

ETHICS, TECHNOLOGY and ENGINEERING

The responsibility of engineers (Chapter 1)

Role responsibility: The responsibility that is based on the role one has or plays in a certain situation.

Moral responsibility: Responsibility that is based on moral obligations, moral norms or moral duties.

Professional responsibility: The responsibility that is based on one's role as professional in as far as it says within the limits of what is morally allowed.

Passive responsibility: Backward-looking responsibility, relevant after something undesirable occurred, specific forms are accountability, blameworthiness and liability.

Blameworthiness: Backward-looking responsibility in the sense of being a proper target of blame for one's actions or the consequences of one's actions. In order for someone to be blameworthy, usually the following conditions need to apply: wrong-doing, causal contribution, Freedom of choice and Foreseeability.

Active responsibility: Responsibility before something has happened referring to a duty or task to care for certain state-of-affairs.

features of active responsibility:

- Adequate perception of threatened violations of norms
- Considerations of the consequences
- Autonomy
- Displaying conduct that is based on a verifiable or consistent code
- Taking role obligation seriously

Ideals: Ideas or strivings which are particularly motivating and inspiring for the person having them, and which aim at achieving an optimum or maximum.

Professional ideas: Ideas that are closely allied to a profession or can only be aspired to be carrying out the profession

Technological enthusiasm: the ideal of wanting to develop new technologies possibilities and taking up technological challenges.

effectiveness: the extent to which an established goal is achieved.

efficiency: The ratio between the goal achieved and the effort required.

Separatism: The notion that scientist and engineers should apply the technical inputs, but appropriate management and political organs should make

the value decisions.

Tripartite model: A model that maintains that engineers can only be held responsible for the design of products and not for wider social consequences or concerns. In the tripartite model three separate segments are distinguished: the segment of politicians; the segment of engineers; and the segment of users

Technocracy: Government by experts

Paternalism: The making of (moral) decisions for others on the assumptions that one knows better what is good for them than those others themselves.

Whistle-blowing: The disclosure of certain abuses in a company by an employee in which he or she is employed, without the consent of his/her superiors and in order to remedy the abuses and/or warn the public about these abuses

Actor: Any person or group that can make a decision how to act and that can act on that decision

Stakeholders: Actors that have an interest in the development of a technology

Technology assessment: Systematic method of exploring future technology developments and assessing their potential societal consequences

Constructive technology assessment: approach to technology assessment in which TA-like efforts are carried out parallel to the process of technological development and are fed back to the development and design process

Codes of Conduct (Chapter 2)

code of conduct: A code in which organizations lay down guidelines for responsible behaviour of their member

Professional code: Code of conduct that is formulated by a professional association

Corporate code: Code of conduct that is formulated by a company

Aspirational code: A code that expresses the moral values of a profession or company

Advisory code: A code of conduct that has the objective to help individual professionals or employees to exercise moral judgements in concrete situations

Disciplinary Code: A code that has the objective to achieve that the behaviour of all professionals or employees meets certain values and norms

Profession: in an occupations with specific characteristics. There is no agreement on what characteristics are exactly required to call an occupation a profession.

- Knowledge and skills
- a monopoly on the carrying out if the occupation
- assessment only possible by peers
- service orientation to society
- ethical standards

Integrity: living according to own moral values, norms and commitments

Honesty: Telling what one has good reasons to believe to be true and disclosing all relevant information

Conflict of interest: The situation in which one has an interest that, when pursued, can conflict with meeting one's professional obligations to an employer or to clients

Corporate social responsibility: The responsibility of a company towards stakeholders and to society at large that extends beyond meeting the law and serving shareholder's interest.

Mission statements: Strategic objectives of the company and answers the question where company's stand for.

Core values: Qualities that a company considers desirable and which ground business conduct and outcomes.

Stakeholders principle: Principles that guide the relationship between a company and it stakeholders

uncritical loyalty: Placing the interests of the employer, as the employer defines those interest above any other considerations

Critical loyalty: Giving due regards to the interest of the employer, insofar as this is possible within the constraints of the employee's personal and professional ethics

Confidentiality duties: Duties on employees to keep silent certain information

External auditing: Assessing of a company in terms of its code of conduct by an external organizations

Global code of conduct: A code of conduct that is believed to apply worldwide

Professional autonomy: The ideal that individual professional achieve themselves moral conclusions by reasoning clearly and carefully

Normative Ethics (Chapter 3)

Ethics: The systematic reflection on morality

Morality: The totality if opinions, decisions, and actions with which people express, individually or collectively, what they think is good or right

Descriptive ethics: The branch of ethics that describes existing morality, including customs and habits, opinions about good and evil,, responsible and irresponsible behaviour, and acceptable and unacceptable action

Normative ethics: The branch of ethics that judges morality and tries to formulate normative recommendations about how to act or live

Descriptive Judgements: A judgement that describes what is actually the case what was the case or what will be the case

Normative judgements: Judgements about whether something is good or bad, desirable or undesirable, right or wrong

Values: Lasting convictions or matters that people feel should be strived in general and not just for themselves to be able to lead a good life or to realize a just society

Intrinsic value: Value in and of itself

Instrumental value: Something that is valuable in as fat as it is a means to, or contributes to something else that is intrinsically good or valuable

Norms: Rules that prescribe what actions are required, permitted, or forbidden

Virtues: A certain type of human characteristic or quality

Normative relativism: An ethical theory that argues that all moral points of view - all values, norms, and virtues - are equally valid.

Universalism: An ethical theory that states that there is a system of norms and values that is universally applicable to everyone, independent of time, place or culture

Absolutism: A rigid form of universalism in which no exceptions to rules are possible

Consequentialism: the class of ethical theories which hold that the conse-

quences of actions are central to the moral judgement of those actions

Utilitarianism: A type of Consequentialism based on the utilities. In Utilitarianism actions are judged by the amount of pleasure and pain they bring about. The action that brings the greatest happiness for the greater number should be chosen

hedonism: the idea that pleasure is the only thing that is good in itself and to which all other things are instrumental

Utility principle: the principle that one should choose those actions that results in the greatest happiness for the greatest number

Moral balance sheet: A balance sheet in which the cost benefit for each possible actions are weighed against each other.

Freedom principle: Moral principle that everyone is free to strive for his/her own pleasure, as long as they do not deny or hinder the pleasure of others

Act Utilitarianism: the traditional approach to Utilitarianism in which the rightness of actions is judged by the consequences of those actions

Rule Utilitarianism: a variant of Utilitarianism that judges actions by judging the consequences of the rules on which these actions are based. These rules, rather than the actions themselves should maximize utility

Duty ethics: Also known as deontological ethics. The class of approaches in ethics in which an action is considered morally right if it is in agreement with a certain moral rule

Good will: A certain notion in Kantian ethics. According to Kant we can speak of good will if our actions are led by the categorical imperative. Kant believes that the good will is the only thing that is unconditionally good.

Hypothetical norm: A condition norm, that is, a norm which only applies under certain circumstances, usually of the form "if you want X do Y"

Categorical imperative: A universal principle of the form "Do A" which is the foundation of all moral judgements in Kant's view.

Universality principle: First formulation of the categorical imperative: act only on that maxim which you can at the same will that it should become universal law

equality postulate: The prescription to treat persons as equals, that is, with equal concerns and respect

Reciprocity principle: second formulation of the categorical imperative: act as to treat humanity, whether in your own person or in that of any other, in every case an end, never as means only.

Prima facie norms: Are the applicable norms, unless they are overruled by other more important norms that become evident when we take everything into consideration.

Moral autonomy: The view that a person himself or herself should determine what is morally right through reasoning.

Virtue ethics: An ethical theory that focus on the nature of the acting person. This theory indicates which good or desirable characteristics people should have or develop to be moral.

The good life: The highest good or *eudaimonia*: a state of being in which one realizes one's uniquely human potential . According to Aristotle, the good life is the final goal of human action.

Practical wisdom: The intellectual virtue that enables one to make the right choice for action. It consists in the ability to choose the right mean between two vices.

Virtues for morally responsible engineers:

- Expertise
- Clear and informative communication
- Cooperation
- Willingness to make compromises
- Objectivity
- Being open to critic
- Stamina
- Creativity
- Striving for quality
- Striving for quality
- Having an eye for detail
- Report work carefully

Care ethics: An ethical theory that emphasizes the importance of relationship, and which holds that the development of morals does not come about learning general moral principles.

Social ethics of Engineers: An approach to the ethics of engineers that focuses on the social arrangements in engineering rather than on individual decisions. If these social arrangements meet certain procedural norms the resulting decisions are considered acceptable.

Normative Argumentation (Chapter 4)

Argumentation theory: An interdisciplinary study of analysing and evaluating arguments.

Conclusion of an argument: The statement that is affirmed on the basis of the premises of the argument.

premises: The statements, which are affirmed as providing support or reasons for accepting the conclusion.

Valid argument: An argument whose conclusion follows with necessity from its premises: if the premises are true, the conclusion must be true.

Modus ponens: Form of a valid argument in which the conclusion "q" follows from the premises "p" and "if p then q".

Fallacy: An error or deficiency in an argument.

Modus tollens: Form of a valid argument in which the conclusion "not-p" follows from the premises "if p then q" and "not q".

Deductive argument: An argument which has a conclusion that is enclosed in (implied by) the premises

Plausibility principle: The principle that enumeration and supplementary argumentation in a non-deductive argumentation can make the conclusion plausible (acceptable).

Inductive argumentation: A type of non-deductive argumentation. Argumentation from the particular to the general.

Critical question: question belonging to a certain type of non-deductive argumentation to check the degree of plausibility of a conclusion.

Sound argumentation: An argumentation for which the corresponding critical questions can be answered positively and which therefore makes the conclusion plausible if the premises are true.

Argumentation by analogy: A type of non-deductive argumentation. An argumentation based on comparison with another situation in which the judgement is clear. The judgement is supposed also to apply to the analogous situation.

Mean-end argumentation: A type of non-deductive argumentation. An argumentation in which from a given end the means are derived to realize that end.

Causality argumentation: A type of non-deductive argumentation. An argumentation in which an expected consequence is derived from certain actions.

Proof from the absurd: A deductive argumentation in which a certain propo-

sition is proved by showing that the negation of the proposition leads to a contradiction.

Characteristic-judgement argumentation: A type of non-deductive argumentation. An argument based on the assumption that a certain judgement about a thing or person can be derived from certain characteristics of that thing or person.

Fallacies:

- Attack on the person
- confusion of law and ethics
- straw person
- Wishful thinking
- Naturalistic fallacy
- Privacy fallacy
- Ambiguity

Fallacy of risk :

- sheer size fallacy
- fallacy of naturalness
- Ostrich fallacy
- delay fallacy
- Technocratic fallacy
- fallacy of pricing

Ethical Questions in the Design of technology (Chapter 6)

Engineering design: The activity in which certain functions are translated into a blueprint for an artefact, system, or service that can fulfil these functions with the help of engineering knowledge.

Design process: An iterative process in which certain functions are translated into a blueprint for an artefact, system or service. Often the following 6 stages are distinguished: problem analysis and formulation; conceptual design; simulation; decision; detail design; and prototype development and testing.

Problem analysis stage: The stage of the design process in which the designer or the design team analyses and formulates the design problem, including the design requirements.

design requirements: Requirements that a good or acceptable design has to meet.

Technical codes and standards: Technical codes are legal requirements that are enforced by a government body to protect safety, health and other relevant values. Technical standards are usually recommendations rather than legal requirements that are written by engineering standardization committees.

Certification: The process in which it is judged whether a certain technology meets the applicable technical codes and standards.

Conceptual design stage: the stage in which designer or the design team generates concept designs. The focus is on an integral approach to the design problem.

Creativity: The virtue of being able to think out or invent new, often unexpected, options or ideas. Creativity is an important professional virtue for designers.

simulation stage: The stage of the design process in which the designer or the design team checks through calculations, tests, and simulations whether the concept designs meet the design requirements.

decision stage: The stage of the design process in which various concept designs are compared with each other and a choice is made for a design that has to be detailed.

Design criteria: A kind of design requirements which are formulated in such a way that products meet them to a greater or lesser extent. Design criteria are often used to compare and choose between different concept designs.

trade off: Compromise between design criteria. **Organizational deviance:** Norms that are seen as deviant or unethical outside the organization are seen within the organization as normal and legitimate.

detail design stage: The stage in which a chosen design is elaborated on and detailed.

test: The execution of a technology in circumstances set and controlled by the experimenter, and in which data are gathered systematically about how the technology functions in practice. **Value conflict:** A value conflict arises if (1) a choice has to be made between at least two options for which at least two values are relevant as choice criteria, (2) at least two different values select at least two different options as best, and (3) the values do not trump each other.

Trumping (of values): If one value trumps another any (small) amount of the first value is worth more than any (large) amount of the second value.

Cost-benefit-analysis: A method for comparing alternatives in which all the relevant advantages (benefits) and disadvantages (costs) of the options are expressed in monetary units and the overall monetary cost or benefits of each alternative is calculated.

Discount rate: the rate that is used in cost-benefit analysis to discount future benefits. This is done because 1 dollar now is worth more later.

Multiple criteria analysis: A method for comparing alternatives in which various decision criteria are distinguished on basis of which the alternatives are scored. On basis of the score of each of the alternatives on the individual criteria, usually a total score is calculated for each alternative.

Threshold: the minimal level of a (design) criterion or value that an alternative has to meet in order to be acceptable with respect to that criteria or value.

Value sensitive design: An approach that aims at integrating values of ethical importance in a systematic way in engineering design.

Regulatory Framework: The totality of (product-specific) rules that apply to the design and development of a technology.

Normative design: Design in which the normal configurations and working principle of the product remains the same.

Radical design: The opposite of normal design. Design in which either the normal configuration or the working principle of an existing product is changed.

working principle: The (scientific) principle on which the working of a product is based.

Ethical Aspects of technical risks (Chapter 8)

Hazard: Possible damage or otherwise undesirable effect.

Risk: A risk is specification of a hazard. The most often used definition of risk is the product of the probability of an undesirable event and the effect of that event.

safety: The condition that refers to a situation on which the risks have been reduced as far as reasonably feasible and desirable.

Acceptable risk: a risk that is morally acceptable. The following considerations are relevant for deciding whether a risk is morally acceptable: (1) the degree of informed consent with the risk, (2) the degree to which the benefits of a risky activity weigh up against the disadvantages and risks, (3) The availability of alternatives with a lower risk and (4) the degree to which risks and advantages are justly distributed.

Uncertainty: A lack of knowledge. Refers to situations in which we know the type of consequences, but cannot meaningfully attribute probabilities to the occurrence of such consequences.

Ignorance: Lack of knowledge. Refers to the situation in which we do not know what we do not know.

Ambiguity: The property that different interpretations or meanings can be given to a term.

Inherent safe design: An approach to safe design that avoids hazards instead of coping with them, for example by replacing substances, mechanisms and reactions that are hazardous by less hazardous ones.

safety factor: A factor or a ratio by which an installation is made safer than is needed to withstand either the expected or the maximum (expected) load.

Negative feedback mechanism: a mechanism that if a device fails or an operator loses control assures the (dangerous) device shuts down.

Multiple independent safety barriers: A chain of safety barriers that operate independently of each other so that if one fails the others do not fail.

Risk assessment: A systematic investigation in which the risks of a technology of an activity are mapped and expressed quantitatively in a certain risk measure.

Failure mode: Series of events that may lead to the failure of an installation.

event tree: Tree of events in which one starts with a certain event and considers what events will follow.

Fault tree: Tree of events in which we move backwards from an unwanted event (a fault) to the events that could lead to.

Animal tests: Tests for determining close-response relationships by exposing animals to various dosages and assessing their response.

Type I error: the mistake of assuming that a scientific statements is true while it actually is false. Applied to risk assessment: the mistake that one assumes a risk when there is actually no risk.

Type II error: The mistake of assuming that a scientific statement is false while is actually is true. Applied to risk assessment: the mistake that one assumes that there is no risk while there actually is a risk.

Informed consent: Principle that states that activities are acceptable if people have freely consented to them after being fully informed about the (potential) risks and benefits of these activities.

Risk-cost-benefit analysis: This is a variant of regular cost-benefit analysis. The social costs for risk reduction are weighed against the social benefits offered by risk reduction. So achieving an optimal level of risk in which the

social benefits are highest.

Best available technology: As an approach to acceptable risk, best available technology refers to an approach that does not prescribe a specific technology but uses the best available technological alternative as yardstick for what is acceptable.

Personal risk: risks that only affects an individual.

Collective risk: Risk that affect a collective of people and not just individual, like flooding.

Risk communicators: Specialist that informs, or advise how to inform, the public about risks and hazards.

Precautionary principle: Principle that prescribes how to deal with threats that are uncertain and/ or cannot be scientifically, established. Following format can apply:

- threat dimension
- uncertainty dimension
- action dimension
- prescription dimension

The distribution of responsibility in engineering (Chapter 9)

Collective responsibility: The responsibility of a collective of people.

problem of many hands: The occurrence if the situation in which the collective can reasonably be held morally responsible for an outcome, while none of the individual can be reasonably held responsible for that outcome.

Distribution of responsibility: the ascription or apportioning of responsibility to various actors.

Moral fairness requirement: The requirements that a distribution of responsibility should be fair (just) . In case of passive R. This can be interpreted as that the person should only be held responsible if that person can be reasonably held responsible according the following conditions : wrong-doing, causal contribution. Foreseeability and freedom of choice. In terms of active R. it can be interpreted as implying that persons should only be allocated responsibilities that they can live by.

effectiveness Requirement: The moral requirement that states that responsibility should be so distributed that the distribution has the best consequences, that is, is effective in preventing harm.

Liability: Legal responsibility: backward looking responsibility according to

the law. Usually related to the obligation to pay a fine or repair or repay damages.

Regulations: A legal tool that can forbid the development production or use of certain technological products, but more often it formulates a set of boundary conditions for the design, productions and use of technology.

Negligence: Not living by certain duties. Negligence is often a main condition for legal liability . In order to show negligence for the law, usually proof must be given of a duty owed, a breach of that duty, an injury or damage and a causal connection between the breach and the injury or damage.

Duty of care: the legal obligation to adhere to a reasonable standards of care when performing any acts that could foreseeability harm others.

Strict liability: A form of liability that does not require the defendant to be negligent.

Product liability: Liability of manufacturers for defects in a product, without the need to proof that those manufacturers acted negligently.

Development risk: In the context of product liability: Risks that could not have been foreseen given the state of scientific and technical knowledge at the time the product was put into circulation.

Corporate liability: Liability of a company (corporation) when it is treated as a legal person.

limited liability: the principle that the liability or shareholders for the corporation;s debts and obligations is limited to the value of their shares.

Hierarchical responsibility model: The model in which only the organization's top level of personnel is held responsible for the actions of the company.

Collective responsibility model: The model in which every member of a collective body is held responsible for the actions of the other members of that same collective body.

Individual responsibility model: the model in which each individual is held responsible insofar as he or she meets the conditions for individual responsibility.