

# Skills in Ethics for Engineers

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## Good and bad

The other day I talked to three young engineering graduates working for a building services consultancy. They enjoyed designing things but hated meetings with architects. They felt ill-prepared for discussions with other professionals and couldn't see why they often failed to get their point across.

The trouble was the two groups of professionals evaluated things in different ways. What they thought of as good or bad outcomes were different and they rationalised their judgements differently.

Now when it comes to matters of good and bad and evaluating things I am persuaded by G.E. Moore that I am in the realm of Ethics<sup>1</sup>.

For Moore, Ethics was about good and bad. He also wrote good is "indefinable" though sometimes, because of connections between things, I might conclude something is good or bad by aggregating lots of constituent indefinable goods and bads, but there is no universal way of doing this.

## Examples

Under the heading "Is the iPod Good Design?"<sup>2</sup> a blog reports

"It's gorgeous and tactile, ... the software interface is excellent ... but ..., the batteries are ... beyond terrible."

The author lumps these things together and, using the qualifier "good", concludes

"I no longer think the iPod qualifies as good design"

Or another blogger frames judgement of the iPod by asking

"What are you willing to cough up for cool?"<sup>3</sup>

1 G.E. Moore. *Principia Ethica*. Cambridge: Cambridge University Press, 1903.

2 Virginia Postrel, *Dynamist.com* blog archives, <http://www.dynamist.com/weblog/archives/001676.html>, accessed 24 March 2006

3 Christopher Breen, *Review: iPod nano, Playlist*, 9 Sept 2005

Such expressions seem too trivial to deserve the label ethical yet they're connected to bigger concerns. For example a negative review might result in lower sales and affect livelihoods. Or the comment about poor batteries might imply that more batteries are thrown away with consequent environmental damage.

Take the technical statement about an electronic switching device which asserts

“In a good design the shock wave trajectory is defined and no metallic parts are obstructing the plasma expansion”

Why is this good design? It doesn't appear to have much to do with broader issues until you read that under fault conditions

“What can be achieved by a good design is, that no massive parts are ejected which can cause severe consequential damage.”<sup>4</sup>.

So, technical details are discussed because they connect with wider issues which can affect safety, livelihoods and so on — though this connection is seldom made explicit. Within an engineering discipline desirable characteristics are embedded in design rules or regulations which form a rarely questioned ideology: “A good motor, for instance” as Tindall and Calvert suggest, is “... one with a high power to weight ratio.”<sup>5</sup>. Such rules of thumb are justifiable but often the justifications are hidden from students. Rather students are expected to have, as Underhill proposes, “A good understanding of ... design rules of current technology”<sup>6</sup> The ethics of a discipline thus gets expressed in traditional, specialised rules and practices and this, as Sivin puts it, results in “... broken connection between techniques and common visions of the good” which he adds “makes it very difficult ... to know what a good engineer is supposed ... to be.”<sup>7</sup>

Technologies develop and events alter public concerns. To remain a good engineer old rules of thumb must be adapted and new rules adopted. Creating an awareness of the need to adapt design precepts to social and technological change is one reason for teaching about ethics.

## Means

G.E. Moore wrote that both outcomes and the means to achieve them have good and bad aspects and neither should be ignored; both the product and the process matter and since engineers are a part of the process, their conduct matters too. Students alerted to this are likely to ask, “What do I need to know?”; “What is the

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4 Gekenidis, S. Ramezani, E. Zeller, H., Explosion tests on IGBT high voltage modules, Proceedings of the 11th International Symposium on Power Semiconductor Devices and ICs, Toronto, Ont, 26-28 May 1999, pp.129–132

5 Tindall, C. & Calvert, P., Computer-Aided Synthesis and Optimization of Induction Motor Design, IEEE Transactions on Manufacturing Technology, Volume 6, Issue 2, Jun 1977 pp.31–37

6 Underhill, M.J, The magic of marginal electronics, Electronics & Communication Engineering Journal, Volume 5, Issue 6, Dec. 1993, pp.359–368

7 N. Sivin, The Roanoke Conference II. Concluding Remarks on Conference, Technology and Culture, Vol. 21, No. 4. Oct, 1980, pp. 621-632.

formula?"; "What do I need for the exam?". They want directions — codes of conduct. Now codes of conduct are couched in general terms and are a guide but it is easy to come up with situations where obeying one rule causes you to break another. Such codes too, are often drawn up while sitting in cosy armchairs, a product of idealism and a gift to the dramatist. In Shakespeare's *Measure for measure*<sup>8</sup> the descent into pragmatism from idealism transforms tragedy into comedy whereas in Ibsen's *Wild Duck*<sup>9</sup>, the adherence to a rigid code results in tragedy and both plays offer reminders of what may be at stake for engineers confronted by an unyielding code and righteous administration. Mission statements are also guides to what is to be done. A current example, is offered by Google, who, idealistically, announced their mission is

“to organize the world's information and make it universally accessible and useful”<sup>10</sup>,

There are some snags to doing this. First this is in conflict with the privacy and property rights of others; Google doesn't have rights to all the world's information. But perhaps the written code is not important, but what matters is the conduct and its context, but Google failed on this count too when faced by social, political and commercial realities, it assisted the censorship of data in China.<sup>11</sup>

Circumstances can matter. That is why, in professions that deal with breaches of a code severely, they have tribunals which consider the code and the circumstances of the breach. One view is “the only way to perfect a code of engineering ethics”, is to decide “upon specific questions as they arise” then, “the body of decisions thus furnishing a code”<sup>12</sup>.

Another writer thought differently and presumed

“A good engineer is one who lives up to the obligations of her employment contract, ... conforms to the etiquette of the job situation, and whose individual engineering practice at least equals the performance standards of the profession.”<sup>13</sup>

Individuals, though, are not just employees and two authors remind us that engineers may suffer personal conflicts which involve loyalty to the family, neighbours or colleagues.<sup>14</sup> Often codes can be politically inspired and represent the biased interests of a narrowly defined group. And yet another writer highlights

8 William Shakespeare, *Measure for Measure*, London: Penguin Classic, 2005

9 Henrik Ibsen, *The Wild Duck*, Adapted by David Eldridge, Methuen, 2005

10 <http://www.google.com/corporate/>, 2005, viewed 31<sup>st</sup> March 2006

11 Mure Dickie, Internet provider sees choice as lesser of two evils Google's acceptance of restrictions on its China-based service has drawn charges of hypocrisy, *Financial Times*, London Edition 1, January 26, 2006, p.7

12 Frederick Haynes Newell, *Ethics of the Engineering Profession*, *Annals of the American Academy of Political and Social Science*, Vol. 101, *The Ethics of the Professions and of Business*, May, 1922, pp. 76-85

13 Bowie, Norman E., *Are Business Ethics and Engineering Ethics Members of the Same Family*, *Journal of Business Ethics* 4, 1985, pp.43–52.

14 Albert Flores and Deborah G. Johnson, *Collective Responsibility and Professional Roles*, *Ethics* 93, April 1983, pp.537–545

“the myriad of codes of conduct” that the engineer may face.<sup>15</sup>

There is no shortage of advice. How to deal with the variety and extent, inconsistencies and ambiguities of codes of conduct looks like a topic for students to explore.

## Emotion

However, paper and pencil exercises in applying a logic of ethics, like a code of conduct, are not the same as being confronted with a shortage of time, bullying, reticence, deviousness, ignorance, muddle, misunderstanding, anger or tears which all raise the emotional temperature and affect judgements<sup>16</sup>.

Sometimes this helps by stoking up passion for expressing a valuable opinion, and sometimes it hinders by encouraging rash and coercive reactions or even withdrawal.

Experiencing the emotion is the only way to discover its effects, students (and maybe the teacher) may never have encountered relevant situations in an engineering context — being asked for a bribe, for example. This raises questions about the need for a kind of emotional education. And how it can be provided.

Drama provides a context in which an audience empathises with the actor and experiences the wrench of feelings which can overwhelm logic and ethical codes. A prime example occurs in Arthur Miller’s tragedy, *All My Sons*, which has an engineer’s dilemma at its heart<sup>17</sup>. Or perhaps it is more practical to set up role playing exercises where the students act out scenarios. There is, however, a technique for this. For example, since such role plays may deliberately provoke conflict, some care is needed both to formalise the time and place of engagement and promote calm and respect outside of the arena.

## Headline grabbing

Many scenarios for debating ethics present agonising choices or apocalyptic events. The Challenger disaster for example<sup>18</sup>. They grab attention and encourage debate but can prevent students from identifying themselves with the characters in such dramatic circumstances.

Perhaps there has to be a mixture of headline grabbing events together with down to earth examples, like accepting an expensive lunch from a contractor or failing to get someone else to check a calculation. Paradoxically major events are often subject to public enquiries that bring minute details to the surface which inform teachers and students. There are, however, examples with moderately serious consequences but seemingly minor engineering infractions that offer scope for talking about ethics and engineering design. In one example, a reporter wrote

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15 Payne, D, .Engineering ethics and business ethics: commonalities for a comprehensive code of ethics, IEEE Region 5, 2003 Annual Technical Conference, 11 April 2003 pp.81–87

16 Martha C. Nussbaum, *Upheavals of Thought: The Intelligence of Emotions*, Cambridge: CUP, 2001

17 Arthur Miller, *A View from the Bridge & All My Sons*, London: Penguin Classic, 2000

18 Nancy Dunne, *Nasa Taken To Task for Failures In Management*, Financial Times, June 10, 1986, p.6

“a ... pensioner in Plymouth... came back from ... the cinema to find investigators ... outside her door, "holding a massive antenna."

After picking up the 'distress' signal from Mrs Donaldson's Freeview box, two lifeboats and a police launch spent ... three hours ...looking for ... a mystery vessel in trouble.

Two weeks previously, a faulty TV digital box in Portsmouth resulted in ... search of the harbour area”<sup>19</sup>

How could a faulty set-top box cause such events? Did the engineers think about possible fault conditions? Such examples provide a context for looking at engineering responsibilities. Though we always seem to be searching for examples where things have gone wrong and that might give the wrong impression of the outcome of engineering projects. Perhaps the emphasis should be shifted, as Foucault put it, it is “not that everything is bad, but that everything is dangerous” therefore “we always have something to do”<sup>20</sup>. For the engineer this implies it is not just enough to see that something is designed, made or installed. There is always work to be done in ameliorating the dangers.

## Communication

There is one last thing I want to mention — communication.

Engineers commonly play a small but significant part in an enterprise and must convey their judgements and uncover other people’s concerns.

For example, engineers may not be users of what they're helping to create, a hospital perhaps. Often the users or potential users are unavailable or unknown. How then are the users interests to be communicated?

The engineer will often be commissioned by investors who are not immediately affected by the project. Their interest may be primarily on the investment returns. How should those directly affected be consulted?

Consultation guides decisions but it is not enough to work out the right action. Engineers must also convince others, probably using non-technical terms, and the engineer may be required to digest objections however they are expressed. The required skills of persuasion and interpretation can be taught in part but they also benefit from opportunities for rehearsal and criticism. The development of fluency in the vocabulary of evaluation and judgement needs practice.

## Conclusion

Let me summarise. Engineers need to recognise that their viewpoint is partial and specialised. And they need

- skill in getting a grip on the goods and bads surrounding engineering projects in their discipline,
- skill in making judgements using their subject expertise,

<sup>19</sup> Mike Slocombe, Mayday! Mayday! UK Digital TV Boxes In Trouble Again, digital-lifestyles.info, 14 Feb 2006

<sup>20</sup> Michel Foucault, “On the Genealogy of Ethics,” in Michel Foucault: Beyond Structuralism and Hermeneutics, ed. Hubert L Dreyfus and Paul Rabinow, 2nd ed., Chicago: The University of Chicago Press, 1983, pp.231-32.

- skill in conveying those judgements clearly to others
- skill in consulting with those outside the profession and
- a willingness to accept with good grace the judgements of others that may have overriding claims

And all of this within the provocative mêlée of politics, technology and industry.

In short even with my introductory list there is plenty to teach and learn about ethics and all of it relevant to the student of engineering.