1   **Gestalt principles and their application**

2   Our vision system tends to perceive objects in patterns innately based on some
3   fundamental rules. The Gestalt principles summarize these rules and describe how visual
4   perception classifies related items and organize them into groups. The principles serve as robust
5   guidance in visualization display. If we can organize information to readily perceived patterns,
6   the viewers can spontaneously learn the display with minimal verbal instruction. This article will
7   introduce five Gestalt principles: symmetry, figure and ground, similarity, proximity, and
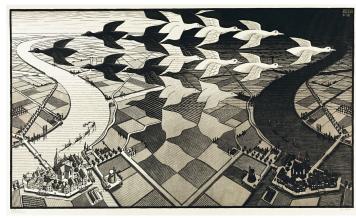8   continuity, and their applications in visualization design.
9   The principle of symmetry states that items sharing similar configuration are likely to be
10   perceived as a unified group. Symmetry reflects balance and equilibrium, which are inherently
11   harmonious and satisfying, and it often guaranteed an aesthetic design. Functionally, symmetry
12   is appealing to designs that are oriented to order and simplicity (Mullet and Sano, 1994).
13   Symmetrical layouts are particularly effective in organizing complex information content in
14   Graphical User Interface (GUI). For example, to simplify the organization for users, GUI
15   designers can first classify subtypes of functions into hierarchical groups (i.e., basic "orientation"
16   function nests in "layout" global function). Then displaying the hierarchy on an expandable
17   window, which can divide content into the basic and advanced functions by clicking on the
18   global function. Symmetrical design with equivalent spaces of advanced functions window and
19   basic functions window makes the functional division more obvious. Thus, the symmetry
20   enhances proper functional interpretation without intrusive verbal labels.
21   The principle of figure and ground states that the items are visually distinguished as the
22   primary item (figure) and the background (ground). Size and contrast of items are the two main
23   factors assist vision classifies figure and ground (Ware, 2012). For example, newspapers printing
24   in small and black text on a white background ensure that text is the primary element. This
25   principle is also used to create a visual illusion in arts with balanced cues for figure and ground.
26   Many of M.C. Escher's work took advantage of this principle (Figure 1). Both black and white
27   birds are depicted using the color contrast. Only one set of the birds tends to be perceived at a
28   time because we visually group one as the figure and the rest as the ground. Hence, Gestalt
29   principle can also be intentionally used to "complicate" viewers' perception.
30   More often, visualization design applies multiple Gestalt principles for powerful
31   grouping of complex information. For example, the Sony MiniDisc recorder's design (Figure 2)
32   uses the combination of three Gestalt principles: 1) similarity, items sharing similar
33   characteristics tend to be grouped together; 2) proximity, items that are close to one another tend
34   to be grouped together; 3) continuity, elements that are smooth and continuous tend to be
35   perceived as a single entity (Mullet and Sano, 1994). The controls with the similar function on
36   the device are grouped together by their similarity (i.e., shape, size, texture), and the proximate
37   spatial distance. Also, the large space between the grouped controls naturally indicates different
38   functions. The concave bounding borders encompassing the "number" controls enhance the
39   grouping effect and sensuous design. The effective grouping of individual elements helps users
40   to learn the control panel easily.
41   Gestalt principles are the innate rules of visual grouping. Perception tends to organize
42   objects in their most simple forms, in order to prevent us from overwhelmed by complex
43   information content. Industry can take the advantage of these basic visual rules to organize
44   complex information. It does not only simplify the perceptual process at the users' end, and also

45 produces an aesthetic design. On the other hand, artists can confound viewers' perception and
46 create an illusion based on the rules.

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51   **Figure 1**
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54   **Figure 2**
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59   **Reference**
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61 Mullet, K., & Sano, D. (1994). Designing visual interfaces: Communication oriented techniques.
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63 Ware, C. (2012). *Information visualization: perception for design*. Elsevier.
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