figure 2a, with equal time intervals between sound events playing equal spatial interval With deliberate attention, you can mentally superimpose a structure on this sequence, such as hearing consecutive pairs of clicks, as in 12/34/5/6. However, this phenomenal segmentation is achieved much more naturally and easily, simply by increasing the intervals between some clicks, similar to figure 2b. This is an example of the auditory temporal analogue of the principle of visual spatial intimacy: There is also a spatial auditory version that includes pairs of identical sounds separated by equal intervals, but also from different directions, such as left, left/front, front/right, right. The hearing analogues of visual similarity, as shown in Figure 3, are also easy to establish, but with differences and similarities in color, size, etc. are replaced by differences and similarities in volume, height and timbre of sounds. The auditory analogues of some other principles of gestalt can also be built. Contemporary Work Figure 9: Principle of Past Experience 2. The principles described above, along with other non-illustrated here, such as the principle of symmetry (symmetrical components will usually be grouped together), the principle of castality (convex rather than concave patterns are generally perceived as shapes), and others are part of the classic legacy of perception studies. In modern studies, from which we can cite only a few examples, the fundamental ideas and questions raised by the hestaalits are developed and lengthened in different directions. For example, contrary to classical visions, more recent studies have shown that even such a basic feature as figure-based articulation may in some cases be based on experience (Peterson skow-Grant, 2003). For example, although displays with two homogeneous regions, neither of which surrounds the other, the purpose of the shape and the ground is often ambiguous, in some cases, when one region resembles an object, such as a tree in figure 9, the region is preferably perceived as a figure. Palmer and his colleagues have developed several new principles for organizing a visual field. For example, Palmer (1992) proposed a general principle of the region: elements are usually grouped if they are located within one closed region. The illustration is shown in Figure 10a. however, with closed circles superimposed, the preferred grouping becomes 12/34/5/6. Palmer and Rock (1994) proposed the principle of element connectivity: elements are usually grouped together if they are connected by other elements. This principle is illustrated in figure 10b. Like Figure 10a, figure 10b is also based on figure 2c, but, due to some related elements, the preferred perceived grouping is 12/34/5/6. Figure 10: Principles region and element element The researchers also presented computational models of some of the principles of gestalt (Kubovy and van der Berg, 2008), studied their possible neural foundations (Sasaki, 2007; Han et al., 2005; Tszyu and von der Geidt, 2005; Roelfsema, 2006), and tried to link them to natural image statistics (Geisler et al., 2001; Elder and Goldberg, 2002). Unresolved issues formulated by Wertheimer, the principles of gestalt include the clause ceteris paribus (all other things being equal) (Palmer, 1999). That is, each principle should be applied in the light of the fact that other principles are not applied or constantly applied. If two (or more) principles are applied for the same input and they favour the same grouping, it will generally be strengthened; however, if they disagree, usually one wins or the organization perception is unclear. Here are a few examples of one principle dominating another. However, although it has been considered to some extent in literature (e.g. Dubovi and van der Berg, 2008), there is a significant theoretical problem about how to predict which principle will prevail, in what circumstances have yet to be worked out in much more detail. The principles of gestaltate are usually illustrated with fairly simple drawings, such as those that were higher. Ideally, we should be able to apply them to an arbitrarily complex image and, as a result, to perform a hierarchical analysis of its contents that corresponds to our perception of its entire and sub-whole. This ambitious goal has not yet been achieved. It was suggested that most of the principles of the Gestalt are special examples of the comprehensive principle of Good Gestalt, in the sense that being continuous, closed, similar, etc. are ways to be as good, orderly, simple, etc. Closing, etc. it is more difficult to establish what exactly makes the template visually good, simple, unified, etc. One of the important issues that has not been discussed much in classical literature is the origin of the principles of gestalt. Why are perceptions organized in accordance with intimacy, continuity, closure, etc.? Gestaltists tended to believe that these principles are one of the main properties of the perception system, providing the basis for our ability to communicate sensory signals. The opposite view is that the principles of gestaltate are heristic, stemming from some common features of the outside world, based on our experience with things and their properties (Rock, 1975): objects in the world are usually located in front of some background (picture-earth articulation), have a common texture different background textures (similarities), consisting of parts that are next to each other (closeness), . in general (common destiny) and have closed contours (closure) that are continuous (continuity). In general, although these principles have been discussed for more than 80 years and are presented in most perception textbooks, there are still a number of questions that need to be addressed. Links to Bregman, A. (1990). Hearing scene analysis: perceptive sound organization. Boston, Massachusetts: MIT Press. Elder, J.H. and Goldberg, R.M. (2002). Environmental statistics of the laws of the gestaltate for the perception of the organization of contours. 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