

ENGINEERING, MANAGEMENT, AND ETHICS - TWO HATS OR THREE?

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Abstract: The notion of individual responsibility is even in our current era of institutional and corporate decisions and enterprises of much import and of particular importance for technology. However, problems of collective and corporate responsibility are becoming and still will become more and more topical. Engineering ethics codes should be developed, improved and operationally implemented in the future. The rules sketched out here of priorities for handling responsibility conflicts have subsequently to be elaborated much further. All this, then, would be necessary to meet the ideal requirements of our joint and individual responsibility for technology in our society.

Resumen: En nuestra actual era de empresas y decisiones corporativas e institucionales, la noción de responsabilidad individual es de gran significado y de particular importancia para la tecnología. No obstante, los problemas de la responsabilidad colectiva y corporativa se tornan, y se tornarán cada vez, más actuales y decisivos. Los códigos éticos de la ingeniería deberían, pues, desarrollarse, mejorarse y hacerse efectivos operativamente en el futuro. Por eso, las reglas esbozadas aquí sobre prioridades para el manejo de los conflictos de responsabilidad han de ser elaboradas con mucho más detalle. Todo ello sería necesario, por tanto, para encontrar los requisitos ideales de nuestra responsabilidad individual y colectiva respecto de la tecnología en nuestra sociedad.

PROBLEMS OF RESPONSIBILITY IN AND FOR TECHNOLOGY

Economics and Engineering are different fields. Do the ethics questions as a consequence differ between them? Moral judgements and ethical problems with respect to technology *and* economy are usually problems of bearing, attributing and distributing responsibility. We can understand man or woman as the normative being which means that he or she is morally distinguished from other creatures by

the capacity to bear, acknowledge, consciously identify and accept responsibilities for the outcome of his or her actions and role fulfilments. Humans are so to speak the moral beings. Yet, moral responsibility is but one sort of responsibility which might be located within a rather complex realm of different responsibilities, e.g. engendered by contracts or some other mutual agreements which might not necessarily be moral in the narrower sense, i.e., that they might not affect the life, limbs, psyche, and well-being of other people or living beings in general. These ethically speaking not morally relevant responsibilities might be called ethically neutral. But they are still normative and *prima facie* to be abided by the respective persons who have taken over these non-moral responsibilities. In addition, these ethically neutral responsibilities might get into conflict with moral duties and ethically relevant obligations, i.e. moral duties in the narrower sense. Should a manager just follow up with managerial and economic strategies of maximizing profit or pressing for time in risky operations and strategies of implementation of a new technology or so? Or should he refrain from any risk for lives and limbs of other people in acceding to operational plans of implementation of a new technology? Is safety to be valued first - even despite some set-backs with respect to economic development and a possible maximization of gains or profits? Should for instance an engineer who is employed in a dependent position, in case of a risky decision to occur "blow the whistle" - as the respective metaphor reads - and give a warning information to the public about the expected risks or hazards or negative potential outcomes? Should loyalty to his firm or supervisors or the taking into consideration of his personal career within the firm override his moral responsibility or coresponsibility for the safety of the public? Or has moral responsibility to take precedence over the responsibility of contractual kinds although even the abiding by contracts certainly also has a moral hue to it or even a moral dimension insofar, e.g., as we are also morally obliged to abide by the law. There is also a question whether or not moral responsibilities occurring in economy and technology are identical or overlapping or maybe at strains with one another. An affirmative answer would amount then to the thesis that ethics in economy and moral judgements in technology could be at times in conflict with one another or at least diverge within some region of overlap. Indeed, one could well argue that ethical problems in economy are further-reaching than moral problems in technology, because there are many problems in the economic management and distribution of jobs etc. which are not directly relevant for or influenced by technological factors.

However, basically there is a large overlap between the two fields, and as far as technology is involved and technological implementation at stake within economic decision-making, the problems of ethical relevance of both fields are pretty much the same or at least narrowly connected with one another (cf. Lenk/Maring 1995a).

It seems, however, that with respect to the question of safety managers sometimes would ignore this relatedness. This might dramatically be highlighted by the analysis of the catastrophe of the US spacecraft *Challenger* in 1986, when 73 seconds after take-off from Cape Canaveral the manned spaceship exploded and seven astronauts lost their lives. A direct cause was a brittle sealing ring of rubber which according to expectation and warnings of the engineers from the rocket producer firm Morton Thiokol broke under the conditions of low temperature below freezing point. One day before take-off the engineers, most notably Allen MacDonald, the project leader, and Roger Boisjoly, the very expert for sealing rings in rocketry, had warned and protested against take-off plans for the next day. They informed NASA about the danger that the sealing rings would break below freezing point. They were assisted by the deputy director of the engineering department of the rocketry firm, Robert Lund, who also informed Jerry Mason, a superordinate engineer within the same firm. Mason however silenced Lund and finished the debate by saying, "Take off your engineering hat and put on your management hat". Lund gave in and gave his consent to the take-off which he notified to the project leader of NASA who okayed the take-off without mentioning any doubts. The catastrophic accident ensued. (Later on the engineers who had launched the warnings, MacDonald and Boisjoly, were - even after the accident - transferred to another department which they deemed a kind of quasi-punishment after the fact.)

Do indeed managers decide differently from engineers? Is this a case where apparently ethical aspects of decision-making and factual judging diverge for the ethics of technology and economics? Are the management hat and the engineering hat indeed different hats - in ethical respects?

In any case, the example shows immediately how intriguing the problems of responsibility and its interpretation as well as its distribution are: Who was the responsible one in this case? Everybody who had been involved? Just NASA, not one individually? Each to a certain degree? How much, then? (Cf. below to the questions of distributing responsibility.) Let us turn first to questions of responsibility in gene-

ral, especially to the problems of definition and delimitation of responsibility and specific responsibilities.

1. Responsibility as Relational Concept

“Responsibility” is not just a concept solely to be used descriptively - someone is responsible - but also above all an evaluative attributive concept - somebody is held to be responsible. It is this attribution which opens the normative, even ethical dimension of action in a stricter sense. The concept of responsibility itself is a diverse concept of structure or relation that is linked to assignment, attribution and imputation, a scheme that needs to be analysed and interpreted with respect to the following elements:

someone: the subject or bearer of responsibility (a person or a corporation)

is

responsible

for: something (actions, consequences of actions, situations, tasks, etc.)

in view of: an addressee ("object" of responsibility)

under supervision or judgement of: a judging or sanctioning instance

in relation to: a (prescriptive, normative) *criterion of accountability*

within: a specific realm of responsibility and action.

Responsibility is firstly a concept that figures within a relational attributive norm (controlled expectation of action and behaviour). Responsibility means that a person must justify actions, consequences of actions, situations, tasks, etc. in front of an addressee and before an instance of justification, both not being necessarily identical with one another, to whom he or she has obligations or duties of rendering justification, in accordance with standards, criteria, norms, etc. The responsible person is accountable for his or her own actions, or under specific conditions also for actions performed by others for whom he or she is vicariously responsible. (Parents, for example, are liable for their young children for a certain wrong conduct by these, maybe in the sense of the violation of their supervisory duty.) The concept of responsibility would give structure to the social reality (of norms and actions) and to social relations. One can differentiate between the typical bearers of responsibility in terms of active roles and observer roles. One imputes or attributes a specific responsibility to oneself as an

actor or to others from the perspective of participant, observer or scientist, in relation to rules and norms that apply beyond the individual. The attribution (in a particular case) activates, that is, instantiates, the general pattern of responsibility in a specific instance. Imputation of responsibility lies as much in self-interpretation as in the interpretation of the actions of others.

Responsibility is therefore attributed or imputed: on the one hand one establishes from the perspective of *observation* that somebody (A) is responsible, causally or according to a criterion, for an action (for acting or refraining from action), for the consequences of an action, or for the occurrence of an event. On the other hand, the actor (A) can also be *made* responsible. This attribution can thus be understood either descriptively or normatively; it is descriptive or normative. Both can be differentiated by a careful analysis, even if in effect both attributions are often considered simultaneously.

The discussion about the attribution of responsibility shows that the distinction between the descriptive and normative attitude and a descriptive or normative assumption of the attribution or imputation, respectively, has thus far not been sufficiently taken into consideration. A necessary condition of the descriptive attribution (to describe A as responsible for X) and of the normative attribute (to make A responsible for X) is that the (intentional) actor (A) is the causal agent, or is at least capable of intervening in the causal chain that leads to X. An evaluation of A can be made, with references to (normative) criteria; it is indeed only according to a criterion that the bearer of responsibility can or could be held responsible. The origin of the descriptive concept of responsibility also, as closer analysis will show, can be traced back to the normative one, i.e., to social and conventional normatization or to a requirement established by an authority.

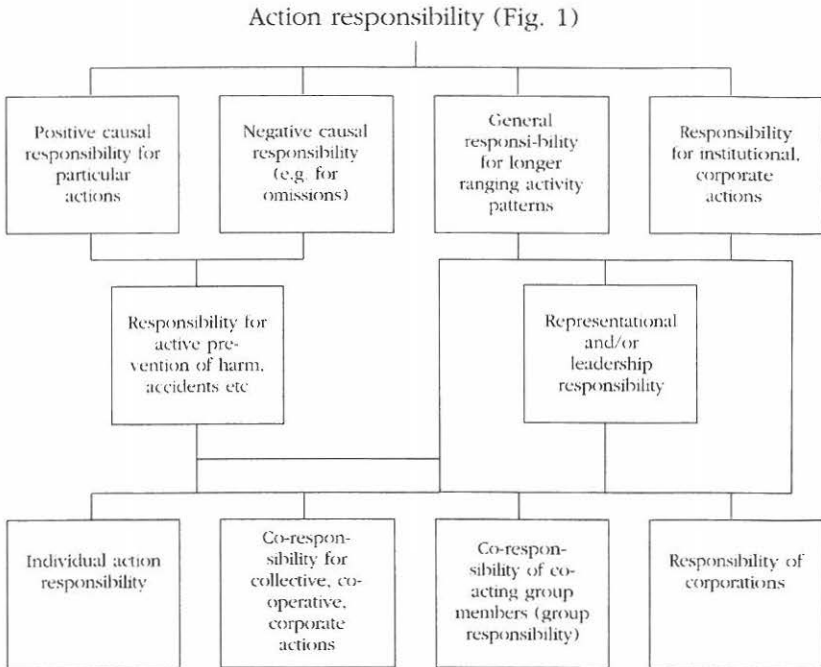
As one distinguishes between a general responsibility for the results of an action from a kind of role-responsibility and task-responsibility, and from the purview of legal and moral responsibility, a second aspect of interpretation becomes clear: the responsibility for the result of an action is at first just seen as a superordinate, schematic, formal categorization; it must be related, through the contextual specifications of tasks or roles or through (universal) moral or legal interpretation, to the appropriate realm of substantial values and norms. Only then can its content and sense be comprehensible.

Distinct types of responsibility would render structure to the social, that is, the normative, reality in different ways. They have spe-

cific structural implications¹. Conceptual instruments of analysis such as institutionalized normative rules and criteria of (types of) responsibility also may structure the concrete responsibility attributions and their consequences. Thus, specific and more concrete expectations and demands follow from the relevant applications of the various types of responsibility. Certain tasks and duties, for example, are tied to a role that relates exclusively to the role-bearer, and are not so person-oriented as, e.g., in the cases of an activated moral responsibility.

2. Different Analytic Types of Responsibility

The most obvious and general level of how to describe responsibilities is referring to one's being responsible for the results and consequences of one's own actions. We may call this type the *action responsibility* (see Fig. 1):



¹ Structural implications in this context meaning structurally produced, that is, assumed or implied (analytic) consequences of the basic theory or concept.

An agent is to be held responsible for the outcomes of his or her actions by an instance to which (s)he is accountable. An engineer designing a bridge or a dam is responsible to the supervisor, employer, client and/or the public for the respective design in terms of technical correctness, safety, cost, feasibility etc. Frequently, accountability questions are raised in exemplary negative cases, by failing in one or some of these respects. The breaking of a dam may be due to false statical computation or to careless, negligent or even cheating work or poor craftsmanship or using cheap material. Therefore, it is important to emphasize negative action responsibility in the form of responsibility of prevention - and at times of preservation respectively. Professionals, e.g., have the responsibility to the public to ensure high standards in their work and to avoid risks of disasters as far as possible at a reasonable cost. The responsibility to avoid mistakes, failures, pure quality of work etc. is part and parcel of causal responsibility but also an instance of the respective roles and task responsibility to be mentioned later. A negative causal responsibility would analytically be directed at avoiding careless omissions.

There is an active responsibility for taking the initiative actively to search for potential sources of dangers and risks which can be called prevention(-oriented) responsibility. The engineer in charge of quality control has systematically to search for technical weaknesses. In his case, the prevention responsibility becomes part of his role responsibility formally connected with his job activity. From the action responsibility in the narrower individual (act utilitarian) sense we have to distinguish the general responsibility for longer ranging activity patterns. (E.g., as a parent one is not only responsible for individual actions and their consequences with respect to one's children but in a much more comprehensive manner encompassing many possible actions as well as omissions.)

Very often, we have institutions or corporations acting collectively. Therefore, there is a responsibility of institutional or corporate actions: It may coincide, though not be identical, with the individual responsibility of a person being in a representative position (the representing actor be it in an individual group or a institution or corporation). Leadership responsibility with respect to outside addressees and instances are but one example of this kind of responsibility.

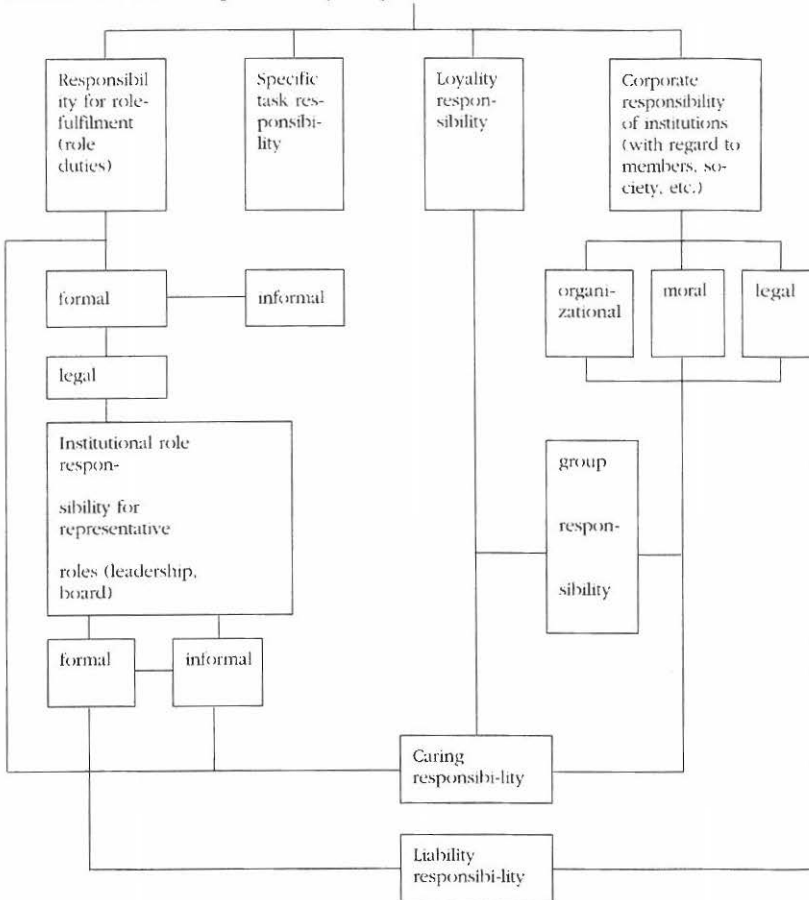
The most usual case of responsibility dealt with so far is individual action responsibility. But if a group is acting collectively or individuals participate in a joint group action, there is the co-responsibility

of partaking members, of the co-actors, so to speak. The responsibility for group actions is sometimes called collective or group responsibility (Ladd) (cf. below).

Action responsibility would still reside on the most general level of abstraction. It has still to be substantiated by content, be it by role ascription/description, legal, or moral considerations.

Therefore, the second level is comprised of the types of *role and task responsibility* (see Fig. 2):

Role and Task Responsibility (Fig. 2)



(It does not seem necessary to give examples here, since everybody takes over and fulfils roles and tasks assigned to him or her or chosen by oneself.) In taking over and fulfilling a role or a task (e.g. in a job) a role-holder usually bears a responsibility for (normal, i.e. acceptable, or optimum) role-fulfilment. These role duties might be assigned in a formal way or be more or less informal. They can even be legally ascribed or at least be legally relevant. If the role-taker is a representative in corporate or institutional role patterns his responsibilities may be connected with the respective institutional role responsibilities (e.g. in leadership). A role (like that of a parent) might comprise the responsibility for a dependent's well-being, i.e. a caring responsibility (which is a rather interesting type for the moral point of view).

Beside general role responsibilities we encounter also responsibilities correlated just with specific tasks, be these derived from a role pattern or not. Loyalty to a person or institution need not be connected with a particular role. Therefore, a loyalty responsibility is to be dealt with on different terms. It may come in the form of a caring responsibility, too.

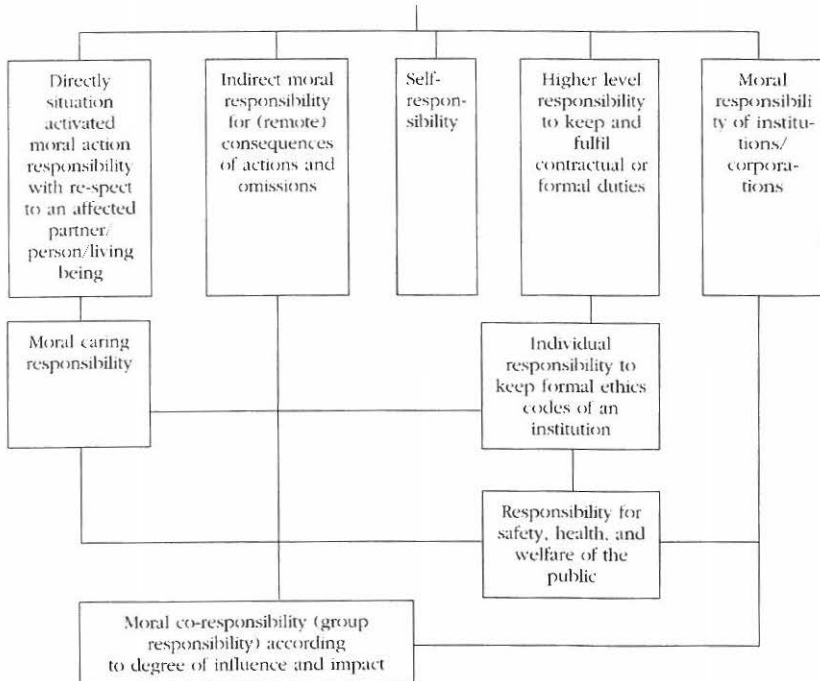
In addition, we have the corporate responsibility of institutions or corporations, if these have a special task or obligation to perform with respect to clients, the public or members of the organizations etc. This type of responsibility can be of legal, moral or neutrally organizational character. There may again be a coincidence with a group responsibility (of a group being in charge of the institution or corporation). Role-holders and institutions or corporations might be held liable in terms of legal, moral or social qualifications - e.g., with respect to social control for the latter. The liability might be an accountability to incur punishment or to pay an indemnification or to reinstate a former condition.

The third level of responsibility consists of types of *universal moral responsibility* (see Fig. 3)². At first, then, we have the *direct moral responsibility* for the agent's acts and results of his or her acting as activated by the action situation. This responsibility is directed toward persons or living beings whose well-being (life and limb as well as psychical and emotional state) is affected by the agent's activity. (The moral point of view is always conceived in terms of the

² To be sure, a fourth level of responsibility types would have to cover a diagramme of the variants of legal responsibility including their relationship to legal liability and guilt. A fifth type of responsibility is the religious responsibility of the faithful.

affectedness of persons/living beings. Usually it refers to other people, but it may also pertain to oneself - self-responsibility - or to other living beings affected by the agent's activity.) More remote consequences of the agent's activity - possibly combined with the impacts of other people's actions or omissions - might amount to an *indirect* moral (co-)responsibility. Neglecting of safety check or a wrong approval-stamp on airplanes might result in loss of lives - as had actually occurred in the DC-10 case of the 1974 Paris crash of a Turkish airliner; in 1972 three inspectors of the DC-Long Beach plant had wrongly approved modifications of the fatally dangerous cargo door locking system without any work on the cargo doors actually having been done. A similar case was the fouled approval of air brake testing of the prototype in the Goodrich case. More complex problems of indirect co-responsibilities are raised with the mentioned problems of synergetic and cumulative threshold effects below within interacting systems, e.g., in pollution or depletion problems.

Universal Moral Responsibility (Fig. 3)



As came out rather recently, beside legal responsibilities, corporations seem also to bear moral responsibilities (particularly if they don't want to improve dangerous conditions as, e.g., the management of Convair in the DC-10 case (Eddy/Potter/Page 1976) or the Air New Zealand in the case of the crash on the Antarctic Mount Erebus (French 1984, Ch. XI)). This is certainly a type of moral responsibility different from an individual's moral accountability.

The corporate moral responsibility frequently coincides, but need not be identical with the moral coresponsibility of members of a decision-making board. Corporate moral responsibility therefore is analytically not to be confounded with moral coresponsibility of group members partaking in a collective action or decision-making process (cf. below).

Caring responsibility certainly is not only role-bound but also morally relevant. It is the responsibility to take care for the well-being of a dependent person or living being just by specific acts but in a general permanent obligation.

In Engineering Ethics Codes - as in many other Codes of Science Associations - the responsibility for the safety, health and welfare of the public is stressed - even considered to be of "paramount" importance (cf. e.g. IEEE). This responsibility, a combination of indirect moral responsibilities as mentioned above and of the obligation to abide by the Ethics Code of the respective professional society, is certainly also a *moral* obligation, though on a higher or secondary level.

Besides immediate action- or impact-oriented responsibilities there is also a higher-level moral responsibility to keep and fulfil contractual or role duties and promises, to live up to ethics codes of professional societies, etc. This obligation is certainly a universal moral one, if the fulfilment of a task, contract or role does not contradict another overriding moral norm.

In general, thus, we have a rather differentiated interplay of levels and types of responsibilities, the *moral* obligations being but one spectrum. Moral responsibility may be activated by a special type of action and in connection with a special role, but it is rather universal. It is not peculiar to a specific person or role but would apply to everyone being in the same situation and/or role. Morality and moral responsibility are universal. Moral responsibility is individualized in that sense that it cannot be delegated, substituted, deplaced or replaced or shoved off from the respective person (or corporation/institution). It can-

not be diminished, divided up, dissolve or vanish by being borne by a number of people. It is irreplaceable and undiminshable in that sense.

3. Problems of Distributing Responsibility

There is a nice illustrating case in the literature on collective responsibility. "A vicar had accumulated a remarkable amount of accomplishments for a hamlet of wine-growers. The wine-growers decided therefore to donate a barrel of wine to him celebrating the thankfulness on a special occasion. Each wine-grower should contribute two litres of his best wine from his cellar. Consequently, everyone of these poured the two litres they had agreed on into the open barrel.

On the occasion of the respective celebration and after solemn speeches the barrel was opened and the first glass presented to the vicar. But the glass contained but pure water, and the festive mood changed to general shamefulness" (Jöhr 1976, 127).

It is not known whether the event mentioned in this example did really take place, but it is a very nice illustration of the problem of distributing responsibility. The example shows immediately how intriguing the problems of responsibility and its distribution are: Who is responsible in this case? Everybody? Not one individually? Each to a certain degree?

Problems of distributing responsibility are to be found today in particular in highly developed industrial societies shaped by technology and advanced economies. Personal acting seems to disappear behind collective, institutional and/or group actions. Group and collective action is on the one hand the acting of and the acting within organizations (corporate acting) and on the other hand the action of many actors under strategic and competitive conditions; sometimes the actors are rather independent of one another. With respect to collective actions there are at least two classes of distribution problems or rather distributability problems (which may however overlap): 1. the problem of attributing responsibility in the case of non-corporate collective actions of many actors (be they corporations or individuals) and with respect to dynamic processes and development of the market and 2. the problem of attributing and distributing responsibility within the organization with respect to internal corporate segregation of work and role assignment as well as with respect to the

corporate division of labour and production (cf. Lenk/Maring 1995b). Today and in the near future these problems are becoming extremely relevant and pressing. This is true, to be sure, not only because of the impact of new systems-technological phenomena and processes on their own, but due also to the high social interconnectiveness of action systems, markets and the evergrowing worldwide interrelatedness of societies in general.

Questions of distributing collective and corporate responsibility can be distinguished and analysed according to the following approaches:

1. relations and mutual dependence of agents and legal rules,
2. models of moral responsibility distribution,
3. responsibility and non-corporate actions,
4. responsibility and corporate (institutional) actions and
5. responsibility and (information) systems.

3.1 In the philosophical literature the problems of complex groups of interrelated agents causing the relevant actions and outcomes and questions of responsibility are usually dealt with unrelatedly but very globally, whereas in jurisprudence the problems are dealt with in more detail and some interesting approaches to solutions are attained (which apply to philosophy as well). By way of summarizing we might say that the actually convincing principle of attributing the responsibility to extant agent is running into some difficulties. These result from the divers and diverse forms of collective action and the non-individualizability of the causal integration within or with respect to synergetic and cumulative processes. Legal rules (*de lege lata*) typically fall short of considering ecological damages and damages that occur far from the sources of emissions and in regard to an adequate provision. The need for legal regulations is being widely recognized. Such topics as joint and total liability, including a mutual right to compensation, with recourse to the respective development of spheres of danger, (strict) product and danger liability that is independent of fault, the turnabout of the burden of proof, high probability of the extant causal agency, compensation out of capital funds, incentives to internalize externalities, etc., are being discussed and proposed in the literature. Prime difficulties of legal solutions certainly lie in the non-liability of permitted actions in subliminal individual contributions and in the definition and establishment of limiting and threshold values. (The

relevance of legal considerations for philosophical discussion should be carefully tested.)

3.2 Cases in which somebody fully and exclusively has to take the responsibility are examined in philosophy as a rule. But are there not also other cases of co-operative responsibility, collective/co-operative decisions, and collective action in general, that are gaining much more importance today, in which someone carries full responsibility by sharing responsibility, according to the degree of the individual co-operation or accountability? In other words, does the extent of the distribution of responsibility generally reduce the degree of moral responsibility?

As a provisional thesis, the following insight should be emphasized in regard to this problem: the centre of the model of the distribution of responsibility is the question of the distribution of normative and descriptive responsibility - according to a theory of action - and the (equivalent) reduction of the collective responsibility to individual actors, which is dependent on the form of collective actions and causes; the respective form of collective action is also decisive and should, in the following, constitute a criterion for the distinction of various ways of attributing responsibility. A further point of emphasis is the distribution in terms of the responsibility type. If one makes a distinction between a duty to compensate and moral responsibility, then a division as a solution is more likely in the former case than in the latter. Particularly relevant to the distribution of responsibility are negative formulations of preventative and preservation responsibility as well as the responsibility to avoid omissions and failures, which seems to be more suited to be open to a regulation of the contributory and participatory form of responsibility distribution. One should also differentiate in regard to necessary and sufficient conditions of the onset of consequences and damages depending on the failed or omitted or unintentionally neglected actions of several actors.

3.3 Basic problems of responsibility distribution do not only arise out of the non-corporate collective action of many actors (be they corporations or individuals), but also out of specific strategic conditions, particularly in division-of-labour capitalist processes, that is, in labour segregation in the market external to corporations. The effects, results and side-effects of such actions have - and not just nowadays - an increasingly explosive nature. Maybe the difficulty can be clarified with the help of examples and model hypotheses regarding of social traps,

which until now were discussed mostly within the realm of individual rationality vs. collective irrationality (e.g., Prisoners' Dilemma, cf. Hardin, Lenk/Maring 1990).

We all know that negative external synergetic and/or cumulative effects may occur when a large number of actors act along the lines of individual need calculations (only directly responsible for their own interests and acts). Particular components, that as such are relatively, i.e., subliminally, harmless, can lead as a whole to damages or even to the loss of highly appreciated "commons" or public property. It is characteristic of these damages that property rights, i.e., individual rights to use resources, e.g. public ones, are poorly or not at all defined or that they are not observed at all. Externalities are characterized by an incongruity between that outcome for which one is actually responsible and that for which one is made responsible (liable). To avoid the external social costs, these results must, for example, be internalized - incorporated into the 'production functions' of a business.

Distribution of responsibility comes in at least two forms - In regard to this problem two subproblems emerge: firstly, the question of distribution of responsibility for or in view of cumulative and synergetic damages and, secondly, the question of responsibility for unforeseen or even enforeseeable consequences. With regard to moral judgement, it follows from the subproblems that a personal action responsibility in many a situation and case cannot in general be attributed to an individual agent alone nor, under many a circumstance, can the cause be attributed to a single domain. Not only in the sense of task and role responsibility, but also in the moral and legal sense do the concerned individuals bear a co-responsibility corresponding to their active, potential or formal participation, to their constituting or influential shares (to be determined in each individual case). An extension of the responsibility of operationally manageable models of the distribution of (co-)responsibility are, considering the consequences of collective action, imperative. Appeals to the avoidance of social trap situations alone are not very useful. One should also introduce operationally available and efficient measures such as legal sanctions (product liability, collective responsibility, etc.), financial incentives to change production, determination of property rights for public goods, etc. The following rule could serve as a guideline: as many laws, regulations and prohibitions as necessary; as much incentive, individual initiative and individual responsibility as possible.

3.4 A second and different category with respect to the problems of responsibility distribution includes the external responsibility of corporations, i.e., the corporation and some or all of its members (representative responsibility vs. participatory responsibility), and corporation members alone (reducible to the specific types of responsibility); internal responsibility in differently structured corporations (hierarchies etc.) as individual responsibility and co-responsibility; the delegation of responsibility; and varying types of responsibility.

Moral responsibility - this is the main and leading hypothesis - is usually, in regard to (at least ideal) corporate action, differentiable and ramified: it is corporations as such, corporation members, or the corporation and its members among others that can be held morally responsible. The attribution of individual moral responsibility must be separately justified in each case. In general, one should make a distinction between the external (moral, legal, role) responsibility *of* the corporations and the (corresponding) internal responsibility distribution.

Beside the role or task-specific, the legal and the corporative action responsibility, corporations and institutions do have a moral responsibility or an accountability analogous to moral responsibility. This moral responsibility can also be understood as a higher level responsibility; it would exist in addition to and independent of the specific individual responsibilities of the individual corporation member. Individual responsibility and corporate responsibility do not have the same meaning; they cannot simply be mutually reduced to one another. The responsibility of one kind or type does not replace the other form, although in general, these analytically distinguished model concepts may overlap in social reality.

Corporations can act "intentionally", though in a manner non-reducible to individual action (i.e., they act in the secondary sense, on a higher level of social fiction, on a symbolic or semantically structured and interpreted plane; their actions because of this and the social consequences are no less real than a person's actions). Such a corporate responsibility, that is not equivalent to the immediately bearable, direct, personal responsibility applies to businesses, the state and corporations as well as to technical and scientific organizations. Until now, the traditional a priori combination of the attribution of moral responsibility to natural persons, i.e., the concepts of responsibility linked to individuals, appeared to be insurmountable barriers regarding the attribution of moral responsibility to corporations and situations.

Must that be so? We think, no. Rather, the exclusive limitation to the individualistic model thwarted. Should one not rather develop a hierarchical model that adequately and differentially puts the responsibilities on the various levels?

Making or holding corporations responsible may also constitute a first step of attributing responsibility in corporate action; the (corporation internal) distribution problem can be dealt with in a second step. The latter is difficult to deal with according to responsibility types. The following working hypotheses are formulated to address this point.

1. Only general distribution rules can be laid down with certainty.
2. These rules are (ideally) to be applied to each individual case with extra provisos regarding the special conditions.
3. The responsibility distribution is determined by the structures of the organization, decision-making structures (Internal Decision Units) and principles (individual and collective instances and units; unanimity or majority principles). (This applies to the social structure in general, too.)
4. The external responsibility in view of third parties, society and for their relevant instances, is dependent on the corporate structure, on the influence and control of individuals, on the contributions of (individual) agents and in general on the internal responsibility distribution (in the sense of competency and task distribution and role-structure).
5. The internal responsibility for the fulfilment of tasks and roles with respect to colleagues is also primarily determined by the corporate structure. It is primarily an accountability to superiors and a special case of the role and task responsibility. (The observation of these duties is generally legally required, usually in form of a contract; it can also be morally required.)
6. Tasks and competencies and the accompanying responsibility can be delegated. The responsibility of the delegating person does not (necessarily) end there. In general, however, moral responsibility, cannot be delegated.
7. The (normative) responsibility for the consequences of actions is primarily a result of the individual contributions of action and production. The individual director or the Chief Executive Officer, as well as the performer or executive, would *act* indeed. (The performance of an order or a command does not, however, generally exculpate the

performer.) The distribution of such an external or the respective internal responsibility, which assumes other responsibility distributions, results from the respective contribution to the action or production and from the involvement of the actor or contributor.

8. Role and task responsibility results from formal as well as informal roles and tasks; the responsibility and its (external or internal) distribution depends on corporate structure, hierarchy and position.

9. Moral responsibility (in a narrower sense) as simply directly and personally attributable responsibility in view of external or internal addressees is made topical by its own action and possibilities of action. Moral responsibility is a function of power, influence and knowledge. The co-responsibility determines itself correspondingly with regard to the strategic placement of an individual in a corporation. It is increasing with growing formal authority of the bearer and the level or position within the hierarchy or corporate decision structure. The moral responsibility of A can be larger, smaller or equally large as that of B. However, responsibility distribution is not suited to percentage distribution analysis; it is better suited to comparative statements. Moral responsibility is not really divisible; it is open to sharing though. It can be borne solely (exclusively) or jointly (each person fully or partly). In the distribution model of moral responsibility the individuality of the attribution and the morally required non-disappearance of the co-responsibility it is necessary to take seriously the moral accountability even in view of a growing number of participants (which might factually tend to minimize the personal share of the responsibility).

10. The legal distribution of responsibility is dealt with separately according to legal or natural persons, to the respective civil or criminal law, to legal aspects of administration or the state or constitutional approaches. In this way the legal person is, as a rule, liable to third parties for those who act on its behalf according to (German) civil law though not (in Germany for instance) according to the criminal law. Internally speaking, the corporation may have claims against natural persons (e.g. members). This is not the case with corporations which are not "legal persons" according to the German civil law.

4.5 There is a further problem of the responsibility distribution emerging from the use of expert and information systems (cf. Lenk 1989). Can these be responsible? Besides the "responsibility [...] in the systems" (Haefner); can we make complex informational decision-making systems and expert systems responsible? Is that not an unno-

ticed introduction of irresponsibility with no one to be appointed guilty, an infringement or transgression of a taboo or even a categorical mistake on the side of the analyser?

It is indeed meaningful and important to make computer systems more reliable, but it is not meaningful to attribute moral trustworthiness and responsibility to them. Indeed, that would be absurd and sound odd! Computers are not moral beings, just as information systems are not social beings. In spite of their far-reaching social implications, human beings must carry the full responsibility for the use or misuse of technical systems - but which human beings? The programmer? The director of the computing centre? The entrepreneur? The politician? ... The responsibility may, in view of the possible far-reaching implications of responsible decisions for humans, especially individuals, hardly seem bearable, but morally it still exists. Human beings cannot morally deprive themselves of their power of decision and their accountability, they cannot and should not cede their moral responsibility to computers and information systems. (This thesis must, however, still be established and worked out). In view of the factual expansion of automated conditioned decisions, this responsibility dilemma, which the participants and the higher decision-makers cannot avoid, will become more and more pressing in the future. Responsibility cannot be allowed to be diluted, either in anonymity or under the protection of committees, or in the information and decision-making systems. Possibilities of a counter-reaction exist in a higher sensitization of the responsibility awareness, in the development of a Code of Ethics for computer experts, in the interdisciplinary research and in an alliance in teaching and training of all knowledge-oriented disciplines, etc.

4. Engineering Codes of Ethics and the Resolution of Responsibility Conflicts

We recorded approximately 450 Codes of Ethics or similar regulations like scientists' or engineers' oaths. The recorded codes come from various professional organizations (mostly American), especially from associations and societies of engineers and scientists. Initial comparisons and overviews indicated large correspondences in the Fundamental Principles and Canons; differences are found mostly in the specific Guidelines. The contents offer more of a sort of ethos of the respective profession than a genuine code of ethics (if "ethics" is

understood in the strict sense relating to universal moral norms). A disadvantage in respect to the applicability at least for the respective professions in Germany is that the codes are too strongly oriented to engineers as self-employed or top managers; most (German) engineers do not fit these categories (but this seems to be true in the USA, too). A fundamental function of the Codes is the sensitization of engineers, scientists, engineering unions, and science and technical professionals and organizations to ethical problems and to conflicts between ethics and, for example, economic goals. Further possibilities of implementing, applying, institutionalizing and operationalizing the codes should be carefully considered and, if meaningful, the improved Codes should then be installed and enforced.

Regarding professional Codes of Ethics the following thesis can be presented or postulated (cf. Lenk 1991): Professional regulations and rules of behaviour such as the Codes of Ethics should not just be regarded as representing the current professional *ethos*; comprehensive ethical considerations including universal applicability and commitment, general social values and goals have also to be recognized and reformulated within the Codes as somehow obligatory or effective guidelines; the orientation to the common good(s) should be strengthened, various institutional controls and possibilities of obtaining and furthering discipline within the group, corporation, organization or institution should be included; particular notice should be given to the question of the structural interrelations with the market and in working life (in businesses and corporations as well as institutions), to institutional corporate responsibility and to moral ideals (representing virtues which cannot be legally enforced, institutionalized or controlled). If the codes should still find stronger and increased entry into the positive law and gain a kind of legal status (maybe via clauses that need to be filled in like "good customs" (§ 138 BGB, German Civil Law)), the chances of the realization of the codes would thereby be greatly enhanced, because appeals alone and susceptibility and the sensitization of the individuals - especially of dependent employees - do not seem to be sufficient, as necessary as they are indeed. Institutional supporting measures are also required. It remains important to include ethical and moral basic instructions in education as well as in technological, technical and on-the-job-training and to provide for accompanying measures, i.e., similarly the discussion and publication of case studies, to establish ethics committees, to design and render committing professional hippocratic oaths or analogous vows etc., and to give legal support for ethical employees under pressure, so that the

professional Ethics Codes do prove not to be just pretences or ineffective alibi appeals that have nothing to do with real life. (Our books - *Technik und Ethik (Technology and Ethics)* (eds. H. Lenk, G. Ropohl, Stuttgart 1987, 2nd edition 1993), *Wissenschaft und Ethik (Science and Ethics)* (ed. H. Lenk, Stuttgart 1991) and *Wirtschaft und Ethik (Economics and Ethics)* (eds. H. Lenk, M. Maring, Stuttgart 1992) - offer lots of material on this topic.)

There is a sort of social traps involved in abiding by or profiting from ethical codes: People who follow the rules must often deal with disadvantages, while those who transgress them can benefit from advantages (especially when the infringement can be hidden). Problems of control, sanction, trust and security also arise; these cannot be solved through codes alone. Additional institutional measures are indeed necessary.

Regarding responsibility conflicts in practice, there are no isolated solutions or suggestions for such cases; instead, applicability rules or practical guidelines on an intermediate level should be developed. These rules should differentiate, for example, between moral ideals (covering virtues as mentioned above) and moral (obligatory) rules (Hennessey/Gert). A combination of individual and institutional measures is necessary: To further and strengthen individual ethical competence is a necessary, but by no means a sufficient step for the efficient solution of responsibility problems and conflicts. An implementation of ethical considerations in law and politics would supplement and enhance this step. In particular, the codes should explicitly set priorities and decision criteria, which would aid in the solution of the respective responsibility conflicts.

As mentioned above, most engineers and scientists nowadays work as dependent employees in industry. Insofar the respective company codes, principles of management, as well as guidelines for specific jobs, etc., are relevant for them. In such codes are usually discussed in business ethics. In practical job situations technology-related and science-oriented questions and problems are combined, so that a clean-cut separation of these is neither beneficial nor meaningful in this realm. Responsibility for technology and science (or research activity) is particularly concretized in corporate acting in and for businesses. Therefore, business ethics and engineering ethics as well as the external responsibility of the researcher are closely related.

5. *Priority Rules*

In considering different types of responsibility, we will also have to develop priority rules, as for example, that moral responsibility takes precedence over role-responsibility. We would like to propose the following 10 rules of preference and priority which are not systematically arranged in a successive order and valid under prima-facie-conditions (that but except the first four ones presented just is they may be over-ruled by higher and more binding moral obligations). (The first four rules are adapted from Werhane 1985, pp. 72.)

1. To weight moral rights of the respective individual; these moral rights are non-alienable predistributive or primordial rights overriding utility considerations.

2. To seek a compromise taking into consideration interests of everyone on an equal basis; in case of an unsolvable or seemingly unsolvable conflict between equally relevant basic rights the condition mentioned in the clause is especially important.

3. Only after considering the moral rights of each party one should vote for the solution which causes the least damage or maximizes utility for all involved parties.

4. Only after application of rule 1., 2. and 3. utility considerations are to be weighted against potential harm. That means in general: Non-alienable (predistributive) moral rights are prior to considerations of avoiding harm and damage and these latter are prior to utility considerations.

5. In practically unsolvable conflicts one should look for fair compromises (that is for compromises which involve proximately equally distributed or proportionally justified distributions of disadvantages and utilities respectively.)

6. General (higher level) moral responsibility is to obtain a preference over restricted nonmoral prima-facie-obligations.

7. Universal moral responsibility generally takes preference over role and task responsibility.

8. Direct or primary moral responsibility is usually but not always to be considered prior to indirect responsibility for remote consequences. (This is true because of urgency but should at times and in cases be modified according to importance and impact of consequences and long range effectiveness.) (See also rule 17 below.)

9. Primary and personal moral responsibility precedes the secondary or second-level corporate responsibility.

10. The public weal as well as "the common good" surpasses all other specific, special, specious and particular interests.

11. In technical rules and regulations for applied science important principles of priority are formulated regarding safety regulations, e.g. Rule DIN 31.000 of the German Technical Regulation DIN explicitly states: "With respect to safe design (it is imperative that) that solution has to be preferred for which the safety goals will be reached in a technologically meaningful way and the best economical manner. In case of doubt safety requirements take precedence over economical consideration."

12. Safety goes on top of technical-functional and economic considerations (as for instance DIN 31.000 would postulate).

13. Global or continental as well as regional and local environmental compatibility are to be differentiated and have to be taken into account: system-relevant or decisive environmental compatibility and usually the comparatively speaking more comprehensive compatibility stay in front. Sustainable development of ecosystems is particularly urgent on each of these levels.

14. Urgency of ecocompatibility and sustainability (especially a system-decisive one) are to top economic utility.

15. Social and human compatibility would in the case of conflict precede above environmental and nature or species compatibilities which are however still to be considered by the way of reaching for meaningful compromises.

16. Human and social acceptability surpass functional efficiency and utility.

17. Concrete humanity and humaneness should go in front of abstract requirements and formal universal principles.

Such rules of priorities are conducive to tracing and probably solving conflicts between different types of responsibilities obtaining in a particular actual situation of conflict. Whereas differentiating between the levels and types of responsibilities is necessary for the discovery and identification of conflicts, the rules of priorities could helpfully be applied in solving or at least regulating and assessing the respective conflict-situations and in tracing their special sources. Yet, in this realm much work has still to be done in the future.

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