The Royal Academy of Engineering

Proceedings of a conference on:

Ethics and the Engineer

Embedding ethics in the engineering community

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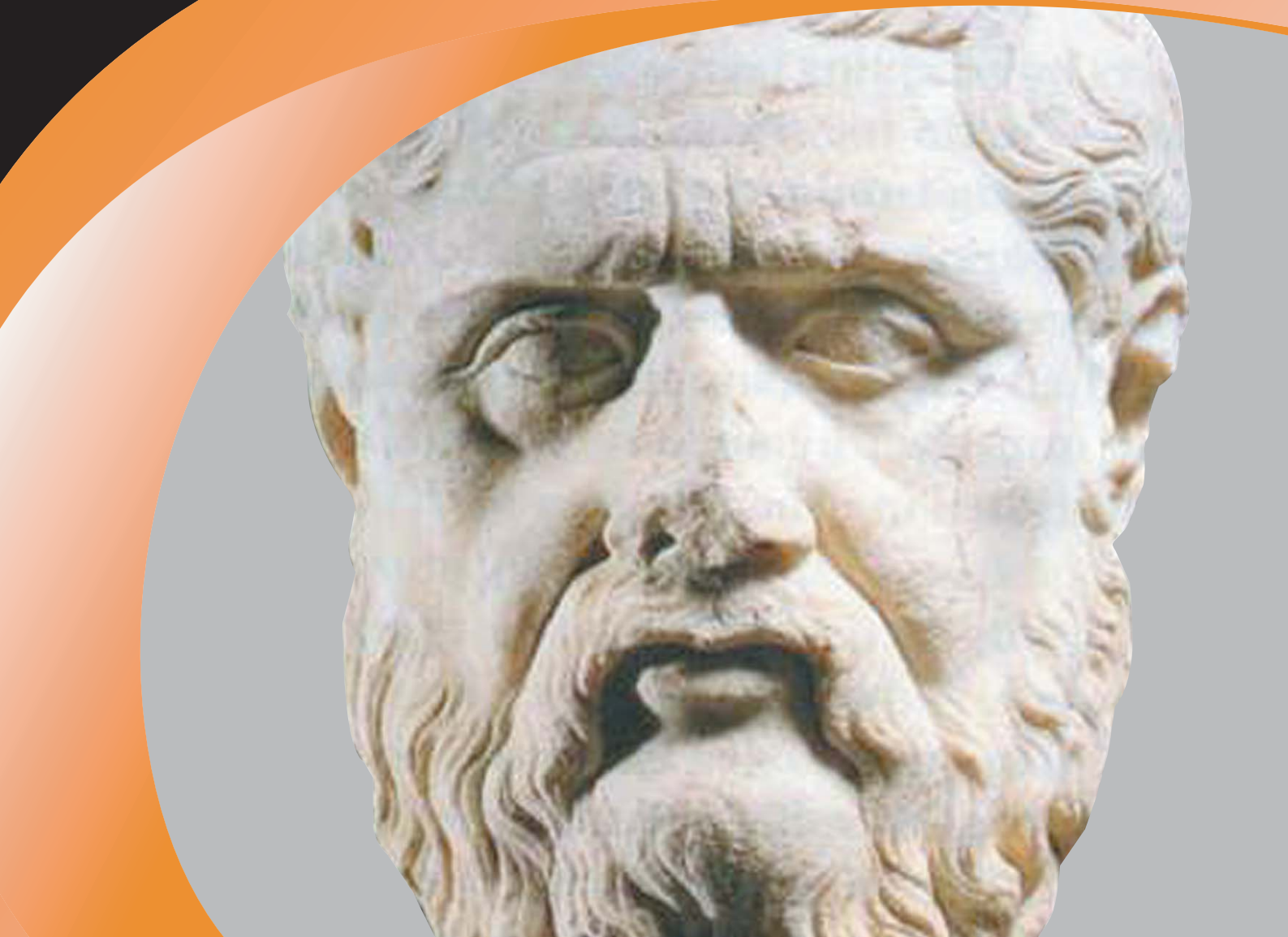

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Chaired by Lord Broers FREng FRS and Professor John Uff CBE QC FREng

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Ethics and the Engineer

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Foreword

When the Royal Academy of Engineering embarked on a series of initiatives to focus on the challenges of applying ethics to the real world context of engineering in the 21st century, it was clear that the subject was going to stimulate some searching questions and debate.

The conference on October 13th, **'Ethics and the Engineer: Embedding ethics in the engineering community'** certainly lived up to that expectation. Some 150 delegates from across a wide range of disciplines formed a very engaged audience for a series of presentations summarising the recent work of the Academy, together with perspectives and experience from outside the profession. The complexities of the issues raised did not prevent a healthy debate taking place, with considerable enthusiasm displayed for the profession to 'grasp the nettle'. Indeed, as the President noted in his opening remarks, if we don't address these issues we may be faced with the alternative of an overlay of external corporate regulation that fails to recognise the critical role that individual engineers play in building today's complex systems.

The conference was notable in bringing together both academic and professional bodies to consider the role they must play in driving forward the subject. I am also pleased that it provided a stimulus for the major engineering professional bodies in the UK to make a common commitment to the Statement of Ethical Principles. This will be further refined over the coming year with input from the wider professional community and Engineering Council(UK). Similarly, the launch of a framework for teaching ethics provides the basis of ongoing discussion and initiatives in the academic community and joint activity with industry and the professional bodies.

Special thanks go to all those who gave their time and wisdom in preparing the material and, in particular, those who made presentations. There is still much more to be done to embed the conclusions reached in the real world in which professional engineers operate, and this will be the focus of activity in the coming year.

Chris Earnshaw FREng
Chairman, Royal Academy of Engineering,
Ethics Working Group

Welcome and introduction

Lord Broers: I would like to welcome everybody to this ethics conference, which follows on from a series of events that the Royal Academy of Engineering has been holding and activities that it has been going through. This has all been triggered by one of today's speakers, John Uff. In response to challenges posed by John, the Academy established a multidisciplinary working group and we are very grateful to many of you who have joined that, chaired by Chris Earnshaw. The group has looked at two key areas of concern to engineering, these being ethics and the role of engineering institutions, and the teaching of ethics in engineering undergraduate courses.

There has been significant progress in both of these areas and we have documentation with us today. First of all, there is an engineering ethics curriculum map for the universities, and there are some numbers on the teaching of ethics in engineering. We also have a statement of ethical principles and we shall be discussing these issues this evening.

Last night in the Academy, we had a dinner at which we pulled together another broad group, including some senior people from the engineering industry – chief executive officers from engineering companies involved in construction and transport. We had people there who are in charge of food standards, both in Europe and in the UK, and we had representatives from the medical profession. We discussed a similar topic and it ended up being a very fruitful evening, from which a couple of points arose which fit quite well into our agenda this evening.

The first point came from our representatives from the medical profession who were concerned about the way we are in danger of having professionalism eroded in this country. One could blame the media for this but perhaps we should blame ourselves instead. It is perceived, even by the medical profession that there is a steady erosion in respect for the professions which iterates all the way through to this risk and responsibility issue. One senses that perhaps the media or the politicians or a group of people would like to do away with individual responsibility and facing a professional responsibility, and place all of the responsibility on the No. 1 person in an organisation. That, of course, is quite impractical and a silly way to do things. We all agreed very strongly on this, and we agreed that this erosion was taking place and that we should resist it with all the strength we should, and that individuals have to carry their own responsibility. Certainly, leaders and people in charge of large companies have to ensure that there is a distributed set of responsibilities that go through their organisation, that there are codes of behaviour and that they are followed. However, it is quite inappropriate to place all of the responsibility on somebody remote from where things are actually happening. That was one point that arose.

Secondly, there was a recommendation by everybody that, as engineers, we should try to proceed towards some kind of adherence at least to a statement of ethical principles. The veterinary and medical communities take an oath and, although I do not think we are quite ready to do that, the general thought was that we should proceed in that direction - at least, perhaps, in the Academy. I shall be asking the Academy to consider whether the Royal Academy of Engineering should take the lead here and at least offer to the fellowship the opportunity to say that people would adhere to a set of principles. Eventually, it would be very useful if we could go all the way and have some visible, public statement that engineers are following a set of ethical principles.

Let me now hand over to John Uff. I have to apologise that I shall have to leave this meeting early to join Margaret Thatcher for her 80th birthday celebrations.

Ethics and the law

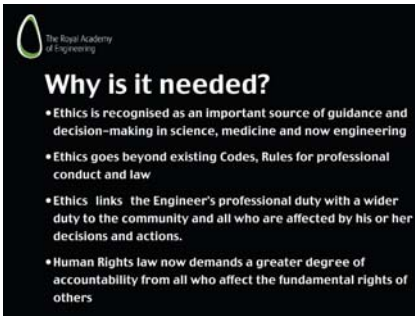
Professor John Uff, CBE, QC, FREng
Emeritus Professor of Engineering Law
King's College, London

The title of my presentation is Ethics and the Law, but I shall talk more about ethics than law. However, it is as well to bear in mind that there is a legal background – a sort of net – which will catch you if you try to escape, and this will always be there. Perhaps more importantly, we should bear in mind that the law creates structures within which rules and codes are intended to be operated.

Within your packs you have a number of documents, including a Statement of Ethical Principles (SEP). I am delighted to see this document because, at various stages, I did not think it would ever see the light of day. It represents the very latest thinking and it is the product of the hard work of a large number of multi-disciplinary, highly-talented people.

Statement of Ethical Principles

This is what I shall talk about, and I shall ask these questions. Why is it needed, how does it fit in, and what makes it work?



Why is it needed?

To address the first of those questions, why do we need it? Ethics is now recognised as an important source of guidance for decision-making in many areas. The President has spoken about medicine. Our code, or our statement of ethical principles, was narrowly preceded by a very interesting initiative from the Council for Science & Technology, which decided that scientists needed such a code and there was indeed very serious talk about an equivalent Hippocratic oath for scientists, although that is still on the back-burner.

In terms of engineering, however, we should remind ourselves that we are by no means first in the field and we might recall that Canadian engineers all wear an iron ring, which is made from the remains of a celebrated disaster – a bridge which collapsed as a result of defects which went undetected. That was the beginning of the Canadian ethical experience.

Thus, ethics is an important guiding principle and it should govern important decisions. It goes beyond the existing codes – we all know that the institutions to which we belong have their own codes and this document goes beyond them. It links the engineer's professional duty with a wider duty to the community and, although existing codes touch on that area in different ways, this statement seeks to bring that together in an updated manner. You will find a good deal of emphasis on this element of it. We have to remember that, although human rights law comes in for a good deal of battering in the press these days, one of the things it demands is a greater degree of accountability from all who affect what the courts may deem to be the fundamental rights of others. So you are all warned.

How does it fit in?

How does it fit in? As I have already indicated, it complements and updates the existing institutional codes and rules – whatever they are called. It is drafted intentionally to be common to all engineers and all institutions. As to its impact on law, it covers duties under civil law as well as criminal law

although, on analysis of particular circumstances, you will find that the actual boundaries of law fall a long way short of what the statement of ethical principles requires of professional engineers. Specifically, it re-defines and updates what I call rather inelegantly the societal and public interest elements of the existing codes.

What makes it work?

What makes it work? One of the points I have been trying to make in addresses and writings for some years – and I shall make this point several times in the next few minutes – is that we are not creating something else just to talk about. If we produced the most wonderful code in the world, but then did nothing about it, then it would have no impact and it would be of no use. The significant point is that it is there to be enforced if necessary but, more important than that, to be recognised, to be accepted and to be acted upon by engineers, and seen to be acted upon by those who are affected by their work.

The Royal Academy is not in a position to regulate or enforce – it is not a disciplinary body – and only the engineering institutions have such powers and functions under their charters. They therefore will need to adopt the SEP as part of their rules, but enforcement and sanction will remain exclusively with the institutions and the appeals tribunal. Those of you who follow human rights will realise that one of the requirements of human rights law is to have an independent tribunal and an independent tribunal is not constituted by a tribunal of your peers. In other words, if you have a tribunal consisting of 10 chemical engineers, that is not deemed to be an independent tribunal. You will find that all the tribunals that are set up to be compliant with human rights include a majority of non-members of whatever institution or club it is.

In order to get round this problem, rather than bringing in huge numbers of non-engineers to sit on the disciplinary bodies, most of the institutions have signed up to an alternative deal, whereby there will be an appeals tribunal which is compliant with human rights law. The interesting point about that tribunal is that human rights law requires a high degree of transparency and things can no longer go on behind closed doors. The proceedings will become public, as will the decisions – and I will return to that in a moment.

How will the SEP be developed further?

How will the document be developed further, and what is its future? Later this evening, we will see what is going on in the universities and teaching institutions and we will see that this is a subject that has been grasped with enthusiasm – I hope – in many institutions. Teaching and research will lead to further developments but, in addition, publicity for this document, which I trust will be widespread, will enable members of the public more readily to challenge what they regard as unethical conduct by engineers. In some countries – and I will just mention Australia – it is expected that large numbers of complaints come in from the public about the conduct of all sorts of professionals and particularly engineers, and those are adjudicated by the relevant institutional body. The same should happen if members of the public in this country are concerned with the way in which engineers interpret the duties which we place on them, and the requirements of the Statement of Ethical Principles.

Let me just remind you of a few of them. One of them says:

> "Present and review engineering evidence, theory and interpretation honestly, accurately and without bias and quantify all risks."

How many times has one read in the press complaints about professionals putting over their views in a manner which does not comply with that rule? Another requirement is to minimise and justify effects on the environment and to have regard to future generations. So there it is – and we trust that it will be read by the public and that they will take it very seriously, and that the institutions will be asked to decide questions as to whether engineers have complied with the code. As I have said, human rights law will ensure transparency. The most important point is that, in the fullness of time, we will have real cases – not just talking points but real cases which will show whether the SEP needs to be amended or extended. It will also tell us exactly what it means.

Is the SEP in reality a new talking point for engineers?

Let me just mention a few examples of what ought to be the subject of inquiry under the SEP. There is the nuclear power versus sustainable power debate: how can the public be assured that engineers can be trusted to be truthful and objective, as expressly required by the statement?

Secondly, many or most disasters could be prevented by timely action. We were reading only a few days ago about the outcome of the Hatfield trial. Can engineers be educated to know how to act and when, in those circumstances?

The third example is that of damage to the environment. Most of this is caused by systems and installations designed and managed by engineers but how can the public know whether engineers are sensitive to what they – the public – regard as the needs of the environment?

Then there is the huge subject of corruption. How can the public be assured that engineers act honestly?

I conclude by suggesting that engineering ethics is vital to our modern society and that the SEP deserves your support, and it deserves to be implemented. Thank you.

Lord Broers: Thank you very much, John. We will carry on with the presentations and take discussion at the end of the meeting.

The next presentation will be by Mr Richard Parry-Jones, Chief Technical Officer at Ford, who will speak to the title Ethics and the Corporate World. Richard will go through a modern-day version of the Hippocratic oath, using the same principle of ethical guidelines for the engineering profession. He will also cover what the Ford Motor Company does to ensure that their employees are provided with ethical guidelines.

Ethics and the corporate world

Mr Richard Parry-Jones
Chief Technical Officer & Group Vice-President
Global Product Development, Ford Motor Company

I shall talk a little about how we try to tackle the problem of ethics in engineering from a corporate point of view but, in the first few minutes of this gathering, I have discovered that some of my thoughts are already closely aligned with some of those expressed by the previous speaker. What I say may therefore be either repetition or reinforcement, depending on your point of view.

Trends

I will start by talking about some trends that are happening to us as engineers, the first of which is globalisation. Ethics in the past were very much a feature of the values and behaviours in a given society. Our own personal ethics tend to come from our family or our immediate growing-up environment. In the broader sense, as we develop as individuals, our ethics are learned in the societal values and ethics that belong to the society in which we grow up.

In prior times, perhaps, when we were not such a global industry, values and judgments in one region or in one country were unique and different from those in other countries and regions. Perhaps in the old days, we were designing cars for European customers – or even British customers, if you go back far enough – and the expectations of engineers in making decisions about ethical issues in those products were very much aligned with the customers in that particular country.

As we grow and globalise the industry, of course, we have to wrestle with the fact that European customers, to give an example, expect a minimum of six airbags in every vehicle, and preferably eight, and seatbelt wearing is approaching 97 per cent compliance. In India however, where we are potentially selling the same vehicles, the compliance with seatbelt wearing is below 20 per cent. The whole idea of how to specify, and make decisions about essentially moral judgments about the level of safety consciousness and equipment that customers in India should have, versus the expectations that you grow up with and operate in your day to day work in a European country, is quite a challenging ethical dilemma. However, we are having to export our ethical standards to other countries and we have to draw a very fine line between doing the right thing and becoming cultural imperialists, imposing our ethical values on cultures which do not share them. This is a very tricky area.

The next area is litigation. Fortunately or unfortunately, depending on your profession, the world has become a more litigious place. Generally speaking, we all want to blame somebody else, or find somebody responsible for whatever went wrong. Although in many cases there is someone who is responsible, it is also true that life is full of accidents – all accidents are preventable but only if you have some foresight into the causes. What we are seeing increasingly therefore – and I have worked for many years in America – is a very litigious culture, and even an industry that is self-perpetuating in litigation. This challenges the conformance of engineering decisions even more tightly to adhering to ethical decisions in all cases because there is a very high chance – higher than ever in our history, I think – that those decisions will be examined in a court of law.

The next point on my list is the loss of faith in large institutions. Younger people in particular are especially disillusioned with large companies, large bodies, and with government. You only have to think back to the Enron case which led to the Sarbanes-Oxley legislation in North America, which has spread its tentacles to other parts of the world, to realise why there is high publicity given and that it is therefore quite logical that people are losing faith in the integrity and the ethical behaviour of the people who run large institutions. We therefore have a degree of cynicism and scepticism out there in the public, about the professions and the companies that employ them. These are some of the challenges we have to take into account as we think through this issue.

Roles and responsibilities

I have tried to think about who are the stakeholders in this, apart from the consumers and the public who consume and use our products and services. The people who are responsible for shaping the ethical values of our engineers are largely three groups.

There are the universities who have a good deal of opportunity to shape the early thinking of engineers about their ethical responsibilities. In the universities where I have taught, I have to say that I have been disappointed at the level of the emphasis given to this subject in undergraduate teaching. It is an opportunity, for sure.

As a simple example, I find that the issue of safety is barely addressed in a number of undergraduate curricula, even in leading universities in different parts of the world – I will not name them, but they are the ones with pretty good reputations.

The next area, as we have just heard, is the institutions, and their accreditation requirements and the ways in which perhaps we could more formally build in statements of ethical principles to the very idea of becoming a chartered engineer. There, we can borrow heavily from the medical profession.

Last but by no means least, there is the role of companies, because companies in the end determine the expectations that individuals have of themselves. They have a large overlay, if you like, of the corporate culture and the corporate expectations – the role modelling behaviours have a large overlaying factor on whatever ethical behaviours and values individuals bring when they start their professional career with a company. Many of these codes of conduct, as in the Ford Motor Company, are pretty rigidly codified and quite heavily enforced. In many ways, in parallel to the ways in which the institutions could enforce the SEP, we see very similar – and I am sure this applies in many of your companies – defined codes of conduct, defined expectations and consequences if those expectations are not fulfilled and complaints are raised. Thus, the companies have a big role in this as well.

Medical profession

I could not resist picking up the Hippocratic Oath because we can learn from it. I have just highlighted some of the points, rather than going through every single one. There are three areas which we would perhaps immediately consider as transposable to our own engineering profession. Fundamentally, engineers spend their time improving the human quality of life by harnessing the forces of nature and using their experience to improve human quality of life. It is therefore not too big an exaggeration to say that engineers consecrate their lives to the service of humanity, if you think about all the good that engineers do in improving people's lives.

Another point I would like to pick out is practising their profession with conscience and dignity. As I like to put it to my engineers, when they are making a tough decision about a specification or a test, they should try to imagine that there is customer looking over their shoulder, listening to the conversation and looking at the data. When they come to their decision, they should have that customer virtually behind them, nodding their head approvingly and pleased with what they are doing – pleased with their integrity and pleased with their judgments and diligence.

The last area I wanted to point out is the issue of discrimination and not allowing any bias with regard to age, gender, disability, creed, ethnic origin, political affiliation and, to intervene between the duty of the engineer and the consumer. Consumers, of course, are not always people who buy or use our products. In my industry, for example, consumers include pedestrians, they include people who breathe the city air in which our vehicles operate and, nowadays, they include people who live on the planet and may be affected by global warming consequences of the CO2 emissions. Thus, we have some opportunities to learn from the medical profession.

Engineering profession

I have taken three examples here from the engineering codes of ethics that already exist. The first is from the National Society of Professional Engineers: "Engineers in the fulfilment of their duties shall conduct themselves honourably, responsibly, ethically and lawfully, so as to enhance honour, reputation and usefulness of the profession."

There are similar definitions in the ABET definition and in the code of ethics from the Institution of Engineers in Australia. Australia has a good deal of attention and plays a leading role in many cases in this area. That one particularly refers to the health and safety of the community – the broader issues, in other words, of the consequences of individual actions, much beyond the individual consumer effects.

Importance of ethics

From our own corporate point of view, we know that we produce products that can and do have a significant effect on the environment and on society. Here, of course, it becomes very tricky again. On the one hand, we want to make sure that engineers are sensitive to the environmental consequences of the products they produce, so that they seek out the most efficient solutions. On the other hand, however, if they are seriously misaligned with the expectations and values of the consumers or members of the society they are serving, you could end up with a situation where a product may well be environmentally much more acceptable, but which consumers are not interested in buying. This could either be because they are too expensive, or because – as it more likely – consumers prefer to have more features, more performance, more space, or more 7KW stereo systems, or whatever you wish to talk about. It is therefore very important that we do not confuse the engineer's duty to serve the broader range of consumer interests without encouraging them to become single-issue lobbyists who are only interested in one particular issue, because that misalignment can cause companies to go under and engineers to lose their employment.

My second point is that Ford is a family company and carries with it, internally in its culture, many family values. It feels that it is responsible to its consumers, of course, and to the global community in which it enjoys its reputation and its welfare. It has a duty to set ethical standards to deliver to, because a large

company like ours has huge global reach, it is highly visible, and the way that we behave is part of the standard-setting process in our society.

Next, every engineering decision has to be an ethical one, as if the customer is sitting at the engineer's side. That is the acid test for whether we are doing the right thing: would we be really happy if the consumer watched and heard every word, and was still very happy with what we did? If the answer to that is yes, then we probably have got the ethical question right.

Lastly, Ford's workforce, suppliers, customers and all the other stakeholders who are affected by our business are part of the solution to today's issues and we have the responsibility to work with all of them to the same basic principles. We have to take responsibility for our supplier base and so, for example, we cannot go and source parts from lower-cost countries where, for example, child labour is being exploited. One has to extend these ethical principles way beyond the boundaries of the conventional enterprise, to the so-called 'extended enterprise', to have a sustainable and ethical company.

I just want to pick one phrase, which is that the ethical code of our company is captured in one sentence: 'Integrity is never compromised.' There are many ways of codifying that. We have various policy letters and codes of conduct, which you have to sign every year to confirm that you understand the policy and are conforming to it, and declare any exceptions to the policy that you happen to have incurred in the last 12 months. We expect our employees and our executives to honour the spirit as well as the letter of this code of conduct.

Most important of all, there are the executives because, if executive behaviour is not in line with these, then you cannot really expect the workers - the employees and the engineers – to behave any differently.

For the future

What can we do for the future? We could ask ourselves what steps we could take to reinforce the importance of engineering ethics, both within our industry and outside it. There are numerous sets of guidelines that exist but, as we have seen with the proposed SEP, clarity and unification is required. This is an important step and I very much support the movement in this area, to make these ethical principles more recognisable by engineers and the public.

A significant portion of the engineering community is not chartered and we should make these ethical principles a key part of becoming a chartered engineer. In other words, I am in favour of promoting the equivalent of the Hippocratic Oath for our profession. Of course we, as employers, need to emphasise the importance of obtaining chartered status and strengthening the engineer's accountability to common ethical principles.

That is all I had to say. I wanted to talk to you about how we view the ethical issues and also perhaps talk about some of the global implications of some of the things that we might otherwise consider in a very local context. I am looking forward to hearing your remarks and I hope we have a good discussion this evening.

Lord Broers: Thank you very much, Richard. Next, we will have a medical perspective from Mr Anthony Giddings. Tony will talk about the hidden difficulties in the ethics of medical practice.

The views of other disciplines

Medicine

Mr Anthony Giddings
Council Member of the Royal College of Surgeons of England

Simply put, the job of the doctor is to relieve suffering.

In mid-Victorian England, it seemed a relatively simple task. We see here a sick child and we see the anxious parent. We see the caring doctor. Medicine was generally of limited benefit in those days but it was usually simple, and usually safe. Today, it is very different. Medicine is often complex and highly potent and, while extraordinarily effective for some, it carries significant risk for all. The patient and the doctor are faced with a bewildering set of opportunities nowadays and the choice is often difficult.

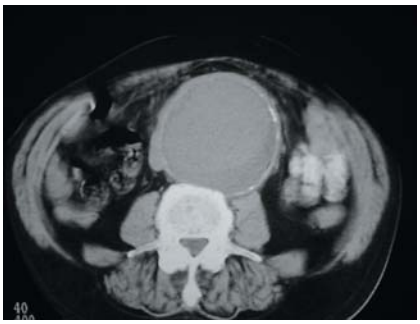
Some topics

Ethics is an enormous field. Here are 12 topics which we might discuss, and each one might consume an evening.

- Paternalism: the doctor's temptation to tell the patient what to do.
- Autonomy: the patient's right to do as they wish.
- Openness: a necessary condition but one which is threatened by mishap and litigation.
- Consent: recognising the need for knowledge and judgment on both sides.
- Confidentiality: it is a duty, certainly, but one which has limits.
- Genetics: by which we might glimpse and manipulate the future.
- Reproduction: giving and denying life.
- Assisted dying: the relief of suffering by an act which is both kindly and, at present, criminal.
- Omission: failing to act when needed, allowing natural causes to prevail.
- Research: setting the needs of mankind in general against the interests of the individual.
- Rationing: responding to infinite demand by setting priorities, and
- Whistle-blowing: protecting others from incompetence and abuse.

Issues

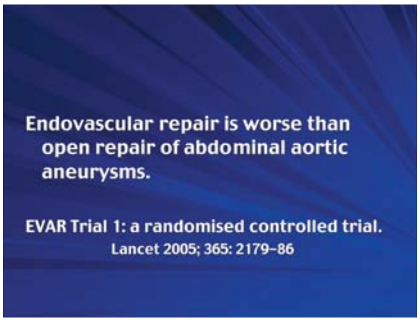
Each of these is too big for this evening, so let me take a few principles which are issues in my mind, as an ordinary surgeon, and not as an ethics expert.



The pace of change in technological development has driven practice. The patient's interests, which we seek to discharge, have become difficult to identify. Legislation and regulation have not helped always, and professional structures and cultures have not always reinforced what we would wish. The problems remain with the individual doctor.

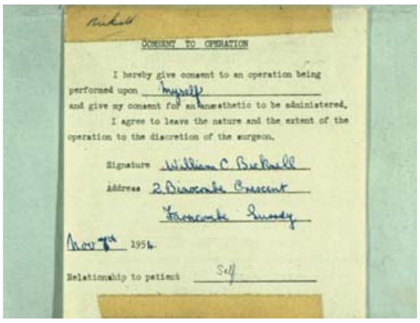
This is a transverse section through the abdomen. You will see here the recognisable spine and, in front of it, normally there should be a tube called the aorta, as big as your thumb. This is a ballooned aorta, which threatens to rupture and, if it does, the patient will die without an operation. This is a simple sort of decision to make.

However, let us say that this condition – which commonly does not produce symptoms – is present in an otherwise healthy individual. Should we screen to identify it? Should we recommend operation which, in itself, carries risk? If so, how should that be assessed? These are difficult choices which are offered to us by the evolving technology. In addition to that, we now have an opportunity to replace this aorta by a fabric graft liner, which is inserted by a minor-ish procedure, from an artery in the groin. Is this an appropriate management? Of course, we would try this because it is the latest thing, and we have the technological imperative to follow and we may find that it is jolly good. The patients prefer it, even though it may be less effective.



The trial has been done and it is subject to many late complications: we would not scientifically recommend it, but doctors actually prefer having this done, to an open operation. So these are complex decisions.

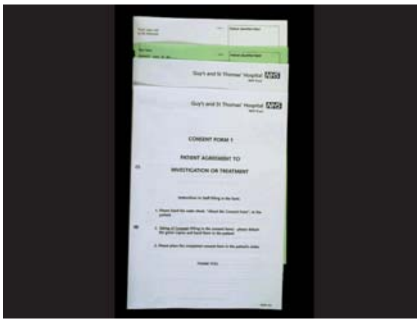
Let us assume that we might now develop a tablet which could prevent the expansion of that vulnerable blood vessel. This might then be trialled, perhaps supported by the manufacturers, whose sponsorship and commercial interest in journals, is everywhere to be seen. Clearly, it may be the case that a message will emerge which will be of commercial benefit, but public interest is not always served.



This is a consent form for a patient having an operation in 1954. It says:

> "I agree to leave the nature and extent of this operation to the discretion of the surgeon."

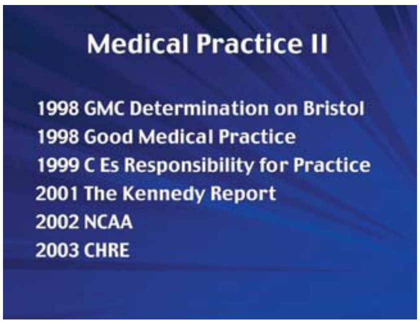
We do not know, in this case, whether the choices were simple but we can suspect, however, that the trust was blind.



Today's consent form, however, consists of many pages and it serves to illustrate a proliferation of bureaucracy in an attempt – which is ultimately futile – to cover all aspects of the process of consent. It does not, and indeed cannot, replace the informed and open relationship between doctors and patients, which is required for consent to be valid. In fact, the task of completing this form may divert both from their duties to each other.

Medical practice I

Much advice on the duties of doctors comes from the GMC. This is a doctor-dominated body established in 1858 by the Medical Act, primarily to protect patients from those who were seen as unqualified quacks. Its quasi-judicial functions continued virtually unchanged for over a century, through the foundation of the NHS, which established all doctors as theoretically independent practitioners and into the 60s, when we were advised, when I qualified, never to criticise colleagues. I should say, ladies and gentlemen, that this was not out of a spirit of brotherhood, understanding and goodwill, but to diminish gossip and slander between rivals.



Medical practice II

In the last 10 years, the situation has moved on. The events in Bristol painfully illustrated that doing our best, while essential, was not nearly enough. They also showed that each of us must look after our colleagues as carefully as we do our patients and that our own errors arise from the systems in which we work at least as much as they do from our human frailties.

Since then, the GMC has been liberal with good advice and the Government with well-intended but often reactive and ineffective legislation. Making

hospital chief executives responsible for the quality of clinical practice is one such effort. All too commonly, I fear, chief executives delegate the responsibility without the means or the clinical freedom to exercise that, and it does not work.

The risk of such legislation, which I suspect is about to be repeated for the management of MRSA in the Queen's speech this autumn, is that that accountability which is provided has the satisfaction and dignity of lawful blame but the improvement potential of a public lynching.

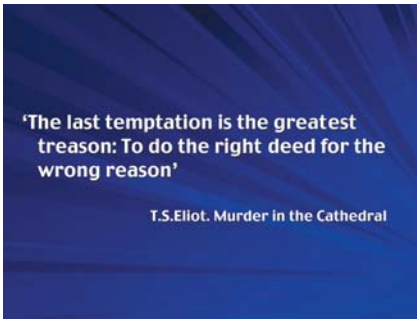
Sir Ian Kennedy's landmark and thoroughly researched report sets out the complexities of modern practice far more constructively. It jointly exposes many defects of medical custom and practice and steers us towards a more open and effective relationship with our patients, colleagues, managers and government. However, this will be a long journey and there are risks to patients and practitioners along the way.

There is now a body, the NCAS, to help poorly performing doctors, and another regulator, the Council for Healthcare Regulatory Excellence (CHRE), which is already challenging the GMC in court to be more vigilant in its duty of public protection.

Colleges and associations have set many criteria and given advice. They have collected mega- multi-gigabytes of data. They have sharpened our skills in management but we are not there yet. There remains a huge gap between the official advice and daily practice and some administrative safeguards in fact make things worse.

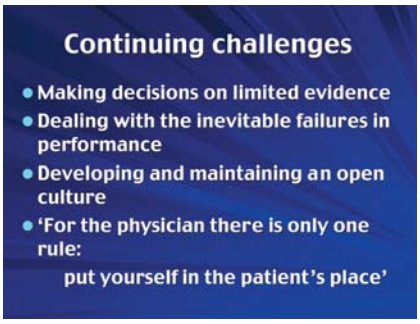
I will briefly illustrate this by reporting on a research study we have conducted, in which we have looked at the process and the behaviour of surgical teams. To aid our analysis, we used a video recording. The first thing I discovered was that research ethics committees acted against the public interest by treating this as though it were a drugs trial and hedging about our activities with such confidential difficulties and such constraints that we were unfortunately not able to use the data as we wished. Regrettably, this exposed another factor, about which we really should be concerned, which is that many of the staff displayed such inappropriate professional sensitivity to being watched that one must ask serious questions about the culture of secrecy which is thereby revealed at the heart of what is a public service.

I come now to my last issue, which is that of the individual doctor. This is a painting of Thomas Chatterton, who committed suicide as he thought himself 'not worthy'. Regrettably, this happens to some caring doctors who make a mistake and, thereby, a patient suffers a harm or even dies. Along that all too human scale of sensitivity and responsibility, at the other end, we have many examples of doctors who build a defence against their vulnerability by manifesting arrogance. Such was Rodney Ledward.



Judging one's self and one's own failings remains vital and it is a hard task. Sometimes, even our own motives require extra scrutiny. Take the treatment of mild hypertension. The data suggests that we have to treat 20 people, who are otherwise quite well and normal, in order to prevent one stroke, and we have to treat them for life. So does the doctor decide to treat all 20, in order to be above criticism and, as it were, to pass any risk to that patient cohort, who all must endure the side effects, inconvenience or expense? Or does the doctor exercise the professional judgment, to which we have heard reference, which is the essence of our job?

We must also remember that, in making that judgment, we are vulnerable to the last temptation as the greatest treason – doing the right deed for the wrong reason.



Conclusions

In summary, I would conclude that our rapid development of technology has increased the number of contentious issues and demands. Putting the patient's interests first is actually very challenging. Legislation and regulation have tended to be reactive and rarely definitive. Professional initiatives have not yet achieved an open culture and ultimate responsibility must remain with the individual doctor.

Continuing challenges

We face the continuing challenge of making decisions on limited evidence and dealing with the inevitable failures in performance in ourselves and others, and developing and maintaining an open culture.

Perhaps, finally, we should remember the aphorism attributed to Lister: "For the physician, there is only one rule: put yourself in the patient's place."

Thank you.

Lord Broers: Thank you very much for that. It is very clear that the medical profession is ahead of us in thinking but you have such difficult problems and I suppose that is useful to us too, as we watch you coping with this. Thank you very much for that presentation.

The next talk it by Baroness O'Neill, who will give us the philosophical perspective and address the issue of trust and the professions.

The views of other disciplines

Philosophy

The Baroness O'Neill of Bengarve
Principal of Newnham College, Cambridge

I am going to tear up my script. I was going to talk about the code but others have done that. It is a much mutated code. Sometime, long ago, John Uff and I did some drafting, and what we had was quite short and succinct. It has since been revised and revised and revised, and I have to say that it has been rather expanded. I do not think anything has been lost, except at one point – and I will mention that because I hope that there might be a little room for thinking about that issue.

Let me say a little about ethics first. There is a lingering suspicion, which I suppose dates to the 1930s – which, by the way, is quite a long time ago – that there is nothing to be said that is objective about ethics, but that it is all a matter of what people will call value judgments, which are merely subjective – so that is that.

I do not need to remind you of the cultural and professional costs of this sort of lazy relativism, and I do not think that the proponents of this position actually believe it. If you want to test that, then just stand back and listen, and notice them making all sorts of ethical judgments which they take to have some objective weight.

Broadly, the issue is this. What you might call the 'normative disciplines', which certainly include law, policy making, ethics - but many aspects of other, empirical disciplines - aim at rigour. However, in this case, the rigour is not a matter of showing that they are true of the way the world is – you cannot falsify normative claims by showing that people break the norms. The 'direction of fit', as philosophers tend to call it, is in other direction, and it is the action that fails to fit the norms that is called into question. This is not the time for me to comment on fundamental arguments on which people rely in reaching ethical conclusions.

The Statement of Ethical Principles is a very useful document in many ways and I would like to say a little about its three main components. They have now been divided into four, but I suspect that the first two are really aspects of one set of standards, which we may call professionalism in a broad sense – acting with rigour, honesty and integrity and not borrowing other people's work or condoning that, and ensuring that your own work is duly judged. It is, for example, retaining the data by which it can be judged, audited, repeated or whatever is necessary. That sort of standard seems to be integral to professionalism and, in a way, nobody disputes it. After all, doing a professional job is still considered high praise and so it is worth asking ourselves – and here, I veer away from the philosophy to think a little about the so-called accountability culture that we are building for ourselves – why, if professionalism is so respected, are the professions not more respected?

By 'the professions', I do not mean anything very precise, but let us take it that it will certainly include medicine, engineering and many others. I will come back to some answers in the moment. But why is professionalism not more

respected? The answer lies pretty close to the point on which Mr Giddings put his finger, namely the sort of thing that has gone on in many of the professions with self-serving judgment of failure. We have seen that again and again and it is not just one profession, and the GMC example is only one. However, of course, those who make laws and regulations and who issue guidance and so on are not idle in the face of this. We have seen an amazing revolution in this country which we might call a revolution in regulation. There is a wonderful book called The British Regulatory State by Michael Moran, who is a political scientist, which tells you just how far, how deep and how penetrating this movement is. What has it left the professions with?

Well, we certify competence at point of entry. Increasingly, we are busying ourselves about certifying continued competence with continuing professional development. But we are losing the power to regulate, or indeed to form, our own professional culture, because the formation of the culture is dominated by regulatory and legal requirements. Can we, should we, seek to get this back? I believe we should because I do not believe that the forms of regulation and accountability that are being pushed upon the professions enable them to do good work. I do not mean that all regulation is either redundant, or incentivises poor work, but an enormous amount of it creates requirements for a paper trail, requirements for box-ticking, or requirements for meeting certain standards, which fill the days and lives – particularly of our younger colleagues. These are not necessarily the ways in which good, professional work will be secured.

Two points have come up in the second and third part, or third and fourth parts of the engineering standards, which suggest why this fails. The second group of standards, that comes out as the third, is that we really have to respect the public interest. It was interesting that, in Mr Giddings' talk, he referred to clinical ethics, and not to medical ethics or health ethics more broadly. The doctor's responsibility to the patient is analogous to the engineer's responsibility to the client. Doctors, in fact, have many other responsibilities and there is the question of the ethics of public health, which did not surface in the list of topics from clinical ethics. You cannot ask for informed consent to public health standards. It is political philosophy rather than ethics that is most relevant there.

In engineering and in other client-centred professions – architecture would be a good example, as would law – the role of the client is well-defined and responsibilities to the client are well-defined. However, the importance of the second group of principles is that they recognise that what you do as engineers, or what architects or lawyers do, also impacts on a wider public. One of the great challenges for a revived professional ethics and a revived professional culture in this country is to find deep ways of institutionalising regard for the public good and the public interest, including environmental interest.

The third group of principles is also rather different from those that we used to recognise as central to professional ethics in the past. They have to do with responsible communication. There was the lovely example of that consent form from 1954 which was so simple, in effect; 'It's up to you, doctor. Do what you judge best.' Now, of course, we demand more, but what we are demanding is destroying rather than generating public trust so that, when you have to sign a consent form - which is about as complicated as taking out a mortgage - you do not exactly feel that you can judge what is going on, and tell where to place and where to refuse your trust. It is an enormous challenge

to see how professions and professionals should communicate with people who do not share their expertise but, like them, are busy people with limited time and a need to work things out quite fast. It is a particular challenge to know how that can be achieved in the face of the litigation culture that has already been mentioned.

I believe that plain English is a part of the remedy but it is certainly not the whole of it. Probably, face to face communication – what John Henry Cardinal Newman called in the 19th century 'present communication', - directly to those affected, is probably indispensable.

Those are a few thoughts around the area of what it will take to make a reality of these principles, so that they are the sort of thing that, in the small hours and in the dead of night, when it would be tempting to cut a corner, each of us finds it just obvious that one does not do *that*. That is the challenge in front of the professions that are trying to internalise standards which, when we reflect, each of us probably recognises. Thank you.

The views of other disciplines

Science

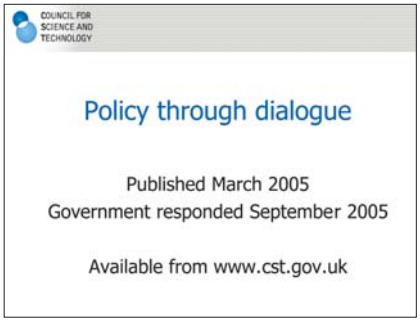
Professor Geoffrey Boulton, OBE, FRS, FRSE
Vice-Principal, University of Edinburgh and
Regius Professor of Geology

Thank you for inviting me to this discussion, which is extremely timely. I speak as a member of the Council for Science and Technology which is an advisory body to the Prime Minister and which is currently involved in a consultation about an ethical code for scientists. However, I am also still a practising scientist, working on issues such as climate change and nuclear waste disposal, in both of which the 'are you certain?' and 'is it safe?' questions offer temptations to simplify what is known and what is understood, and to skate over the uncertainties, in order to make a point in debate, or move the argument on.

Such issues, in my view, are at the heart of the current dilemma about the role of the scientist in society. Arguably, the scientist should be Janus-faced, facing in two directions, with two sets of ethical responsibilities. The first would be towards his or her profession – a direction that is well-established and generally well-understood by all in the profession and ideally by the public too. The ethic includes, for example, as Baroness O'Neill has said, acting with skill, honesty and care, not committing plagiarism and declaring conflicts of interest.

The second direction of gaze is much more difficult: it is the question of a scientist's responsibility to society. The central issue here is whether discussions of the assumptions and uncertainties of scientific work should take place behind closed doors with professional peers or within a company or a governmental department, with a public statement merely presenting a conclusion that hides any underlying equivocations. Such processes are often hidden behind statements such as 'the science suggests that this should be done', or 'that should be done'. In practice, however, the science is often wrapped up in unstated values of which we scientists ourselves are sometimes not aware.

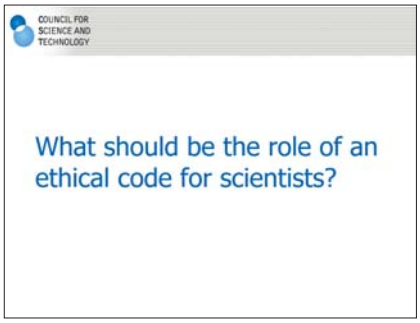
On the other hand, there is the question whether we should move towards a more mature, public engagement, in which scientific assumptions and uncertainties are clearly stated and any decisions about the use of a technology or process are through informed personal decisions, and any decisions about policies are legitimated by some form of public consent.



Policy through dialogue

The Council for Science and Technology has advocated this latter route in a report to government earlier this year, entitled Policy through Dialogue, which has now been accepted by government. There is, however, a dilemma – in part reflected in Lord Broers' recent Reith lectures – that greater public engagement could slow down the development and adoption of new technologies and processes, such that the pace of innovation in Britain will be retarded, compared with that of many of our competitors. It will be inefficient in exploiting the potential of a science base to the great disadvantage of the economy.

In my view, however, there is no alternative but to take the route of public engagement. The relative absence of engagement processes, far from speeding up decision-making, has slowed it down. Examples of those with which we are all very familiar include genetic modification, MMR, BSE, radioactive waste. There has been a failure to recognise the complex nature of public concerns about the way that scientific uncertainties have been handled and presented; about the uncertainties that underlie our judgments; about the valuation of costs and benefits which are often implicit rather than explicit, and questions about controlling interests – who owns and who benefits? Ultimately, of course, there are views on the sort of world in which we want to live. So what role could an ethical code play, and does it need to be explicit and overt?



What should be the role of an ethical code for scientists?

The functional role of a code, both for scientists and the public, and the role of the scientist in the broad public interest question about how we should use scientific knowledge and understanding, is one which requires clarification. My view is that an ethical code could be a means of clarifying that relationship. A code could be a vital ingredient, if the processes of public engagement, to which the Government appears to be increasingly committed, are to be effective.

In such a code, is the societal element important? Or should the code be restricted to a matter of professional propriety? Should scientists have a responsibility to consider whether and how their work relates to the interests of society and, if it does, should they have a responsibility to reflect on how they should engage with others – including colleagues, the public and policy makers? Clearly, it is right that individual scientists take an ethical stance in at least one, if not both, of these domains, but does either require greater understanding of the ethical questions of much scientific work and debate? The answer is yes, they do and, as a consequence, they ought to be part of the training of scientists. I am very glad to see that the Academy is exploring this crucial issue in a very effective and practical way.

From what I have said, an explicit ethical code would need to address two issues. First, how can we be confident that members of the scientific professions have a shared understanding of their ethical responsibilities and are actively reflecting on what this means for their work? Secondly, how can an ethical approach taken by the scientific community be better shared with the public?

There are a number of options for a code:

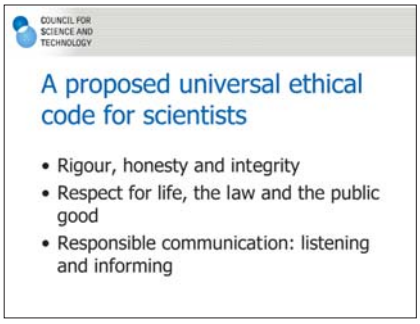
1. An enforceable framework, setting out the standards and tied, for example, to conditions of employment or funding, to membership of professional bodies, or even to national and international legal frameworks.

2. Guidance on acceptable standards that, in a practical way, help people to identify the ethical implications of their work and help in making difficult decisions.

3. An educational, aspirational code, that aims to raise awareness and stimulate discussion of ideals, standards and responsibilities.

A group was brought together about a year ago by David King, the Chief Scientific Advisor to the Government, which included several CST members and Baroness O'Neill and John Uff, who have spoken this evening. They judged that it was the third of these options that was needed and that a document

should be produced to reflect them. Such a document should apply to all of those who use a scientific method, including engineers and it would therefore need to capture a small number of broad principles that are shared across disciplinary boundaries. Such a document could form the basis of discussion across the scientific community and between the scientific community and the public and policy makers. It should therefore be a means of provoking thinking and questioning, rather than giving all the answers.



A proposed universal code for scientists

The group came up with a document, entitled *Rigour, Respect and Responsibility: a Universal Ethical Code for Scientists*. This has been circulated within the civil service scientific profession. The CST is currently seeking views on whether this is a potentially useful approach and how such a code should be used in practice.

There have been some interesting responses so far. For example, a group called Think Tank, which is at the Birmingham Science Museum, has decided to run a workshop with 150 15-year olds, asking them – after a little tuition and discussion – to comment on the code. I believe that some of the work that was done last year has contributed towards the Academy's own Statement of Ethical Principles for Engineers. I shall therefore be very interested to hear Chris Earnshaw's comments.

My personal perspective is that this debate is now very timely. New scientific knowledge is being created at an unprecedented rate, with profound implications for our understanding of and our intervention in the nature and health of individuals, and society and the environment. Exploiting this understanding in a society that has lost old habits of deference has become increasingly problematic such that the rules of engagement - between governors, the governed and the scientists and engineers and medics – need to change. In this setting, the overt ethical code that I believe we ought to contribute, should help to clarify the roles of professionals and, in particular, of scientists, technologists and engineers. We should get on and think about this very carefully and clearly, and move forward from here. Thank you.

John Uff: Thank you very much. We will now move on to the next topic, Ethics and the Engineering Institutions. The first speaker will be Chris Earnshaw, who has been the driver of the group. He has chaired the committee at the Royal Academy.

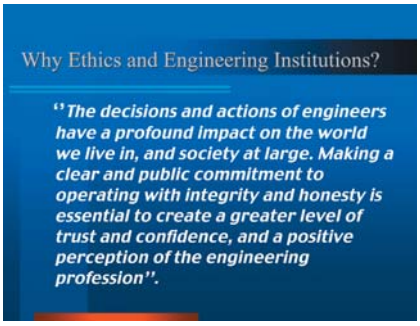
Ethics and the engineering institutions

Introduction

Mr Chris Earnshaw, FREng
Chairman of the Academy Working Group on Ethics and Engineering

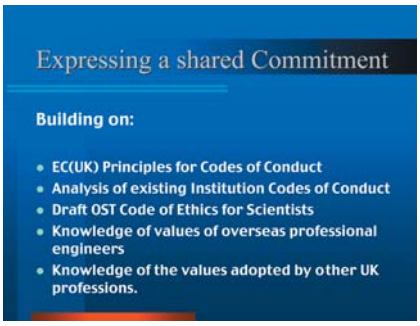
I would like to come back to the Statement of Ethical Principles, to which almost all of our earlier speakers have referred, and tell you a little more about the genesis and some of the thinking, and indeed the process, that has led to the publication of that document. Today is the first time that it has been circulated to a very wide audience albeit that, in the run-up to today, we have shared it with many of the institutions that have played a leading role in creating it.

Some of you may recall that there was a meeting held about 18 months ago at the Academy's headquarters in Great Peter Street, at which some of the institutions talked about their approach to ethics. Lord Broers threw down a challenge at the end of that meeting for the institutions to work with the Academy and with the Engineering Council UK, to come up with a combined and coherent single statement of their commitment to ethics. What we have in the Statement of Ethical Principles is the result of that work.



Why Ethics and Engineering Institutions?

I do not need to spend long arguing the case for ethics to be considered by the engineering institutions – each of the speakers have done it very clearly this evening. There is a statement on the very first page, on the cover of the document that you have this evening, which sums it up very nicely. I would just pick out two points: it is all about facing out to the wider society, and increasing the level of trust and confidence in the profession. The fact is that today, the decisions of engineers touch everyone on this planet – either through direct contact with a product of engineering, or the indirect effects of engineering decisions. Even if you live in the remotest part of the under-developed world, engineers somewhere else are probably having an impact on your lifestyle and environment.



Expressing a shared commitment

It was not a question of starting from scratch because a good deal of work had already been done here and indeed around the world. We have heard reference by earlier speakers this evening to the work in places like Australia and Canada. One of the first places we started was to look at the Engineering Council's own *Principles for Codes of Conduct* that was published some years ago, and which sets out 15 key principles. It became very clear, as a result of analysing how institutions had chosen to express those principles that, first of all, they had all done it different ways and it took us quite a while to conduct that analysis. Secondly, the principles actually cover much more than ethics and it was at that point that we realised that what we needed to do was not necessarily to harmonise the codes of conduct, but actually to create something that over-arched them. What you have tonight is the Statement of Ethical Principles, and we have chosen to call it a statement of principles rather than a code, for fear that it would become confused with existing codes of conduct.

As we heard from the previous speaker, we have been able to draw on the work that has been done by CST and the documents that they have published. Indeed, there is a very high degree of commonality – as you would expect – between the Statement of Ethical Principles, and the draft that has been circulated in the form of a Code of Ethics for Scientists.

We have also been able to work with other institutions in other professions. You will realise from the speakers this evening that we have been able to engage with the medical profession and with Onora's philosophical perspective, and that has greatly enriched the debate that we have been having over these past few months.

Consulting the profession

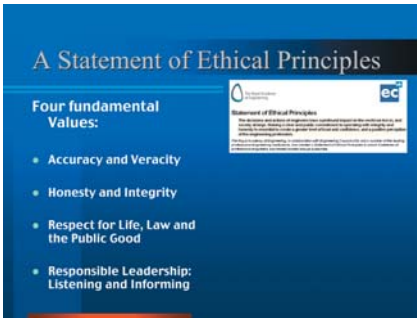
Many institutions were directly involved in the working group that was established jointly by the Academy and ECUK, as listed on this slide. It would be a physical impossibility to get every institution in the room – there are over 30 of them within the orbit of ECUK – but between them, we have covered a very large part of the waterfront with those particular institutions. I am very grateful for the proactive contributions they have all made, through a great many meetings, to reach the point where we are today.

A common statement of beliefs

A very important aspect of the statement is that it is expressed in language which, we hope, is understandable and relevant to the wider society. Looking at the way individual institutions have chosen to express the principles in their own codes of conduct, it is often the case that they are expressed from a rather inward perspective. They often talk about members' interests and protecting the institution but we have tried to step above that and actually set down the principles in ways that relate to the wider public and society at large.

We have tried to step above the individual rules that are expressed in many codes of conduct and we have adopted a value-based set of statements, which should inform the individual rules that are put in place by institutions. Indeed, we do not think that these principles should be limited in their applicability just to the professional institutions, but they should be capable of embracing the wider engineering community, as defined by Robert Malpas. It encompasses much more than those who have chosen to be either chartered engineers or members of institutions.

We have also tried – and I do not know whether we have entirely succeeded – to express this in terms that are independent of any particular cultural perspective. Indeed, there are words there about respecting the rights of different cultures, and to do it in a way that would apply globally, and not just from a UK perspective. Although the institutions involved in the creation of the statement are all headquartered here, they all have members around the world, and they all have members who are working in different parts of the globe, so we thought it was very important to take those perspectives. We were particularly able to take on board work that had been done in the US, Canada, Australia and New Zealand, in informing our discussions.



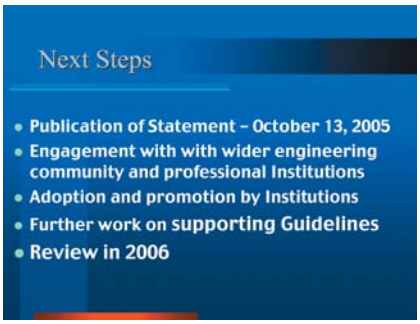
A Statement of Ethical Principles

Onora touched on the way we have grouped together the fundamental values. We had great debate about whether we could actually embrace these with just three headings, as the Scientific Code has done. We decided, on balance, that in the engineering world it was worth bringing out very specifically the separate heading of accuracy and veracity, but we would accept that it is very

closely tied up with honesty and integrity. I will not take you, blow by blow, through the individual subtext of each of those headings, but we believe that each of the bullets is worthy of consideration in its own right and I would encourage you to reflect on the document. You need to look at the document as a whole and it is not a question of taking any once piece – it should be considered as a whole. There is no implication that any one of these groupings has a particular priority over another, but they should all be looked at together.

Positive feedback and commitment

It was only a few weeks ago that we reached the point of being able to circulate a final, or at least a first edition, of these principles. They were sent back to the institutions that were involved in the creation, in a letter jointly signed by Lord Broers and Kel Fidler as chairman of ECUK, seeking formal endorsement from the institutions. We are very encouraged by the very positive response that we have had in just the last few weeks, and there are still more to come. In some cases, institutions have been able to take the code and debate it formally at their own councils or boards of trustees, and we have had unreserved endorsement back from those institutions. In some cases there may be detailed comments but, by and large, it has met with a very positive response from the institutions involved.



Next steps

The next task is to broaden the engagement. We have published it today and there was a press release from the Academy, drawing people's attention to the fact that this document has now been created. The next step will be to engage with the wider engineering community – that is, all of the engineering institutions represented by ECUK. Indeed, we would like to draw the attention of industry which, as Richard Parry-Jones said, is another important stakeholder in this. You will hear in a few moments about how this is also being conveyed into the educational community.

We would like to think that the institutions will publicly and transparently make a commitment to adopting the principles set out within the sphere of their own operations and promoting it to their members. Behind the headline statements in the Statement of Ethical Principles there is another document, which we have called the guidelines. Work is still ongoing but that gives some practical examples and aids interpretation of the principles in the modern world, and we hope to publish that very shortly.

By the time we get well into 2006 and this has been communicated more widely, we think it will be appropriate to step back and review the principles in the light of experience and of feedback. The Academy is committed to doing that at some point before the end of the coming year.

That is all I wanted to say and it gives you some idea of the amount of work. Let me end by thanking all of those who have contributed - a great deal of personal energy has gone into this. I would particularly like to thank Ernest Shannon, who has done a great deal of the drafting and analysis which has been extremely helpful.

John Uff: Thank you, Chris. I certainly second your thanks to Ernest Shannon who, as you say, have done much of the detailed drafting.

As Chris said, there was another partner in this initiative, which actually took place at the Royal Academy of Engineering, but it was a joint affair with ECUK. Professor Kel Fidler will speak on the views of ECUK and his views on the sufficiency, or insufficiency, of the existing codes of the many institutions that subscribe to ECUK.

Views from ECUK

Professor Kel Fidler, FREng
Chairman, ECUK

In the past, the approach to professional ethics by the engineering profession had tended to copy the practice of other major professions. However, the majority of breaches of codes of conduct brought to the attention of the professional engineering institutions concern professional misconduct rather than negligence. This reflects the fact that, unlike lawyers, medical doctors or accountants, most professional engineers are employed in business-to-business contexts, where the consequences of failure to observe the codes are addressed through commercial or employment law.

Of course, engineers owe a higher duty to the public than to their employer, particularly in terms of health and safety. However, as the recent Hatfield rail crash trial illustrated, within a complex organisation, it is difficult to assign blame and responsibility to individuals.

The situation has been further complicated for the engineering profession because, until recently, professional engineers had to satisfy two, not necessarily congruent codes of conduct, one for their institution, and the other for their registration authority. In the old days it was the Council of Engineering Institutions, in the immediate past the old Engineering Council and now the ECUK Engineering Council.

An increasing interest in the efficacy of codes of conduct led to an attempt – unsuccessful at first – to rationalise the situation by creating an aspirational code on which institutional codes of conduct were to be modelled. This was the second attempt, translated into the Engineering Council UK guidelines, which had been adopted without change by several institutions and have strongly influenced many others. Nevertheless, the codes of conduct currently advising institutions are characterised by being essentially negative, lists of things to be avoided, and largely peripheral to the real and daily ethical challenges faced by today's professional engineers.

I welcome this publication of the Statement of Principles, and the accompanying guidance. At last we have the real possibility of offering the profession a set of precepts against which they can measure their practise of their profession. If, as I hope, the principles are adopted widely, then I believe we can look forward to greater support for individual engineers from their institutions.

I think the nature of our professional engineering institutions, with their rich, varied, learned society activity, makes them ill-suited to act as stern disciplinarians for the profession. Better by far for the institutions to provide inspiration and guidance with support, where possible, for those making tricky decisions. Otherwise, to whom else can professional engineers turn?

I close by thanking the Academy for seizing this opportunity, which was provided by Professor Uff's original challenge to the profession, to work with the leading institutions to devise this intelligent response to the needs of today's professional engineer.
Thank you.

John Uff: We hear a great deal about how the public misunderstand engineers, don't know what they do, don't know what they are. One thing the public certainly would misunderstand is the idea that there should be something like 30-something institutions, all with individual codes. This is one of the reasons why ECUK and the Royal Academy are delighted that we have been able to arrive at a common document which now, as Chris tells us, has very wide support within the many institutions.

We now turn to the next topic, which is teaching ethics in engineering. Andrew Haslett will deliver the first address. Andrew has been intimately involved in the evolution of the ethical initiative through the Royal Academy, and has a particular interest in teaching.

Teaching ethics in engineering

Inroduction

Mr Andrew Haslett, FREng
Director Group Technology, ICI plc & Chairman of the Academy Working Group on Teaching Ethics in Engineering

I shall say a little about the construction of this section. I will start off by introducing the work of the Teaching Ethics in Engineering Group and then we will hear from Professor John Archer, Principal and Vice Chancellor of Heriot-Watt University, who will say a little about his perspective of the introduction of teaching engineering ethics there.

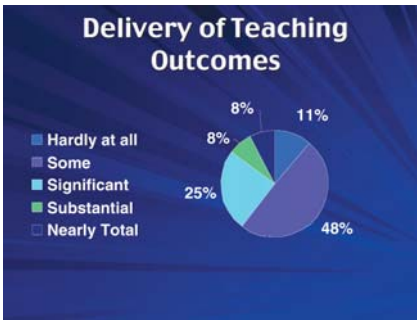
We will then hear from a real, live, uncaged teacher of professional ethics at Sheffield University, who has been doing this for quite a number of years now. He has been a passionate and effective contributor, both to the Royal Academy of Engineering working group, and the Teaching Ethics in Engineering subgroup. He is Professor Ian Howard.

Since this is an educational event, we will have a video for you. We wanted to bring to you the voices of as many people as possible and that simply was not practical in the time and space available. Using the talents of Professor John Monk of the Open University, therefore, we have assembled some talking heads to give you their perspectives as students, employers and teachers, on the teaching of engineering ethics and its importance.

We started this, knowing that the teaching of undergraduates was important, but very unclear as to what was going on, and what to do about it. Working with the Engineering Professors' Council, whom I have to thank for their tremendous support in doing this work, we discovered to our pleasure and surprise that there were quite a number of people who were already active in teaching engineering ethics across our departments of engineering in the UK. You will see the names of the people who have been active in the working group. They cover many different disciplines and a wide range of universities.

We have also been very pleased to have contributions from professional philosophers, who have considerable experience of helping medics to develop their teaching of ethics, and some experience of engineering ethics. We had one teacher with experience of designing A level curricula to help people preparing to go to university to understand the wider social implications of science.

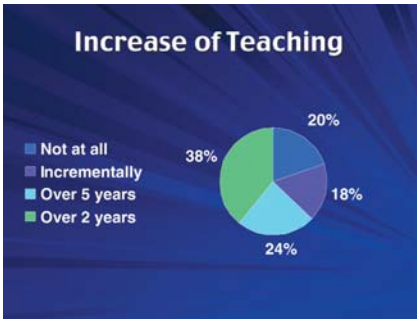
We have been able to produce something that you have in your pack. This is a map on how to introduce the teaching of engineering ethics into the curriculum. This is not a very complicated document and I will not take you through it in detail, but I would invite you to look at it afterwards. It is just two pages. In order to use it, you may find the traditional small print of an engineering specification on this side, which explains what the terms mean and how to apply them – which is considerably longer than the document itself. On the back, there is something about the strategy, process and issues that you might have to deal with in going from a state of not teaching engineering ethics at all in your curriculum, to doing it absolutely and completely. I shall not say any more about that but, having produced that, we then went out to take it to a wider community.



Delivery of teaching outcomes

We wrote to all 263 departments of engineering in the UK, asking them some fairly basic questions. First of all, we asked them about the map. We asked them to what extent the delivery of teaching outcomes already fulfilled the requirements set out in the map. This is not a very prescriptive map, because it does not tell you exactly what you have to do. It certainly does not require you to introduce huge amounts of new course material but we estimate that somewhere between one and two per cent of the contact time with the students requires to be about professional matters and ethics. However, this does require you to introduce the considerations of ethics and examples into a rather larger proportion of course material than that, and it requires you to assess the learning outcomes – again, mostly integrated into other assessment processes.

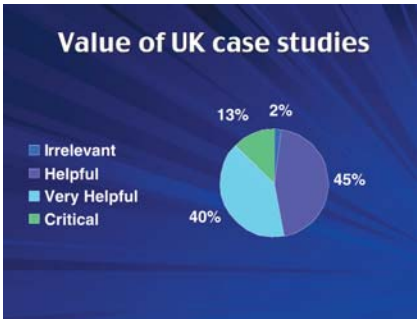
We had answers from 21 per cent of the 263 departments, which I am told is an exceptionally high percentage response for any question which does not concern the availability of funding. Given that there is inevitably a high degree of self-selection in the answers, I suspect that the level of the adoption of the map amongst those who did not reply is much lower than amongst those who did. A quarter of those who replied are doing a significant amount of teaching of engineering ethics and eight per cent think they are doing nearly all of it. Half of those who replied are doing some significant amount and we have 11 per cent who were brave enough to reply and say that they were hardly doing it at all.



Increase of teaching

The other piece of feedback we obtained in the verbal section is pretty strong support for the map as a useful, practical and appropriate framework for thinking about increasing the delivery of the teaching of engineering ethics, which was actually our next question.

We asked whether people intended to increase the teaching. Not at all? Twenty per cent said that. Some of those who said this were those who were already doing quite a lot, and some of those who said it were those doing hardly anything at all. You can see that there is actually quite a significant momentum amongst this particular group for making progress over the next two years and there is some momentum in the rest of the group for making at least modest progress over the next five years, or incrementally.



Value of UK case studies

You also have the survey in rather more detail in another pamphlet in your pack, and I invite you to look at that. There are various issues that departments feel need to be addressed in terms of teaching material, skills development and curriculum development. However, the one overwhelming requirement that comes through, both from the working group itself, and also strongly confirmed by the feedback, is that people would very much like some relevant, practical, UK-focused case studies – the most desirable will be accompanied by the engineer who was involved, who can talk to their experience, but at least are real-world.

There are also things that do not address disasters that we have known, but actually address the problems that people come across every day – whether you should or should not design a gas chamber, or what you would do in the position of the man who tried to get the management to address the problems of Challenger. Those are useful, but not quite the same as what you do when your client wants you to use a lower specification in Kazakhstan

because they cannot afford a higher one, and the money will have to come out of the hospital budget if you insist on protecting the environment as much as you feel you ought to.

You can see from this piece of feedback just how highly desired this case-study material is. That is one of our next challenges – how we can help produce that case study, both as a profession of practising engineers in providing those examples, and also as a community in terms of assembling the resources to do the not inconsiderable task of putting it all together.

That is enough from me. Let me hand you on to the next speaker.

The challenge for academia

Professor John Archer, CBE, FREng, FRSE
Principal and Vice Chancellor, Heriot-Watt University

I shall probably reinforce a number of the things Andrew has said. I shall specifically interpret academia as being the role of universities in the engineering schools and departments within the universities. I will speak from the perspective of Heriot-Watt University, because this is early days for us in terms of how we take forward the issue of ethics in engineering.

We are challenged to help the formation of engineers into the 21st century. In that sense, it is about preparing them for professional careers within the context of the things that the university engineering departments do. For those universities that have had medical schools and have been able to take advantage of the things that they know about in medical ethics, they may well be further down the line than many other universities.

At Heriot-Watt, we do not teach specific modules on engineering ethics. However, if I ask my colleagues what they do, they all tell me that there are many elements of ethics for engineers within the things that they do, and so it is rather tricky to sort out exactly what is happening. We find that there are elements of ethical practice in a whole range of modules, through the undergraduate curriculum and into the masters level curriculum.

We have found the map to which Andrew has just referred really helpful, because it helps us to think about this issue and how we will take it forward - there are some very helpful and good ideas in it. It has been particularly useful to us at Heriot-Watt that a number of colleagues have been involved in helping this process in the committee work that has gone on. It has given us greater insight into some of the things that we need to do.

There are a whole host of challenges for university engineering schools and departments in taking these matters forward. Let me describe first of all the particular problems of new undergraduates coming into universities from school and embarking on engineering curricula and learning, sometimes for the first time, that engineering solutions are open-ended and that there is no right answer all the time. Particular challenges in the early years in developing the ideas that are incorporated into ethical approaches for a future life as a professional engineer, need to get them thinking about the way in which solutions that they come up with are not only technically sound, but are also ethically sound. The road map helps us in taking this forward.

There is also the knotty issue of assessment. Undergraduates are sometimes a little cynical and, if you do not give them marks – if you do not assess them, with something meaningful towards their final degree – they do not always take them as seriously as you might expect. One of the challenges, therefore, has been in how to change the way in which we examine, and award marks towards their final degrees, by taking into account elements of the ethical issues.

I must say that this is also similar to some of the challenges that we have had in building sustainability issues into the curriculum. It is important that we assess it properly. Part of that assessment is obviously rooted in learning outcomes, rather than in learning assertions.

In a university like mine, we have a considerable number of international students on our programmes, as well as UK students. A significant number of our academic staff also come from international backgrounds. This raises the issue, when we talk about the ethical dimensions of engineering, that we have different cultural interpretations of what this means. It is very interesting within the classroom context, with the discussion that can take place between people coming from different perspectives. If we are educating engineers to work in a global environment, then it is really important that we add, as one of our challenges, the understanding of the cultural dimensions that we can have in these issues.

As far as professional accreditation goes, it is really important to university engineering departments that the relevant professional accreditation from the professional institutions is achieved. Working with those institutions, we also want to make sure that the accreditation processes are firmly embedded in learning outcomes, rather than prescription. Thus, there are challenges that will emerge there. I am not giving you the solutions to these issues, because this is a dynamic process which is ongoing.

Let me just finish with a variety of approaches that are under consideration and sometimes in use in my own university, about embedding ethics, and about this preparation for professional careers. We very much value a focus on relevant case studies, but there are not enough at the moment. The idea of linking that to guest lecturers, for whom the case studies have applied, is a very important dimension to that.

There is also the issue of multiple solutions and we are also looking at scenario developments, to see how we can incorporate things that have alternative outcomes.

Dealing with confidential information: some of the very valuable design work that we do, where we collaborate and co-operate with colleagues in industry, can involve confidential information, and there is a very interesting exposure to our students to learn about dealing with such things.

There are issues when we come to the examination of students, in which we have to develop strong rules about plagiarism. An issue in plagiarism, concerns something 'borrowed' that is not necessarily acknowledged, and is used further to develop another good idea. Actually this rings many bells when you think about what engineers do. We build on all sorts of ideas. However in the context of examination in the university environment, the attribution of things to their origin is an important part of the learning process. The use of good ideas by engineers is an area where there is sometimes a degree of confusion. That is an issue that we need to work through.

We encourage the study of professional codes but, as you have seen, there are more than 30 of them. Some of them say the same things, and some add slightly different twists to them. Trying to get towards something that is a standard is very important and a useful exercise. We must not forget the international dimensions of this because, as has been said earlier today, this is a UK code. We just need to be alive to the fact that things are sometimes different in other parts of the world.

There are issues for students coming from different cultures when we use the word 'cheating' in examinations. In some cultures, co-operation and collaboration, and helping one's colleague, are an important part of friendship

and 'normal' behaviour. We have to be very strong and clear about the rules we make in the university in the examinations, but we also need to understand some of the other cultural dimensions to these things.

There has already been allusion to 'blame' as an issue. There is corporate blame and individual blame and, when things go wrong, people are always looking for who to blame. Bringing that sort of context into engineering education is interesting in terms of developing ethical approaches. However, this evening, the work that has been done in order to get us to where we are now, is a very important step and a landmark. From the engineering perspective in universities – and particularly in my university – we welcome this enormously. Thank you.

John Uff: Thank you very much, Professor Archer. I am glad you mentioned the differences between the different codes. Of course, it is envisaged that each of the codes will simply align themselves with the Statement of Ethical Principals with a short sentence saying that 'members shall comply with the Statement of Ethical Principles'. You will not need Counsel's advice on that or, if you do, you have just had it!

Let us now hear from our final speaker, Professor Ian Howard from the University of Sheffield, who I believe was described as an 'uncaged teacher of ethics'.

The teacher's experience

Professor Ian Howard
Department of Mechanical Engineering
University of Sheffield

I will be producing examples to illustrate many of the points that John Archer has made. I shall be telling you how I made real the idea – the very good idea – of teaching ethics to third year mechanical engineering students at Sheffield. In the main, I believe I have succeeded but I have failed as well, and I will tell you about that too.

At the beginning of 1999, my then head of department said to me: 'Ian, I have decided that you should teach our new course on the professional responsibility of engineers.' To my natural question of, 'Why me?', he said it was because I was the only one in the department capable of doing it. Combined with the flattery, and the careful footwork in the quagmire of departmental politics, he had a real truth. I really was then the only one who could take the job, without either making a complete mess of it or stirring up too much trouble.

Things are in fact very different now, because of the widespread concerns that have brought all of you to this meeting, and the work going on at places like the Royal Academy of Engineering and the Engineering Professors' Council. Briefly, people given those responsibilities now, have so much more to draw on than I had, and need not feel as isolated as I was then. In particular, the possession of the map that is now being publicised widely will be an enormous help to teachers who are now put in the place that I was then.

Fortunately, I soon discovered Caroline Whitbeck's textbook*, which uses the analogy between the practice of ethics in engineering and the discipline of engineering design. My students are able to make much of this. Also, like many other teachers worldwide, I and my students have drawn upon the excellent case studies put up by Whitbeck and her MIT students on their website. So, for me, having a good example of a working course was immensely helpful in getting mine started – even though it was very different from what I wanted to do myself.

As regards the students, they know very little of real engineering practice before they come to us. They only have rudimentary skills of integrating their knowledge to deal with practical, technical problems. Also, being young, they can be very innocent when it comes to problems of social interaction and so we have two dominant concerns - teaching students how to deal with ethical and other professional problems arising from complex human interactions, all within the context of real engineering practice.

Our discipline is a lifetime's art, an accumulation of knowledge and experience that changes our thoughts and emotions gradually over time. This is often gentle, but it can sometimes be brutal as we interact with and learn from our colleagues, business acquaintances, friends and enemies. You cannot teach that to students who do not want to know – except in the most superficial sense of their being able to pass a formal assessment at minimal level, perhaps, if they are lucky.

** Ethics in Engineering Practice & Research, Cambridge University Press. ISBN 0 521 47944 4*

Most students rise to the challenge very well - after all, they really do want to be good engineers. However, when pressed, it is clear that they have the normal fantasy of the young. They are good people with no intention of harming anyone, so how can they possibly create ethical problems for themselves or worse, for others. In my view, one of the best things any educator can do for the young engineers in their care is to provide a supportive environment in which students can explore their ethical responses to situations drawn from real engineering complexity, without suffering the terrible consequences of bad mistakes in the world outside the university walls. A good course must include as much as possible of this protective, guided experience, for we are educating not only our students' intellect, but their emotions. This all takes time, practice and regular re-engagement.

The basic problem is that one needs experience to deal with practical ethics well, just like engineering itself. However, there is a great pressure on staff in universities to be time efficient, by providing formal instruction to large groups and so on. Ideally, practical courses on ethics should allow the guided development of individual students through direct contact with experienced engineers in personal tutorials or small group activity. This is very expensive.

Realistic teachers will compromise between these two competing demands by creating various activities of simulated engagement with engineering scenarios drawn from real life. So, good case studies, guest lectures from experienced, working engineers, and role play, are essential components in a successful course. They require very substantial amounts of preparatory work to balance the often-conflicting requirements of engineering reality, and being simple enough for the students to grasp the principles.

In terms of increasing demands on the students, personal lectures are the easiest to engage with. Case studies embed the students in a well-understood, real engineering environment but take the student through what other people have done. Role play gives each student a personality in a scenario which evolves over time. The response of each player in a role play influences all subsequent events and so the outcomes can be very different for different groups of individuals. In my experience, students learn most from this but it is the most demanding to set up and organise. My students like it very much and would prefer that a far greater proportion of the course was illustrated by role-play exercise.

As John mentioned, students must be assessed. A natural method for courses like this is by continuous assessment. However, in starting our course, we recognised the danger that weaker students would attempt only the assessed parts and so we decided to force them to engage with the course as a whole by having a formal examination paper.

Here is part of one of the compulsory questions:

"Question: Give a reason why the relation between a professional engineer and the user of the products or services containing the fruits of their engineering expertise is different from that between a medical doctor and theirs.

Answer: A professional engineer will try to modify or process the fruits, while a doctor will advise patients to eat fresh fruits. This is because a professional engineer tries to improve on the product to achieve better nutrition and quality, while a doctor will take existing fruits, which is good enough for them."

One of our Far Eastern students wrote that answer, which illustrates several important things.

First of all, assumptions about who understands what in language and culture can easily be wrong. That question was validated and was subjected to the detailed scrutiny of a departmental committee and had the critical attention of the external examiner but still we did not spot that someone from a non-UK and non-European cultural background might not understand the metaphor. Another point is that this candidate was only partially literate. Many students from this source are inarticulate as well and they therefore do not engage with the practice sessions because of these cultural and linguistic products, compounded by their great reluctance to take part in group work. They also hate open-ended activity, having been trained at school and college in getting the right answer to well-posed questions. Such bookwork examples are hardly representative of real engineering or of real concerns in engineering ethics.

To sum up, a significant minority of the students have difficulties with the subject. They either do not attend, if they are from the UK, of they attend but do not engage if they are from the Far East. On the other hand, the majority have a very valuable experience and in fact the subject is likely to stay with them far longer in their subsequent professional career than most of the other areas of formal instruction that they receive at my university. They do well, and are very complementary about the course – in fact, they are a joy to teach.

Panel discussion

John Uff: We will now have the panel discussion.

Whilst listening to the various contributions, several questions have occurred to me. I will put these to the panel and invite their comments.

Several references have already been made to 'the Hatfield show trial', as I think it should be called, in which the CPS has decided yet again to invest millions upon millions in an attempt to find somebody guilty of manslaughter. Yet again, they failed. Did we learn anything about running the railways from that trial? I think that is very doubtful. As a matter of course, instead of encouraging prosecution or even public inquiry into disasters and events of this sort, should there be an inquiry into whether any of the professional engineers involved are guilty of breaching the Statement of Ethical Principles, from which we might learn something?

Andrew Haslett: We have a conflict between the legal process, which is about apportioning responsibility, and the investigative process, which is about understanding what happened. Clearly, if you have a disaster like that, then something went wrong. In my experience, I was always taught to investigate incidents by starting with the statement that we were there to discover what had happened so that we could learn from it, rather than to allocate blame. Having said that, I have personally investigated incidents where it was clear that some of the actions of some of the actors were very blameworthy.

In the legal process, you have the problem of people being asked to incriminate themselves in order to help your understanding. There are the ethics of that process whereby people who suspect that they have done something wrong can simply not co-operate with the inquiry. In a managerial context, of course, the disciplinary process is not as equitable and, in that sense, people are encouraged to incriminate themselves in managerial inquiries.

My personal preference would be to start off by understanding what went wrong and to make laying blame and holding people to account a lesser part of the process. In that case, I think you might well discover that there had been breaches of professional ethics.

John Uff: Yes. Perhaps I could just add that today also happens to be the day on which the Royal Academy has published its long-awaited report called Accidents and Agendas, which reviews the whole process of investigating accidents. One of the points it makes, quite rightly, is that investigations are not concerned with liability or blame, but they are concerned with establishing causation. It seems to me that it is but a small step to go further and ask the question whether there is a breach of any of these professional codes.

Would anyone else like to add anything on that topic?

Baroness O'Neill: There is something to be learned from the discussions that have taken place in medical ethics, and particularly the Kennedy report on the Bristol Royal Infirmary Inquiry. One of the most interesting recommendations is that you really have to choose: in the end, if you wish truth-seeking to be the aim of an inquiry, you cannot also have blame apportionment as the aim. Unfortunately, if you have issues of compensation and indeed of the destruction of people's careers, it is extremely difficult not to find the truth-seeking subverted by the blame-seeking.

The NHS has set up an outfit called the Patient Safety Agency, which seeks to model the investigation of incidents on the investigation of air crashes. This seems to be an absurd analogy because the pilot and the passengers are typically dead after an air crash, but that is not the case after every medical mishap. One has to choose. There is a solution in medicine, which is no-fault insurance of some sort but whether that would be popular with all professions is another story.

John Uff: Yes, it is interesting to contrast the debate about no-fault liability, in which it is always say, 'We can't afford it', with the millions of pounds that are shovelled into the CPS attempts to secure convictions for manslaughter.

Baroness O'Neill: And of course there is the legal aid for applications.

Richard Parry-Jones: I am very much in agreement with my fellow panellists here. It seems to me that we need to think about how to connect this question to the question of an ethical code. One of our professional duties is to have an openness to finding the root cause of any failure mode that occurs, that escapes our engineering process. Essentially, all disasters or accidents are failure modes that we have not detected and taken counter-measures to during the engineering process – whether it is at the commission stage, the definition stage, the requirement stage, the synthesis stage, the verification stage or indeed the pre-production stage. If we do not catch the failure mode during those periods, it gets out and it occurs and the failure mode will happen. One of the things we need to capture in our expression of how our ethical practices and policies should go forward is that it is incumbent upon the engineer and it is a duty of the engineer to participate in finding causation of failure modes that occur.

Chris Megone (University of Leeds): I am a philosopher, so let me declare an interest. I just have a comment, to which perhaps the panel can respond. The speaker from Heriot-Watt was talking about ethics and the curriculum currently at Heriot-Watt. He said that a number of his tutors said that ethics came into current courses but there was not an explicit module on ethics in engineering.

A third-year medical student at Leeds was talking to me just the other week saying that, where ethics came into the medical curriculum in that sort of a way, where they were focusing on a topic, ethics was being alluded to as relevant but it was not explicitly being taught. She had not been able to see the point of ethics to a medic. As a result, when she came to do a life-cycle module, where she would have to do a good deal more ethics around case studies at the beginning of this year, she was expecting not to enjoy ethics at all. In life-cycle, by contrast, every week they look at a case study and they are expected to respond to it by commenting on basic science, clinical aspects, social and legal aspects and ethical aspects, taught in a group of about 25, split into four groups, each of which looks at one of those aspects every week. Two weeks later, she had suddenly seen the point of ethics, because it was much more worked out how it was integrated with these other aspects of her practice. In fact, she has now transferred to doing an inter-collated BA in ethics this year.

This is just an aside but it made it seem important for me for ethics to be dealt with in a sustained and integrated way. I wonder whether Ian Howard, particularly, from Sheffield, would think that is the case, as opposed to where ethics comes up in rather small piecemeal parts in the curriculum and is not addressed formally.

Ian Howard: You are absolutely right. The recommendation from the working group, and it is explicit in the map, is that we recommend very strongly that ethics is woven right the way through the course in a properly integrated way. This is what people said about design, and we have all seen design aspects of courses where providers of various topics in engineering courses say that they do design but in fact they mention it here, that they do not do anything about it and the students do not have any specific design development which comes from the art base of our subject. It requires time and engagement with somebody who really knows what they are talking about.

There is a danger, which you have pointed out very well, that people can say that they do ethics in that bit, and that is the ethics, but in fact it is not – because the students have heard a few things about ethics. They may have heard an example, but it has not made any change in how they see themselves and how they see the world around them, in which case it has no value. It has to be done well.

David Collier (Faulkland Associates): It seems a very good Statement of Ethical Principles. It encourages us to minimise and justify adverse effects on wealth creation and a few other things but most of the dilemmas that have affected me in my life, or my colleagues, have been to do with minimising and justifying adverse effects on the risk to human beings. I cannot really see much coverage here. I can see 'quantify all risks', which, of course, is impossible, but I wondered whether there was an explicit choice about leaving matters of health and safety, and so on, to the codes of practice.

Baroness O'Neill: That was my one question about the way that the original, shorter principles for scientists had been developed. Why was there the specific on quantifiable risks to the exclusion of uncertainty? I would have thought that many people, particularly with environmental interests, would just fasten on that and say, 'Trust engineers – they only look at the risks they can quantify.'

Chris Earnshaw: I am possibly in danger of going into semantics. We certainly did have a debate about whether all risks could be quantified and whether we should remove that word. There was a view that, even if you only estimated

the risk, or said whether it was large or small, you needed to take a view on its significance, if I could put it that way, rather than its absolute measure.

Baroness O'Neill: That was not quite the point I was making. I know that the terms are used differently in different disciplines but my thought was about the difference between risk and uncertainty. Even if one cannot get a precise estimate of risk, it is still an estimate and it still makes sense to be thinking of it numerically, whereas I think that uncertainty is an epistemic notion of rather wider applicability.

Chris Earnshaw: Yes, I accept that point.

John Uff: Could I change the subject and throw in my second question? There were some very interesting references to relations between engineers training here and their experiences in other countries and indeed the experiences that are brought here by people from overseas. Are there real differences between the notion of ethics between this country and lesser developed countries? Or are they the same principles, applied to different problems?

Ian Howard: I have a really nice example of that. I do a role-play exercise and one of the roles is that of the health and safety engineer – the engineer from the Health and Safety Executive. I have been helped by one of my PhD students who is a well-qualified Italian engineer who has worked as a professional consultant in a wide range of Italian industries. This role play works very well, according to whether the health and safety engineer insists on various players doing certain things as regards the safe operation of plant.

So we went around and then we opened it up to group discussion and my student at the end of it said that it would work quite differently in Italy because there, somebody would bribe the health and safety engineer. This was an excellent example for the students, because he was talking from personal experience in Italy. We are not talking about a country in the Middle East, the Far East or South America, but about a member of the European Union. I know very well from other colleagues that there are cultural differences in the perceptions of engineers and engineering practice, right the way through the European Union, and they are very different.

John Uff: One of the speakers at the conference organised at the Royal Academy 18 months ago was a young female engineer whose specialism was health and safety. She had worked in India and her problem was to ensure that proper health and safety procedures were followed. She issued the workers with safety boots but the next day they would be back on site wearing flip-flops, because they had sold the safety boots to support their families. Each time they were provided with safety boots, they all went the same way. I suppose that is a sort of ethical dilemma but I do not recall quite how she solved it. Would anyone like to suggest?

Baroness O'Neill: I do not recall that, but it is worth emphasising that it is likely that, at the level of fairly abstract principles, there will be a good deal of cross-cultural agreement. The nitty-gritty comes when you consider what counts as corruption in this culture, or what is seen as a bribe and what is seen just as a hospitality or courtesy. What is seen as an absolute duty to one's family, but which we might call nepotism? The only way to deal with that is as you are doing it, by actually exploring with, at best, an international group of students, as to how that would be different.

We have this problem, real, live and facing us in the universities all the time, when we have students who have not been brought up to recognise as cheating what we regard as cheating.

John Uff: Could I bring Kel in on this. Is the ECUK conscious of international differences of the sort we have just been discussing? Do you have a solution?

Kel Fidler: Not to the extent that you might think at the moment, although we clearly have a very important international agenda with regard to recognition of qualifications of those from overseas through, for example, the Washington Accord and so on. There are some interesting questions there that arise, which may or may not be classed as ethical. For example, a country might be accredited, either by a UK accreditation agency from a professional engineering institution, or by the American agency, ABET. They actually have slightly different requirements in some degrees which, in the case of that third country, might actually lead to the UK saying yes, and ABET saying no. There are thus some slight disparities somewhere, and that is one of the tensions that we have with regard to international activity.

Perhaps I could just make a remark which is not ECUK. Although I am billed as chairman of ECUK, I am also the vice chancellor of a university so perhaps I could just make a comment on international activity there. There are some great tensions in the recruitment of international students. For example, many of the universities in this country are very proud of their widening participation activities and the fact that we give access to students from disadvantaged backgrounds. At the same time, however, some of those universities are recruiting the children of very rich Chinese parents and this is clearly an issue of concern to us. In addition to that, we recruit large numbers of overseas students in some universities, but we have not actually internationalised the curriculum. There are some very great concerns there, from an ethical point of view.

John Uff: Thank you very much. Of course, there are some fascinating ethical problems in the medical world with international practice, where we contribute to their ethical problems by taking away all their doctors and nurses to work here.

James Armstrong: I chaired the committee of the Royal Academy, appointing visiting professors to universities. Several of you have mentioned this role of bringing in the external experience to the undergraduate area, and case studies, which are vitally important.

One thing to develop out of this was a book that I wrote some years ago on engineering ethics for decision makers. In that, I developed a system for auditing continuously the ethical content of major projects – not now as an undergraduate exercise at all, but as a major task. Many of our major projects spread over a period of several years and you have to appraise the situation continuously to make sure that you are sticking to the principles with which you started and that you are not allowing expediency to modify your attitude towards things. The development of an auditing technique which runs in parallel with the project management group is very important.

John Uff: That is a new concept – the auditing of ethical content. Perhaps arising out of that, one of the themes that many people have referred to is the importance of case studies but one of the questions is how we will get those, other than by looking on the net. Does anyone have any proposals as to how we can add to the teaching materials and, indeed, the materials from which we should all be learning? Does the Academy have any ideas?

Chris Earnshaw: The Academy and the institutions themselves potentially have much to add here. I would like to see some of those case studies being facilitated by the institutions, by virtue of their relationship with both their members and with industry. To be effective, they need to be relatively up-to-date because it is no good referring to things that happened 30 years ago where, perhaps, cultural and social norms were different. As other speakers have said, because there can be significant cultural differences even between the US and Europe, it is somewhat limiting if you always use a US example. Always pulling things off MIT's website will clearly not be the answer.

Andrew and I have talked about this and connecting industry with academia is a very important part of the ongoing work.

Andrew Haslett: Just to build on that, we have an outline plan. Paul Kirby from Cambridge, who is in the audience, is on the Teaching Ethics group and he has taken the leadership in devising a plan. I would agree with Chris that it will not be too problematic to identify people who are willing to contribute their experience to make real case studies – there will obviously be quite a networking and organising activity involved. The challenge, however, will be in how to translate that into useable teaching material. We know what territory we want to cover and we know roughly what the issues are. The costs are significant. Our concern would be that, if everyone set out to do a little of this, not necessarily to an appropriate standard, it could create material that cannot readily be shared – although, of course, there is always room for local initiative and for introducing people who are readily available locally if you are teaching. At the moment we do not have a solution to that. We are in dialogue with the Higher Education Academy and the funding authorities and others, to see if we can find a way of obtaining the resources we need to make some progress.

Chris Earnshaw: It is often assumed that the best ethical dilemma examples relate to big disasters and therefore you get into all sorts of complications if there are legal ramifications ongoing. However, I do not think that is the case at all and many of the most challenging ethical problems are right at the cutting edge. There are many case studies there that fall well short of disaster situations that need to be brought to the fore.

Andrew Haslett: If you think of the relationship to design, it is a rather curious concept to teach people how to do good design by looking at examples of bad design. We have many examples in our profession of the successful resolution of ethical dilemmas but, because they are not published widely to philosophers, they are not picked on as the case study examples. In fact, I was talking to someone last night who constantly deals with ethical dilemmas to do with engineering in different countries, and how the engineering object, the environment and so on, are seen, and what local resources are available. He has some good material, but I am afraid it will not be a disaster – it will be a success.

John Uff: It is almost time to wind up, but I cannot resist one last question from Sir Alan Muir Wood.

Incidentally, the report to which I have just referred, Accidents and Agendas, published today by the Royal Academy, makes the point that we should not just look at accidents that end in disasters but near misses are often just as interesting and do not suffer from the press in the way that real accidents do. That is another source for you.

Sir Alan Muir Wood (Halcrow Group): The observation I would make, arising out of the discussion this evening, is that we as engineers are fundamentally synthesists, putting something together. We are also people who are much influenced by seeing the value of what we are doing, rather than the input. This makes me feel that we should be thinking much more radically about our whole system of the education of engineers.

I do not like to admit that the architects have got things rather better than we have in any respect but they start off by teaching design, and then they teach the technologies that add to that design. We do it precisely the other way around and I have found, in some of the most esteemed universities, that people are brought up in sub-disciplines which are not connected together. This makes it very difficult for them then to look at our profession as a whole and to take it wider in seeing how the technical part of our profession relates to the environment and all the other aspects of this. Hence, there is my suggestion that we need to take a very radical look at our whole education system, because motivation is the basis of any success in bringing students to understand our profession in all its width.

John Uff: Thank you very much indeed. It is now time to close the meeting and I will ask Chris Earnshaw to make the concluding remarks in a moment.

I have enjoyed this discussion enormously. I am pleased that contributions have referred to many different aspects of the Statement of Ethical Principles. I was reminded of one of them as we came into this splendid complex of buildings, as you will have done. I was very pleased to see that the statue of Newton had on it an acknowledgement to William Blake.

Chris Earnshaw: The agenda says 'summing up' but I will not attempt to do that. I will use most of this time for thanking all of the contributors, both this evening and in the run-up to today's event, because a great deal of work has gone into this over more than 12 months, to get us to the point of being able to have the debate and the presentations today. I would like to thank everyone who has been involved, both in the working groups and indeed in the extended working groups – for example, there was the work that John Monk did to pull the video together, which was extremely helpful and provides us with ongoing valuable material.

As I listened to the earlier speakers – I had a vague idea of what they were going to cover, although we had not shared scripts or notes – I was struck by just how many links there were between both the speakers and the work that we had been doing in developing the material, in the generic principles and the specific material for enhancing the quality of education. There were some very obvious links to some of the points that Richard and Onora made.

This is a very timely focus. We, the engineering community, are coming from some way behind. We have heard several references to the Hippocratic Oath and, if I remember rightly, that was from about 300 BC, so we have a few years to catch up on. As Lord Broers said in his opening remarks, and as was echoed by several speakers including Onora, we need to recognise that this is about personal responsibility and not lose these issues in the morass and complexity of regulation which often obscure what we have been talking about tonight.

There is a need for engineers to seize the agenda and not to rely on regulation and have it done to the engineering profession, and that is what will happen as we saw by Sarbanes-Oxley and so on, when a profession did not quite get a grip of what represented proper ethics.

We have heard about a number of ongoing challenges, not least that we are all operating now in a very global environment. The issue of culture has a profound impact on the way we approach ethics – and that is clearly challenging the educationalists. You have been able to bring out some of those issues and work with them, and enrich the process by bringing different cultural perspectives. There are perhaps some lessons there which industry can learn from education.
This just reinforces the ongoing value of linking together the different stakeholders and particularly, as Richard mentioned, the three principle stakeholders of industry itself, the professional bodies which represent individuals, and the educational environment. If we can work together in the coming months and years in getting a flow of information between those communities, then we will clearly be much better for it.

I will end by picking up on something that has been mentioned by several speakers, which is the value of approaching this in an inspirational way. I think Kel mentioned this, but other speakers picked it up as well, that we are likely to have more impact and gain greater respect, public trust and confidence by talking about this in the positive and not always the negative. We should not always be analysing and focusing on disasters, but actually setting out some inspirational values which drive the profession forward, and that are appropriate to the coming century, rather than the century we have just exited.

There are some key messages there, which we must work with. There is more work to be done and the Academy will continue to lead in driving forward these initiatives.

John Uff: Thank you very much, Chris. Thanks to the Royal Academy and ECUK. Please join me in thanking the speakers.

Close of Meeting

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