FORM

Text abridged and adapted from *Art and Visual Perception* by Rudolph Arnheim (1974)

Shape and form

"**Form** is the visible **shape** of content" wrote the painter Ben Shahn, and this is as good a formula as any to describe the distinction between shape and form used in these chapters. Under the heading "Shape," there were some principles of the organization of visual material. However, shape can only be separated from its meaning (form) only for the sake of extrinsic analysis. Whenever we perceive shape, consciously or unconsciously we take it to represent something, i.e. the form of a content.

Most practically, shape serves, first of all, to inform us about a thing through its external appearance. But a shape is never perceived as the form of just one particular thing, but always as the form of a kind of thing. For example, the difference in appearance between a teacup and a knife indicates which object is suited to containing a liquid and which to cutting a cake. But apart from telling us about their individual selves, each of them teaches us automatically about whole categories of things, and, by extension, about containers and cutting tools.

Therefore, we see every shape as a *kind* of shape; and each kind of shape is seen as the form of whole kinds of objects. To use an example of Wittgenstein's, the shape of the line drawing of a triangle can be seen as different forms: a triangular hole, a solid, a geometrical figure; as standing on its base or hanging by its top corner; as a mountain, a wedge, an arrow, a pointer, etc.

Not all objects tell us by their shape about their own physical nature. A painted landscape has little reference to a flat piece of canvas covered with brushstrokes of pigment. A figure carved in stone reports about living creatures that are very different from the inert pieces of marble. Such objects are made for vision only. But they also serve as form for whole categories of things: the painted view of the Grand Canyon reports about landscapes, and the statue of Lincoln speaks of thoughtful men.

All shape is semantic; that is, merely by being seen it makes statements about kinds of subjects, but it does not simply present replicas of its subjects. This fact is less evident in our Western tradition, based on centuries of more or less realistic art. This old doctrine is that art aims at a deceitful illusion, and that any deviation from this mechanical ideal needs to be explained, excused, and justified. It is an approach developed from some of the principles of Renaissance art from the fifteenth century on.

If a style of picture-making fails to fit this standard —and all styles of art, modern or ancient, in practice fail more or less conspicuously to do so— the discrepancy is explained in one of the following ways. The artist lacks the skill to accomplish what she wants to do; she depicts what she knows rather than what she sees; she blindly adopts the pictorial conventions of her peers; she perceives wrongly because of defects in her eyes or her nervous system; she applies the correct principle from an abnormal point of view; or she deliberately violates the rules of correct representation.

This **illusionistic doctrine** continues to produce a great deal of misleading interpretation. Therefore, it cannot be said strongly enough or often enough that *image-making, artistic or* *otherwise, does not simply derive from the optical projection of the object represented, but is an equivalent, expressed with the properties of a particular medium, of what is observed in the object.*

The illusionistic doctrine has its origin in a double application of what is known in philosophy as "naïve realism." According to this view, there is no difference between the physical object and its image perceived by the mind; the mind sees the object itself. Similarly, the work of a painter or sculptor is considered simply a replica of the percept. Just as the table seen by the eye is supposed to be identical with the table as a physical object, so the picture of the table on the canvas simply replicates the table the artist saw. At best, the artist is able to "improve" reality or enrich it with her fantasy, by omitting or adding details, selecting suitable examples, or rearranging the given order of things. Illusionists are oblivious to the fundamental difference between the world of physical reality and its image in paint or stone.

Orientation in space

So far what we have discussed about the form of images specifically refers to representation in particular media, whether two-dimensional or three-dimensional. But there are characteristics of form that also refer to ordinary perception when we recognize or fail to recognize an object as itself or as one of its kind. What conditions must visual form meet for an image to be recognizable?

To start with a relatively simple factor, how important is spatial orientation? What happens when se see an object not right-side-up, but in an unfamiliar position?

As we saw in the chapter "Shape," the identity of a visual object depends not so much on its shape as such as on the structural skeleton created by the shape. A lateral tilt may not interfere with such skeleton, but then again it may. When a triangle or rectangle is tilted (Fig. 1*a*), it does not become a different object. One sees it merely as deflected from its more normal position.

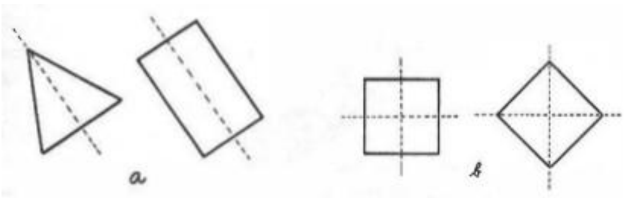

Fig. 1: Tilted triangle, rectangle, and square.

If, however, one tilts a square by a similar angle it changes into a completely different figure, so different that it acquires a name of its own —diamond or rhombus (Fig. 1*b*). This is so because the **structural framework** has not shifted with the figure. A new symmetry lets the vertical and horizontal axes pass through the corners, thus placing the accents of the figure on the four points and transforming the edges into oblique roof shapes. Visually we are dealing with a new figure, a pointed, more dynamic, less stably rooted thing.

Spatial orientation presupposes a frame of reference. In empty space, with no forces of attraction, there would be no up and down, no straightness or tilt. Our **visual field**, or **retinal field**, provides such a framework. But there is also "**environmental orientation**," When a painting on the wall hangs crookedly, we can see the tilt as long as we refer the picture to the framework of the walls. Within the narrower world of the painting itself, however, the verticals and horizontals of the frame determine the two basic axes. In Fig. 2, the inner figure, under the influence of the tilted frame, tends to look like a tilted square, although by itself or within a vertical or horizontal frame, it looks like an upright diamond.

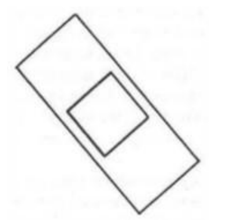

Fig. 2: Figure and frame of reference.

In addition to the coordinates of the **retinal field** and those of the **visual environment**, a third framework of spatial orientation is provided **kinesthetically**, by the muscular sensations in the body and the organ of equilibrium in the inner ear. In whatever position our body or head or eyes may be, we sense the direction of the gravitational pull. In daily life these kinesthetic sensations are usually in harmony with those derived from the visual framework of the environment. But when one looks up at a tall building, even the awareness of the tilted head may not be quite sufficient to compensate for the apparent backward tilt of the façade.

So far the examples have been of moderate tilt, which often leaves the structural skeleton essentially unaltered. A turn of ninety degrees tends to interfere with the character of visual shapes more drastically by causing the vertical and the horizontal to exchange places. A figure lying on its side will lose its symmetry and will have its shape pointing in a lateral direction like an arrow. Even more radical is the change when the object is turned upside down. The two figures in Fig. 3 are both triangular but their shapes differ. Version *a* rises from a stable basis to a sharp peak; in version *b* a broad top balances heavily and precariously on a pointed foot.

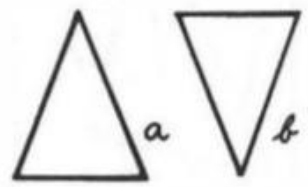

Fig. 3: Triangles with contrasting orientation.

To observe the spatial orientation of objects in the physical world is one thing; to draw pictures of them is quite another. For young children especially, the empty space of the drawing paper imposes no constraints, and in the beginning one spatial orientation seems to be as good as any other. But when the one-sidedness of the gravitational pull introduces the distinction between up and down in children's drawings, the visual world is enriched both physically and symbolically. When modern painters or sculptors create works that can be looked at validly in any spatial position, they pay for this freedom by settling for a relatively undifferentiated homogeneity.

Projections

In the examples of spatial orientation thus far discussed one might have expected no change of visual identity since geometric shape had remained unaltered. Instead we noted that under certain conditions a new orientation will bring to the fore a new structural skeleton, which gives the object a different character. Turning now to deviations that involve a modification of geometric shape, we find that "non-rigid" change may or may not interfere with the identity of the pattern, depending on what it does to the structural skeleton.

Cut a fairly large rectangle of cardboard and observe its shadow cast by a small light source. Innumerable projections of the rectangle can be produced, some of them looking like the examples of Fig. 4.

Fig. 4*a*, obtained by placing the rectangle exactly at right angles to the direction of the light source, resembles the object very closely. All other angles of projection lead to more or less drastic deviations of appearance.

Fig. 4*b*, though without symmetry and right angles, is readily seen as an undistorted rectangle, tilted in space. Here again the **principle of simplicity** is at work. Whenever a three-dimensional version of a figure is sufficiently stabler and more symmetrical than the plat projection, the observer will tend to see the simpler shape, extended in depth.

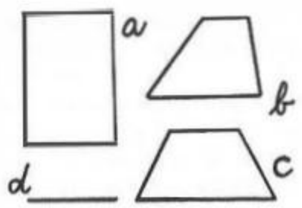

Fig. 4: Projections of a rectangle.

Fig. 4*c* is much less likely to be seen as the projection of the rectangle which in fact it is. As a flat upright, it has a vertical symmetry of its own. It is a rather simply shaped regular trapezoid, and the tension created by the unequal angles is compensated within the plane. Its structural skeleton does not point to a rectangle.

Fig. 4*d*, finally, is no longer a projection of the rectangle at all, but rather one of the thickness of the piece of cardboard. One can understand intellectually that this view, too, is derived from our object, but the deviation can no longer be *seen*.

Looking at projections has confronted us with the phenomenon known as the *constancy of shape and size*. The percept produced by the brain from the retinal projection is such that we see the object as it *is* physically. Asked what she sees when shown the shadow of our tilted cardboard rectangle (Fig. 4*b*), a person will tell us that she *sees* a rectangle of constant, stable shape. Asked to draw a picture of it, she may well draw a rectangle.

Fig. 4*a* indicates that as long as we deal with a flat object, such as a cardboard rectangle, there exists one projection that does such complete justice to the visual concept of the object that the two can be considered identical —namely, the orthogonal projection, obtained when the plane of the object is hit by the line of sight at a right angle. Under this condition, the object and its retinal projection have roughly the same shape.

The situation is much more complicated with truly three-dimensional things, because their shapes cannot be reproduced by any two-dimensional projection. It will be recalled that the projection on the retina is created by light rays that travel from the object to the eye along straight lines, and that consequently, the projection shows only those areas of the object whose straight-line connection with the eyes is unobstructed.

Fig. 5 shows how the selection and relative position of these areas change in the example of a cube (*b, c, d*), depending on the angle at which the observer (*a*) sees it. The corresponding projections are indicated approximately in *b', c',* and *d'*. Here again, as the projection changes, the observer should be expected to see the shape of the object change accordingly. Once more, **"constancy of shape"** comes to the rescue. We must ask, however, what is it that remains constant since a three-dimensional solid cannot be truly represented by any flat projection?

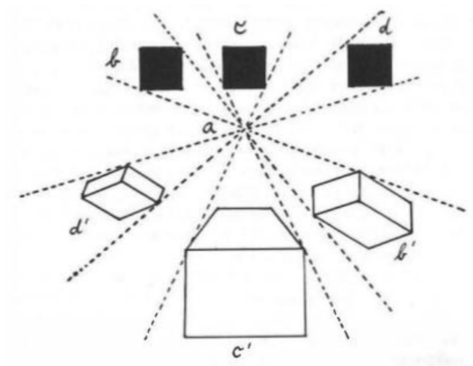

Fig. 5: Projections of a prism .

Which aspect is best?

The **visual concept** of the object derived from perceptual experiences has three important properties. It conceives of the object as being three-dimensional, of constant shape, and not limited to any particular projective aspect. Strictly speaking, the visual concept of anything that has volume can be represented only in a three-dimensional medium, such as sculpture or architecture. If we wish to make pictures on a plane surface, all we can hope to do is to produce a translation —that is, to present some structural essentials of the visual concept by two-dimensional means. The pictures achieved in this way may look flat like a child's drawing or have depth like a hologram, but in both the problem remains that the all-aroundness of the visual conception cannot be reproduced directly in a single plane.

Once we accept reducing a volume to one of its aspects, we must decide which view to select for any particular purpose. For some objects all aspects are equal or equally good —for example, a sphere or an irregularly shaped piece of rock. Usually, however, there are definite distinctions. In a cube the **orthogonal projection** of any surface dominates. In fact, oblique aspects of the surface are seen as mere deviations from the square-shaped one. This distinction is based on the **law of simplicity**. The dominant projections are those which produce patterns of the simplest shape.

Take an apparently simple object —a chair (Fig. 6). The top view (*a*) does justice to the shape of the seat. The front view (*b*) shows the shape of the chair's back and its symmetrical relation to the front legs. The side view (*c*) hides almost everything, but gives the important rectangular arrangement of back, seat, and legs more clearly than any other views. Finally, the bottom view (*d*) is the only one to reveal the symmetrical arrangement of the four legs attached to the corners of the square seat. All this information is indispensable and feeds into the normal visual conception of the object. How can it be conveyed in one picture?

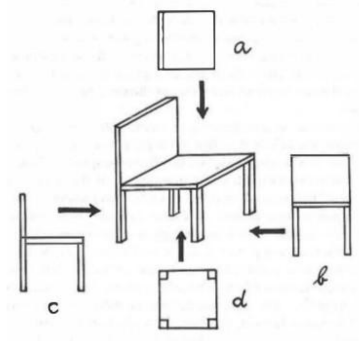

Fig. 6: Projections of a chair.

The Egyptian method

One **solution** of the problem is best exemplified in the wall paintings and reliefs of the Egyptians and in the drawings of children. **It consists in choosing for each part of an object or combination of objects the aspect that best suits the pictorial purpose**. The pictures obtained by this procedure were formerly condemned, or at best tolerated, as the inferior creations of people who were incapable of doing better or who drew what they knew rather than what they saw. Only when similar methods were adopted by artists of the twentieth century did theorists begin hesitantly to realize that deviations from correct projection are not due to such operations as twisting or squashing the faithfully perceived object, but are freely invented equivalents of the observed shape in the two-dimensional medium.

The Egyptians —as well as the Babylonians, early Greeks, and Etruscans, who used a similar style of representation— were commonly thought to have avoided **foreshortening** (see its section below) because it was too difficult. This argument is clearly refuted by a relief that represents workmen chiseling a stone statue; the shoulders of the living men are given in the conventional front view, but the statue has a perspectively "correct" side view (Fig. 7). Thus, in order to express lifeless rigidity the Egyptians used a procedure that, in the opinion of the average nineteenth-century art teacher, created a much more lifelike effect. It is evident, therefore, that the Egyptians used the method of **orthogonal projection** not because they had no choice, but because they preferred it. This method permitted them to preserve the characteristic symmetry of chest and shoulders and the front view of the eye in the profile face.

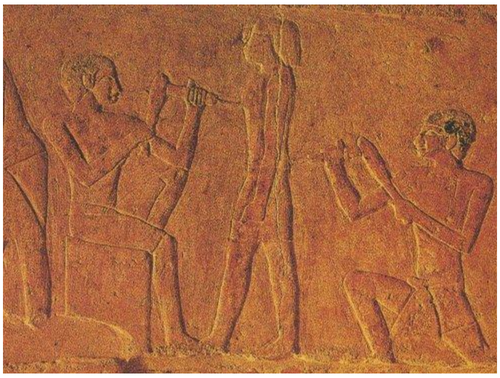
Fig. 7: Egyptian relief showing sculptors working on a statue.

Pictorial representation is based on the **visual concept** of the total three-dimensional object. The method of copying an object or arrangement of objects from one fixed point of observation —roughly the procedure of the photographic camera— is not truer to that concept than the method of the Egyptians. Drawing or painting directly from the model is quite rare in the history of art. Even in the epoch of Western art that began with the Italian Renaissance, work from the model is often limited to preparatory sketches and does not necessarily result in **mechanically faithful projection**. When the figures in Egyptian art look "unnatural" to a modern observer, it is not because the Egyptians fail to present the human body the way it "really is," but because the observer judges their work by the standards of a different procedure. Once freed of this distorting prejudice, one finds it quite difficult to perceive the products of the "Egyptian method" as wrong.

Comparison between the Egyptian and Western methods

What is required of the viewer is much more than enlightened tolerance for a method that has been "superseded by the discovery of correct perspective." Rather she must realize that there are **different solutions to the problem of representing three-dimensional objects in a two-dimensional plane**. Each method has its virtues and its drawbacks, and which is preferable depends on the visual and philosophical requirements of a particular time and place. It is a matter of style.

Fig. 9 shows a tracing after a painting by Oskar Shlemmer (Fig. 8). Drawn in rough accordance with the rules of central perspective, it corresponds in that respect to what a camera would record if such a scene were taken from a particular point. In this sense the picture is quite realistic.

Fig. 8: Oskar Shlemmer's painting (c.1930s).

A supporter of this traditional realistic method would object to Fig. 10, which indicates schematically how a similar scene would e represented in children's drawings and early forms of art. She would point out that the table is upright rather than horizontal, that foreground and background figures are the same size, and that one figure is lying sideways and another is upside-down.

Fig. 9: Tracing after Oskar Shlemmer's painting (c.1930s).

However, a supporter of this early method would object to Figs. 8-9, deploring the representation of a rectangular table as a crooked trapezoid. She would point out that the three figures, objectively of equal size, vary in the picture from giant to dwarf. Although all three should be in the same relation to the table, one is shown frontally, the second in profile, and the third from the back; two figures are intersected by the table, whereas the third covers much of the table top with her own body and rubs shoulders with her neighbor, supposed to be seated at some distance. Nothing could be less realistic than such a crazily distorted picture.

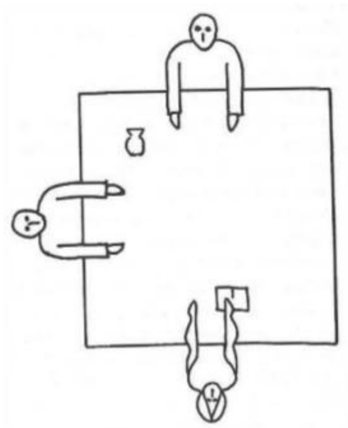

Fig. 10: Orthogonal projection of Oskar Shlemmer's painting (c.1930s).

Our supporter of the **orthogonal projection** will show little appreciation for the fact that the distortion of size and shape makes possible a strong depth effect, or that the projection offers an interpretation of the scene from the viewpoint of one particular spatial location. Nor will she acknowledge that the alteration of sizes, angles, and shapes creates a clever and fascinating variation of the objective situation. Instead, she will say that perspective distortion has lost all the natural qualities required for a two-dimensional medium. The apparently modest request that a picture should reproduce the structural skeleton of a visual conception apparently has disturbing consequences. The orthogonal representation fulfills this demand to the letter by matching squareness with squareness, symmetry with symmetry, and location with location.

Now it is true that the perspectively distorted drawing of the square looks like a square not only to the grown-up Westerner, but also to her child and to a "primitive" if the latter is able to look at the perspective drawing not as a surface decoration but as the real object. The puzzle of perspective representation is that it makes things look right by doing them wrong. There is an important difference between the two procedures discussed here.

The primitive or child accounts for the squareness she sees in reality with an actual square in the picture, a method that greatly strengthens the direct impact of the shape. She actually makes it be what it suggests it is.

Perspective distortion, to be sure, is compensated in perception by the **constancy of size and shape**, but there is a weakening indirectness about this method. The distorted stimulus pattern, which causes the experience, influences the percept even though the viewer may not be aware of it and be unable to realize or copy it.

The power of all visual representation derives primarily from the properties inherent in the medium and only secondarily from what these properties suggest by indirection**. Thus the truest and most effective solution is to represent squareness by a square**. There is no question that in abandoning this directness, Western art has suffered a serious loss. It has done so in favor of the new virtues of **realism and expression**, which were more important to those who developed **perspective art** than the qualities they had to abandon.

Foreshortening

Both methods, Egyptian and Western, make particular two-dimensional aspects represent complete solids. Whether perspectively distorted or rectangular, the table top stands for a whole table. In order to fulfill this function an aspect should meet two conditions. It should indicate that it is not the complete thing but only a part of something larger; and the structure of the whole it suggests should be the correct one. When we look at a cube head on, there is nothing in the perceived square to show that it is part of a cubic body. This may make it unsatisfactory as a projection, although it may be acceptable as a pictorial equivalent.

Fig. 11: Horse from a Greek amphora (c. 540 BCE).

According to a rule in perception (the **principle of simplicity**), the shape of the perceived aspect (i.e. the projection) is taken spontaneously to embody the structure of the whole object. If we are shown a flat square, we see it as one aspect of a flat board. The same is true for a disk, which we see as part of a disk-shaped board. If the circular object is rounded, however —for example, by means of shading— we see it as part of a sphere. This may be misleading. The rounded object may be the bottom of a light bulb, which is not a sphere. Even so, perception automatically completes the whole body according to the simplest shape compatible with the perceived projection.

This perceptual tendency often produces satisfactory results. A sphere is in fact what any of its aspects promise it to be. To some extent this is true for the human body. The whole volume roughly has what the front view suggests. No basic surprises emerge when the body is turned; nothing essential is hidden. Within obvious limits, the shape of the projection embodies the **law of the whole**.

Fig. 12: Greek amphora with black charioteer and horses (c. 540 BCE).

This was not true, for instance, in a straight front view of a horse, like the one in Fig. 11, taken from the Greek vase in Fig. 12. Knowledge may tell us that those are horses but contrary perceptual evidence tells us that these are penguin-shaped creatures, monstrous horse-men. Atypical front views of this kind are artistically risky, though they are sometimes used precisely for this reason.

The term **"foreshortening"** can be used in three different ways.

(1) It may mean that the projection of the object is not orthogonal —that is, its visible part does not appear in its full extension but projectively contracted. In this sense, a head-on front view of the human body would not be considered foreshortened.

(2) Even though the visible part of the object is given in its full extension, an image can be described as foreshortened when it does not provide a characteristic view of the whole. In this sense, the Greek horse is a foreshortening, but not in a truly perceptual and pictorial sense. It is only our knowledge of what the model object looks like that makes us regard this orthogonal view as deviation from a differently shaped object. The eye does not see it.

(3) Geometrically, every projection involves foreshortening, because all parts of the body that do not run parallel to the projection plane are changed in their proportions or disappear partly or completely.

Projective contraction always involves an oblique position in space. Obliqueness provides visual evidence that different parts of the object lie at different distances from the observer. At the same time, it preserves direct perception of the structural pattern from which the projection deviates. The foreshortening of a face, caused by a turn to an oblique position, is not perceived as a pattern in its own right but as a mere variation of the frontal symmetry. No trace of that symmetry is left in a straight profile view, which is why the profile is not generally thought of as a foreshortening. The profile has a structure of its own.

It seems best, then, to call a pattern foreshortened when it is perceived as a deviation from a structurally simpler pattern, from which it is derived by a change of orientation in the depth dimension. Not all projective contractions succeed in making clear the structural pattern from which they deviate. For example, if the projective pattern has a simple shape, this simplicity will tend to interfere with its function because the simpler the shape of a two-dimensional pattern, the more it resists being perceived three-dimensionally —it tends to look flat. In Fig. 13 the top view of a sitting man is foreshortened into a square-shaped projection. Owing to its squareness, the figure displays great stability in the plane and resists decomposition into a three-dimensional object.

Fig. 13: Bird's eye view of human figure framed into a square.

Overlapping

In spite of the visual acrobatics it implies, overlapping cannot be avoided since objects and parts of objects block one another's access to sight everywhere; and indeed, once the relations of shapes in pictorial compositions are carried beyond the simple arrangement of coordinated units, there is great visual delight in the interferences and paradoxical juxtapositions produced by accumulating things in space.

A requirement for the adequate perception of **overlap —or superposition—** is that the units which, because of projection, touch each other in the same plane must be seen as: (a) separate from each other and (b) belonging to different planes. The drawing by Picasso of Fig. 14 shows that overlapping is perceived when the frontal shape —in this case, the breast— makes the other, the arm, clearly incomplete. This meets the criteria.

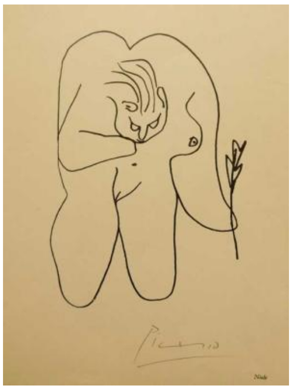

Fig. 14: Pablo Picasso: *Nude lithograph* (N/d).

Fig. 15: Overlapping of two figures.

When the overlapping units together form a particularly simple shape, they tend to be seen as one and the same thing. Thus, in Fig. 15 the shoulder and arm of the woman may be taken to belong to the man —a misinterpretation strengthened by the fact that the resulting simple symmetry also fits the basic visual concept of a human body.

Since in every example of overlapping one unit is partly covered by another, the covered unit must not only be made to look incomplete, it must also evoke the right kind of completion. When frames or other impediments cut across limbs at the joints (shoulders, elbows, knees), visual amputation rather than overlapping is the result, because the stump looks complete in itself. In bad drawings, it is also precisely at these joints that the unity of the figure breaks down. When the border of a picture cuts across a figure, the painter or photographer generally avoids the effect of amputated stumps or torsos by placing the cut so that the shape is seen as continued beyond the border.

These rules are not limited to the images of objects known from nature, such as animals or humans. The segment of a disk will or will not appear as a part of a circular shape depending on whether the curvature, at the points of interruption, suggests continued extension or an inward turn toward closure. It is not our anatomical knowledge but the nature of the shapes of the body that determines whether an organic object is perceived as complete, transformed, or mutilated.

What good does overlapping do?

If one compares Fig. 16*a*, a tracing after an ancient Egyptian frieze (Fig. 17), with a drawing of two geese walking in single file without overlapping (Fig. 16*b*), one realizes that the parallelism of the two birds, which conveys their togetherness to the eye, is shown more strongly when it occurs within one visual unit.

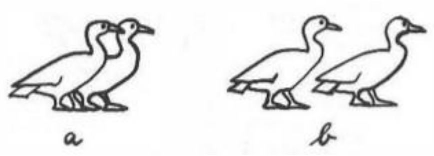

Fig. 16: Overlapping and consecutive figures.

Overlapping intensifies the formal relation by concentrating it within a more tightly integrated pattern. The connection is not only close but also more dynamic. It represents togetherness as interference through

Fig. 17: Ancient Egyptian Old Kingdom: *Geese* (c. 2560 BCE).

mutual modification of shape. Strictly speaking, the interference caused by overlapping is not mutual. One unit always lies on top destroying the wholeness of the other. In Fig. 16*a* the effect is rather one-sided. The duck on the left is in front and complete, whereas the duck on the right is only partially seen. Thus, overlapping establishes a hierarchy by creating a distinction between dominating and subservient units. A scale of importance leads, by way of two or more steps, from foreground to background.

Fig. 18: Peter Paul Rubens: *Pastoral Scene* (1636-1638).

The relationship is one-sided, however, only in the specific instance. In a complex whole the dominance-subservience relation at one place may be counteracted by its reversal at another, so that each partner is shown as both active and passive. The compositional scheme of a Rubens painting (Fig. 18) illustrates the difference between the simple, one-sided relations in the Egyptian composition and the baroque counterpoint of overlapping and overlapped elements in the Rubens, which adds up to a complex intertwining of the two lovers.

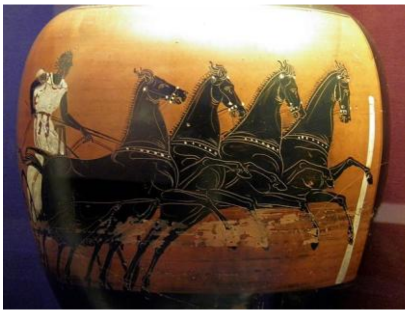

Fig. 19: Prize amphora for the winner of the chariot race at the ancient Athenian games (c. 410-400 BCE).

Overlapping offers a convenient solution to the problem of how to represent symmetry in relation to a figure within the picture. The image of the charioteer with his horses on the Greek vase depicted in Fig. 12 is an illustration of the problem. Fig. 19 shows another amphora with overlapping horses as a more suitable solution.

Interplay of plane and depth

The third dimension enriches pictorial possibilities. Pictorial depth is represented at early stages by separate horizontal strips, one on top of the other. At a later stage, overlapping is employed to obtain a three-dimensional arrangement of foreground, middle ground, and background, more or less interrelated. Later still, the whole depth dimension fuses into one indivisible continuum, leading from front to back, and from back to front.

When pictorial compositions are meant to occupy three-dimensional space, they are at a midpoint between two extreme spatial conceptions, to both of which they must be related. The two conception are those of zero percent constancy and one hundred percent constancy. At zero percent constancy, the picture is a total projection compressed in a flat frontal plane; at one hundred percent it occupies a fully three-dimensional stage. In practice, no picture occupies either of these extreme positions. Any picture has intermediate spatiality, tending to one or the other extreme in accordance with its style; it derives its meaning precisely from the interplay of both views.

Competing aspects

No more than one aspect of any three-dimensional object is visible at any place and time. In the course of her life and in fact during almost any particular episode of her daily experience, a person overcomes this limitation of visual projection by looking at things from all sides and thus forming a comprehensive image from the totality of partial impressions.

Inevitably, some aspects are selected to the detriment of others. The tradition established by Renaissance art admitted of only one solution for this dilemma. The painter had to choose the one aspect best suited for her purpose and had to accept whatever was hidden, foreshortened, or distorted from that particular view. As we have seen, early forms of art are unaffected by this rule and freely combine the most informative aspects of each part of an object or spatial situation, without paying attention to the discrepant viewpoints. Such styles of representation are committed to the object or situation as such, not to any one of its views.

Some modern art, especially cubism, also resorted to combining views from several angles in the same whole, but it did so in a characteristically different way. The modern artist was heir to a tradition that had come to identify an object with its pictorial projection. The correctness of the projection seemed to guarantee the validity of the image. Later, in the nineteenth century, such representation was found to be one-sided, subjective, accidental —which at fist occasioned applause, and then apprehension. Although the transitory images aptly reflected the passing and superficial experiences that had come to typify the life of Westerners, the world represented by these images began to look alarmingly insubstantial. Artists were exposing the fact that in their relation to reality, modern human beings were sentenced to catching nothing but glimpses. When the following generations, in reaction to this trend, struggled to recover the stable world of the more innocent eye, they resorted to the "primitive" procedure of combining aspects, but in a significantly modern way.

At early stages of representation, aspects are always put together in such a manner that, despite inherent spatial contractions, there results and organic and characteristic whole. Since the intention is to reproduce things as correctly, clearly, and completely as possible, the aspects are fitted together harmoniously, organically, and often symmetrically. The more characteristic aspects are chosen, especially front views and side views; head and neck are placed symmetrically between the shoulders; and a frontal eye can be located in a profile head because it represents a relatively independent entity.

The cubist procedure has sometimes been interpreted as if the artist wanted simply to give a more complete view of an object by combining various aspects. To appreciate the result, the observer is presumably to fly on the wings of his mind from one perspective view to the other, or to find himself at different locations simultaneously. By such mental acrobatics the viewer herself would perform the dynamics actually inherent in the work. In fact, of course, she is looking not at the three-dimensional object but at a flat picture of it, in which the aspects clash in deliberate contradiction. The tension created by visual incompatibility is heightened when different, mutually exclusive views appear together, e.g., a profile view fitted into a frontal view.

Realism and reality

In dealing with the two-dimensional representation of three-dimensional space, we have encountered a peculiar paradox. The example of three people sitting at a table (Figs. 9-10) showed that when such scene is presented as a **mechanically correct projection**, it leads to distortions in the frontal plane. In contrast, when the scene is translated into its **two-dimensional equivalent**, it can be read as the projection of a physically absurd scene, in which the table top stands upright and the three people are attached to it like flaps. It follows that there are appropriate and inappropriate ways of reading pictorial representations of space, and that the proper way is determined in each case by the style of a given period or developmental stage.

The Renaissance artists practiced the new skill of faithful projection not only in tribute to the ideal of scientifically authenticated realism, but because of the inexhaustible variety of appearances derivable from natural objects in this fashion and the corresponding wealth of individual interpretation. It is not surprising that this extreme exploitation of projective distortion eventually led to a radical countermovement, a return to elementary shapes and the elementary schemata of permanent structural norms. The reaction became conspicuous in the geometrical simplifications of Seurat and Cézanne and the primitivism pervading much art of the early twentieth century.

The realists had initiated the destruction of organic integrity. They had made objects incomplete or separated their parts with intervening foreign bodies. Modern artists did the same without the requirements of overlapping as an excuse. Obliqueness had been introduced to represent depth. Modern artists distorted the orientation of axes without justification. The destruction of local color had been carried to its extreme by the impressionists, who had used reflections to apply the green of the field to a cow or the blue of the sky to a cathedral. In consequence, modern artists became free not only to make a red object blue, but also to replace the unity of one local color with any combination of different colors.

What looks lifelike?

We have come a long way from the narrow belief that only **mechanically faithful replication** is true to nature. We realize that the whole range of infinitely different styles of representation is acceptable. However, mere tolerance for different approaches is not good enough. Just as our civilization may perceive a particular manner of representation as lifelike even though it may not look lifelike at all to the adherents of another approach, so do the adherents of those other approaches find their preferred manner of representation not only acceptable, but entirely lifelike.

For example, reactions to photography and film have shown that progress in pictorial lifelikeness creates the illusion of life itself. The first motion pictures, shown in about 1890, were so crude technically that they give us little illusion of reality today, but the mere addition of movement to the black-and-white image sufficed to make the first spectators scream with fear when the train rushed headlong toward them.

Today we can hardly imagine that the paintings of Cézanne and Renoir were rejected not only because of their unusual style, but also because they in fact looked offensively unreal. It was not merely a matter of different judgment or taste, but of different perception. Our ancestors saw on those canvases incoherent patches of paint that we are no longer able to see, and they based their judgment on what they saw.

Form as invention

Many of the previous examples will have helped to illustrate that image-making does not start from the optical projection of the object represented, but is an equivalent made with the properties of a particular medium, of what is observed in the object.

Each medium prescribes the way in which the features of a model are best made. For example, a round object may be represented as a circular line by means of a pencil, but a brush may produce an equivalent of the same object by a disk-shaped patch of paint.

But form is determined not only by the physical properties of the material, but also by the style of representation of a culture or an individual artist. A flat-looking patch of color may be a human head in the essentially two-dimensional world of Matisse; but the same patch would look flat instead of round in one of Caravaggio's strongly three-dimensional paintings.

It takes a great deal of "spoiling" before we come to think that representation is not only an imitation of the object but also of its medium, so that we expect a painting not to look like a painting but like physical space. This unquestionably less intelligent concept of representation, far from being natural to man, is a late product of the particular civilization in which we happen to have lived for a while (from the Renaissance on).

The capacity to invent a striking pattern, especially when applied to such familiar shapes as a head or a hand, is what is known as artistic imagination. Imagination is not just the invention of new subject matter, and not even the production of just any kind of new shape. Artistic imagination can be more nearly described as the finding of new form for old content, or —if the dichotomy of form and content is misleading— as a fresh conception of an old subject. The invention of new things or situations is valuable only to the extent that they serve to interpret an old —that is, universal— topic of human experience. There is more imagination in the way Titian paints a hand than in hundreds of surrealist nightmares depicted in a dull, conventional manner.

Levels of abstraction

One dimension in which the artist can exercise her freedom is the degree of abstraction she uses to represent her subject. She can replicate the appearance of the physical world with the meticulous faithfulness of the *trompe l'oeil* painter, or, like Mondrian and Kandinsky, she can work with completely nonmimetic shapes, which reflect human experience by pure visual expression and spatial relations. Within representational art, many styles of picture-making limit themselves to portraying the things of nature with just a very few structural features. This highly abstract mode is prominent in early stages of art, i.e., in the work of children and "primitives," but also certain aspects of the Byzantine style of Christian art, and modern Western art.

The patterns that result from limiting representation to just a few features of the object are often simple, regular, and symmetrical. When the mind is freed from its usual allegiance to the complexities of nature, it will organize shapes in accordance with the tendencies that govern its own functioning. We have much evidence that the principal tendency at work here it that toward the simplest structure, i.e., toward the most regular, symmetrical, geometrical shape attainable under the circumstances.

It should be noted that although in the instances under discussion the representational features derived from the physical world are few, the artist may nevertheless develop those few features into an elaborate play of shapes, which may be described variously as geometric, ornamental, formalistic, stylized, schematic, or symbolic.

As a first step toward the understanding of such highly abstract styles, we note that under certain cultural conditions more realistic art would not serve the artist's purpose better, but on the contrary interfere with it. Primitive images, for example, neither derive from detached curiosity about the appearance of the world nor from the "creative" response for its own sake. They are not made to produce pleasurable illusions. Primitive art is a practical instrument for the important business of daily life; it gives body to superhuman powers so that they may become partners in concrete tasks. It replaces real objects, animals, or humans, and thus takes over their jobs of giving all kinds of services. It records and transmits information. It makes it possible to exercise "magic influences" on creatures and things that are absent.

What counts in all these operations is not the material existence of things, but their effects. Modern science has accustomed us to thinking of many of these effects as physical events. This view is of relatively recent origin, and is quite different from a simpler notion that finds its purest expression in primitive science. For example, disease is not caused by the physical action of germs, poisons, or temperature, but by a destructive "fluid" emitted by some hostile agent.

Early stages of development produce highly abstract shapes because close contact with the complexities of the physical world is not, or not yet, pertinent to the task of picture making. It is not possible, however, to turn this statement round and assume that highly abstract shape is always the product of an early mental age. People often create elementary images, not because they have so far to go, but because they have so far withdrawn.

An example may be found in Byzantine art, which was a withdrawal from the most realistic style of representation they world had then seen (Greek art). Art became the servant of a state of mind that, in its extreme manifestations, condemned the use of images altogether. Life on earth was considered a mere preparation for life in Heaven. The material body was the vessel of sin and suffering. Thus visual art, instead of proclaiming the beauty and importance of physical existence, used the body as a visual symbol of the spirit; by eliminating volume and depth, by simplifying color, posture, gesture, and expression, it succeeded in dematerializing human beings and the world. The symmetry of the composition represented the stability of the hierarchic order created by the Church. By eliminating everything accidental and ephemeral, elementary posture and gesture emphasized lasting validity. And straight, simple shape expressed the strict discipline of an ascetic faith.

The art of the twentieth century offers another striking example of high abstraction obtained through withdrawal. Like Byzantine art, it renounced the skillful illusionism of its ancestors. Here, a specific psychological reason can be found in the changed position of the artist. The crafter who had fulfilled an stabled need in the affairs of government and religion was gradually transformed into an outsider —the producer of surplus luxury goods to be stored in museums or used to demonstrate the wealth and refined taste of the rich and privileged. This exclusion from the economic mechanism of supply and demand tended to transform the artist into a self-centered observer.

Such a detachment from the give and take of civic existence has its pros and cons. On the positive side, a spectator can stand back, and thus see better and more independently. At a distance, personal commitments lose their power; accidental detail drops out and essence reveals its broad shape. The detached artist, like the scientist, withdraws from individual appearance to seize more directly upon fundamental qualities. An immediate understanding of the pure essentials is attempted through the abstractness of the best modern painting and sculpture. Pure form aims more directly at the hidden mechanism of nature, which more realistic styles represent indirectly by its manifestations in material things and events. The concentrated statement of these abstractions is valid as long as it retains the sensory appeal that distinguishes a work of art from a scientific diagram.

On the negative side, high abstraction risks detaching itself from the wealth of actual existence. The great works of art and science have always avoided this limitation; they have encompassed the whole range of human experience by applying the most general forms or principles to the greatest variety of phenomena. We need only think of the enormous variety of creatures that a Giotto, Rembrandt or Picasso subordinates to the overall principles determining their view of life and thus their styles. When contact with a full range of human experience is lost, there results not art, but formalistic play with shapes or empty concepts.

Visual information

What has been said against the mechanical replication of physical things and about the visual interpretation of meaning through organized abstract form may have seemed to apply only to art. When it comes to images intended to convey factual information or scientific texts, dictionaries, technical manuals, etc., mechanical exactness of representation would seem to be the one obvious requirement. And yet this is not so.

Recording by photography, the most faithful method of image-making has not really superseded the human crafter, and for good reasons. Photography is indeed more authentic in the rendering of a street scene, a natural habitat, a texture, or a momentary expression. What counts in these situations is the accidental inventory and arrangement, the overall quality, and the complete detail rather than formal precision.

But when pictures are to serve technological or scientific purposes —for example, illustrations of machines, microscopic organisms, surgical operations— the preference is for drawings, or at least for photographs retouched by hand. The reason is that pictures give us the thing "itself" by telling us about some of its properties: the characteristic outline of a bird, the color of a chemical, or the number of geological layers.

This means not only that the best picture is one that omits unnecessary detail and chooses telling characteristics, but also that the relevant facts must be unambiguously conveyed to the eye. This is done by means of **perceptual factors: simplicity of shape, orderly grouping, clear overlapping, distinction of figure and ground, use of lighting and perspective to interpret spatial values**. Precision of **form** is needed to communicate the visual characteristics of an object.

A drafter charged with producing a faithful likeness of an electric mechanism or a frog's heart must invent a pattern that fits the object —exactly as the artist must do. And since producing a likeness means nothing but bringing out the relevant features, it is not surprising that the drafter must understand what these traits are. Biological, medical, technological training may be needed to make a usable reproduction of an object. Such knowledge will suggest to the artist an adequate perceptual pattern to be found in the object and applied to the picture.

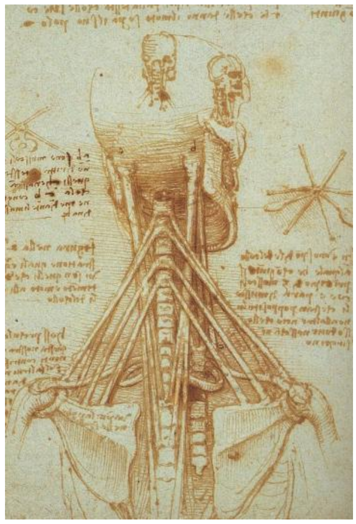
Fig. 20: Leonardo da Vinci: *Anatomy of the Neck* (c. 1515).

All reproduction is visual interpretation. The interpretations of the uninformed drafter, based on nothing but what she can see at the moment are likely to be misleading or too vague. Leonardo da Vinci's scientific drawings (Fig. 20) are remarkable because he thoroughly understood the structure and function of the things he was depicting and at the same time could organize complex perceptual patterns with the maximum clarity.

The relation between intellectual knowledge and visual representation is frequently misunderstood. Some theorists talk as though an abstract concept could be directly represented in a picture; others deny that theoretical knowledge can do anything but disturb a pictorial conception. The truth would seem to be that any abstract proposition can be translated into some kind of visual form and as such become a genuine part of a visual concept.

Leonardo's statement, "the neck has four movements, of which the first consists of raising, the second of lowering, the face, the third of turning right or left, the fourth of bending the head right or left" does not in itself dictate a particular image. But it is based on a visual conception, and anybody can use this bit of theory to look for the mechanisms of the four movements in the human body and articulate a visual idea of her own.

Since representing an object means showing some of its particular properties, one can often achieve the purpose best by deviating markedly from "photographic" appearance. This is most evident in diagrams. The pocket map of subway lines issued by the London Transport Corporation gives the needed information with maximum clarity, and at the same time delights the eye with the harmony of its design (Fig. 21). This is achieved by renouncing all geographic detail except for the pertinent topological features —that is, the sequence of stops and interconnections. All roads are reduced to straight lines; all angles to the two simplest, ninety and forty-five degrees. The map omits and distorts a great deal, and because it does so, it is the best possible picture of what it wants to show.

Fig. 21: Transport for London: Tube Map.