Some Aspects of Modern Industrial Life

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Introduction

After his marriage with Mary Paley, in 1877, Alfred Marshall resigned St John's College fellowship and moved from Cambridge to Bristol where he was appointed, on the 26th of July 1877, as Principal and Professor of Political Economy at the newly-founded University College. It was his thirty-fifth birthday, and he was guaranteed a salary of £ 700 per annum, of which £ 500 was in respect of the Principal's work, £ 200 for that of Professor (Groenewegen 1995: 275-84). On 7 October 1878, Marshall gave his Inaugural Lecture as Principal of University College (Whitaker, 1972: 53-61) titled "Some Aspects of Modern Industrial Life". The text of the Lecture was never published but a long manuscript – albeit with some missing parts – is preserved in the Marshall Library Archive, Cambridge.

This Inaugural L ecture has drawn little attention and interest over time and a very few people refer to it (Whitaker 1975, 1996; Maloney , 1990: 186-87). The reasons of this curious neglect are rather obscure especially because the text is interesting and worthwhile being published.

In 1875 Marshall went to the United States in order to inquire into the situation of American industry and economy. What he saw, learned and concluded is well synthesized in the speech given at the Moral Science Club in Cambridge "Some Features of American industry" but even better in the numerous letters written to his mother in which Marshall accurately describes the characteristics of the developing American industry, its methods of production, its industrial organization and relations, the levels of wages, the condition of labour and so forth.

Once in Bristol, Marshall had a very busy time especially as Principal of the College with a lot of administrative duties and responsibilities that left him a very limited time for scientific study and research and this made him feel uneasy. This is confirmed in a letter written to Foxwell (21 November 1880): "I'm not very happy here: not because I dislike my work; but because I do not really like it: and it is a pain to me to see one month after another pass away with practically nothing done that I really care for" (Whitaker 1996 vol I: 129). Moreover, the scarce time to be dedicated to his main interests affected, according to Marshall, the quality of his work. So, for instance, with regard to his I naugural L ecture, Marshall must have been really unsatisfied. This is confirmed in a letter written by Mary Paley to Foxwell (10 October 1878) : "Alfred would scarcely allow me to send you a copy of the Inaugural, he sternly resisted my sending one to Mr Sidgwick, for he says he had to do it rapidly and amid so much other work that he is not at all proud of it" (Whitaker 1996, vol. 1: 103). It is not by chance, perhaps, that a similar discontent involved also the volume *Economics of Industry* written together with his wife in those years!

The Lecture has many reasons of interest since we find in this "young" Marshall's contribution almost all the main foundations and the "nagging thoughts" of a more mature Marshall: the role given to history as an essential part of any scientific knowledge; his evolutionary point of view with the importance given to mind, mental activity and imagination; his deep concern for international competition and new rivals to Britain expressed also in *Industry and Trade* (1919) , particularly Book I, Chapter V "Britain's industrial leadership under strong challenge", and more seriously in his private correspondence (Whitaker, 1996); his ambivalent sentiment towards Trade Unions (on the one hand considered as helpful means for educating people and improving their condition and on the other hand as dangerous organizations when they act for their own particular interests and impose fix rules); his concept of progress understood also as an amelioration process of human character and the fundamental role recognized to education, the chief means through which a nation, a people, a generation can evolve.

The subject of the Lecture corresponds perfectly to his main worries: in fact we find those elements that, especially after his visit to the States, must have appeared urgent with regard to Britain. We want to underline here two of them. First of all, "education". Marshall's effort for reforming education is well known (Cook, 2006) as is his hostility towards the study of the classics – especially ancient Greek – as a compulsory part of the *curriculum studiorum* in Cambridge. In his Inaugural Lecture, he underlines the necessity for a young student to " learn those

facts which will enable him to understand more of the world in which he lives, to think new thoughts & obtain new power" while stating? that "if a boy spends his energies in acquiring a knowledge of vocabularies & of the genitive cases & irregular verbs of a language which he does not use in after life, so far his education has been a failure: not a complete failure because he has got some benefit from the grammar; but a failure". In order to keep pace with the times, Britain had to become "modern", first of all through the modernization of education, the essence of economic and social progress. He used his Lecture to excoriate business education which consisted of 'barren facts which the boy threw off when he went into business as a bird shakes the raindrops from its feathers when the rain is over'.

Secondly, it is very interesting the way in which Marshall opens the Lecture by blaming the dangerous habit that a generation could have of revelling in its (past) success. Efforts, sacrifices, and challenges are the main ingredients to progress from one generation to another. Again, the message seems very clear: Marshall knew that Britain was loosing his economic supremacy while other countries, first of all America, were greatly developing. The main problem was that British people rested on their laurels from past success and nothing was done in order to change and develop. This aspect worried Marshall for all his lifetime: his concern can be seen in fact in *Industry and Trade* but even more clearly it appears in some pages of his correspondence, as for instance in a letter to Westcott (1901): " Fifty years ago (…) America had few specialities, and so had France. (…) We owed our leadership partly to accidental advantages, most of which have now passed away. But we owed it mainly to the fact that we worked much harder than any continental nation. Now, on the average, we work less long and not more vigorously than our fathers did: and, meanwhile, the average amount of thoughtful work done by Germany has nearly doubled; and a similar less marked improvement is to be seen in other countries. Americans and Germans jeer at the way in which many of our business men give their energies to pleasure, and play with their work; and they say, truly as I believe, 'unless you completely shake off the habits that have grown on you in the last thirty years, you will join Spain' " (Whitaker, 1996, II: 292-3) . Marshall also wrote to Edward Caird, Master of Balliol, at the end of 1897, concerning the strikes of the Amalgamated Society of Engineering, which he probably considered to be Britain's "Achilles' heel": "I am wholly a trade-unionist of the old stamp. …Everywhere the tried men who had made trade-unionism the greatest of England's glories, have been pushed aside. …Lately they [the Engineers] have used their grand prestige, I hold, for Englands ill. …If the men shd.. win, & I were an engineering employer, I would sell my works for anything I could get & emigrate to America. If I were a working man, I would wish for no better or more hopeful conditions of life than those wh I *understand* to prevail at the Carnegie works now" (ibid. 203-4).

The Lecture here reproduced has some missing parts and has some notes by Mary Paley on the first page where she writes "This, I believe, is the inaugural lecture given at University College Bristol in Oct 1877": the indication of the year is incorrect. Other notes by Mary are on pages 39 and 40.

Text

[1] The traveller returning from distant countries has a natural bias towards exaggerating the wonders that he has seen.

And in the same way, the old man who remembers the time of our fathers, or the historian who has past his life among our remote ancestors has a natural bias towards exaggerating the greatness of the ages that are gone by. The moralist too finds that it is an effective rhetorical device to contrast the pettiness of man as he is with the grandeur of man as he was.

And we often hear a panegyric on the marvellous power of modern machinery ended by a lament for the decadence of man who has to use it.

This habit of expatiating on the virtues of our forefathers & the vices of ourselves has doubtless something to be said for it. It is certainly good that a man, when he looks at others, should dwell on their good points; so that his mind may **[2]** be filled with the images of beautiful & noble things towards which to strive. And, if he thinks about himself at all, it is better that he should dwell on his faults than on his virtues.

Again the various appliances of the present age enable a man to know so much more & to do so much more than he could have known & done even a hundred years ago with the same ability & industry that perhaps a few very foolish people might become conceited by emphasizing their own achievements with those of their forefathers unless they were continually reminded of the difficulties against which the earlier generations contended & of their resource & energy in overcoming them.

But on the other hand there is much to be said against this habit. Humility belongs to the individual not to the age. Those who are not extravagant in their praising of past ages & in their blame of the present, are often at no pains

to emend the fact that they regard themselves as conspicuous exceptions to the degeneracy which they deplore. And again, though there are some men to whom it is well to speak of their faults, there is no one who is not injured by being told that he is worse than he really is. Nothing tends so much to lower a man as the conviction that he is incapable of rising to better things: nothing tends to raise a man so much as the hope that he may do great things. And on the whole it may be questioned whether a moralist who spends his energies on decrying the pettiness and dullness and commonplaceness of the present age does not do more harm by chilling men's aspirations than he can do good by checking their conceit.

In fact in argument as elsewhere honesty is the best policy, exaggeration is a blunder. And the exaggeration of evil **[3]** is a double blunder.

But it is not easy it is not possible for us to take a comprehensive survey of the virtues & vices of our own generation & compare them with those of past times. History has recently made wonderful strides; but it does not & it never can enable us to measure in the balance the goodness & badness, the greatness & smallness of the vast myriads of the English people in past generations. We cannot even look among us & guess with any approach to accuracy how many of those among whom we live are capable of great things.

But yet we know that some periods in past history were great & that others were small. And we can see that all great times had something in common, & that all small times had something in common. History shows us that all great times were times of action, times of change & excitement, times when men were doing new deeds & thinking out new thoughts; & feeling out the emotions that were raised by the freshness of the times.

Art indeed seems to require leisure. There is an element of repose & of self chastening reserve, not perhaps in all good art but at least in almost all of that art which endures throughout all time. And therefore Art has attained its culminating point not as often in periods of strong excitement as in the periods **[4]** that have immediately followed them. For in a time of strong daring men have learned to work earnestly towards their aims, they have learnt to reverence those actions which were strong in purpose & went straight to the attainment of a difficult end, they learnt to care little for that which had not the clear ring of truth. And when the turmoil was over the whole force & grace of men's nature found its expression in glorious art. It is then true of art as it is of every thing else that is noble, that its origin is to be found in times of change & transition, in times when men's whole energy was called forth in wrestling with new difficulties. These have being the great times of the worlds history.

And the small times of the worlds history have been times in which men have slid along accustomed grooves have grappled with no new difficulties, & have had little ambition beyond that of doing the things which their forefathers did as well as their forefathers did them.

[5] They have felt themselves safer in adhering to well established precedent than in striking out a new course for themselves. There has been little change. The problems of their time have been so much like those of the preceding that this method of getting along worked fairly well. So they have become well satisfied with themselves. They have done little; & therefore they have had plenty of time to debate about their method of doing it. They have been generations of critics, of learned gossips, well versed in proprieties: able to show how everything that happened was rather like something else that great men of past times had dealt with in a certain way, & which therefore all praiseworthy people of the present day would deal with in the same way. But because they have preferred to react the old rather than to work out the new, therefore they have learnt nothing, & they have taught nothing to future **[6]** generations. They have not revelled in the energy of times & therefore they have not truly lived: they have scarce had any share in the grand life of this old world of ours.

When then men have had great things to do, they have themselves become great; when they have had small things to do they have become small.

This fact gives us some means of guessing what future ages will say of our generation; & perhaps the only means. For we cannot fairly judge ourselves by the canons of criticism. The canons of criticism must be based on the forms of the past; & the form of whatever is best in our own age must be unlike the forms of what was best in the times of our ancestors, because whatever was by their genius best adapted to the needs of their age cannot be also that which is best adapted to the widely different needs of our age. But though the forms of the past are useless for our present purpose, we can use the experience of the past to help us to measure ourselves in this way: we can see whether we in this generation have difficult work to do, & we can see whether we have the [as] spirit of **[7]** the great ages of the world which rises with difficulties & rejoices to do difficult things with all its might.

I think that if we look around us we see difficulties on every side, & we see men contending with them manfully. The chief struggles now as in almost every other great age of the world are those which are raised by the new thoughts & new feelings surging up in men's minds with regard to religion. There is both in men's religious beliefs & their disbeliefs less sluggish complacency, less selfish worldliness than there used to be. It is an age of earnest belief & disbelief.

Or if we look at the world of thought we find science bounding along her new career like a greyhound

slipped from his leash. Men do not say let us seek out the things that our forefathers thought difficult and do them; nearly everything in science that our forefathers thought difficult, most things that our fathers thought difficult have been done. The present generation has taken for its task those things which earlier generations pronounced to be impossible. But I must leave this theme to others. What I wish to do tonight is **[8]** to take a rapid survey of the difficulties that are being encountered by the present generation in their industrial life.

Industrial life is many sided; but I think we shall find that on almost every side difficulties are increasing & men are bracing up their energies to overcome the difficulties. I think that if we look at the industrial work of the present age we find a great increase of that mental activity which is a chief characteristic of every great age.

Looking at industry generally, we find that what was settled has become unsettled. Men have constantly to forecast the future working out difficult & complex changes in their head, as the chess-player works out in his head distant moves on the brand **[10]** that their neighbours are not more enterprising than they are. But now the battles of trade competition are now waged from afar: they are quick, sharp and decisive. But now the changing enigmies of trade & the rapidity of inventions alter in a very short time the whole character of a trade; and if a man now consoles himself with the reflection that his neighbours are as sleepy as he is , he will have shortly to console himself with the further reflection that his neighbours are as poor as he is. Again there has been a great change in the relations of employers & employed. This is partly a consequence of the rapid changes in the manner & matter of the work done by the various trades, partly a consequence of the growth of large factories & of production on a large scale. In old times men were hired by the year to do customary work in a[n] customary way at a customary wage. But now employment is generally by the week; & employers & **[11]** employed are constantly scanning the signs of the times to see what changes in wages the morrow may bring forth.

But further in old times when a man did make a bargain with his employer he had to think only of his own interest & his duty to society generally: now he has also to think of the wishes of his Union. Duty to his Union seems to the Unionist to be a virtue akin to patriotism. Unionism at its best does resemble patriotism in calling forth deeds of self-denial and educating their mind. But Unionism is more apt to be misdirected than patriotism; & either Unionism or patriotism misdirected induces men to do things which they would be ashamed to do in their private their private **[repeated in the original]** capacity and for private ends.

In fact whatever branch & whatever rank of industry we look at we find that men's minds are now torn this way & that by conflicting notions with regard to their duty. In particular the questions of right and wrong that are connected with the work of trade combinations whether of employers and of employed are as urgent , & offer, I think, as hard an exercise to the mind as any moral difficulties that have ever troubled the world. **[12]** Now there is in many respects an increasing difficulty in that task of reading the signs of the times which occupies both employers and employed. Not only is business more complex, more highly organized, more various, & more rapidly varying than it was; but an entirely new set of difficulties had been brought in by the growth of the modern system of credit & of its power of producing a general rise or a general fall in prices.

It may be well to examine this difficulty rather carefully partly because it affords a good illustration of the fact that modern business is of much more recent date than we are wont to think, partly because recent events in England generally & in Bristol in particular make its discussion specially opportune. In old times when payments were made chiefly with gold & silver coins prices could not rise or fall with great rapidity.

[13] But now paper in various forms is a far more important means of payment that gold & silver. There is one building in London called the Clearing House in which the total amount of payments made by cheque in any single week in the year amount to as large a sum as all the gold & silver in circulation in the United Kingdom.

Again Sir John Lubbock took the trouble of analysing twenty three millions of money that were paid into his bank some years ago & found that the amount paid in coins was only 6 percent that is a 1/166th part of the whole: all the rest was paid in various forms of paper, chiefly cheques & bills, which amounted to 16/17th of the whole sum. Well, all these bills & cheques rest on a basis of mutual trust & confidence, they rest on credit.

[14 + 15] Variations of credit raise & lower prices: making and mar[ing] men's fortunes as they go credit moves with rapid but stealthy steps; the signs of her movement are hard to read: but woe be to the man of business who fails to read them.

Let us see how in times of commercial prosperity credit rises, & raises prices. ||| It must be remembered that the machinery of credit **[part missing]**

[21a] There have been commercial storms in all ages; but in older times they moved slowly, they did not affect all trades as they do now: the trades that are most affected by a storm now, such as the iron trade & other trades that make machinery & manufacturing plant & railways were not in existence; & few men vexed their minds with the difficult attempt to forecast a coming storm.

[21b] Another difficulty closely allied with this is that of over production. The cry always raised after such a time. The cry is not new: all the things that are said now about overproduction used to be said before. But because the

movements in prices are more violent than they were the question of over production exercises the mind of the English people to a greater extent than it did. I must not stay to go into the question. Now; but yet in the light of recent events I hardly like to pass it by without raising a protest against the course that has been adopted by some able and genuine friends of the working classes with regard to overproduction. They have insisted on the true doctrine that in some peculiar circumstances a trade can benefit itself by limiting production; & have omitted to insist the same time upon the legally true but less palatable doctrine

[21c] that if we all all **[repeated in the original]** diminish production together we shall all infallibly grow poorer and poorer together.

Wealth not money but things.

Less things produced, less to be consumed

Only way out of depression for all who can to go on producing

trades which are employed give occupation to others confidence grows: more trades employed

These give occupation to more & so on..

Political distrust may delay; but can't prevent revival

There is one way, one sure way, & only one sure way to prevent revival; and that is to produce little: then everyone will have little, & will buy little & the disorganization will last for ever.

But I must return.

[27] Now looking at all this work we see that it requires energy, & concentration of purpose, it requires the use of the scientific imagination, of that power of picturing to oneself & realizing people that one has not seen & needs that one has not seen, & events that one has not seen & mechanical & chemical & physical combinations that one has not seen.

And when the work is well done & means are perfectly well adjusted to ends, the result has a grace & a delicacy which make it kin to the work of art. A hammer seems a very simple thing; but in fact several hundreds different kinds of hammers are made each adapted to its special work; & when a skilled workman is using the right kind of hammer for his work there is a rhythm & grace about his movement which would be lost if he had the wrong kind. When a machine is perfectly adapted to its purpose, having no useless material, when it moves quickly & easily & does its work without effort, it has beauty like that of the race-horse, a beauty which it requires some knowledge to appreciate, but a beauty for all that.

And the making of such machines trains the mind & gives it a tone which has something of the ring of greatness about it.

[28] Of course all this work is paid for; & there is in what is called the society of culture a habit of talking of such work as though there were necessarily something mean & sordid about it. Of course some machines are made merely fort the sake of being sold: but so are a great many pictures & poems .

It is better to make a wheelbarrow for the sake of money & only for the sake of money, than it is to write a partisan poem merely to please a patron as many poets did in earlier times. For they deliberately coined into money the best things that they possessed; while the wheelbarrow maker need not allow his inner life to be much disturbed by his making of wheelbarrows.

But if a poet or a painter or a wheelbarrow maker thinks first of doing his work well & only secondly of the money he will get for it, **[29]** neither he nor his work is in any way lowered or debased by his being paid for it. If you convince a man that his work is sordid when it is not sordid, you do him I repeat a deadly injury. The belief that it is sordid will cramp him & go a long way towards making him sordid. But if there is in his business room for vigorous & creative intellect in adapting means to ends, & devising new means & new ends, and you can convince him of this you will do him a service. All the force and the energy that is within him will be drawn out towards his work; & he will become strong by doing hard things. If there is room in his business for imagination & delicacy & grace; & you can convince him of this; you will do him a great service. If he is the right man for the work, all that is best within him will go forth towards that which is best in his trade. He will aim at excellence for the sake of excellence , he will take an artistic pride in the things that he makes & sells. I do not suppose, I do not hope, that we shall ever cease to be a nation of manufacturers & merchants of artisans and shopkeepers: but I do hope and think that we may become a nation of artists, of men who glory in their work **[30]** because it is the best work that their heads & hands can do; because they have tried to make it satisfy their notions of fitness & adaptation to its purpose of grace and beauty better than anything of its kind that has gone before. ||| When we look at the industrial life around us **[as]** a whole we are I think justified in concluding not only that this generation has difficult things to do, but that there is more mental energy spent on doing them than in any other generation of the worlds history. It seems to me that future ages will pronounce this age great on account of its industrial progress if on no other account. || But this age will, I think, also be remembered as an age in which evil was interwoven with good in a marvellous way. For it must be admitted that men give themselves up their business more completely

than they used to do; & though most kinds of business offer a noble career to a man who enter business with high aims, there are few businesses which will raise the aims of a man who has been educated to think only of low aims.

Probably the thirst for gold does not lead men into meanness & dishonesty so often as it used to do. Probably there are fewer business men than there used to be who care for nothing but eating & drinking. But the hurry of modern times does certainly increase one danger – the danger that men may lead lives which **[31]** though neither mean nor sordid are yet petty; simply because they can find no time to do thoroughly well any one thing. The number of small details that have to be attended to in modern life is something terrible. Details must be done, a man who intends to do his work honestly cannot shirk them. But details do not educate a man, they do not bring out what is best in him; & if a man spends his whole life upon details, upon things which he hurries through trying to get them over as quickly as he can, he is not likely to make any near approach to greatness.

A man's best safeguard against this danger seems to be a firm resolve to take time to do at least some one thing as well as he possibly can do it. Such a resolve truly kept will be the salt of his life; & will prevent it from becoming petty whatever his occupation be. If the work that he takes for his highest aim, to be done with his best strength, is part of his regular business as the designing **[32]** of machinery if he is an engineer or furniture if he is a cabinet maker, so much the better. But there are some businesses particularly some of those which are chiefly concerned with buying and selling goods, in which there may be no part of a man work which he can love with his whole heart & soul. And in this case it is best that he should seek his ideal work outside of his business. He may seek it in philanthropic work, he may seek it in the fine arts, or in literature or in sciences. But some one thing he must do with all his might or he will fall short of the best life of which he is capable.

Thus whether we look at the difficulty of the work that has to be done by modern industry, or at the danger that in modern industry men's energies may be frittered away in hurry, we see that the fate of this generation more than that of any other depends upon the education & the aims which men bring with them when men start in business. It is true of education as of other things that our needs are so different from those of our forefathers that if we are filled with their best spirit we shall not follow in their tracks but shall strike out a new & a more difficult & a loftier path for ourselves.

[33] We shall not be content with imparting to a boy knowledge which he will forget as soon as he is grown up, we shall not be content with starting off his thoughts in a course, in which they will no longer run when he leaves school. We shall no longer be content to cram him with arid heaps of facts & figures, of genitive cases and irregular verbs. ‖ The mind does indeed get some training by learning facts & there are few directions in which the mind can progress far without a good knowledge of facts; & a boy must learn facts; but he should learn those facts which will enable him to understand more of the world in which he lives, to think new thoughts & obtain new power. I do not mean that there is no use in such a study as that of the elements of a foreign language. The study of a foreign grammar & particularly of the Latin grammar is one of the best methods of learning to analyse & classify the rudimentary forms of speech & of thought. It teaches the student to apply a general rule to particular cases; &, in the hands of a really able teacher, it may be made a means of instruction in the philosophy of language, so that the student **[34]** may gradually get to see that some rules of grammar are conventional while others are necessary. And now that the different nations of the earth are moving together in business, in social life & in science; some knowledge of modern languages has become a necessary means towards most important ends. All this is true, but it also true that the main purpose of the study of a language is to give access to the great thoughts of the great minds who have written in that language. So that if a boy spends his energies in acquiring a knowledge of vocabularies & of the genitive cases & irregular verbs of a language which he does not use in after life, so far his education has been a failure: not a complete failure because he has got some benefit from the grammar; but a failure. If however he goes on to learn the rudiments of a second language, & makes no use of this knowledge either; then the time he has spent on it is almost completely wasted: for his second grammar taught him very little that he might not have learnt from the first.

The school education of men of business in the **[35]** last generation was then nearly as bad as it could be because it consisted chiefly of barren facts which the boy threw off when he went into business as a bird shakes it's the **[so in the original]** raindrops from its feather when the rain is over.

The boy obtained in school but a very slight & narrow training from his mind; & carried from it little or no knowledge & interests which could tend to draw out the best faculties of his mind in his after life.

We have now to aim at better & higher things. Firstly we have to aim at giving every man some artistic feelings, some power of appreciating what is beautiful. Every man should take with him to business some power of appreciating literature the noblest of the arts. But for this end we must not teach him the rudiments of many languages, but the best literature of one or two languages. The vocabularies of ten languages & endless lists of irregular verbs will not give a man the breadth of thought , the taste and the delicacy of appreciation that he may

probably need in his business & that he will certainly need for his own inner life. But something of these qualities he will get if he learns to write a good piece of prose in any one language even if that be his own; and if he reads and re-reads **[36]** during one short year some of the best literature of one country even if that be his own.

Literature too gives a man knowledge of human nature. Of this study indeed he learns much naturally in the play ground during school life and afterwards in business itself. But there are sides of man's nature which can be best studied in literature, others which can be best studied in history, others which can be best studied in the moral sciences. And among these may be reckoned Political Economy, the science of business; but of the claims which a study of this science has to form part of the education of the business man, I will not speak now.

[37] But secondly education should give the mind strength. It is the special work of mathematics to give the power of reasoning correctly, and of knowing when a thing is proved. There is not and so far as we can see there cannot ever be a study which can do this work nearly as well as mathematics can. So that even if we looked only at its use in nourishing a man's mental vigour, we might say that mathematics is to the mind, what bread is to the body, the staff of life. But further the applications of Mathematics in Mechanics and Physics train the mind to experiment.

It is to their combined work that we owe nearly all the power that we have over nature. And there are very few branches of industry in which a man who is ignorant of geometry and mechanics and physics does his work as well or with as little labour to himself as he would if he had **[38]** a knowledge of them. In old times men worked so much in accustomed grooves that they learnt by trial and error in the course of many generations that certain methods of doing things would succeed and that certain others would not. They did not understand the Laws of Nature; they could not predict what would happen in a case that they had not tried.

All that they knew about a method which they used was that it would work; they had no means of knowing whether it was better or worse than any other method that they had not tried. But we have to aim at doing things which our forefathers did not. If we build a bridge we must know exactly what pressure there will be at each part of it; we ought to predict before hand exactly where it will break if it does break; so that we may be able to say additional strength would be a useless burden as well as expense , but additional strength put there would double the strength of the bridge.

Engineers of old days, and those engineers of modern times who have not received a thorough scientific training cannot do this; and except when they are **[39]** following in the steps of some one who has worked out the problem on scientific principles, they are forced to make all the parts so strong that whenever the chief pressure come the bridge will stand. Thus they not only incur needless expense, but make an unsightly object. So it is with the builder. If he has not studied the applications of mathematics to mechanics he can only guess roughly where the chief strain will come in his beams and his arches and his roofs. With less material, less labour and less expense he would have made a stronger building if he had learnt in his youth the sciences that bear upon the work of his after life.

[In the original this part is covered by a paper: Marshall wanted to delete this piece] ……..away the sciences as a training for the mind and rest also in order in practical importance for the technical training of the business more is leading almost every branch of industry, to do something better or more simply than before, and to do other things that could not be some at all. Geology, physiology and botany have a narrower range of application but each of them in its own domain is rapidly increasing man's power and broadening his thought.

[40] Well: when we look at the work of those who founded University College, shall we not say that they did their best to enable this old town of Bristol to play her part in making this age a great age.

Other institutions

Two good schools

Good trade school

But they determined to found a college to supply for persons of either sex above the ordinary school age the means of continuing their studies in Science, Languages, History and Literature, and more particularly to afford appropriate instruction in those branches of applied science wh **[i.e. which]** are employed in the arts and manufactures.

[41] The work of the old and the new institutions are essentially different; though they partly overlap. They are old and are doing their work well: we are young, let us rejoice that they are doing their work well; and resolve that we will play our part as well as they are playing theirs.

Of the many parts of our work I have spoken of but one tonight. To speak of it still;

Let us endeavour to give to the businesses man of Bristol more of that true literary education which refines the mind and broadens its interests in human life. But above all let us endeavour to educate him that his business will ever be calling **[42]** forth the knowledge and the mental faculties which he has acquired at College. Let us so

equip him with a knowledge of the scientific principles that bear upon the business of his after lives, that he may abandon rules of thumb; that he may understand for himself the reason of all that he does: that if he tries a new experiment he may be able to predict its result with tolerable accuracy, so that his experiments may not be at haphazard, but all of them near to the mark. He will not then waste his time and his substance upon new endeavours, made almost in the dark; endeavours that do but discourage others. With the bright light of science guiding him on his path he will go boldly and rigorously on trying that which **[43]** has not been done before, overcoming new difficulties pioneering new paths. He will then not only help to cause this country of England and this town of Bristol to hold a front place in the first van of industrial progress. But further because he has pursued those studies which will be called in to play in his business, therefore his business will every day give him scientific problems which he will glory in solving because they are problems; therefore he will be helped by his business, he will almost be forced by his business to lead an intellectual life. Though a business man, nay, rather because a business man he will play an important part in making this age a great intellectual age.

Bibliography

Cook, S. 2006. Education, in Raffaelli T., Becattini G. and Dardi M. (2006).

Groenewegen, P. 1995. *A Soaring Eagle: Alfred Marshall 1842-1924* , Aldershot, Edward Elgar.

Maloney, J. 1990. Marshall and Business, in Tullberg R. M. (ed) 1990.

Raffaelli T., Becattini G. and Dardi M. (eds) 2006. *The Elgar Companion to Alfred Marshall* , Cheltenham, Edward Elgar.

Tullberg R. M. (ed) 1990. *Alfred Marshall in Retrospect* , Brookfield, VT, Edward Elgar.

Whitaker, J. K. 1972. Alfred Marshall: the Years 1877-1885, *History of Political Economy* , vol. 4 (Spring), pp. 1-61.

Whitaker, J. K. 1975. *The Early Economic Writings of Alfred Marshall* , 2 vols, London, Macmillan.

Whitaker, J. K. 1996. *The Correspondence of Alfred Marshall Economist* , Cambridge, Cambridge University Press.

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