

SCIENCE AND ART

BY

S. W. SHIVESHWARKAR

(Department of Scientific and Industrial Research, Delhi)

ALL good science must exhibit a certain amount of artistry and all good art must essentially satisfy certain scientific requirements. It is proposed to discuss broadly the relation of Geometry and Mechanics to Art.

Art begins with drawing inasmuch as Art comprises representation on material objects of some æsthetic subject, real or imagined. By the very definition of Geometry, all drawing is essentially geometrical in the wider sense; Geometry being the study of shape and size, a mathematical method to scrutinize the shapes and sizes of isolates of Nature as perceived by the senses and conveyed to the mind. Persistent use of this method may have the tendency to make it a "second nature" of the mind which will then be incapable of judging whether the impression it has gathered has any independent existence in Nature, whether the regularity of shapes in the Universe is its intrinsic quality or whether the regularity is only a creation of mental imagination due to the geometrical method employed. (We are, of course, not alluding here to the Pure Mathematician who deals with imagined systems such as n -dimensional geometry; to that extent pure mathematics is just a thought rather than a science.) The Artist does not suffer from geometrical thinking because unlike the geometer he eliminates the method of logical deduction and is concerned only with the æsthetic impression that shape and size create on his mind. In his detachment from geometrical methods, he draws more on his own imagination and feeling than on the actualities of Nature. We do not class the photographer as an artist. The photographer is only a geometer. He uses a geometrical apparatus called a Camera and lets his lens do the work which the Artist would let his mind do. Let us now come to the scientist who deals with the particular branch of science which is called Mechanics. We shall call him the Mechanist. The Mechanist goes further than the geometer and studies the equilibrium of pieces of matter if at rest or their motion, if moving. But in spite of these differences in their outlook and

methods, there is an essential unity of purpose among the Geometer, the Mechanist and the Artist, viz., to extract and study isolates of Nature. Because of this unity of purpose the view-point of anyone of them has a certain effect on the others.

One such common characteristic is that even when the scientist and the Artist are studying the internal properties of an isolate of nature, they cannot forget the relation to the external world.

For instance, take the case of the Geometer. He commences with his points, lines, and circles and with the help of axioms and logical analysis lays down qualities of the grouping known as "properties" of one or the other of the constituents. But a point as an abstraction or a perfect isolate with nothing else in the picture has no meaning for him at all. It has no "properties". He cannot even say that "it has position but no magnitude," because unless he compared it with some other entity he could not define "position" or magnitude. Magnitude must be in terms of some unit. So also a circle isolated from the rest of the Universe is meaningless. Having no relationship to anything it cannot be interpreted. It is only when the point or the circle is associated with other entities such as lines, chords, tangents, etc., that they have qualities. It is only then that they have a "geometry".

The Mechanist is in the same situation. He takes out a chunk of Nature so to speak and studies its motions and equilibrium in any set of circumstances he wishes to analyse. He then tries to piece these together in a logical way starting from certain laws of nature which he formulates having discovered their universality. He isolates from Nature what he himself experiences, viz., mass, inertia, and force. He knows that force is necessary to change the state of motion of a piece of matter. In other words mass has inertia. By his studies, he can even predict the position of heavenly bodies at any future time. Like the Geometer he is interested in shape and size also because these affect the motions of bodies. But there is a difference. The Geometer is concerned only with the shape and size of the

constituents of the group. He is not interested how the whole group is situated. For instance to the Geometer it may not matter whether an egg is placed on a table on its end or its side. He is concerned with the oval shape only and the properties say of its chords and tangents, etc. To the Mechanist the distinction is vital for on it depends whether the egg will stand or fall or if disturbed from its position will break or not. He is concerned with the Statics and Dynamics of the circumstance.

But consider the Artist. He also draws his stimulus from the world around him as do the Geometer and the Mechanist. He also takes extracts from the real continuum of existence. He is also concerned with form, movement, force and even mass, because equilibrium and balance are essential to æsthetics. His activities are however primarily social whilst those of the scientist are only in the narrower sense social in that they might provide material for the correct action to be taken for material prosperity of the Society. Like the Psychologist and the Sociologist the Artist focusses his art on the relation of man to his environment, on the activities, the joys, the sorrows that are stimulated in human beings by human beings and nature. In this sense he might depict in art the "spirit" of man. He might detach himself from his objectives and go to a higher level of abstraction but taken as a rational endeavour on his part, Art affects the emotional reaction of social

beings with the rest of the human beings. The Artist is most concerned with the world around him. To this extent his work is drawn from the realities of Nature which the Scientist studies on logical basis. The novelty about his work is that he brings social appreciation to bear on his abstractions. Thus although in his work the detailed form may bear resemblance to Nature, the general form need not. The resemblance of the detailed form to Nature is essential to achieve interpretation. It is in this sense that the Artist cannot depart completely from qualities of a scientific nature. It is in this sense that all good science must exhibit a certain amount of artistry and all good art must satisfy certain scientific requirements. It is here that Science and Art are inter-connected.

Instances of such relations are numerous. It is an elementary result in statics that a triangle on a broad-base with its vertex within the base-line remains in stable equilibrium. The stability will suggest that it is devoid of movement. Hence the Pyramids of Egypt convey the idea of time-lessness and eternity. Hence also the teaching posture of Buddha in the Ajanta and Ellora rock-temples with its broad triangular outline with a broad base conveys Nirvana (Supreme Bliss) the eternal hope of man. An obtuse-angled triangle with a tilt forward depicts strain. A man dragging a load with a rope would form such a triangle with the load and the ground.

EXPLOSIVE RIVETS

A NEW use for aluminium is the manufacture of explosive rivets in which a charge of powder takes the place of a riveting hammer for expanding the driven end. The explosive rivet is specifically adapted to the fastening together of metal plates which are accessible only from one side, but will doubtless find much wider application.

The explosive rivet has a cavity in the aluminium shank in which is placed a small charge of a high explosive, which is set off when the rivet is heated up to a critical temperature. The heat necessary is furnished by a special riveting iron—a silver-tipped electrically heated tool held against

the rivet head. In about 2 seconds the rivet is heated sufficiently to cause the necessary explosion, which expands the shank of the rivet in such a way as to fasten together securely the metal sheets. The rivets now being made are of aluminium alloy, only $\frac{1}{8}$ in. diameter, but the development of larger rivets, up to $\frac{1}{4}$ in. diameter is proceeding. They are supplied in the age-hardened condition and do not need the careful refrigeration following heat-treatment before use which is necessary with rivets of the same alloy that are used for ordinary clinching.—(*The Times, Trade and Engineering*, Vol. 50, Jan. 1942, p. 36.)