social communication but, at a more basic level, to serve pattern recognition, perceptual constancy, spatial orientation, etc. The principles underlying such natural inclinations have been best explored in the visual realm.[2-6]

Of particular importance are the contributions of Gestalt psychology. Several principles have been elaborated, which demonstrate a clear bias in our perception. First, it has been found that perception is an active process of searching for order, categorizing, and interpreting. This can be demonstrated by simple experiments. Babies strive towards visual clarity when lines out of focus are projected to them. They learn to operate switches in their pillows by head movements to put the lines in focus. The Necker cube (see chapter 8) illustrates another perceptual activity. When we look at an image of this cube, we initially see either the lower left or the upper right square as the front of the cube. Regardless of what we see first, after approximately 3 seconds, we suddenly perceive the other square in front. It is as if our attention, once having recognized one feature, detaches in order to be free to see what else is to be seen. In Rubin's cup, we experience the same phenomenon of ambiguity. We see either two human profiles or the cup in the center first (Fig. 1).

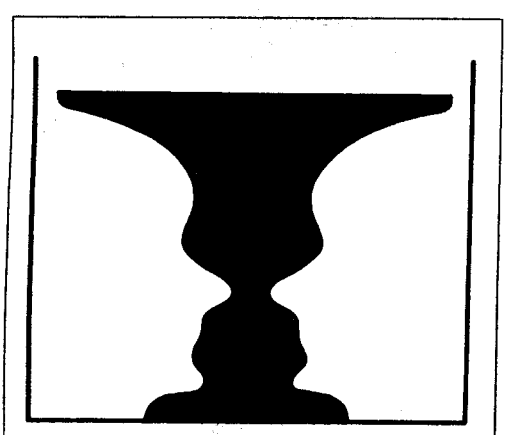

Fig. 1. Rubin's cup. In this case, the dark cup contrasts against the background and, thus, is perceived first. The profiles are discovered later. If they, however, were black, they would catch our attention first.

However, if we instruct the observer that a cup can be seen, then he will be biased and see the cup first. Furthermore, if the cup and the general background around the figures are white, then he or she sees the dark profiles first. Apparently, we have a tendency to see a figure in contrast against a lighter background (Prägnanztendenz). Our perception actively constructs contrast by emphasizing certain characteristics upon repeated presentation while eliminating others considered as unimportant. This tendency does not characterize visual perception alone but perception in general, as reflected in man's

tendency to express his views in a polarized, dogmatic way (to "state his point clearly").[7]

We also are biased to see *gute Gestalten* (distinct forms) when we briefly observe geometrical figures, squares, triangles, and circles that show light irregularities or asymmetries. Even then, we perceive a complete or a symmetrical figure. We also generalize and repress the irregularities. In this context, experiments performed by Wertheimer[8] with children are noteworthy. He presented children with simple symmetrical figures, from which parts were cut out. If the experimenter tried to place the piece cut from a square onto the missing part of a circle, the children protested and became emotionally upset. They wanted the gestalt to appear perfect. Our perception thus strives to perceive regularity and symmetry and, accordingly, tends to project the latter onto observed objects.

In 1931, Sander[9] (and Fechner already in the nineteenth century) found that people experience as aesthetically appealing squares and also rectangles with the ratio of the sides corresponding to the golden section (1:1.63). Rectangles that deviate slightly from a square shape are experienced as "bad squares," and larger deviations in the rectangle are considered to result in a "bad rectangle." Sander argues that this principle of "gute Gestalt" explains the appeal of different architectural styles. Renaissance architecture, in essence, has a quiet beauty that makes the observer feel comfortable. The architectural principles by which this effect is achieved include the dominance of squares and rectangles in the above-mentioned proportions. Furthermore, right angles and circular arches are used in preference to other forms; windows are placed in metrically regular rows, and horizontal structures are symmetrical.

In contrast, Baroque architecture induces awe and unrest to the extent of ecstasy and transmits a dynamic experience. The stylistic means by which this is achieved are imperfect squares and rectangles, which are exaggerated in width and length. Arches are elliptical and wide, acute angles are used instead of right angles, the axis of symmetry is not in the middle, etc. Slight irregularities and deviation from the perfect create tension and unrest. Baroque thus overcomes the perfect form of the Renaissance by creating forms which stop just before perfection and which stimulate corrective activity on the part of the observer.[5]

Our perception seeks and enjoys order,[4] and this quest seems to be a general principle which derives, in part, from the limited capacity of our brain to process information. Our short-term memory seems to have the capacity to process 16 bits per second; less is perceived as boring, and more is stressful. In patterns, we attempt to discover regularities that allow us to form "supersigns" to reduce the amount of information confronting us.[10]

In 1936, Metzger[11] suggested that there is a tendency of senses towards

order which creates order even where it does not exist. Schuster and Beisl[5] also point out the need for pattern recognition to facilitate information processing in the following quote: "...man is dependent on finding regularity in his environment because he can thereby perceive his surroundings better and with less difficulty of retention. Therefore, finding such patterns or supersigns is rewarding." That regularity, as opposed to irregularity, is perceived as beautiful was also experimentally demonstrated by Dörner and Vehrs[12], who asked persons to place red and green colored squares onto a grid to produce in one case a beautiful and, in another, an unattractive arrangement. Designs intended to be beautiful allowed the observer to perceive crosses and rows, i.e., presented supersigns. Unity is another characteristic listed by Hospers[13] as an element of aesthetic perception.

If it is too easy for the observer to discover order, then the object lacks aesthetic appeal, as it also does if one cannot discover relational regularities. Thus, an aesthetic object must have a certain amount of order that should be neither too complex nor too simple. It must allow processes of reduction of information to occur, i.e., permit the discovery of supersigns.[5]

Of course, our effort to see regularities and to categorize does not find its origin in our limited capacity to process information only. It is economical and also highly adaptive to recognize categories of animals, plants, etc. and to attribute certain characteristics to them.

A remarkable experiment (first conducted by Francis Galton in the nineteenth century[14]) by Daucher (H.Daucher 1979, unpublished work) suggests how templates are formed by means of a "statistical learning process." He superimposed the photographs of 20 female faces upon one another. Facial features then created an image in which the individuals' outstanding features became absorbed and the typical or characteristic ones preserved (Fig. 2). The resulting composite face was considered "beautiful" to observers, suggesting the existence of innate reference patterns (templates) that set a standard against which the perceived is evaluated. Daucher's experiment demonstrates how many fleeting experiences are abstracted and compiled in one's memory to create schemata or templates. This indicates that our perception is basically categorical or typological.

Children begin to categorize at an early age. For example, when they address a dog, a cat, and a cow as "wau wau," they apparently refer to shared characteristics. The tendency to categorize is innate, and educational efforts aimed at correcting the child by teaching it that a cat is not a wau wau and must be distinguished from a dog only serve to refine categories. Categorial schematic perception is one of the prerequisites for language, and it predominates in childrens' drawings (Fig. 3).[15]

Visual art makes use of the basic characteristics of our perceptive

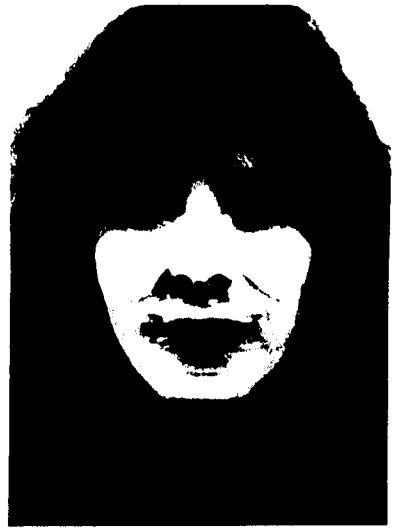

Fig. 2. Templates are formed by "statistical learning." The superimposed exposure of the twenty photographs *(left)* results in a typological presentation *(right)* since the individual features are superseded by the shared "typical" ones. Photo: H. Daucher 1979, unpublished manuscript

mechanisms, as is impressively illustrated by the Dutch artist M.C. Escher, who experiments playfully with our perceptive biases.

In other products of art, the basic characteristics of aesthetic perception are used as a means to catch and retain the attention of the observer to convey encoded messages by means of pictorial description, allegories, and symbols. Our urge to recognize order is of great importance in this context, since it leads to the active discovery of a message that is accompanied by a highly rewarding experience (flash of recognition). Through this experience, the message is reinforced. In my opinion, this is the basic function of art. It is not surprising, then, that primitive art takes advantage of our perceptual biases. For example, the prows of the canoes of the Trobriand Islanders have intricately carved boards. The designs have symbolic meaning, and they are composed in such a way that one first sees a dominant human figure, but, after a few seconds, one perceives the two eyes of the figure as the eyes of birds shown in profile. And on still another level, one suddenly realizes that the entire board is designed to show a face. This form of coding seems fairly widespread in the aboriginal art of New Guinea (Fig. 4).

Fig. 3. In children's drawings, the tendency for schematic presentation predominates. Asked to draw her mother, a girl (age 7) first created a highly stereotyped, schematic woman's face *(left)*. Only after the mother insisted that her daughter draw her as she saw her, did she create a face with the individual features of her mother *(right)*. Photos: Nguyen-Clausen.[15]

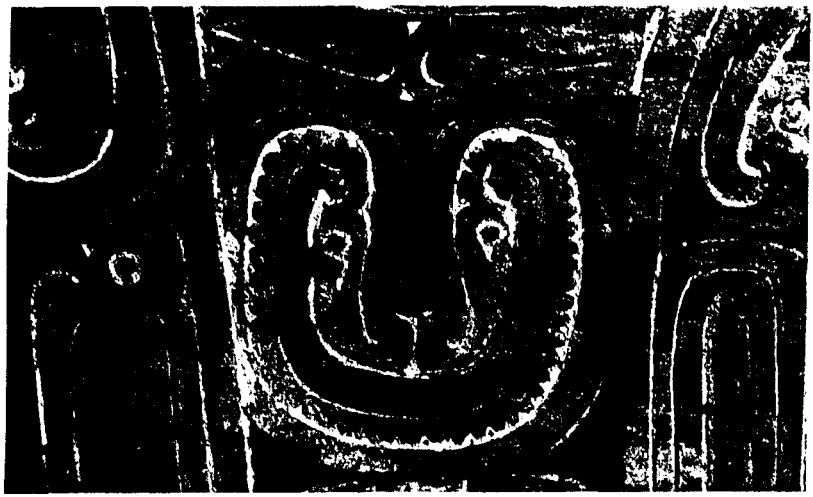

Fig. 4. The closure boards (Lagim) are carved with an apotropaic design. As a supersign, it portrays a face. But this is composed of a number of ornamentally intertwined heads of ritually important mythical birds. In the center of the board, four birds are joined into a human figure, reminiscent of a Polynesian tiki. The figures' eyes are also the eyes of two birds viewed laterally. The mouth of the figure, with many small teeth, surrounds the head in a fashion similar to that found in Hawaiian figures. Photo: I. Eibl-Eibesfeldt

Interestingly, aesthetic biases of the basic type are not unique to man. Through choice experiments with monkeys, raccoons, and birds, Rensch[16,17] demonstrated that animals show aesthetic preferences in that regularity, symmetry, and order are preferred to asymmetry and irregularity. In a series of imaginative experiments, Desmond Morris[18] had chimpanzees paint. The resulting paintings had aesthetic appeal. Aside from this appeal to humans, he found the following interesting regularities: The animals filled the sheet symmetrically, staying within the given frame. Had Morris already painted a square or a spot on one side, then the animals painted on the opposite side of the sheet, later connecting the two structures with a few strokes. One individual produced fan patterns again and again, filling the sheet harmoniously. The patterns were far from simple scribblings. If different colors were given to the chimpanzees, they avoided smearing the colors on top of each other. Had a chimpanzee produced a fan pattern in one color, then it continued by placing the other colors between the existing strokes, thus producing another fan within the fan. Individuals developed individual styles, which they varied in a playful manner. Thus, the activities were performed for amusement. They demonstrated control of composition, the existence of individual style, and thematic variations. They reflected general principles of aesthetics and the achievement of an optimal balance of tensions, since the animals often refused to continue painting when they appeared to have finished.

When I heard about Morris' fascinating findings, I took paint, brushes, and sheets to the Hellabrunn Zoo in Munich and had two chimpanzee females paint for me. The dominant one produced rainbow structures filling the whole sheet. The subordinate one, however, used only the lower part of the sheet and painted a spot. Given the next color, she just painted within the spot, continuing to paint there until the sheet became waterlogged. She behaved as if she did not dare to enter the free space. This strongly reminds me of certain projection tests used by psychologists to ascertain latent problems. I continued my experiments for several weeks, and, surprisingly, the individuals maintained their own styles of painting, which seemed to express certain consistent personality traits (Fig. 5).

Morris exhibited his chimpanzee paintings in an art gallery among paintings of modern artists – without telling who had painted them. Some experts praised them as particularly vital and important works of art, especially those with a tachist (action art) orientation. However, other abstract paintings can also be reduced to those basics of aesthetics like balance, rhythmicity, opposition, and linkage. The motivation of the chimpanzees, as can be derived from their behavior, was playful experimentation. This is probably the primary motivation of human tachists too – experimenting with their skills and with their spectators as well.