

TEACHING THE PROFESSION OF MANUFACTURING

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Abstract The roots of industrial society lie in the careful attention given to reflective thought on the needs of others, and in the conscious development of work as a process of enlightenment for both client and craftsman, working in relationship. This is embedded in the Protestant ethic in the West and is particularly visible in Quaker practice. It is also embedded in the East in Zen practice. The close one-to-one care, attention and guidance given to an apprentice by a master craftsman, central to both these traditions, is also central to the teaching tradition of the University of Cambridge and forms the core of the Cambridge Manufacturing Leaders' Programme.

Enlightened work

Work is effort applied to difficulty and it always has internal and external results. There are always tasks which require internal effort, developing the self control necessary to master a skill for instance, which results in the internal competence to be able to apply that skill. External fruits come later. In all growth processes the internal stages occur unseen - below ground - and any gardener nurtures that process, feeding the roots. What flowers comes later and of its own accord, i.e. the internal always precedes the external, and patience is essential because *time* is the true judge.

Engineering uses science, embodies an ethic, and is an art. Most engineering education concerns itself with the science, with the art being developed later, in practice, under professional guidance. Far too commonly, there is no explicit discussion of the ethic embodied in particular engineering practices, leaving engineers inarticulate about the effect they have on other people's lives. There is much to be gained by the conscious prompting of discussion in this area (Platts, 1998a). For nearly nine hundred years engineers have been practising philosophers. We live in a civilisation created by artisans. Whereas a trader sees industry as a source of opportunistic deals, a master craftsman understands that work is an enlightenment process for both craftsman and client. He strives at his work, for it to always carry the light. He strives at himself, for his virtue to be capable of the task. His work is a *calling*. *Craft* is focused on the *process*. *Trade* is focused on the *product*.

Master craftsmen carry this practical philosophy in two ways. Firstly there is a dimension of *sacrifice* evident in their work, sacredness both in process and product (Latin: sacrificio - to make sacred) so that it definitively carries life's meaning. Then there is evident in themselves a powerful ascetic self control. They work a long way beyond being self centred. (Latin: virtus - strength. *Virtue* - to have the clarity of soul, the strength of soul, to hold to what is right and not let go.) The roots of this practical philosophy lie in the transmission of Indian astronomy and mathematics, and Greek philosophy and geometry into Europe via Islamic Spain in the twelfth century. The two threads which emerged, of moral philosophy (virtue) and natural philosophy (craftsmanship) are normally thought of quite abstractly and separately in Europe. However it is from the dynamic interplay of the two and their practical application that our present technical civilisation emerges.

The roots of industrial society

McClelland (1961), in his book *The Achieving Society*, points to the roots of industrial society in the dedicated (in the *making sacred* sense) responsibility and self control of the Protestant movement in Britain, in the determination not to accept intermediaries between themselves and their Maker but to directly face both moral and physical reality and to seek God's guidance to work out their salvation moment by moment, day by day. Max Weber (1976), equally, points to this in *The Protestant Ethic and the Spirit of Capitalism*. McClelland describes the Protestants as being permanently on their toes with an alert, learning sensitivity, not driven by self interest but by a deep concern to take the initiative to do what is right. They are what Abraham Maslow (1987) calls inner-directed people. McClelland quotes figures from Hagen (1961) looking at the religious affiliation of significant British innovators in the industrial revolution period 1725-1850 (82 innovators), against the proportions of the population of England, Wales and Scotland in 1800 (a little over 10.8 million). Against a general background of Anglican or unknown religious affiliation, the non-conformists produced 34% of the innovators from 6% of the population. Though he discusses the particular importance of the Quakers he does not extend the arithmetic. If they are separated out, all the other non-conformists produced 24% of the innovators from 5.8% of the population, while Quakers produced 10% of the innovators from 0.2% of the population. This level of importance out of all proportion to their tiny numbers requires that their approach be studied and its lessons drawn.

The Quaker approach is of work being taught as an end in itself - as a way of life, where the meaning of all things is seen in the context of the whole and thus each thing is done for its intrinsic value, a process in which craftsman and customer both express themselves, both listen, absorb and respond, and both find themselves incrementally enlightened through their relationship. The Protestant work ethic honoured the process of work as a process of growth and said "everyone must have something meaningful to do".

There is a tension in the modern era between the process of growth through expressed relationship described above and the cold presentation of a product abstractly made. The latter is no substitute for the former but as the power of technology increases, it increasingly makes the relationship opaque, so the understanding which creates the

product is not transferred to the customer along with the product (so the customer is merely served, not enlightened) and neither is the proper understanding of the customer's need articulated to the craftsman, so he too is paid, but not enlightened. Because the relationship is never truly formed there is no possibility for it to enlighten and a world full of material goods evolves devoid of meaningful human exchange. The core task of the management of technology is not to make those goods. It is to make the relationship transparent. Human growth occurs when true need and true competence speak to each other.

As with many words, common use of the term *craftsman* has steadily robbed it of any depth of meaning. It pays to examine it more closely, and in particular to go beyond the term *craftsman* and understand what lies hidden in the further term *master craftsman*. As the saying goes, "a bad workman blames his tools". The simple definition of a craftsman (or craftswoman) is that he (or she) does not do that. They have achieved fluent control of their tools, of all the tools that make up their environment, and they have established a fluent relationship with the materials, processes and products of their chosen field and are able to craft things. A master craftsman is something more. A true master craftsman has progressed beyond this to a deep understanding of humanity itself so that he is able to see *what needs to be* crafted, and at the same time he deeply understands and can guide students through the process of struggle, learning and growth that yields maturity. He can grow future craftsmen and indeed future master craftsmen. The result of a craftsman's work is products. The result of a master craftsman's work is *people*.

Japanese experience

In Japan the same sort of inner awareness and sense of responsibility is established from a Confucian starting point. Business journals from the Pacific rim will now sometimes refer to the Confucian work ethic. The writings of Confucius (Waley 1938), Lao Tzu (Wing 1986) and Sun Tzu (Wing 1989) taken together provide a very substantial and articulate core of meditative material guiding leaders towards seeking meaning rather than seeking power (Platts 1994). The common saying "when the best leader's work is done the people say it happened naturally" (or, as it is sometimes rendered, "... the people say we did it ourselves") is after all a translation from Lao Tzu. The I Ching (Wilhelm 1951) is equally useful meditative material towards the path of virtue. Through the Tokugawa period in Japan (1600-1868) some of the key elements of Japanese religious thinking evolved, to develop in the people an attitude towards their work as a *calling* very similar to that found by the Protestants in Europe. In particular towards the end of that period the Shingaku movement, and the teaching of its leader Ishida Baigan, were very influential in this direction (Bellah 1957).

While starting from Confucian roots teaching in Japan has been substantially shaped by Zen practice. In particular the teaching of craftsmanship is structured through the shu-ha-ri cycle of minute attention to detail, the development of complete technical fluency and then an on-the-toes alert responsiveness to circumstances very analogous to Quaker practice in the West. Zen learning (Digenti, 1996) emphasises the closeness and subtlety

of the master/student relationship and its longevity, through repeating cycles of action and reflection over thirty to fifty years, in a three-fold learning process.

The ancients describe *shu ha ri* as a learning process which goes from "shallow to deep to shallow," so that there is firstly a superficial understanding based upon learning rules by rote; the second stage involves expanding the learning to various applications and situations, in order to deepen; and the final stage is shallow again, as "upon reaching the final stage all bonds are broken and one is completely free. This freedom, however, is none other than to observe the rules." The final stage of mastery brings one back to the first steps of learning the rules, but now the rules can be understood from a perspective of freedom, in that they are applied not through slavish imitation but through an understanding of their inherent wisdom.

In this context, the responsibility carried by the master for formative guidance - for care and respect for the person being guided - and the responsibility of the student to try to give life to the guidance of the master - a reciprocal caring and respect - is tangible. But so is the Japanese view of life as a learning process of growth towards aware maturity, in which activities are always worked at for their spiritual content. In his introduction to Herrigel's book *Zen in the Art of Archery* (1985) Suzuki says:-

"One of the most significant features we find in the practice of archery, and in fact of all the arts as they are studied in Japan and probably also in other Far Eastern countries, is that they are not intended for utilitarian purposes only or for purely aesthetic enjoyments, but are meant to train the mind; indeed, to bring it into contact with the ultimate reality. Archery is, therefore, not practised solely for hitting the target; the swordsman does not wield the sword just for the sake of outdoing his opponent; the dancer does not dance just to perform certain rhythmical movements of the body. The mind has first to be attuned to the unconscious.

If one really wishes to be master of an art, technical knowledge of it is not enough. One has to transcend technique so that the art becomes an 'artless art' growing out of the Unconscious."

The importance of time

This exactly reflects the Quaker view. What it also includes is the active direction of attention to that spiritual aspect. Pulling a quote from the professional development literature, Eraut (1994, p.104) remarks:-

"The 'act of attention' brings experiences, which would otherwise simply be lived through, into the area of conscious thought; where treatment may vary from actual comprehending to merely noting or hardly noticing."

It is in this realm of the direction of attention that leaders of any kind, but particularly leaders who shape how many people spend their working day, carry a great responsibility. The processes of growth are slow and have to be nurtured over decades.

Referring to professional learning, the Dreyfus brothers (1988) identified five stages of professional development which typically take more than a decade to achieve and which many people never achieve, and which real professionals would say repeat and never end. Echoing the three phases of shu-ha-ri they phrased these stages as:-

Novice

Rigid adherence to taught rules or plans. Little situational perception. No discretionary judgement.

Advanced beginner

Guidelines for action based on attributes or aspects (aspects are global characteristics of situations recognisable only after some prior experience). Situational perception still limited. All attributes and aspects are treated separately and given equal importance.

Competent

Coping with crowdedness. Now sees actions at least partially in terms of longer term goals. Conscious, deliberate planning. Standardised and routinised procedures.

Proficient

Sees situations holistically rather than in terms of aspects. See what is most important in a situation. Perceives deviations from the normal pattern. Decision making less laboured. Uses maxims for guidance whose meaning varies according to the situation.

Expert

No longer relies on rules, guidelines or maxims. Intuitive grasp of situations based on deep tacit understanding. Analytical approaches used only in novel situations or when problems occur. Vision of what is possible.

Quaker experience

In Quaker experience there is a similar long timescale involved in presenting good practice in public and it being accepted, during which time one has to notice two different levels of reaction: the aggressive, destructive reaction at ego level that is the unconscious response of people seeing their own bad practice in the mirror of good practice, and the much slower and deeper response of the soul as it sees and realises that good practice *is possible*. This way of working inwardly to be guided so that the Spirit would manifest in their actions is described by George Fox (1975, p.169), writing in 1654 about a group of Quaker businessmen who had come to live by their consciences (Quaker is a nickname. Their proper title is The Religious Society of Friends of Truth):-

"Many Friends, being tradesmen of several sorts lost their custom at first; for the people would not trade with them nor trust them, and for a time Friends that were tradesmen could hardly get enough money to buy bread. But afterwards people came to see Friends' honesty and truthfulness and 'yea' and 'neat' at a word in their dealing, and their lives and conversations did preach and reach to the witness of God in all people, and they knew and saw that, for conscience sake towards God, they would not cozen and cheat them, and at last that they might send any child and be as well used as themselves, at any of their shops.

So then things altered so that all the enquiry was, where was a draper or shopkeeper or tailor or shoemaker or any other tradesman that was a Quaker; insomuch that Friends had double the trade, beyond any of their neighbours. And if there was any trading they had it, inasmuch as then the cry of all the professors and others was "if we let these people alone they will take the trading of the nation out of our hands."

Similarly their careful custodianship of wealth is described by William Penn (1978, p.12) writing in 1693:-

"Lend not beyond thy Ability, nor refuse to lend out of thy ability; especially when it will help others more than it can hurt thee.

If thy Debtor be honest and capable, thou hast thy Money again, if not with Encrease, with Praise: If he prove insolvent, don't ruin him to get that, which it will not ruin thee to lose: For thou art but a Steward, and another is thy Owner, Master and Judge.

The more merciful Acts thou dost, the more Mercy thou wilt receive; and if with a charitable Employment of thy Temporal Riches, thou gainest eternal Treasure, thy Purchase is infinite: Thou wilt have found the Art of Multiplying indeed."

They were also utterly pacifist. George Fox again:-

"I live in the light of that Spirit which takes away the causes of war."

Master classes

This acute sensitivity, seeking out the root causes of things, and realising (making real) its potential for good, is the heart of all creativity. It provides a framework for assessing the quality of teaching of manufacturing leadership. Specifically, it highlights the real responsibility of the teacher as an exemplar and catalyst, not simply as a custodian of information.

This is central to all Cambridge teaching. Perhaps the most striking feature of all Cambridge teaching is that it is rooted in relationships. No teaching is ever abstract. This is visible in the one-to-one tuition on real problems, in context, in their companies, which is at the core of the Manufacturing Leaders' Programme (Platts, 1998b). But it is also visible in the way that the programme not only honours and preserves but actually points

to the programme member's existing relationship in his company with the people he is responsible for, and makes it the central feature of his programme. His (or her) tutor doesn't simply give guidance from afar but spends time in the company. Guidance in leadership is thus effectively given as an extended master class *to both the leader and his team, in their own context.*

This approach has been at the core of Cambridge's teaching of manufacturing for thirty years. Sensitivity to the detail of circumstance has to be combined with the observations of others captured from their experience and passed on as advice. Out of the struggle of this combination process comes enlightenment - real understanding - the real ability to make a difference. In all this the experience is primary, as much of what the tutor is passing on can only be passed on in context. Competence cannot be developed in abstract. It cannot be taught in a 'handing over information in a classroom' sense, because it is not abstract information. It is a set of dynamic skills, alert sensitivity and well honed responses to circumstances, that has to be developed in guided practice, just as a football team acquires its skills by practising them under the eye of a coach. It has to be demonstrated by a competent practitioner. In other words it requires proper professional mentoring. Schön (1987, p.93) captures the process very effectively in his description of the master class approach to passing on the skill of design in architecture:-

It is as though the studio master had said to him, "I can tell you there is something you need to know, and with my help you may be able to learn it. But I cannot tell you what it is in a way you can now understand. I can only arrange for you to have the right sorts of experience for yourself. You must be willing, therefore, to have these experiences. Then you will be able to make an informed choice about whether you wish to continue. If you are unwilling to step into this new experience without knowing ahead of time what it will be like, I cannot help you. You must trust me."

Some aspects of the assessment process for the Manufacturing Leaders' Programme may help bring the aim of the course into focus. All the course participants have the following guidance, which emphasises in several places the importance of engagement, of openness and of reflection.

THE ASSESSMENT PROCESS

AIM

The core of any learning activity is the reflective process of taking the experience and understanding of others, relating it to one's own experience and understanding, and developing a deeper understanding, soundly embedded so that it becomes an automatic part of one's way of working. The dialogue of assessment and examination provides an audit of this process.

PROCESS

Coursework

The habit of filing reference information in a structured way, and also of working on it to extract and record, also for reference, the essential information, observation or piece of personal understanding, is an important habit. These two steps occur between presented information and an extracted overview, between jotted notes in a lecture and the extracted understanding, or, in a work context, between the jottings of many meetings and conversations, including phone conversations, and the extracted understandings, decisions and commitments. Always, both halves of the habit are of value, including keeping one's rough notebook. Within the course the Director of Studies will ask to see the student's file of presented lecture material and matching extracted overview, and will expect the weekly progress review sheets to capture in outline the learning of the week.

Project diary

During each case study, the student will be expected to keep a project diary and, in parallel with the submission of the case study report for the assessment of the examiners, the student will be asked to submit to the Director of Studies a brief reflective analysis of the learning experience of the project, as evidenced by the project diary.

Written work

Case studies and theses will generally require study of background material concerning a set of observed principles or a line of approach, and study of the actual dynamics of a live situation. A project will fail if the student visibly fails to engage with both of these, i.e. the evidence of that engagement is absent from the written report.

It is possible to study the background material and to extract key words or phrases from it, but to fail to penetrate through to the meaning - the essential lived experience - to which the key words and phrases point, and to make it one's own. A report presented at this level has the feel of work-in-progress, in that it has a not-yet-fully-engaged feel to it. It would be deemed acceptable (subject to circumstances), but not entirely a success.

A successful project is usually characterised by the understanding pointed at by the key words or phrases having been entirely absorbed into the reality of the live context of the student's project and given life there, so that understanding reappears in the student's own words, and own live observations, and in the dynamic activities of the company team of which the student has been part.

Because live activities always contain the interplay of personalities as well as principles, and involve company culture, the report may well include brief vignettes of personalities (including both strengths and weaknesses), and descriptions of the positive development of personal interactions, and the positive development of company culture. As management and leadership are always integrative processes, a case study or thesis should always be considered as an open report, i.e. as both a learning and a teaching document, and will be assessed for the insight, clarity and resilient diplomacy of the guidance it gives.

Whilst being founded on centuries of practice of one-to-one teaching, the Cambridge Manufacturing Leaders' Programme has however another, equally deep foundation: that of the master craftsman. Going back to the beginning of the Victorian period in Britain, the root of that philosophy of service to mankind which is at the heart of the engineering profession is perhaps best captured by the words of Henry Robinson Palmer, spoken at the inaugural meeting of the Institution of Civil Engineers, the oldest professional engineering institution in the world, on 2 January 1818 (Watson, 1988, p.9). They named themselves *civil* engineers because they were *not* military engineers - it defined the moral sphere in which they worked. They were entirely aware that the processes they were using - the processes of learning to work together, to hear and meet each other's needs - were the processes of civilisation itself, and they mattered at least as much as the products they were developing to support those processes. Henry Robinson Palmer was 23, but he was already teaching a self-help group of would-be young engineers in East London. Of the role of the engineer he said:-

"Engineering is a profession which requires not only knowledge of one leading branch of science but of many; not only of one art but of an infinite number.

An engineer is a mediator between the philosopher and the working mechanic; and like an interpreter between two foreigners must understand the language of both."

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