**In making ethical decisions, how much should engineers rely on their own moral judgments rather than established codes of ethics?,**

In the modern, industrialised world of today, engineers working in any engineering discipline around the world having to face ethical dilemmas at some point in their careers simply cannot be avoided. Hence a discussion on *In making ethical decisions, how much should engineers rely on their own moral judgments rather than established codes of ethics?,* can be considered very timely.

Although relying on either option, standard codes of ethics or one's own moral judgments has got its own pros and cons, it can be argued that the advantages of the former clearly outweigh those of the latter. This paper discusses why it is important to rely more on professional codes of ethics instead of mere personal morals and judgments and is structured as follows: First, a short introduction is given on engineering ethics and morals. Following this is a discussion on why codes of ethics should be chosen over personal judgements for the well-being and betterment of the society, along with some relevant examples. This is followed by some personal views on the topic and then conclusions. A list of references and a bibliography are given at the end for further reading.

In a very general sense, engineering ethics can be thought of as "abstract principles which might appear in a code of professional [engineering] ethics or in a textbook in ethical theory" [1,2] or as "a study of good and/or wrong [from an engineering context] as applied to engineers when acting as engineers" [3]. There are many established global organisations such as IPENZ, IEEE and IEE which set widely-accepted standards for the engineering profession based on ethical values for the betterment of society and humanity. On the other hand, own moral judgements can be thought of as a subset of professional codes of ethics where each individual might have his/her own opinion on a certain situation, although it might not necessarily reflect the values, principles, virtues and morals of the profession.

The most important aspect of codes of ethics is that these standards guide their followers towards achieving results that will be in the best interest of a wider community with different values, ideas and interests. For example, the first clause of the IPENZ and IEEE standard codes of ethics state "Protection of Life and Safeguarding People" [4,5] and "To accept responsibility in making engineering decisions consistent with the safety, health and welfare of the public, and to disclose promptly that might endanger the public or the environment" [6,7] respectively. As such, these codes not only set the standards for the profession, but also try to prevent people in the profession from misusing their technical expertise. This effort to safeguard people and protect human life may or may not be a primary objective of all the individuals in the profession; hence personal judgements may not always be acceptable.

Standard codes of ethics try to guide engineers towards making engineering decisions and activities equal and fair for everyone. For example, some engineers might think accepting bribes of any form is unprofessional and unethical while some others might not think so. If an engineer on a certain project accepts a bribe it is very likely that the outcome of some project decisions will be biased towards the party the bribe was accepted from [2], hence the decision would not reflect a true analysis and evaluation of the situation concerned and fairness for everyone [2,8]. However established codes of

ethics reject bribery of any form in an attempt to promote equal rights for everyone in a community. Sections 2.6 and 2.7 of IPENZ [4,5] and Clause-4 of IEEE [6,7] standard codes of ethics are exemplary.

Another great benefit of relying on codes of ethics is that they are generally established and revised by many people in the profession over many years and are fairly thorough and unique to a profession [3]. Hence most of them, if not all, are well refined and include very practical and sensible guidelines for the profession as accepted by the society as a whole; and can be used to help engineers make decisions when faced with ethical dilemmas. For example, a doctor is prevented from disclosing information about a patient to the public by their codes of practice thus giving the general public more confidence to seek help of a medical professional. Although some doctors might not want to disclose such information anyway because of their personal morals, there is no guarantee that all the doctors would not. No patient would want their illnesses and other details to go public after all [9]. Engineering codes of ethics can also be regarded in a similar manner where the client-engineer professional relationships are expected to be maintained with an appropriate degree of trust and confidentiality [3,9]. There is no guarantee on this when only personal judgements are considered since they depend solely on the individual's values and principles.

Protection and backing up from an established strong organisation can be quite helpful in some scenarios. Two of the best examples for this would be the famous Challenger disaster and the Ford Pinto gas tank failure, where the engineers had the correct technical judgements, but simply could not prevent disaster, resulting in many fatalities and extreme cost. One of the best ways to improve the way people deal with circumstances in the future is to learn from past failures, so let's look at some of the relevant details.

On the 28$^{th}$ of January 1986, the NASA space shuttle Challenger exploded just after 73 seconds into its launch, with all the seven astronauts onboard losing their lives. Investigation into the matter revealed that the engineers at Morton Thiokol, the manufacturer of the failed components, were quite aware of the problems that led to this catastrophic incident [10,11,12].

Roger Boisjoly and Arnie Thompson, two of the engineers at Morton Thiokol are quite famous for the immense effort they put in to prevent the Challenger from being launched. Despite their efforts, it is still questionable as to whether they did everything they could to prevent disaster. In an interview with Boisjoly, he had once explained how the engineers at Morton Thiokol refused to launch on the 28$^{th}$ but how the NASA managers pushed for an otherwise [11,12]. Further he had said "Our general manager said how we should make a management decision. [At this point] I became furious because I knew that an attempt would be made by management to reverse our recommendation not to launch" [13,14]. Amid such confidence that the shuttle was going to fail if launched, why could not these engineers go public after they realised they were being overruled and not being listened to? Is it possible that they did not want to go against their superiors and risk losing their jobs? Whatever the reasons were, the end result was catastrophic and how professional codes of ethics could have helped to prevent this needs to be discussed.

If engineers were guided more towards strongly following professional codes of ethics, it is possible that Boisjoly and Thompson would have at least sought help from the

professional body which would have raised a more powerful voice than the mere voices of two experienced engineers. Also the managers would have been more aware of the consequences of not letting the engineers abide by certain codes, since the codes generally provide the backdrop for law and any unethical actions could be brought to justice in a court of law [3,7]. If the engineers' and the engineering manager's actions were compared with the current IPENZ code of ethics [4,5], many sections including sections 1.1, 1.2, 1.4, 2.2, 2.10, 3.1 and Clauses 1, 2, 3, 10 of the IEEE code of ethics [6,7] would be in breach. The engineers were morally correct and had good personal judgements but these were not sufficient to prevent the ultimate disaster, clearly proving that relying on standard codes of ethics is more important.

Another classic example of engineers paying less or almost no attention to codes of ethics is the Ford Pinto case where human lives were valued against dollars [9,10,15]. The president at Ford, Mr. Lee Iacocca had certain specifications for the Pinto that were not to be compromised. Once the engineers found out that there was a safety problem with the Pinto design, Iacocca's reply was "This company is run by salesmen, not engineers; so priority is styling, not safety. Safety doesn't sell [after all]" [10,15]. However the Ford engineers did not go public, do a protest or take some other action to show their disapproval on Ford's managerial decisions to completely ignore the passenger safety issues, since they feared being fired [10]. As discussed in the previous paragraph, even the Ford engineers could have taken better engineering decisions had they been backed up by a standard and powerful organisation. Since almost the same clauses as above would have been in breach, even Mr. Iacocca would have given second thoughts before overruling his own engineers. Once again, the end result was disastrous with a public outrage, many burnt deaths and injuries and even a bad reputation to a once well-reputed company.

One other point that is important to note is the negative consequences a person might have to face if solely depended on personal judgements. The chances are relatively high for an engineer relying merely on personal judgements to get involved in disputes with colleagues due to conflicting interests, hence get blacklisted as a troublemaker [16]. For example, a junior engineer working in a product development team without much knowledge on professional codes of ethics might think it would be a good idea to sell a certain product with a substitute ingredient which is cheaper, at the same price as a product with the more expensive ingredient simply because they yield exactly the same performance, but this will be a breach of professional guidelines. At least Clause-3 of IEEE code of ethics [6,7] will be in breach and the company may even be at fault if sued by a client. This sort of situations would not arise if codes of ethics were closely followed instead of mere personal judgements.

As said by the famous Dutch writer Corrie Ten Boom many years ago, "When a train goes through a tunnel and it gets dark, you don't throwaway the ticket and jump off. You sit still and trust the engineer" [17], even at present billions of people have kept faith in the engineering profession and it's time for engineers to focus more on established codes of ethics in an attempt to minimise failure. History has revealed the negative consequences of relying on personal values and judgements and this course of approach for decision making needs to be changed. Considering all the pros and cons and other related examples discussed in this paper, it can finally be concluded that engineers should try to follow established standard codes of ethics very closely in their professional career and give less priority to their own personal judgments.

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