Which hat should I be wearing when I say that?

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Abstract: *In general, "ethics" is considered to be what holds society together by providing a set of rules serving two linked purposes. First, by encouraging individuals to behave in ways which society approves, and secondly, by dissuading individuals from behaving in ways which would fracture, even perhaps destroy, that society. As corporations are part of our society some such a set of rules should apply to them, also, and hence to engineers, when making decisions. But engineers, being humans, cannot simply respond to "a set of rules" when facing decisions, which always present choices. The choice may get down to the question: which hat should I be wearing? My personal (family) hat? My technical hat? My social-obligation hat? My employee hat? My shareholder hat? And so on, for many of us have a multitude of interchangeable but potentially conflicting hats.*

Introduction

Hats, to some extent, can be identifiers. For example, even though these examples may now be dated we imagine the English public servant in a bowler and the boy at a "good" English school wearing a straw boater, the Chinese in a large-diameter flat hat. The cowboy in a leather hat with the side brims turned up, and the classic chef *must* were that traditional chef's hat. And engineers may generally be visualized in a plastic safety hat, even though many engineers work in offices, not in the field.

In another sense, we may refer to hats the way Edward de Bono (de Bono, 2000) did, with his "six thinking hats", which describe different ways of thinking: white, objective, dealing with facts and figures; red, emotional; black, cautious and careful; yellow, optimistic and positive; green, fertile and creative; blue, concerned with control. These illustrate very well how we humans have, certainly, many different ways of thinking our way though problems.

Choosing the hat we should be wearing when addressing a technical question is easy, well, *relatively* easy, it should be the white hat. But engineers do not always have to deal only with technical questions, we are sometimes beset with questions, problems-to-be-solved, outside our technical expertise, and responding to such matters requires a grasp of ethics in an engineering context.

So, where does this fit into engineering education? We'll come to that, because this paper is addressed, in particular, to the engineering student and to the teachers giving education to that student. And, looking ahead, what will come from the illustrations is not that there's never unquestionally right or wrong when making some decisions, but there can be *both* right and wrong.

Ethics – What Do We Know About Ethics?

This search for a definition begins with reference to the St. James Ethics Centre in Sydney, which has existed since 1988, and provides advocacy, consulting, counselling services. Their mission, which may be taken as covering what's in a definition of ethics, is to encourage and assist individuals and organisations to include the ethical dimension in their daily lives, and thereby help to create a better world. Well, that shows an *application* of ethics, so what about a definition?

Finding a general definition in the literature is far from easy. The Oxford Dictionary related 'ethics' specifically to 'the science of morals, moral principles, rules of conduct', however, one would have difficulty in associating the terms 'science' and 'morals' with each other. There are many references specifically on ethics. An early writer, Garrett (1966), on a more specifically named branch of the general topic, "Business Ethics", specifically stated that "ethics is not about morals" but tended to confuse the situation by adding that ethics is "conformity to conventional social rules or the existing moral judgements of men". Another early writer, Higgins (1968), succeeded in clarifying, perhaps

enhancing, though perhaps further slightly confusing (or, indeed, perhaps all those together), the issue with a clearly stated definition:

> Ethics is the philosophical science which establishes the right or moral order of human acts, that is, in the light of first principles ethics establishes the absolutely necessary norms of free acts whose realization in practice truly makes us men.

It's interesting to note that both Garrett and Higgins placed the initials "SJ" after their names. That connection may have influenced their opinions, the essence of these being that human actions, though having a free will aspect, should be constrained by a higher purpose. And one would expect a more recent book would open with a succinct definition; well, that's what an engineer would expect, but Preston (1996) went through fifteen pages of general discussion before reaching a definition, reasonably clear from these selected sentences, not a definition given in an "engineering manner", in a tightly focused statement, but it sets out what's what very clearly.

> In general, ethics is concerned about what is *right, fair, just* or *good*, not just about what is the case or what is most acceptable or expedient. Ethical claims *prescribe* rather than describe. They are concerned with how people *ought* to behave and suggest how social and individual behaviour can be improved. The terms "morality" and "ethics" are often interchanged. "Ethics" has a double meaning. It may refer to the study of our values and their justification. On the other hand, ethics may also mean the actual values and rule of conduct by which we live, or our "morality".

So, in general, "ethics" is considered to be what holds society together by providing a set of rules serving two linked purposes. As noted earlier and repeated here for emphasis, first, by encouraging individuals to behave in ways which society approves, and secondly, by dissuading individuals from behaving in ways which would fracture, even perhaps destroy, that society. As corporations are part of our society some such a set of rules should apply to them, also, and hence to engineers, both individually and in their roles as members of corporations, when making decisions.

The Application of Ethics to Engineering

Engineers in the USA have been ahead of their Australian equivalents; Babcock (1991) has reported that the first code of ethics was written in 1918. However, one of his sources recorded in 1983 that 'the goal of a universal code continues to avoid the profession', so they are, perhaps, still working on a national code. Harris *et al* (1995) list many of the technically-oriented engineering societies in the USA, compare them with the American Medical Association and the American Bar Association, refer to each having a code of ethics, but express a preference for the code given by the National Society of Professional Engineers. The Institution of Engineers, Australia, a uniform national body, has an ethics policy for members which, though later than the Americans is possibly ahead of them by providing a "Code of Ethics" applying to all professional engineers. The earlier edition was comparatively brief, containing nine 'Tenets' which members were committed to uphold. The current version (IEAust, 1994) is very similar, with a few additions and alterations, the most significant alteration being changing "shall" to "should" in all the paragraphs which indicate acceptable behaviour, making what was mandatory now preferable.

As noted above, engineers whose work is purely technical, or close to that, can make their work-decisions based on numbers and facts, applied logically. However, engineers who move into a management role (as very many do) find their decision-making is more difficult than it was when they dealt with purely technical matters. The increased difficulty is caused by the conditions surrounding managers; their decisions must usually be based on inadequate and ambiguous information, and on uncertainty of outcomes, in situations where conflict is often inevitable. They often find there's a "set of rules", from society as a whole or from within the employing organisation, which are provided as guidelines for their decisions. These guideline-rules usually work very well on straight-forward, technical problems, and hence cannot be disregarded.

But engineers, being humans, cannot simply, will not necessarily, respond comfortably to "a set of rules" when facing management decisions, as described above, and often tricky. The rules may suggest deciding how a choice should be made, but the consequences from such a decision may make

the rule-based decision unpalatable, to, that is, the individual. The choice may also be influenced by loyalty to a person or to the employing organisation, or by preference to a "higher purpose", or by very simple human emotions, or by misunderstanding the nature of the required choice, or - - - the list goes on. This may get down to the question: which hat should I be wearing? Not in terms of de Bono's colours, but of *who I am and what I intend*. My personal (family) hat? My technical hat? My social-obligation (ethical) hat? My employee (loyalty-to-employer) hat? My shareholder hat? My personal survival hat? And so on, for many of us, indeed most of us, likely all of us, have a multitude of hats, interchangeable in the sense they will all fit the wearer's head, but each forces the wearer to face a different direction when having to chose which facet of a decision should be faced.

Can we satisfy the engineers' pictorial mind by forming a model of how we can balance between technical, professional, and social requirements, which sometimes become demands, to find the conditions most vital to satisfying the education dilemma? The influence of those three factors suggest a triangular plane figure poised on a point under its centre of area, with weights on each corner, each weight representing the intensity of one of the demands, as shown by each of those requirements. This concept has received further development in association with Chatfield (1995), a senior undergraduate student.

Another model has been developed from the Management Grid (Blake and Mouton, 1964), which shows management styles are a composite of concern for output and concern for people. In an earlier paper this author (Ward, 1998) has suggested that a third axis, *concern for self*, should be added to the grid, as a reflection on the fact that we all have our own needs and ambitions, and "self" is important provided that it does not conflict with others and the society in which we live. The third axis makes the grid three-dimensional and provides levels of distinction between altruism (having a small-value third-axis) and selfishness (one with a high-value third axis and low values on the other two).

Are There Hats Missing from de Bono's List?

The term "higher purpose" was mentioned above. There are times when our actions are governed not by our own wishes, not by rules, not by conventions, but by our belief that there's something more important, something more, shall we say? Righteous? Which must be upheld? The thinking when wearing this type of hat is another type not identified by de Bono.

One may not readily believe responding to the call of a "higher purpose" could occur in engineering. And one might also not expect the response to be by a young person. Can we explain this in terms of a mixture of hats? Meeting the needs of such a call seems to require wearing another mixture of white, red, and blue, the person uses facts and knowledge, plus emotion, plus control, certainly with no hint caused by the black hat, this one threw caution to the winds.

This following example of a person answering such a call is, admittedly, anecdotal, a word often attracting condemnation when it's evident in a research paper. However, there's much held in the minds of our corporate storytellers worth noting and from which we can learn, the best examples coming from our eminent safety guru in England who has given us books of anecdotal evidence of good and bad practices in engineering with, also, impact of education (one cited here, Kletz, 1988).

There was, once, in Sydney a company with a very cavalier attitude to pressure vessels. Many of those in the factory had isolation valves under the relief valves (very bad, naughty, practice), and there was a couple of large reactors, about 12,000 litres in capacity, which were regularly pressurised, to somewhat between one and two atmospheres, to empty out each batch of flamable products, at a considerable temperature, even though the reactors were not certified as pressure vessels (very, very bad practice, very, very naughty). This situation persisted for many years until the company's luck ran out, one day a government inspector arrived, headed unerringly to those reactors, asked pointed questions, appeared to know most of the answers, and stressed the regulations, after which the company was instructed to install pumps to discharge the product instead of using pressure, which must cease immediately. In addition, there must be an inspection and a physical revision of all pressure vessels. There were less open, rather veiled, remarks about the possibility of fines - - -

The company went ahead with installing the pumps, which were able to empty the reactors quite satisfactorily. All the "true" pressure vessels were checked and modifications were made to bring

them into line with the regulations. Complying with the regulations about engineered plant, particularly items such as pressure vessels, is a legal and an ethical obligation for engineers. One may reasonably conclude there is a moral aspect, too, because a containment failure, even at a modest pressure of a few, even a couple of, atmospheres, can cause a lot of damage to property and the environment. It can kill people, too.

Some time later there was gossip, contained rather closely within a small group in the Engineering Department, that a certain junior engineer had become fed up with the company's attitude to pressure vessels, had grassed on the company and caused the inspector's visit, but is gossip dependable? Certainly, one should never place credence on such unsubstantiated chatter. Well, that junior engineer's boss didn't, until the junior admitted to his boss that he had spoken to the regulating authority. He knew his boss had been aware of the problem of the reactors for some time, and he ticked his boss off for not doing what he did.

Was the junior engineer's action ethical? Well, yes, he responded to a techno-legal commandment (a higher purpose?) which says: *Thou shall not pressurise containments which are not designed for that duty and not certified by the appropriate authority.* On the other hand, perhaps no, because he was not being loyal to his employing company, which is inferred in terms of employment: *Thou shall uphold the name of the company in all your work, and not cause it to fall into ill-repute,* or something like that.

We can only suggest he followed the "greater good" philosophy and risked getting fired in order to "right a wrong". All that may have been in the young engineer's mind, as responding to a "higher purpose". (Incidentally, his boss kept quiet about the junior's confession, so he wasn't fired, and a few years later left to take a better position with a larger firm.) This example from Ward, 2008.)

And So to Ethics Education For Engineers

So let's consider what happens to the student, or graduate, during early employment. We see that both the American and the Australian Codes have something which may be related to personal attitudes. How, then, does that relate to the lower-level, junior engineer?

Answering that expresses an opinion, based on unstructured observation: that the junior engineer is presented with the 'big picture' and becomes aware of the 'Big-E' ethics of the profession, but only by picking that up from the culture of the organisation in which he works.

However, very little of that relates directly to the student-or-graduate-level engineer's work-situation, he or she is most likely to be employed at a junior level where Big-E problems are not encountered. The junior engineer is much more likely actually to face "small-e" ethics, which involve interfacing honestly, ethically, with fellow workers and other individuals. So, if all engineers meet those situations through working life, even after promotion through the ranks, then that learning to deal ethically with the "small-e" problems as a junior may well contribute to shaping the overall ethical behaviour of the senior person.

Which brings us to the question whether an undergraduate course needs, should, include something about ethics, to prepare the student for the small-e problems to be met, and for the Big-E problems which are likely to follow. And that comes to a very basic question: can ethics be taught? In a way which will favourably affect a person's behaviour?

Looking back at the definitions of ethics, in what's held by an individual, one gains an impression that it's related to the very human trait of distinguishing right from wrong. But people are all different, some wear only black and white hats, some wear hats in an infinite number of shades of grey, and some are donned in technicolour; some of these differences are due to ancestry and some to growing-up environment. To change the nature of an individual who has reached undergraduate age (say twenty) would require brain-washing - - - or at least brain-dry-cleaning.

Perhaps such vigorous action is not necessary, well, not in the majority of undergraduates, an impression given by the results of a short, informal, survey carried out in Sydney and in Bradford (England) to assess student responses to "small-e" ethical dilemmas, reported in full elsewhere (Ward, 1995). The problems given to the students were composed from this author's experiences, but,

curiously and coincidently, many mirrored situations described by DeMars (1997), and by Dunckel (1989) (both read after the above-mentioned survey), which suggests that the situations explored in the survey were far from unique to any one person's experiences. This investigation into 'small-e' ethics began with use of a collection of quiz-questions as part of subject titled Engineering Management. One question, each headed: WHAT WOULD YOU DO IF? on a slip of paper was handed to each of a selection of students in the class- - - each of whom was given no more than five minutes thinking time before having to stand, read the question to the class, and present an answer. As an example of a question, here's one based on an item in this author's history:

> You are a factory manager. WHAT WOULD YOU DO IF you hear on the grapevine (it is, of course, only gossip, but passed on by someone usually regarded as a "reliable source") that one of the young women is working in an evening hospitality industry, after office hours.

The students were obviously aware of what was inferred and readily picked it up, and the answer given by a majority is summed up as: "If her work isn't being affected, ignore the gossip, but try to track it down to the truth and stop it." The students found their answers were justified by their being told what had happened in real life. Yes, in an office where this author worked one of the young women was working after hours. Yes, "in a hospitality job", which was, in fact, in the Union Café at the University of New South Wales, so the story was true, but whoever started it around the office put an inference into it which was quite incorrect. The department manager involved did not find out who started it and simply told the truth to a few, which spread the truth and killed the rumours.

What can be concluded from the survey results? Is it possible that there is some underlying, internalised, system of ethics, which 'human nature' provides? Probably, but if so, is it by nature or nurture? May we conclude that engineering students, having a mind-set suited to the technical disciplines, are naturally "ethically-minded"? Possibly, but the results showed slightly more concern for people than for task. Is it possible that the answers were so reasonably uniform because those answering had not been educated, perhaps one might say 'contaminated', by the need to compromise with their employing organisations' political influences? Possibly, but there's been no opportunity to compare-test older engineers. We don't know the answers, but finding so many junior engineers could answer these situations fairly and justly was very gratifying. (Trying the questions on American students would be an extremely interesting exercise, sadly, that opportunity has never arrived.)

So how should an ethics subject be included in an undergraduate curriculum? In a sense, the survey described above did teach ethics in a way which was effective, probably helped by being amusing. The answer, we believe, is there's no need for a complete subject, but ethics, with reference to the appropriate Code, should be included within any management subject in an engineering curriculum.

Conclusion

There is no easy answer to acting ethically. Choosing between de Bono's hats to adopt an appropriate thinking style may help making decisions, but does not prove those decisions are made ethically. This territory is important to engineers because our technical decisions may be simple to us but are sometimes forced by others; and indeed we have an anecdote of an engineer who resigned from a project rather than follow what he believed were unwise, "technically unethical", instructions, he's to be applauded, but how many of us are game to follow such a lead?

As remarked in the introduction, many of the situations we face have no clear-cut yes/no answer, sometimes what appears to be "ethically right" has a touch of wrongness in it, sometimes the "ethically wrong" answer has so much grey shading it's almost "right".

The best statement of ethical behaviour, found by this author, comes from the Vice-Chancellor of Macquarie University (Schwartz, 2007), who gave this advice to members of staff:

> Selflessness: Management decisions should be made solely in terms of the University's interest.
> Integrity: Managers should be free from financial or other obligations to outside individuals or organisations that might influence them.

Objectivity: In carrying out business, managers should make choices on merit.
Accountability: Managers must be accountable for their decisions and actions.
Openness: Managers should be as open as possible about all the decisions they take.
Honesty: Managers have a duty to resolve any conflicts of interest in a way that protects the University's interest.

Coincidentally, there's six items there, the same as the number of hats. But they seem to spell out ethical behaviour better than de Bono's thinking styles, and are much easier to follow than any of the definitions quoted earlier in this paper.

Can we engineers follow those six points of advice?

And as engineering academics, do we follow a code of ethics, such as the example from another country? Are we familiar with (as we should be) with the NTEU Code of Ethics (NTEU, 1998)? The cited version contains fourteen (not six) principles which cover a very reasonable range of work-related conduct to students, colleagues, institutions and society. Following that would allow ethics to come into the teaching process, thence to students, to shape their choice of hat when facing a non-technical decision.

[Many of the illustrations in this paper are contained in this author's recent book (Ward, 2000)].

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