CULTURE AND MANUAL SKILL

By C. W. HANSEL

A CRITICAL analysis of the traditional classical education in Britain reveals in many of its protagonists a narrow and prejudiced outlook, almost a pride in ignorance of science, and a contempt for manual skill. They seek to apply to the social problems of to-day a strangely perverted form of what they regard as the best ideas and practices of Greek times. Their choice and adaptation have been unfortunate, because much that is worthy of imitation has not been followed, and a great deal of inferior substitution has been made. Traditional classical education lies nearer to scholasticism than Hellenism. It is unbalanced in its blindness for everything except book learning, and it is dangerously inadequate in that it ignores the many and only partially caters for the few. Further, it is apparently unaware of the complete transformation of civilization which has resulted from the progress of science, industry, and the arts.

Sir Richard Gregory has said, "There has always been a lag between stages of scientific knowledge and social or moral wisdom. What is particularly needed to-day is to promote public interest in the close relationships of natural science with other humanistic studies which influence the thoughts and actions of all citizens."

The education of the Greek, at the time of Plato, consisted, up to the age of about seventeen, of very simple instruction in the three *R*'s, music, and dancing or gymnasium. Then followed a period of compulsory public service from seventeen to twenty. If worthy of further education, from twenty to thirty he studied mathematics and science, but not to the neglect of public duty. Philosophy was reserved for later life. There is much that is attractive in this system. There is no forcing of the pace, but a natural growth of the mind. There is an insistence on national service from everyone. There is recognition of education as a life-long process, schooling being merely part of it. Education is cultural not vocational, the one object of leisure. There is the exclusion of abstract and philosophical discussion from the education of those lacking maturity and experience. There is an immense and just appreciation of the mother tongue. Only two matters call for criticism: the undue emphasis on memory and the veneration of warlike pursuits: "Pallas I celebrate, sacker of cities, terrible goddess of war" (Aristophanes).

How has Greek education been modified in the traditional classical education of Britain? Every desirable feature of the Greek system has been changed or eliminated and almost every undesirable feature of scholasticism has been retained. The school retains the seclusion of the monastery; it is usually unconnected with home life and with the community in which the pupil will afterwards live his life. Far too much is attempted for the mind of the young pupil to expand naturally, with the result that the English language and literature are neglected in the attempt to cover excessive detail in a multiplicity of subjects by sheer memorization and imposed instruction instead of naturally acquired knowledge through the medium of concrete experience and self-instruction.

One of the most serious defects of classical instruction is the contempt it breeds for manual skill. This is one of the legacies of Greece and Rome.

Archimedes is not mentioned in the twelve volumes of Grote's "History of Greece" or the eight volumes of Thirlwall. Quoting from the Langhorne translation of Plutarch's "Lives": "Eudoxus and Archytas who gave a variety and an agreeable turn to geometry, and confirmed certain problems by sensible experiments and the use of instruments, which could not be demonstrated in the way of theorem. . . . But when Plato inveighed against them, with great indignation, as corrupting and debasing the excellence of geometry, by making her descend from incorporeal and intellectual corporeal and sensible things and obliging her to make use of matter, which requires much manual labour, and is the object of servile trades; then *mechanics* were separated from geometry, and being a long time despised by the philosopher, were considered as a branch of the military art." "Archimedes . . . considered all attention to *mechanics*, and every art that ministers to common uses, as mean and sordid, and placed his whole delight in those intellectual speculations, which, without any relation to the necessities of life, have an intrinsic excellence arising from truth and demonstration only."

Quoting from a Royal Institution lecture by Prof. Benjamin Farrington: "What are called the mechanical arts", says Socrates, 'carry a social stigma and are rightly dishonoured in our cities.' "The word surgery is, of course, simply the modern form of the Greek *cheirourgia*, which means manual operation. And we shall find reason for connecting the decline of anatomy after Galen with the ancient prejudice against the *cheirourgos*, the surgeon or manual operator." "That the Greeks early acquired a contempt for manual labour is certain. 'The noble are those who have escaped the yoke of manual labour' (Herodotus)." "The sick in our cities", writes Plato in the *Laws*, 'are of two classes, the slaves and the free.' "Theirs were the crafts which Aristotle defined as being necessary for the existence of the city but as disqualifying their practitioners from citizenship."

The denial of culture to the craftsman is surely born out of an entirely unbalanced education and a completely mistaken and narrow view of culture. Culture proceeds from all those activities of mind and body that are worthy of cultivation. Matthew Arnold once said "culture unites classes"; this can scarcely refer to a state of mind which fails to recognize the dignity and worth of labour and manual skill.

Sir Richard Livingstone in "Education for a World Adrift" (see NATURE, May 8, 1943) speaks of "spiritual values" and the "noble ideals of Hellenism". The "Age of Science" he identifies with an "Age without Standards". He finds in Greek literature (even in translations) a "philosophy of life" not to be found elsewhere. Does he prefer the inhuman recital of strife, intrigue, and cruelty, for example, in Plutarch's "Lives" to what youth may learn from Smiles' "Lives of the Engineers"? Does he prefer to dwell on "the torture of the boat" rather than on the work of Lister or Pasteur? He asserts that science is non-moral and unconnected with standards of value. Has he read the second Huxley Lecture of the Anthropological Institute, by Francis Galton (see NATURE, Oct. 29, 1901)?

Sir Benjamin Brodie, in an address to the Royal Society (1859), said: "Physical investigation, more than anything besides, helps to teach us the actual value and right use of the Imagination—of that

wondrous faculty, which, left to ramble uncontrolled, leads us astray into a wilderness of perplexities and errors, a land of mists and shadows; but which, properly controlled by experience and reflection, becomes the noblest attribute of man; the source of poetic genius, the instrument of discovery in Science, without the aid of which Newton would never have invented fluxions, nor Davy decomposed the earths or the alkalies, nor would Columbus have found another continent."

Only one defect of classical instruction has been discussed. There are several others. The philosophical speculations of traditional Hellenism and the mechanical memorizing and formalism of medieval scholasticism have dominated educational schemes for centuries. Such a system of instruction has been tried and found wanting—it has masqueraded under the name of education. Let our educational aims be more worthy and appreciative of our glorious English literature, more adapted to human needs, and a study of Christian rather than pagan principles. The English language and literature, together with the arts and sciences (including mathematics) and the cultivation of a sound body, provide the basis of a complete and balanced education and a generous culture.

RHEOLOGY IN THE TEXTILE, LEATHER, SHOE AND ALLIED TRADES

AT a meeting of the British Rheologists' Club, held at Loughborough College on September 18, papers were read by Mr. A. Pollard, Dr. C. A. Maunder Foster, Mr. A. March, Mr. P. Danby and Mr. P. Stanley Briggs, and there was a discussion under the general title of "Rheology in the Textile, Leather, Shoe, and Allied Trades". It is convenient to deal with the proceedings in sections.

Textiles

In weaving, two banks of multiple warp threads are opened ('shedding'), a shuttle holding a single weft thread is passed through the 'shed' ('picking'), and a comb-like reed forces the weft into place ('beating'). The next 'shedding' operation locks the weft into place. Small inaccuracies in these three locating operations are, with staple material, partially corrected by the hairy projections from the yarn. With a smooth yarn such as rayon, which is solid rather than tubular, better location is needed; and the low 'tenacity' of the material calls for less alteration of stress than occurs in the normal 'broadcloth' loom.

In one modern ribbon loom, attention was given to these matters; warp tension was kept constant (the healds moving over the arc of a circle, centred at the line of the weft), the beating reed was given a very low amplitude, and all moving parts of the machine were very exactly controlled. Besides giving accurate and reproducible weaves, the output-rate of this machine is of the order of 1,000 'picks' per minute, or some 4-5 times normal speed of production.

A poor view was taken at the meeting of the engineering ability of many designers and builders of textile machinery in general. One assertion was made, that 'tenacity' of yarn (breaking strain in

ounces per denier) does not necessarily measure its probable behaviour in weaving.

Shoemaking

Great use is made of stitching: upper construction; joining of lining to upper, of upper to insole; of insole to welt, and of welt to outsole. Each of these operations is alike in outline; but as each unit process of the stitching differs according to the particular job, a whole range of machine designs, of awls, needles, shuttle threads, and of sewing threads is required.

For lubricant, the hand cobbler uses beeswax; shuttle threads are waxed; sewing threads are rosined; and the material which, in the making operation, acts as lubricant, after cooling down seals the holes and preserves the threads.

In toe, and in heel, reinforcement is used. For this purpose the toe 'puff' may be shoddy cloth, sized with pitch or pyroxylin; or, for miners' boots, it may be steel. The toe-cap, puff reinforcement and lining must suffer the drafting strains of pulling on to a rigid wooden last; and thereafter must retain shape, and hold together as a unit.

The stiffener for the heel part is required to be rigid at its meridian, thin and flexible at its top edge.

After the shoe has been lasted, there is a hollow space under the middle of the insole; this must be suitably filled with a composition having resilience, before the outsole can be sewn or stuck on. Thus, the foundation of the average shoe is a 'sandwich' of leather insole, cork composition or felt filler, and leather or rubber outsole. Should the filler be too soft, it will shift under the pressure of the foot, to give lumps and hollows in the insole surface which will be uncomfortable in wear.

Resilience, deformability, flexibility and the like are most often judged by the test of the trained finger-and-thumb. It would be desirable to have an artificial digital assembly, not subject to fatigue (or to prejudice), for these purposes.

In the operation of shoe-building, rubbery adhesives are largely used. The processes are repetitive, mechanical, and output is very large (the standard figure for the United Kingdom is rather less than 100 million pairs annually).

The adhesive maker needs, therefore, to maintain a steady consistency in his products; and this task is not simple with some of the present-day materials. For example, with a falling sphere viscometer, a thick paste of reclaim rubber solution may appear to have both thixotropic and dilatant properties. In a case such as this, trials were made, using a rotation viscometer, to obtain a consistent reading, so that a method might be available for works use. Rotation times were taken with different loads, after various periods of stirring. Constant time for a single turn was attained in a typical experiment on a Störmer instrument, after sixteen turns. Provided the load was above a certain lower limit (2 kgm.):

Load 2.1 kgm.	after	1	2	4	8	16	32
Time of single turn (sec.)		36	26	21	16	10	10

Restoration of the system to the former high viscosity figure could not be completed: after 100 hours it was still slowly increasing, in linear fashion.

For measurements on this kind of stuff, the torsional viscometer was recommended as more suitable.