

ASPECTS OF EDUCATION.

Naturalism.

THE two aspects of education which we discussed in *Science*, ix. Nos. 211, 215, 227, have reference to the different ways of training the intellect. They are, however, both liable to degenerate into pedantry. With regard to the study of language, this statement needs little proof. It is difficult, under any circumstances, to reconcile an education which is merely linguistic with the preparation of the active business of life. Perhaps the best example of such a training was the rhetoric of the Romans. Quintilian's famous treatise on education described the training of the orator, and it requires some reflection to discover how so narrow and restricted a course can be co-extensive with all that is demanded by the public service. It might, however, be so in imperial Rome. The business of Rome was to govern subject populations. A Roman statesman would have occasion for oratory in the senate, at the bar, in the governing of the province. Given the traditional inspiration which would be imbibed from a race of rulers, and the practice of public affairs, with which every Roman patrician would be familiar from his childhood, the training of the orator in its widest acceptance might be the only addition which was considered necessary. Humanism, however, lay but little stress on the public use of knowledge which it gave. It taught dead, not living languages. The greatest scholar might live secluded from the world, and, as his erudition deepened, might become less fit either to influence or to understand it.

Realism was by its nature more closely connected with actual life; but that, too, might content itself with books, and the study of books produces book-worms. The rebellion against received opinions which followed the Reformation brought every thing into question, and the groundwork of education with the rest. As feudalism disappeared, there was more need of such an inquiry. In the middle ages the education of the castle had existed side by side with the education of the cloister. The knightly arts of shooting, hawking, swimming, riding, and other bodily accomplishments, were taught to the young page, as the seven studies of the trivium and quadrivium were taught to the young monk. As years went on, the idle governing classes were gradually subdued by aggressive instruction. The schools of the Jesuits were eminently fashionable, and it became necessary to appeal once more to nature. Men of the world and philosophers said, in giving what we call a training to the mind, "Let us not forget that nature has determined the quality, and a large part of the development, of the mind which we aspire to train. If we do our utmost, we can effect but little: let us be quite sure, that, in attempting to produce this small amount of good, we do not cause real harm. Let us educate, not for the school, but for life. Let us see what inherent force will effect for the mind and character of which we think ourselves master." There is some trace of this reasoning in Rabelais; but, although he is certainly an anti-humanist, he should be classed as a realist rather than as a naturalist. The three great naturalists in education are Montaigne, Locke, and Rousseau. Although their characters were very different, there is a strong similarity in their teaching. We will give a short account of the views of each. This is the more necessary, as naturalism is now rampant in our public schools, but its advocates and supporters have little notion to what philosophers they owe the principles which they enthusiastically support.

The contrast between monkish erudition and the training for the world given in the castle of a wise noble is shown by Rabelais in the contrast between the clownish awkwardness of young Gargantua, and the modest self-possession of the page Eudæmon, who, "although not twelve years old, first asking leave of his master so to do, with his cap in his hand, a clear open countenance, beautiful and ruddy lips, his eyes steady and his looks fixed on Gargantua, standing up straight, on his feet, began to commend him with proper gesture, distinct pronunciation, and a pleasing delivery, in choice Latin," whereas all Gargantua did was to cry like a cow, and hide his face with his cap. Rabelais also lays great stress on bodily exercises, and shows that he considers the training of the body quite as important as that of the mind.

The educational ideas of Montaigne are principally contained in

two essays, — one on pedantry, the other on the instruction of children. The one deals with the objects of education, the other with its methods. Montaigne says that the end of education is not to fill the head with a mass of knowledge, but to form the understanding and the heart; not to burden the memory of the pupil, but to make him better and more intelligent. Antiquity presents us with well-educated statesmen and commanders, with philosophers fit for practical life. On the other hand, learning, which is only for show, is of no use to its possessor. If we only knew what Cicero or Plato thought about a matter, we are merely the guardians of some one else's property instead of making it a possession of our own. We warm ourselves at our neighbor's fire instead of making one on our own hearth. We fill ourselves with food which we cannot digest. The most important object of education is independence. The scholar must be able to consider and to employ what he has learned in a hundred different ways. He must be taught to prove every opinion, submit to no authority as such. Learning by heart is no learning at all. Just as we cannot dance, ride, or fence without moving the body, so we cannot speak or judge with advantage without acting for ourselves. The mind must be supported by a healthy body. There must be no coddling or spoiling by foolish parents: the boy must be hardened to endurance and to pain. We are educating, not a mind and a body, but a man, who is compounded of the two. The pupil must be taught to mix with the world, to observe carefully every thing he sees. He must learn more from experience than from books. The character of great men is more important for him to know than the dates of their actions. The greater number of sciences which we are taught are of no use. The pupil must not become a book-worm, but all the conditions of his life — his walks, his meals, solitude, and society — must be made serviceable for his training. He must be taught to speak naturally, with strength and emphasis; not by erudition, but by force of character and clearness of thought. For discipline we must use a kind severity, not punishment and compulsion. The school-life must be full of joy and cheerfulness. The most important thing is to excite a desire for study. Fathers should stimulate their children by their own example, and not keep them morosely at a distance. Montaigne says that he was first taught Latin by conversation, and he recommends the same course for imitation. He tells us that when seven years old he was entirely ignorant of French, but he was well acquainted with pure Latinity, and that without books and without tears. From this sketch we find that Montaigne's object was to educate the man of the world. He wished to bridge over the gulf between the gentleman and the scholar, which existed in his time; but he would produce a gentleman at any price, a scholar if possible.

We cannot tell whether Montaigne had a direct influence upon Locke, but there is no doubt that they agreed very materially in their views. The keynote of Locke's thoughts concerning education is a sound mind in a sound body. This, he says, is a short but full description of a happy state in this world. He that has these two has little more to wish for, and he that wants either of them will be but little the better for any thing else. The first thirty sections of his treatise are occupied with the training of the body. His maxims are summed up in the words, "plenty of open air, exercise, and sleep; plain diet, no wine or strong drink, and very little or no physic; not too warm and strait clothing; especially the head and feet kept cold, and the feet often used to cold water and exposed to wet." The next hundred sections are devoted to methods of education, but there is nothing in them about books. Virtue, wisdom, and breeding are to come before learning. These are to be taught more by precept than by example. We are to guard our children against the evil influence of servants, and to rely particularly on the persistent effect of the home. Above all, we are to teach knowledge of the world. Much of the danger which surrounds young men arises from ignorance of the world. A man forewarned is fore-armed. Breeding must come before book-learning. Teaching is for the purposes of life, and not for the school: *Non scholæ sed vitæ discimus*. The tutor you choose for your son should be a man of the world. Locke puts learning last, because he considers it as the least important learning. He says it must be had in the second place, as subservient only to greater qualities. Seek out somebody that may know how

discreetly to frame his manners; place him in his hands, where you may as much as possible secure his innocence; cherish and nurse up the good, and, generally, correct and weed out any bad inclinations, and settle in him good habits. This is the main point, and, this being provided for, learning may be had into the bargain, and that, as I think, at a very easy rate.

The subjects which Locke selects for learning are very characteristic. He begins with reading, writing, and drawing. He then goes on to French and Latin; the latter to be taught in the same way as French, by conversation and without grammar. He then passes to geography, arithmetic, astronomy, geometry, chronology, and history. Then follows ethics, a certain amount of law, — chiefly civil and constitutional law, — rhetoric and logic, and natural philosophy. Great importance is attached to acquiring a good English style. Greek is omitted; for Locke says that he is not considering the education of a professed scholar, but of a gentleman, to whom Latin and French, as the world now goes, is by every one acknowledged necessary. "When he comes to be a man, he can learn Greek for himself. What a small percentage there is, even among scholars, who retain the Greek they learned at school!" The education thus commenced is completed by dancing, music, riding, and fencing. Every one should learn one trade at least, if not two or three. Gardening and carpentering are especially recommended, but not painting. The pupil is to be well skilled in accounts and book-keeping, and his education is to be completed by foreign travel, which is to be deferred to an age when he can profit by it most completely.

Locke is a great enemy of those specious and spurious studies which were so much affected by the Jesuits. He is a declared enemy to Latin verses. "Do not," he says, "let your child make verses of any sort; for, if he has no genius for poetry, it is the most unreasonable thing in the world to torment a child, and waste his time, about that which can never succeed; and, if he has a poetical vein, it is to me the strangest thing in the world that a father should desire or suffer it to be improved. Poetry and gaming, which usually go together, are alike in this too, — that they seldom bring any advantage but to those who have nothing else to live upon. He does not care any more for music, which wastes so much of a young man's time to gain but a moderate skill in it, and engages often in such odd company that many think it better spared." Locke here would differ much from Milton, who gave music a more dignified place in his programme. In conclusion, Locke tells us that what he has written is designed for the breeding of a young gentleman, but that he is fully aware that every one cannot be educated in the same manner; that each man's mind has some peculiarity, as well as his face, which distinguishes him from all others; and that there are possibly scarcely two children who can be brought up by exactly the same method.

Although public schools in England educate their pupils very much according to the precepts of Locke, they probably do so unconsciously, and are very little aware whose example they are following. Many have heard of Locke's treatise on education, but few have read it or tried to understand it. Whatever effect he has had has been confined to his own country, and he cannot be reckoned as a great influence in Europe. Rousseau, on the other hand, burst upon the world with tremendous force. 'Emile,' although its teaching about education is so little precise and systematic, has made an epoch in educational systems, and is the parent of Pestalozzi, Froebel, and the most modern educators of the present day. The keynote of Rousseau's system is to educate in accordance with nature: he may therefore be regarded as the chief of the naturalists. It is true that his conception of nature was warped by the principles of his philosophy. He considered that man in his natural state, as he came from the hands of his Maker, was perfect, and that he has been spoilt by civilization. This idea was present to the mind of Rousseau in his very earliest writings. By what means, he asks, are we to bring back the child of nature? How are we to form that strange character, natural man? Our particular care must be to provide that he is not prevented from being natural; we must not educate him for any particular function, but merely for the art of living. A man must be taught, above every thing, to lead the life of a man, and that must be done not so much by precept as by exercise. In the time of Rousseau children of the

upper classes were brought up entirely in an artificial atmosphere. This, he says, we must do away with: great social changes may be before us, and we must prepare our children to meet them. The reformation must date from the very birth: mothers must take to nursing their own children. He says, speaking of the unnatural society of his own time, "Once let women become mothers again, and men will then become fathers and husbands." As the child grows, the advice of Milton corresponds with that of Locke. He is to be brought up in the fresh air of the country, set free from bands and swaddling-clothes, taught to endure pain and hardship and change of temperature, he is to be fed on very simple food. The father has duties as well as the mother. As soon as the child is old enough to be influenced by the father's education, it is wicked of him to hand him over to another. Rousseau passes the strongest condemnation on fathers who neglect their children, whereas he sets them the worst example by depositing all his children, as they were born, in the turning-box of the foundling-hospital. Unfortunately many fathers are so occupied that they cannot give their children the minute attention which is necessary for their education, so that there is no remedy but to find a tutor who will as nearly as possible supply the place of the father. The tie between tutor and pupil is to be of the closest character. The second book of 'Emile' is concerned with the education of a child up to twelve years of age. The principal object of this education is courage. The child must learn to bear suffering, and to put up with tumbles and knocks, without uttering a cry. Strength, health, and a good conscience are the objects to be aimed at. Do not reason too much with children at this age: they must be made obedient by authority, and reason will come later. The great object of this early education is to lose time. The child is not old enough for good impressions to be firmly fixed: we must be content with averting bad ones. A child is to learn the elements of property, that some things do and some do not belong to him; but of erudition he is to learn very little. At twelve years, Emile is scarcely to know what a book is. You have educated his character by strengthening his body: if he has the vigor of a man, he will soon have the reason of a man. During this age the process of hardening is to go on: he is to wear loose clothing, to go with his head uncovered, to lie on the damp grass when hot with exercise, sleep all night, to rise with the dawn, to know nothing but a hard bed, to fear no danger, to be accustomed to toil, unpleasantness, and pain, and to defend the soul with the breastplate of a strong body. Thus armed, he will not even be afraid of death. He is to be as much at home in the water as on dry land. He is to acquire arts which are found in the natural savage, the instinct of finding his way in dark places, of measuring distances with eyes and feet, and of beating all those of his age by swiftness of foot. He is to learn the piano rather than the violin. He is to draw from nature, to learn geometry rather by observation than by definition, to learn singing by the ear rather than by the notes. His appetite is to be the measure of his food. The sense of smell is to be educated with all his other senses. At twelve years old, he ceases to be a child: we are now to prepare him for manhood. We find that he is fresh, lively, open, and simple; his thoughts are limited but clear; he knows nothing by heart, but much by experience; he has read more in the book of nature than in any other book; his wit is not on his tongue, but in his head; his judgment is better than his memory; he only speaks one language, but that sensibly. Others may speak better: Emile will act better. He does not follow formulas and authorities, but in every thing which he says and does he is inspired by his own good sense. There is nothing artificial in his manner and bearing, but they are the true expression of his ideas, and the result of his disposition. In this language, and much of the same kind, Rousseau sketches the child of nature. One would think again, that, like Locke, he is depicting the English public-school boy; but he could not have known any such, and the country gentleman who favors such institutions would rather follow any counsel than that of a dreamy revolutionist.

The intellectual education which Emile receives between the ages of twelve and fifteen is not less remarkable than his social training. Nothing is learned from books, every thing from observation. The pupil is not asked to understand what he has taught, but to discover things for himself: for instance, as he takes his morning and even-

ing walk, he is led to observe the course of the sun, how it rises and sets in different places according to the time of the year. In this manner he is led to ask questions about the course of the heavenly bodies, the form of the earth, and the calculation of eclipses. For the study of geography, no maps are placed before him. Starting from his home, he is led to make maps for himself. In this manner the natural desire of the child for knowledge is taken as the starting-place for learning, which in itself is never allowed to be a burden or trouble. Just as growing plants require not only light, but heat, so the growing man needs not only instruction, but amusement. Emile finds out by himself the existence of the meridian line and the peculiarity of the magnetic needle. He observes that by rubbing amber, glass, or sealing-wax, he is able to attract pieces of straw. In this way he learns the properties of positive and negative electricity, and connects them with the magnet. Going to the fair, he finds a conjurer who draws a waxen duck in different directions over a basin of water by presenting to it a piece of bread: he soon guesses that the bread contains a magnet, and is able to imitate the trick to the astonishment of the conjurer. The conjurer takes his revenge by placing a stronger magnet under the table, so that the duck resists all Emile's efforts. The revelation of this trick is an avenue to still further knowledge. We see here that education is made not to depend on words, but on things. No formal instruction is given. Certain things are observed to take place, and the instruction lies in the conclusions which are to be drawn from them. In a similar way great importance is attached to what would now be called technical education. Emile is to have no books except 'Robinson Crusoe,' from whose example he is to learn how to supply all his needs. Instead of reading, he is to visit workshops and practise handicrafts: he will learn more in an hour's work than he would in a whole day's explanation. Even trades are to be estimated by their usefulness. The blacksmith is placed higher than the goldsmith: the baker is worth the whole academy of sciences. Emile must learn a trade. What trade is best for him? Agriculture is exposed to too many casual losses. Many trades are merely the handmaids of luxury, and produce nothing worth having: others are unwholesome either from confinement or from the attitude in which they are practised. There are objections to the more violent trades, such as masons and smiths. The best of all is to be a cabinet-maker, which is useful, cleanly, and instructive. The modern development of technical education seems to have followed on Rousseau's lines, and to have placed working in wood in the first rank.

Thus, when his boy's years come to an end, he possesses, not a great number of opinions and accomplishments, but the capacity for acquiring them. Such learning as he has, is thoroughly natural. He does not know even the names of history, metaphysics, morals, but he is accustomed unconsciously to reason about all of them. He is industrious, moderate, patient, and courageous. He does not know what death is, but, if necessary, he would die without a sigh. He demands nothing from others, and is under no obligation to them, but stands alone and independent in human society. He has no errors but those which are avoidable, and no faults except those from which no man is free. He has a healthy body, active limbs, a mind free from prejudices, a heart without passion. He has been scarcely affected by self-love, the first and the most natural passion: he has lived contented and happy, and free, so far as his nature allows. Do you think, asks Rousseau, that a child who has thus reached his fifteen years can have lost the years which have preceded?

Rousseau's book produced a great effect throughout Europe. It is said that Kant, the philosopher of Königsberg, whose habits were more regular than the town-clock, suspended even his daily walk in order to read him, yet the practical teacher will learn but little from him. His principal effect lay in the strength by which he combated existing prejudices. When Rousseau wrote, education had become not only formal and artificial, but hollow and frivolous. The French revolution might have altered this by its unaided force, but 'Emile' still remains the book in which the ideas of the revolution about education were expressed with the greatest eloquence and vigor.

What shall we say about naturalism in the present day? It is largely practised unintentionally. While different studies are

struggling for the mastery, the natural desire for games and open-air activity occupies the field, and claims more and more of the pupil's life. In the vast development of modern industries requiring capacities of all kinds, some educationalists have seen an indication that special courses of teaching are unnecessary or useless. Nature, they say, and the pressure of the world's business, are the best teachers. How much skilled labor is demanded by a railway? Who trained the pointsman, the engine-driver? Who directed the complicated lines of trains, following and meeting each other with lightning rapidity, yet never colliding except by a terrible catastrophe? The teacher who follows the methods, either of humanism or realism, strives to make the best of the human mind intrusted to him. He wishes to develop its faculties to their highest point, to stimulate its natural capacity to its furthest limit. But when this is done, what guaranty have we that nature has any place for the instrument we have so carefully finished? If every mind were developed to the fullest extent which its powers admit of, yet a large proportion of such minds might remain useless and barren, because they fitted into no place which human society supplies. Leave every thing to Nature, she will fashion the material better than you can, into the form in which she most requires it. This statement is a paradox; and, indeed, natural education is in its essence paradoxical. It will always have advocates and apostles, especially in times when there appears to be a danger of over-refinement or over-pressure; but the wise educationalist will turn to it as a repository of cautions and warnings rather than as an armory of weapons fit for fighting against the ever-present enemies of ignorance and sloth.

OSCAR BROWNING.

THE ELECTRICAL ENGINEERING DEPARTMENT OF CORNELL.

THE equipment at Cornell in the line of electrical engineering bids fair to become, if it is not already, the most complete in the country, and probably in the world. It has been almost wholly contributed by friends of the university, at the suggestion of the director of Sibley College and others interested in its progress. The last and most important addition to the collection is that of the Westinghouse 650-light alternating current dynamo, exciter, lamps, and other material required in establishing the plant. The list of dynamos now includes the Edison, the Gramme, the Mather, the Westinghouse alternating current, the Westinghouse continuous, a number of Weston and minor makes, and all sizes, from a little toy machine made in the university shops, to the 50 or 60 horse-power machines just added to the list.

There comes with this liberality on the part of friends of the university an embarrassment of real importance: there is no immediately available room for the installation of these machines. The dynamo-room now appropriated to the purpose is hardly large enough for the 'cradle' used in conducting experiments on a single machine. The Weston machine is tucked in one corner, and the Edison and Mather machines are temporarily placed in the middle of the floor, and driven as best can be done from there. There is actually no room even to lay down the new machines now *en route* from Pittsburgh, still less to place them for use. In this emergency, the director has obtained permission from the trustees to make temporary provision for them by throwing the existing toilet-rooms into the machine-shop, thus securing a space of some fifteen or eighteen feet by nearly forty, in which to place all these machines. It has long been considered advisable, on the score of safety and convenience, to remove all heavy machinery from the main building, and this transfer of the dynamo-room will give opportunity to effect other improvements there in time. Professor Morris is already arranging new toilet-rooms, and getting ready to tear down the brick partitions which have been found to be in the way of the new arrangement. Professors Van Vleck and Smith are preparing plans for the belting and countershafting, in consultation with Professor Nichols, and the work is to be proceeded with at once. The space now given up to this machinery must, however, in time be required for the extension of the machine-shop, and it is only a question of time when a building must be constructed for this course and its collections. Nearly forty students now enter the course annually, and it is only second to the regular course in mechanical