

blown over. The exposed surface of one large pier is about 800 square feet, and of the superstructure which depends upon it, about 800 more, and so giving 800 feet for a train above, we have 2,400 feet; 21 pounds per square foot is the force of a very strong gale, but it would take no less than 96 pounds per square foot on the surface given to overturn the pier. Even the most severe hurricane on record would equal only one-half this resistant power." It will be noticed that in these remarks, Mr. Gilkes takes the area exposed by the superstructure of one span as that due to one girder only, but it is at least uncertain to what extent the girder on the lee side of such a bridge can be considered as shielded by that to windward. With a perfectly horizontal wind blowing at right angles to the bridge, the shielding effect of the windward girder might be considerable, while, on the other hand, with a wind inclined to the horizontal, its protective effect might be practically nil. This is a point on which further information is wanted. We may also point out that the train which was traversing the bridge when it failed last Sunday exposed considerably over the 800 square feet of surface assumed by Mr. Gilkes. Such an engine and tender as that on the train would expose about 370 square feet of side surface, while the surface exposed by each carriage would be fully 180 square feet, or 1,260 square feet for the seven vehicles, making a total for the train, including the engine, of 1,630 square feet. This is more than double the amount assumed in Mr. Gilkes' paper.

We may add that in the calculations leading to the results quoted above, *Engineering* assumes 400 square feet, or one-half, as the exposed surface of the lee girders, and 1,600 square feet as that of the train. Using Weisbach's formula—

$$T = 0.002252 v^2 \text{ lbs.},$$

we find the pressure corresponding to a velocity (v feet per second) of 72 miles to be 24.6 lbs. per square foot. But, as the *Engineer* points out in a thoughtful article on the subject, the overthrowing effect of a gust of wind upon a structure depends much upon whether the oscillations caused by former more or less rhythmical gusts coincide or not with those oscillations. It is not the statical pressure which proves disastrous to such elastic structures, but the active dynamic pressure, made up of the maximum impact of the wind, together with the greatest moment of oscillation of the structure itself. These involve problems which have not as yet been approached, and the fall of the Tay Bridge is a frightful warning of how disastrous reliance upon simple rule of thumb may be. That the structure was exceptionally weak in this respect does not in any way impair the value of the lesson it teaches.—*Iron Age*.

METHOD OF STUDY IN DRAWING.

(FROM MR. POYNTER'S LECTURES ON ART.)

There is no doubt that the simplest way of beginning is to make copies of drawings in outline, beginning with easy forms, and progressing to the more difficult; and the School of Design drawing-books by Dyce are admirably adapted to this purpose. But this course may easily be carried too far, and in my opinion is useful only at the very earliest stage, as a means of acquiring steadiness of hand. The youth who comes to a school of art to study may be supposed to have displayed sufficient fondness for drawing to have practised it in some form or other from his earliest years, and therefore to have acquired some elementary knowledge. The surest and best method, therefore, for him on entering the school, is to begin to make outline drawings from the round, that is, from solid objects, by which, under proper direction, he can attain as great steadiness of hand as he could from the flat. In pursuing this preliminary course, his object will be to train both eye and hand in an equal degree, by endeavoring to draw with certainty as well as with accuracy; that is to say, he should, after first adjusting on his paper the proportions of the object he is copying, try to make his outline at hand as clear and correct, and draw it with as firm and steady a hand as a young student can command under the difficulties with regard to accuracy which must beset him at the outset. The object, then, of the student is first to attain to a definite conception of the form before him, and in this he will fail unless he can express it on paper with a definite outline; next, to acquire the power of expressing the form with certainty and rapidity, which he will never do if he acquires a habit of drawing inaccurately to begin with, though he may have the full inten-

tion at the time of altering his lines to get them right in the end. In the third place, he must acquire steadiness of hand. This he must gain by the habit of drawing his lines continuous from one determined point to another, without retouching, or, as it is called, painting the line,—a point as important in figure as in ornamental drawing; the quick, and at the same time certain, apprehension of the form he is copying, and the correct rendering of it on a flat surface, being the end the artist aims at throughout his whole career.

This much conceded, the question arises as to the best models for a beginner to work from. My answer would be that he cannot do better than to begin with what he intends ending with, that is, the study of the figure.* All else is usually but time lost; at whatever stage the drawing of the figure is taken up, the student will find it as difficult as if he started with it at first. At the same time I admit that what are called drawing-models, that is, solid geometrical figures in wood, may be of occasional use in the case of young or helpless students. If a student, placed before a cast of a statue or head, shows himself incapable of rendering it in any way intelligibly, he may well be set to do a few drawings in outline from geometrical models; when, if he does not soon show signs of progress, it is probable that he has mistaken his vocation; but this is, of course, a matter for the discretion of the instructor, some students being much slower than others. It would be dangerous, however, to devote too much to this stage of study, especially when carried to the extent to be observed in the schools of the Science and Art Department,* it involves a mere waste of time; and the student should practice by preference from casts of heads, hands, feet, etc., proceeding by degrees to full-length antique figures.

There is a danger, therefore, of the student acquiring a mannered way of seeing and drawing the muscular and constitutional indications, and it is much better that he should proceed as soon as possible to study them as they really present themselves to him—that is, in light and shade—than that he should confine himself to a hard and unreal outline. I may, however, remark in passing that a student may derive much benefit in this early stage, if he looks at, and in leisure moments copies, good outline drawings of the figures, such as Flaxman's illustrations to Homer and Æschylus, so as to learn how far it is possible in pure outline to express the markings of the muscles and joints in the nude figure.

These illustrations have another advantage in being excellent studies of compositions for beginners; and although Flaxman may sometimes be found to give to the faces of his heroes a somewhat exaggerated expression, through a mannerism, contracted apparently in the endeavor to impart to them something of the character of the ancient tragic mask, yet there is a knowledge of the human form, and a grace and purity of design displayed in the grouping of the figures and arrangement of the draperies, which is well worth the attention of the young student.

We suppose the student to have now arrived at the stage of what is commonly called "shading" his figures, and he enters upon the study of *tone* which is probably, of all the departments of study to which he has to devote himself, the most subtle, the most complicated, and the most comprehensive. I might almost go on to call it the most important, for it is so intimately bound up with the study of form and color, that it cannot be kept separate, and is, so to speak, continually interfering with the apprehension of them. It is, however, precisely the point to which our English students, teachers, and painters (always omitting from the latter category certain men of eminence, but including those who practise the most popular kind of work) appear to have the most imperfect appreciation. This I believe to be due entirely to the general system of education in our art schools. You will find that as a rule the pictures in our exhibitions are, in their several degrees, strong on every point but this one.

I have no hesitation in saying that I believe most of the want of perception of unity of tone among our artists arises from the common habit of laborious work with the chalk-point. This use of the point, at all events in the way which is prevalent in our art schools, not only involves loss of time, and the sinking of the study of form and tone in that of mere execution, but concentrates the attention of the student on minute details which blind him to the general effect. It is for this reason that I have always advised my students to make use of the stump, rather than of the point, in shading their drawings; for the former, while it allows of any amount of finish of modelling, lends itself particularly well to the production of broad effects of tone, and

* It must be understood that these remarks are throughout addressed to students of figure-painting for pictures. For ornamental design a more extended course of outline drawing from the first is necessary.

* As much time used to be wasted over highly-stippled drawings of cubes and cones in schools of art, as over the antique figures referred to in Lecture III.