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Technological disasters, crisis management and leadership stress

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Abstract

This paper discusses how psychological stress disturbs decision making during technological crisis and disaster, and how to prevent this from happening. This is exemplified by scientific studies of a Norwegian large scale accident involving hazardous material, and of handling the far-off effects of the nuclear disaster at Chernobyl. The former constitutes an operative level of crisis management, whereas the latter involves crisis management at the strategic and political level. We conclude that stress had a negative effect on decision making in both cases.

Keywords: Disaster psychiatry; Technological disaster; Crisis management; Leadership stress

1. Introduction

"*As a leader I am often under pressure to do what is urgent and what is important. My job is to do what is important*" (Colin Powell).

The purpose of this paper is to discuss how psychological stress disturbs decision making during technological crisis and disaster, and how to prevent this from happening. This will be exemplified by scientific studies of a Norwegian large scale accident involving hazardous material, and of handling the far-off effects of the nuclear disaster at Chernobyl. The former constitutes an operative level of crisis management, whereas the latter involves crisis management at the strategic and political level. Our hypothesis is that stress had a

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negative effect on decision making in both cases. Decision making requires both a receptive use of senses, an ability to think fast and rationally (cognitive function), as well as an ability to act. Every one of these functions can be disturbed by severe stress.

In order to put our two case examples in perspective, we will begin by describing certain aspects of crisis and disaster and the developmental trend in the global picture of disasters.

2. Natural versus technological crisis and disasters: a blurred distinction

Technology has a dual character. It is able to prevent disasters and to cause disasters. By definition, a human induced disaster is the result of a failure of human hand or in human-made products. These can be categorized as (1) transport systems (air crashes, large scale road accidents, train derailments and collisions, passenger ships and other maritime catastrophes), (2) collapse of man-made constructions, (3) large fires of all sorts, and (4) technological and toxic (nuclear power plant accidents, leakage of hazardous substances from waste disposal, etc.). In contrast to war, another type of man-made disaster, such disasters are not intended. A disaster results in considerable death, injury, and destruction and in the disruption of a community. By definition, a disaster is a situation in which the affected community cannot cope even by maximum use of its resources.

Technology is certainly becoming safer. Road traffic, airlines, and railways are subject to stringent safety procedures. However, the absolute number of technological disasters is increasing. As technology develops, there are simply more things that can go wrong, even if unintended and uncalculated. When something does go wrong, or a mistake is made, there has been a human error and someone is always responsible. Whether or not someone does assume the responsibility makes a substantial difference in the psychological reactions of those affected and of the public at large. Today, the mass media rapidly question the management of involved companies and agencies during crisis and in the aftermath of technological disasters, in order to disclose whether or not the management and leadership were sufficiently prepared and trained.

Traditionally, the two types of disaster have been (1) natural, i.e. an act of God and (2) man-made, or in todays' World Health Organization terms, *human induced disasters* [1].

Natural disasters have traditionally been regarded as unavoidable and to a large extent beyond human control. Through man's evolution, natural disasters have become familiar, and to some extent, man has developed psychological coping strategies, acquired a fatalistic attitude—by accepting the inevitable. The United Nations General Assembly Resolution 42/169, adopted on 11 December 1987, designated the 1990s as the decade of natural disaster reduction. In general, the number of deaths and injuries caused by disasters is closely related to a country's level of economic development. Of the 109 worst natural disasters between 1960 and 1987, 41 occurred in developing countries with 758 850 deaths compared to 11 441 in developed countries [2]. Earthquakes, windstorms, tsunamies (tidal waves), floods, landslides, volcanic eruptions, wildfires and other calamities have killed more than four million people worldwide over the past three decades, and have adversely affected the lives of at least 800 million more [1,3]. Whereas the 1988 earthquake in Armenia claimed 30 000 lives because of poor housing construction, the 1989 earthquake in San Fransisco of similar magnitude on the Richter scale, caused death tolls in the dozens. The

effect of a natural disaster, such as an earthquake, depends to a large extent on the breakdown of man-made products. The vast majority of lives can be saved by better warning systems, increased evacuation capacity, better building construction, etc.

If, however, technology can save lives by controlling natural hazards, lack of it may increasingly be seen as responsible for deaths occurring in previously "natural" disaster. As globalization increases, people in developing countries will probably alter their attitude about deaths from natural disasters, from a resigned and fatalistic outlook to feelings of bitter despair: "It could have been prevented". The previous understanding and acceptance of the natural disaster through a general religious and fatalistic outlook may be lost. It is likely that this will increase the psychiatric morbidity of disasters.

In addition, disasters previously classified as natural are today considered, to an ever increasing degree, to be human induced. Possible climatic changes following poor environmental policies may cause increased flooding and windstorms. The 1991 flood in Bangladesh claimed 200 000 lives. Still, there were 300 000 fewer casualties than there would have been without technological advances. There are reports indicating that educated survivors discussed the deforestation of the Himalayas and the weakening of the ozone layer as possible contributory causes, while the uneducated masses felt that God was angry with them.

3. Perception of disaster

Will man's changing perceptions of who is responsible or to blame for disasters, have any psychological consequences? In all likelihood it will. The striking difference in response between a new technological threat and a permanent but natural threat is offered by ionising radiation. In the aftermath of the Chernobyl nuclear disaster there was strong public reaction in several countries to the radioactive fallout from the reactor [4]. In contrast to this is the moderate, or even absent, reaction to the normal backround ionising radiation from radon, which is a much greater risk to health for the population at large [5]. The former can be blamed on somebody, but the latter is more one's own responsibility since it depends upon where you choose to build your home.

The more a human causation lies behind a disaster, the more pathogenic it seems to be in terms of psychiatric morbidity [6]. The severity of human reaction increases along the following line of causality (Fig. 1).

A human induced crisis may be more traumatic than a natural crisis because of its greater unfamiliarity, unpredictability, uncontrollability and culpability. War may be an exemption to this, since the suffering and death in war may take on a deep sense of noble sacrifice and

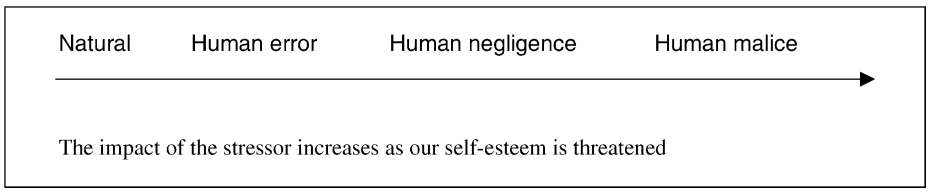

Fig. 1. Major stressors: the human blame continuum.

even increase stress tolerance. In all other situations, the interpersonal context differs from natural trauma in the pernicious and ever present attack on an individual's integrity and self respect. *Nature does not threaten man's self respect, while human error, negligence and malice increasingly challenge, threaten and attack man's self respect.* Human negligence and violence are likely to produce more aggressive responses, psychological withdrawal and social isolation. Such reactions are more detrimental to mental health than the limited phobias resulting from exposure to natural disasters. These characteristics of the stress response will also inevitably affect those responsible for managing crisis and disaster situations.

4. Crisis management

Management can be described as the ability to achieve a defined goal by optimal use of personnel and materiel resources. Crisis management sensu strictiori involves management at staff level in a situation characterized by a critical period of time, in which leadership decisions will, for better or worse, determine the future of the organization.

Crisis management can be conducted on all levels of decision-making:

- political level;
- strategic level (staff level);
- tactical level;
- operative level (on scene-command);
- technical level.

When establishing a crisis management group, typically the everyday resources of the affected company or organization, will be insufficient for coping with the situation. Also, there is an imminent danger of being absorbed by the crisis, in such a way that the ordinary systems seize to function; i.e. a railroad company which becomes overwhelmed by the crisis management tasks, and therefore neglects the day-to-day business of running trains. Typically, a crisis situation involves something new, which demands an ability to learn during the crisis as previously learned experience may come up short.

The critical period, a crisis, arises when the ordinary steady state is disrupted, as illustrated by Fig. 2.

Fig. 2. The time continuum of crisis.

The characteristics of a technological crisis situation frequently become significant stressors for the crisis managers: (1) a severe threat to important values: human lives, finances, ecology, politics, etc. In traditional, western crisis management the values are normally prioritized in the following order: man, environment and materiel, i.e. "people before property"; (2) a complex combination of infrequent events; (3) reduced control; (4) high uncertainty; (5) lack of information; and (6) time pressure. Stress reactions among employees and leaders may reduce their capacity for crisis management and thereby their ability to stop a disastrous chain of events from unfolding. Decision makers may themselves even be exposed to physical danger, whereas the stress of responsibility, fear of failure, and reduced or even loss of control of a situation that perhaps is rapidly changing are frequently experienced. The decision-maker may be forced to choose between evils because there is no available solution that causes no harm. He or she intensely experiences the lack of information on which to base decisions. Disagreements and irrational interactions with subordinates, colleagues, or superiors may increase the burden. To an increasing degree media stress is also an important part of the picture.

5. The Norwegian paint plant large scale accident

One night in 1976, the production plant of Norway's largest paint factory was devestated by a giant explosion. The building collapsed, and as a series of subsequent explosions followed, the fire totally destroyed the production plant and the warehouse. Totally, 30 000 m^2 of buildings were engulfed by flames stretching up to a height of 400 m. The fire was fed by millions of liters of chemicals and by 50 million cubic meters of air. A local windstorm was created by the combustion. The threat of spreading fire and further explosions necessitated the evacuation of about 1000 people in the neighbourhood. Fortunately assisted by previous rain and current wind direction, 150 fire fighters contained the fire within 12 h and extinguished it after 36 h. Six plant employees were killed, and of the 125 survivors, 21 had minor, and two had severe injuries. This is still the largest industrial disaster that has ever occurred in Scandinavia, and many aspects made this a typical example of a "modern technological disaster" and a psychic "shock trauma": the lack of forewarning (90.4% of the employees at work received no warning), the brief but violent impact, the circumscribed but completely damaged area, and the great material destruction yet limited number of casualties. As such, the event was unprecedented, unanticipated, sudden, violent, uncontrollable and brief.

The industrial explosion followed a critical phase of about 10 min duration: a leakage had occurred in a room in the production plant where a single worker was tapping chemical liquid ("shop primer"). The pipe immediately leaked paint which sprayed out under pressure, injuring the worker. The liquid solvent produced gas which spread out on the premises. The gas eventually was ignited by a heating source in a nearby machine, producing the tremendous blast that made the building collapse.

The situation had all the characteristics of a crisis situation: it was a rare combination of unexpected events and it represented a severe threat to vital values for many people, with increasing uncertainties about the situation and about alternatives for dealing with it, and with decreasing control over the events and their effects. The information available to the participants was inadequate and there was severe time pressure and sense of urgency.

Having rescued the injured worker, four men were struggling to stop the leakage. This activity claimed all their awareness. Ordinarily they were all working in another department and therefore were neither familiar with the facilities nor the risk at hand. Why did they not sound a general alarm? Why did they not try to reduce the concentration of the gas? Why took it so long before they realized the explosion risk at hand? Why did they not cut off the electric power supply? The men were facing an emergency situation for which they were unprepared and neither trained nor equipped to handle. We hypothesize that if stress reactions had negative effects, it was probably by reducing the ability of new learning in an emergency situation, which to be solved, demanded capacity for immediate complex learning and the execution thereof.

Several of the known detrimental effects of severe stress upon the ability of the human organism to perceive, evaluate and act, may answer the questions raised, at least partly: reduction of the information search, partial denial of risk, all or nothing responses, response perseverance, stereotypical behaviour, etc.

The discriminative conditions were not favourable for the identification of the critical event: the rarity and complexity of the event and the combination of risk factors, the absence of observers of the accident. Poor knowledge and information about the qualities of paints and solvents were often mentioned afterwards as the main reason for not having fully understood soon enough the dangers inherent in the leakage [7,8]. In fact, one may state that the involved persons made quite impressive efforts considering that their lives were at stake. None fled from a critical situation which in the end killed most of them (Table 1).

In analyzing decision making there are the following six major steps to consider, essential parts of the decision-making process:

1. Recognizing the existence of a problem (critical event identification).
2. Gathering adequate information.
3. Discovering alternative solutions and exploring their probable consequences.
4. Choosing between the alternatives.
5. Implementing the chosen solution.
6. Controlling the effects of the chosen solution.

Decision making require both a receptive use of senses (perceptive functions by sight, hearing, smelling, etc.), an ability to think fast and rationally (cognitive function), as well as the ability to act. Every one of these functions can be disturbed by severe stress. The stress reactions make themselves felt upon three levels (Fig. 3).

Table 1
Risk evaluation amongst Norwegian paint plant workers ($n = 125$) and control group ($n = 119$) after the explosion

Risk evaluation	Paint plant workers, $n = 125$ (%)	Control group, $n = 119$ (%)
Completely and relatively realistic risk evaluation	83.2	84.9
Underestimation of risk	12.0	11.8
Irrational fears (exaggerated fears about lesser risk)	4.8	3.3
Total	100.0	100.0

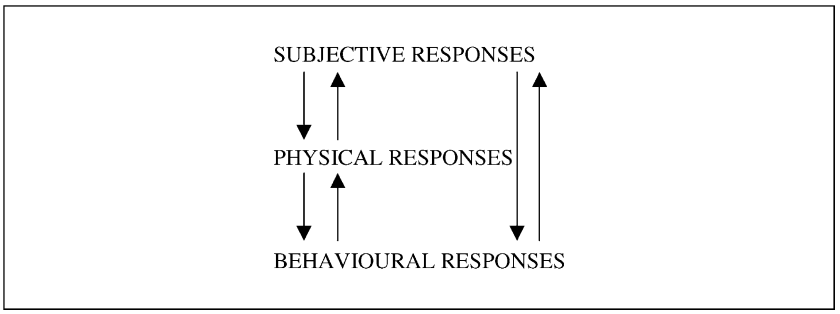

Fig. 3. Stress reactions within an organism.

The subjective level is thoughts and affective responses to the physical threat to life and the psychological threat to self-esteem. They can be exemplified as fear, anger, surprise, helplessness, hopelessness, courage, optimism, etc., all of which were reported by the surviving workers at the plant [7].

The physical responses may express themselves in the neuro-muscular system (hyperactivity, tremor, shaking, restlessness, stiffness, paralysis, loss of voice, etc.), in the cardiovascular system (heart palpitations, fatigue, weakness, fainting, etc.), in the respiratory system (shortness of breath, hyperventilation, etc.), and in the gastrointestinal system (acute diarrhoea, vomiting, nausea).

In the critical situation described, the main reactions were of a physical nature and were task oriented. No spontaneous leadership emerged, thereby causing a lack of tactical management. The men involved had a single focus upon the concrete problems at hand. The dramatic leakage and the injured work mate were perceived to be the immediate tasks to deal with. In common terms one can argue that the individual is "hit" by the invasive qualities of dramatic and strong impressions. Instead of being free and explorative, perception becomes rigid and limited, such as in tunnel-vision. Also the leaders themselves become operative with a tendency towards physical action rather than analytical efforts. This is understandable as the biological stress response with its hyper-arousal and bodily tension causes a physical acting-out. In our experience, becoming operative instead of working at a tactical level is the most frequent stress response among leaders [7,9].

Concerning the physiological reactions each person seems to have a rather stable, characteristic type of response to severe stress. Therefore, if the individual in a stress situation finds that the trembling in a hand makes writing difficult, or that restlessness makes it difficult to sit still, concentrate and make reasonable decisions, one can expect these psychological reactions to be a problem also the next time a crisis appear. Thus, one can set out and train oneself to control the specific maladaptive response. The physical responses mentioned above are liable to be far more disturbing if you have an administrative, coordinating role in a staff setting, than if you are a field operative who can channel all physical tension into a physically strenuous task. One of the more frequent problems for administrative leaders in a crisis or disaster, is the urge to engage in physical work, tasks that will not only lessen his internal tension and provide a feeling of really doing something as well—but which will inevitably leave the management group or staff without its' "head", literally speaking,

leaving the group leaderless. The ability to tolerate a great deal of pressure without acting is crucial for a leader in crisis management. On the other hand, strong anxiety may also paralyse a person, both his ability to think and to act. Leaders do to a surprising extent feel only minor threat against their own life, even if the objective risk may be considerable. The fear of failure and the intense feeling of heavy responsibilities on the other hand, are striking. The latter could be indicative of a more severe threat to one's self-esteem than to one's physical self (Fig. 4).

The effects of stress can, if moderate, be beneficial, but when they become major they will be negative. Rigidity in both perception and cognition expresses itself by liability to cling to one set of percepts and ideas if the individual first was struck by them. Flexibility in decision-making will be reduced. Such stereotypical behaviour can be seen in tendencies to carry out familiar functions in a sudden, threatening situation. On the perceptual and

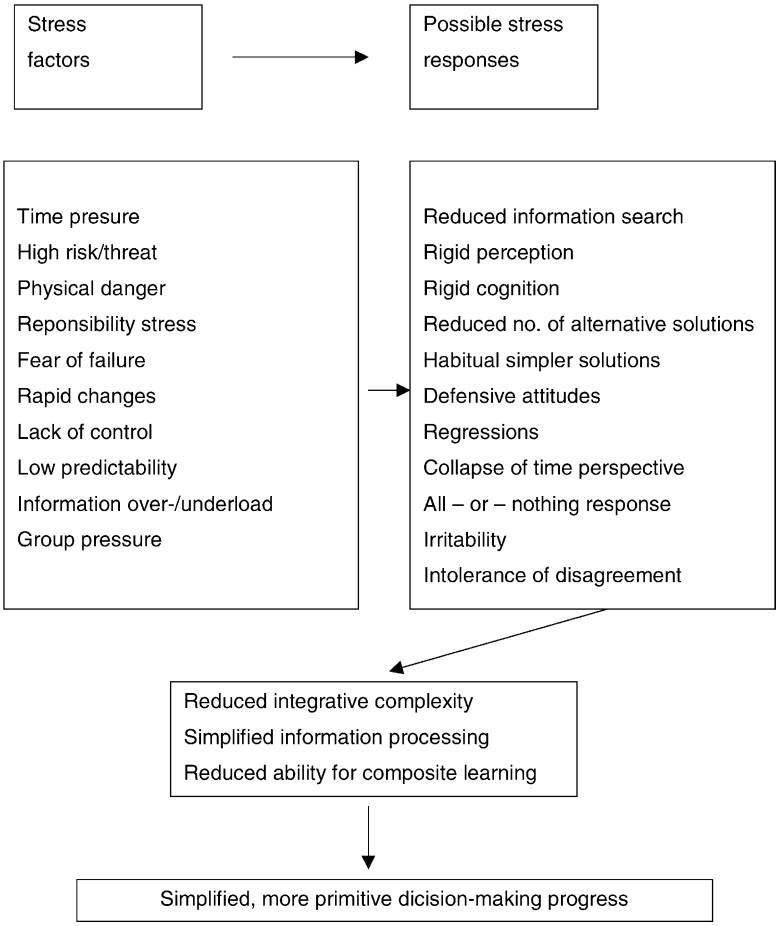

Fig. 4. Effect of leadership stress on decision-making.

cognitive level this is marked by the tendency to interpret new, unknown events in terms of familiar, expected events.

In the paint plant disaster, the blast itself was interpreted by many to come from an area where explosions were expected due to a planned use of explosives in an ongoing construction work. Valuable seconds were lost because of habitual reactions. Crisis managers can be affected by such effects to the extent that they become preoccupied in "planning and handling the last war" to use again the words of Colin Powell. Lack of fantasy to grasp the unimaginable may be fatal at worst, demonstrated recently by the fire and rescue response at the September 11 terrorist attacks in New York; to the senior commanders being preoccupied with mass evacuation efforts, there may have been too little attention paid to the possible structural collapse of the twin towers. One basic reaction pattern in the human organism exposed to severe stress is to try to achieve a functional reduction in stimuli. Another pattern is the receptive reinforcement of some stimuli, at the same time excluding other aspects of the situation. The sensory systems in humans are organized in such a way that differences, contrasts are perceived. Thus certain stimuli are strengthened, others are attenuated. This trend can become much exaggerated under stress in crisis management situations.

6. The Chernobyl disaster

On April 26, 1986 at 1:23 a.m. the accident occurred at the fourth unit of the Chernobyl Nuclear Plant which resulted in the destruction of the reactor core and part of the building in which it was housed. As we know today, some of the radioactive products that had accumulated in the core were released onto the atmosphere, producing a radioactive cloud. The amount of radioactivity released was equal to that from all atomic bombs ever tested above ground. For Scandinavia the meteorological conditions were the worst possible, with wind and rain. Within 3 days the air masses were spread all over mid-Scandinavia where at the same time patchy heavy rain was falling. The cloud also hit the mountain chain along the Swedish–Norwegian border, increasing the fallout in both countries. Already on April 28, increased radioactivity was measured in the Oslo area.

Most people exposed to the far-off fallout from the Chernobyl nuclear plant disaster were only retrospectively aware of the released ionising radiation, or there was a problem of inconsistent or even contradictory information. For instance, on 30 April 1986 in the major news program on Norwegian national television, the director of the Norwegian Health Directorate stated that: "Based on the information we now have about the radioactivity level above Norway, we can guarantee that there is no reason to make any change in daily living". Only a few hours later the major radio news warned people not to drink cistern water at their log cabins. The Norwegian population was subsequently informed that Swedish authorities warned against drinking water from "stagnant water sources". A few weeks later, the Norwegian authorities themselves announced a prohibition against sale of dressed lettuce and parsley from some areas because of the high content of radioactivity in the vegetables. The research findings demonstrate that erroneous anticipation of public reactions played an important role in the decision making process in the acute and semi-acute phase underlining the importance of the first steps of crisis management; i.e. critical event

identification, gathering of adequate information and discovery of alternative solutions and exploring their probable consequences [5].

7. Toxic disasters

In contrast to natural disasters, some of the most powerful toxic disasters like Chernobyl are without a clear "low point" from which "things will gradually get better" [10]. Thus there may be considerable uncertainty as to the damage that such catastrophes may have inflicted. The effects of the uncertainty created by the exposure to radioactive materials bringing about the likelihood of the development, many years later, of a variety of illnesses, have been described by Lifton [11] among the survivors of the a bomb in Hiroshima. The survivors felt themselves involved in an endless chain of potentially lethal impairments. Outsiders saw the survivors as tainted with death, thus adding a stigma to the stressful situation. Even when no or limited amounts of radioactive material is released from a nuclear accident, but the threat of release is present, as was the case at Three Mile Island Nuclear Plant incident, mental health effects have been a main consequence [12].

Human survivor responses have developed during the evolutionary process. Ideation, emotional responses and behavioural acts: fight, flight, surrender, immobilization and attachment behaviour. Such survival responses usually are of an adoptive nature when it comes to natural dangers. In a man-made environment, however, such automatic behaviour pattern may be highly mal-adaptive. Human contamination of the biosphere is a comparatively new crisis. It is more than an ecological emergency, it is also a social and political crisis. Frequently a "culture of uncertainty" is created, particularly if the environmental contamination is not possible to see, hear, smell, taste, or touch. It is a "silent disaster" in which it is not possible for the general public to determine if and when they are being exposed [13,14]. Contamination scares human beings in new and special ways. To be poisoned is psychologically a very different experience from being damaged or injured by traditional external agents [14]. Exposure to a concrete, single time-limited severe event may cause post-traumatic stress disorder (PTSD), a psychiatric disorder characterized by intrusive recollections and reliving of the trauma with symptoms of avoidance and hyperarousal. In contrast, the stressors inherent in radioactive contamination are often ongoing, future oriented, somatically based, and not confined to a single past event that could be processed by the senses. It has been proposed to term the syndrome "the informed about radioactive contamination syndrome" [4,15].

The social alienation of groups contaminated, "poisoned" individuals, has been described by Couch and Kroll-Smith [16], who show how many people construct their reality in concert with others. People experience the contamination of water, soil, and air in a highly charged context of uncertainty. It has been suggested that toxic exposure makes the self, which is the basis of self-esteem and self-worth, the first victim of contamination [5]. People who could be contaminated are likely to be treated as contagious and may well feel rejected and marginalized by their fellow men. This is quite contrary to the "altruistic community" that develops during and after natural disasters. What follows is a loss of trust in institutions aiming to help them in time of need, and people may experience alienation. At the same time they may feel influenced by forces beyond their control and comprehension. They view

the decision-makers and authorities as able but unwilling to act. When some government agency finally finds there is sufficient cause to issue a warning, groups in the community may already be convinced that they are being poisoned. The government authorities, on the other hand, are likely to see the spectrum of "hyperactive" citizens, a "sensationalist press" and would want the public to behave in a more "responsible" and "rational" manner towards a crisis which might very well prove to be no threat at all.

8. Managing the information crisis

When toxic threat cannot be perceived by any of man's senses, he is totally dependant upon others for information. If agencies are unresponsive or seen as concealing facts, people may come to believe that there is a hidden, but serious threat [4,5,17]. Those responsible for handling the situation are faced with the task of providing information that is of a calming and reassuring character. There is a fine line, however, between calming and reassuring on the one hand, and belittling and denying on the other [5].

A pioneering contribution to the risk perception field was Chancey Starr's 1969 article in Science about the acceptability of risk to the public [18]. Starr pointed to the fact that the public accepted much higher risks if they were perceived as voluntary as compared to involuntary ones. Fischoff, Lichtenstein and Slovic at the Decision Research Centre in Oregon were main contributors behind an approach called the psychometric paradigm. The psychometric paradigm identified various characteristics (or dimensions) of the risks that influenced public risk perception. The dimensions identified were controllability, dread, involuntariness, familiarity and impact in future generations [19]. In contrast Douglas and Wildavsky [20,21] argued for a cultural theory in which characteristics of the perceiver were more important in determining perception than the characteristics of the risk itself. Sandman [22] developed an approach in which public outrage was an important factor. According to his analyses, environmental controversies should be analysed as composed by two factors, a technical "hazard" dimension and a moral-emotional "outrage" dimension [23]. The technical factor is evaluated by questions about how much damage might be done to health and/or the environment, whereas the moral-emotional "outrage" factor concerns issues such as: "Who is in control?", "Who benefits?", "Is it fair?", "Can I trust the people in charge?", "Do they respond respectfully to my concerns?", "Do they give me a choice? "[23, p. 39]. Sandman convincingly argues that the public is far more preoccupied with outrage than with hazard, and that risk communication efforts without due concern to the outrages issues are likely to fail.

In order to bridge the gap between experts and public in radiation risk perceptions and ratings, it has been suggested that public education might be an important approach. This implies accepting the expert risk perception as an objective assessment and then trying to "adjust" the bias of the public generally by reducing their "subjective" risk perception. As described by Douglas [21, p. 31]): "*The faith in education is a logical next step from the initial acceptance of risk perception as a problem of misperceptions by the lay public*". Whereas proponents of the cultural theory and the psychogenetic approach disagree heavily on many issues, they have in common that they seriously question the assumption that public perceptions are a matter of misperception [5,24]. One critique of public educational efforts

addresses the fact that experts often want to educate the public about those aspects of a risk that the experts themselves find important, such as accident probabilities, mortality rates or reduction in life time expectancies. Statements like "*the annual risk from living near a nuclear power plant is equivalent to the risk of riding an extra 3 miles in an automobile*" is like comparing "oranges with apples" [5]. More importantly it fails by addressing aspects not seen as important to the public.

If controllability and the lack of possible personal control is a key element for perception of risk, it is not "relevant" to learn more about probabilities or reduction in life expectancy—or as Sandman describes it: "*Technical information, however well taught, is unlikely to change these priorities because they are not grounded in technical judgments in the first place*" [23, p. 39]. Thus, if radioactive fallout creates a situation perceived by the public as "*unfair, beyond my control, leaving me no choice, and with authorities not responding respectfully to my concerns*", it does not matter how well prepared and clear the information that authorities pour out, if it only aims at the technical issues and fail to address outrage dimensions. Thus, "*Outraged people naturally tend to resist learning that they are technically wrong*" [23, p. 39]. Educational efforts to bridge public and expert risk perspectives may also require two-way dialogue, whereas a one-way perspective is typically chosen [5]. A critique of such "knowledge fix" is therefore related to the general finding in attitude research, in which attitudes are more easily shaped than changed. Strong negative attitudes are specially resistant to change, and strongly held attitudes tend to structure how new information is interpreted.

As demonstrated by the rather unsuccessful Norwegian efforts during the acute and semi-acute phase of crisis, crisis managers on the political-strategic level must take these issues under consideration in "peacetime" if they shall be able to act accordingly when the crisis situation appear.

9. Conclusion

How stress responses may disturb decision making in technological crisis and disaster have been illustrated by describing two different crisis situations: a critical leakage of hazardous solvent which demanded operative crisis management and secondly the nuclear fallout from Chernobyl and its demand for political and strategic crisis management involving the governmental information strategies on the "silent" danger towards the Norwegian population. The shortfall in both cases has been related to the lack of preparatory planning and exercises in crisis management under severe psychological stress.

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