Role of beliefs in accident and risk analysis and prevention

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Abstract

This paper mainly deals with an old psychological theme, i.e., the impact of comprehensive reference systems such as belief systems and culture on safety and accident prevention. It is hypothesized that an understanding of the beliefs people hold about risks and the causes of accidents, as well as their perceptions of risk targets and the need for safety, are important prerequisites for effectively managing risk and designing preventive measures. This viewpoint is posited to be highly crucial today, especially in this era of globalization where workers from different backgrounds are relocating, and increasingly complex technology is being exported. Illustrations are given for both developing and developed countries. Different factors are shown to cause bias in accident explanation and risk perception. Among these, people's beliefs about their own ability to cope and also their culture are described as important factors. Both defensive explanations of accidents and illusory or biased risk perception are shown to influence safety assessments and to have important implications for defining the best preventive actions and for writing relevant preventive communications.
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1. Introduction

Much progress has undeniably been made in improving the reliability and safety of modern production systems. However, these systems still involve considerable risk and accidents, sometimes with major consequences that are tolerated less and less well. Technical and organizational solutions have been tried in some cases, with varying degrees of success (Kouabenan et al., 2003). It has been noted on numerous occasions that the interplay between people's behaviors and mental representations often play a major role in accidents and dangerous situations (Kouabenan, 1999). Preventive measures are not always respected, operators do not always wear available protective gear, supervisors and directors often show little concern for accident prevention, focusing instead on meeting production objectives, and so on. In summary, few people seem to be truly concerned with prevention, even though risks are far from being under control. Our hypothesis is that such indifference about accident prevention, and the

relative ineffectiveness of preventive measures, results from different "readings" of the same situation and from poor quality communication about risk and methods of overcoming it. This situation is caused by differing and sometimes biased representations of risks and accidents. We believe that by analyzing the sociocognitive functioning of the different actors at the workplace, and thus their representations and beliefs, we can enrich accident analysis and increase involvement in and commitment to safety and safety measures. We analyzed two complementary types of data, spontaneous explanations of accidents provided by operators, and their perception of risks inherent in the organization.

This paper particularly deals with an old psychological theme, i.e., the impact of comprehensive reference systems such as belief systems and culture on safety and accident prevention. Such approach is especially relevant in the current era, characterized by the globalization of trade, the transfer of production technologies and systems, and the internationalization of labour. Today we see not only "travelling factories", but also many workers relocating to foreign countries. In this climate, culture and even more so beliefs, take on particular importance for safety. Each

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production system carries with it a system of values and standards specific to its developers' country of origin and to certain ideas about work. Likewise, each worker had his or her own set of beliefs, representations, norms, and culture. These representations, and more specifically risk perception and spontaneous (or naive) explanations of accidents, influence all levels of risk management. They affect political or strategic choices, and economic and cultural choices as to what types and levels of risk are acceptable, unavoidable, or useful; they have an impact on measures taken to counter potentially harmful effects, and on whether safety procedures are accepted and followed; they influence how individuals evaluate their personal exposure to risk, their decision as to whether or not to protect themselves, and their receptivity to prevention messages. By gaining insight into the representations, beliefs, and naive causal explanations not only of operators, but also of decision-makers, investors, directors, various other stakeholders involved in an organization, and all those engaged in risky activities, we can understand their attitudes with respect to safety problems and thus the behavioral choices they make.

The present paper seeks to describe the role of beliefs in handling and defining safety measures as well as in designing and developing prevention programs. First, the relationship between beliefs and safety is illustrated (1st part); then, we present the influence of beliefs on accident explanation (2nd part) and on risk perception (3rd part). In the fourth part, we show how culture is an important factor in risk perception and the explanations of accidents. Finally, we underline the relationship between beliefs, safety diagnosis and preventive measures (5th part).

2. Beliefs and perceptions about safety: illustrations in developing and developed countries

Several past studies (Kouabenan, 1998, 1999, 2000a, 2003) have shown that experts are not the only ones affected by safety problems. People at all levels in the workplace, from laborers and operators to supervisors and top executives, have representations of risks and why they exist. Each person has ideas about what causes accidents and how to prevent them. These representations and beliefs, whether held by employers or operators, inevitably influence the general level of safety in an organization and attitudes about prevention measures. This is true for all organizations, whether located in industrialized or developing countries. But it takes on particular importance for firms operating in developing countries, or for workers who come from such countries. In one study involving 72 organizations from the major industrial sectors in the Ivory Coast, we examined how hygiene and safety regulations were applied (Kouabenan, 1990). We found that safety regulations, often mere copies of those of parent organizations located in industrialized countries, were on the whole ignored or applied more or less leni-

ently by employers, most of who came from the former colonizing country. A good half of the organizations maintained hygiene and working conditions that were at best mediocre, at worst unhealthy or dangerous. These observations concur with those made in other developing countries (Rivero-Plaz, 1980; Chew, 1988; Léger, 1986). Granted, the managers (35%) complained about the lack of sanctions set forth in case of rule infractions, and about the rules being complex and poorly adapted to local working conditions. However, these complaints could not conceal their discriminatory attitudes toward worker safety in developing countries. On several occasions, local managers of subsidiary firms – whose parent companies were very strict about safety measures in industrialized countries – claimed not to know that these same measures were applicable in the Ivory Coast. This was the case of a local project manager working for a large Italian public-works company in charge of paving a major national highway. When we asked him to tell us what recruitment criteria he used to hire workers, he replied that it was simply how the person looked or his/her physique: he acted very surprised when we followed this up with a question about a medical exam as a requirement for hiring (Kouabenan, 1990). In addition to people's representations, this type of "mistake" can be partially accounted for by the ready availability of cheap labour in such settings. It is an established fact that the way risk is perceived and handled depends, among other things, on the perceptions of the target of the risk (oneself, others, society in general). Depending on whether risk affects a particular group or the general community, one can observe a variety of totally different attitudes. Such attitudes could raise moral and value issues with a tendency to be more attentive to risks affecting the self or members of the in-group and to be less attentive to risks affecting others or members of the out-group. Indeed the way managers or employers (most of whom are expatriate or western) value the life or the health of the employees of less-developed countries constitute a very important issue which could help understanding poor working conditions the latter are exposed to.

Of course, the rather poor safety conditions in companies located in developing countries cannot be explained solely in terms of representations and beliefs held by employers and managers. Other factors to consider are the local cultural context in which the transfer of technology occurred, as well as the cultural setting and the representations and beliefs of workers. In many cases, the transfer of production methods is poorly planned (Wisner, 1985). Machines and tools are generally developed with a logic native to the exporting country, without taking into account the cognitive functioning and work habits of those who will use the machinery, and without instigating effective training programs for workers who are accustomed to other production modes. This may result in real problems adapting to imported methods. Likewise, poverty and high unemployment rates cause workers to lower their

risk acceptability level and sometimes agree to work with poorly-maintained or maladapted, even inappropriate, tools. In about 29% of our observations, workers had to "make do" and found it difficult to perform their jobs (Kouabenan, 1985b).

Furthermore, unawareness of risk leads to negligence or to the adoption of risky behavior, such as workers standing on automated trolleys or hoppers or on other moving machinery. In 18% of the cases, we observed dangerous or acrobatic postures, whether due to necessity, convenience, or simply carelessness or ignorance (Kouabenan, 1990). We saw workers calmly seated on strongly vibrating vehicles or machinery (in quarries for example), or making desperate efforts to do a job that could be accomplished much more easily. This type of behavior is similar to cases described in the literature on accidents with robotic systems, where operators have been known to voluntarily debilitate or subvert safety systems that have been put in place (Hamilton and Hancock, 1986; Sanderson et al., 1986).

This kind of behavior can be explained by the confidence people may have in the highly complex and quite impressive technologies used in modern production, and by their perceived adaptability and capability to cope. Their representations of how these highly sophisticated installations actually function remain vague, and they are likely to see them as reliable or even infallible. Sheehy and Chapman (1988) described this phenomenon very well when they suggested that the low level of interest given to accidents on automated systems in the safety research is the result of beliefs that such machines "cannot" cause accidents, other than those due to flagrant negligence. On the operators' parts, "blind" confidence in the reliability of production systems – and associated risk-taking – may be linked to education and training, as well as to experience and confidence in one's own skills. Sanderson et al. (1986) reported the case of a fatal accident that happened to an operator described as skilled, well-trained, and experienced who, for unknown reasons, jumped over the safety barriers and was crushed.

In summary, employers' representations of their workers' safety and well-being both in developing and industrialized countries are important indicators of their investment in and commitment to safety. Very often, they believe that safety measures are expensive and time-consuming, that workers do not use available safety equipment anyway, or that they already know very well that they should be careful. We can hypothesize that such perceptions will be accentuated if labor is abundant, cheap, and what's more, not very qualified. For operators too, not only their beliefs and representations, but also their low levels of training, can cause blind confidence in the machinery's reliability, sole reliance on their own experience and competence, and at times an almost fatalistic attitude toward risks and accidents. Culture seems to be a determining factor in forming such beliefs.

3. Beliefs and explanations of accidents

Within both industrialized and developing countries, explanations of accidents are a fundamental and prerequisite element for instituting preventive actions. Accident explanations are generally drawn up by experts, who then go on to design preventive procedures. However, the procedures they devise are implemented by operators, who are rarely consulted during the causal analysis and development of preventive measures. We showed (Kouabenan, 1999) that not only do operators have certain ideas about the causes of accidents that happen in their workplace, but also that the explanations they spontaneously give of accidents are relevant for understanding both the accidents themselves and operators' attitudes and behaviors regarding safety. We call such explanations "naive" because they do not rest on any rigorous investigation methodology, but rather come from people's representations and beliefs about risky situations and self-assessments of their ability to face them. Such explanations answer to a need for safety and control. Explaining unusual, rare, or negative events is a daily activity for all actors living in a society. Explanations are what allow individuals to organize and structure their environment, in effect, to master and control it.

Studies have shown, firstly, that explanations of accidents offered by experts differ from those offered by nonspecialists, and secondly, that experts, like laypeople or nonspecialists, are subject to bias in judging risks and explaining accidents (Fiorino, 1989; Flynn et al., 1993; Slovic et al., 1981). On one side, we have "a technical model that emphasizes values of rationality, efficiency and expertise" (dominant in expert thinking), and on the other side, we have "a democratic model that stresses subjective, experiential, and sociocultural values" (Fiorino, 1989, p. 293). Slovic et al. (1981) mentioned that experts and laypeople are biased in their risk judgments.

Moreover, experts do not always agree with each other. Biases held by experts derive not only from their personal experience and training, but also from the ambiguity of the situations analyzed and from the stakes involved in the analysis, such as who might be held responsible. Choices made regarding what situations to analyze, as well as choices regarding subjects, variables, and hypotheses, are all potential sources of bias traceable to the expert's subjectivity, regardless of the method used. Situational ambiguity and the multiplicity of causal explanations available to the expert force him/her to make choices and therefore to run the risk of attributional bias.

Accident explanations can also be biased by a variety of variables related to the victims (beliefs, hierarchical position, severity of injuries or damages suffered, etc.), the characteristics of the accident (seriousness, social and physical environment), the characteristics of the person doing the explaining (beliefs, hierarchical position, situation involvement, etc.), the explainer's relationship with the victim (fellow worker, subordinate or superior, com-

petitor, relational climate, etc.), the organization's social climate and economic context, addressee of the accident report (prevention bureau, factory inspectorate, insurance company, etc.) (see Kouabenan, 1999). These biases stem from various processes, be they motivational (concern for self-protection, defence of self-esteem, need to present oneself positively, need to believe in a just world), cognitive (partial or selective processing of information about the accident, tendency to confirm one's hypotheses or causal beliefs), or normative (need to conform to norms and social expectations, influence of socialization, etc.). For example, we observed that individuals who occupy high-level positions in the organizational hierarchy explain an accident differently from those at lower levels. Those in the first group tend to attribute accidents to factors that involve the causal responsibility of the second group (inattention, non-adherence to safety procedures, lack of experience, etc.), whereas employees with positions in the lower ranks tend to attribute accidents to organizational factors (time pressure, lack of materials or poor condition of supplies and equipment, lack of protective gear, etc.), management (lack of training programs and insensitivity to safety problems, focus on productivity, etc.), or bad luck (see Kouabenan et al., 2001; Kouabenan, 1999). Likewise, victims and witnesses explain accidents differently: victims attribute them more often to external factors beyond their control or causal role, and witnesses more often mention factors related to the victim's causal role (Kouabenan, 1985a). "Unbeknown to them, prior ideas and attitudes, even the observer's or the accident analyst's sociocultural models of the causes of accidents in general, and of this accident in particular, will influence which facts they will retain and emphasize, and which they will immediately consider unimportant and may overlook..." (Goguelin, 1996, p. 84). (On those points see also our various articles (particularly, Kouabenan, 1999, 2000a, 2000b; Kouabenan et al., 2001).

As a general rule, explanations of accidents are very often defensive or illusory, to the extent that they concern external factors over which the persons involved have no control (factors such as other people, bad luck, working conditions, etc.). This is especially true when the person who explains the accident is implicated in some manner. On the other hand, when the person explaining the accident is not directly concerned or is emotionally detached from the protagonists, the explanations given are internal, that is, they place the causal responsibility on the accident victims or protagonists (Wang and McKilip, 1978; Kouabenan, 1985a, 1999; Kouabenan et al., 2001). The seriousness of an accident seems to be a factor that accentuates defensive biases, especially when the accident situation is one in which the explaining person might be involved (situational relevance). The social, moral, economic, and legal implications of the consequences of an accident, and of the way it is explained, most definitely play a role here.

4. Perception of risks and illusory beliefs

Today more than ever, all organizations – especially those in industrialized societies – are greatly concerned with identifying, evaluating, and managing occupational hazards and health and environmental risks. Various beliefs influence people's perceptions of risks and these perceptions affect their behavior with respect to safety. Indeed, risks are generally perceived more or less directly in relation to whether they are judged as tolerable or intolerable, manageable or unmanageable, beneficial or harmful. Safety is seen as the level of risk judged acceptable. Studies on this subject have shown that risk perception is a complex phenomenon that can be determined by social, psychological, physical, political, and/or cultural factors (Dake, 1991, 1992; Pidgeon, 1991; Vaughan, 1993; Slovic, 1994). It is contingent upon a great number of factors linked either to the risk itself, to characteristics of the perceiver and his/her personal history, to the culture and values of the society or organization (additional details on this last point will be provided later), etc. On the first point, we find that subjective evaluations of risk can be influenced by beliefs about the risk, such as its familiarity, its probability of occurring, its controllability, its perceived utility, its catastrophic potential (number and kinds of people affected), the nature and severity of its consequences (immediate or delayed effects), whether or not it is reported in the media, and whether it is voluntary or imposed, natural or technological. On the second point, we find that risk perception is affected by beliefs about individual or social psychological variables (age, sex, experience, personality, motivation, culture, values, extent of situation involvement, etc.), cognitive variables (information processing capacity, knowledge, amount of information available, and expertise), perceptions of the risk's target (oneself, other people, and society in general), and evaluations of personal exposure and ability to cope with risk (perception of one's skills, vulnerability, precautions taken, control efforts, etc.). Finally, risk perception is influenced by cultural, political, or strategic variables unique to the organization (corporate mission, organizational culture, safety policy, management attitudes, social norms, group pressures, etc.) (see Kouabenan and Cadet, 2005; Kouabenan et al., 2006, 2007).

These different beliefs lead to divergent and biased risk perceptions. Among the biases described most often in the literature, one can cite: unrealistically positive self-evaluations (tendency to see oneself as better than average, and better than how others perceive one to be), the illusion of control (exaggerated belief in one's control over or mastery of events), unrealistic optimism (tendency to perceive positive events as more likely to happen than they are in reality, and inversely, to see negative events as less likely to happen than they are in reality), and the illusion of invulnerability (tendency to perceive harmful consequences of negative events as unlikely to happen). Certain authors (Taylor and Brown, 1994) speak of positive illusions, no doubt because these biases generally reflect a positive self-image.

But most importantly, such illusory beliefs can occasionally if not frequently lead to substantial differences among experts and laypeople, decision-makers and the general public, or managers and subordinates, in how risks are perceived and what strategies are used to manage them. These differences may be why we find different attitudes toward risk. They may also affect the perceived credibility of preventive measures, in general conceived by experts, top management, or governmental officials, yet primarily dependent for implementation on individuals who are not specialists but are directly affected by risks.

5. Culture, an important factor in risk perception and in explanation of accidents

We will adopt a broad definition of culture here. Culture refers to a system of beliefs, values, representations, and shared experiences among the members of a given social group. Thus defined, it consists of views of the world shared by more or less overlapping groups of varying sizes. We can distinguish societal culture (national or ethnic), which is the culture of a nation; corporatist or professional culture, which characterizes a group of trades or occupations; organizational culture, which defines the view unique to a particular organization; and class culture, which reflects the thinking of people belonging to a given social class, defined in most cases by socioeconomic standing. On a scale of nations or continents, one can also speak of regional cultures.

5.1. Culture as a source of bias

As we have seen, cultural beliefs are central to risk evaluation and interpretation. Risks are very often the result of a social construction and thus depend on the society's experiences and history, its needs and level of development, changing ways of thinking, the evolution of knowledge, technological progress, etc. From one society, one people, or one generation to another, there may exist totally different conceptions of risk. Aside from the objective risk inherent in a given situation or technology, there is also subjective risk, meaning risk that one is ready to accept or assume (Kouabenan, 2001). Not all risks are perceived or feared in the same way, either within a community or from one community to the next. Certain activities (fire fighting, first aid, and extreme sports) have risks as their very *raison d'être*; certain societies or organizations encourage risk-taking ("He who risks nothing gains nothing") while others discourage it, etc. Weber et al. (1998) observed, for example, that Chinese and German proverbs seemed to exhort people to risk-taking more often than American proverbs. In developing African countries, not only poverty but also certain traditions and customs lead people to brave and endure suffering, viewed as unavoidable for survival. This is the implicit meaning of certain ethnic groups' initiation rites, which seek to "harden" adolescents and prepare them to face life's trials with determi-

nation. One can therefore expect to find different perceptions of risk between people with such diverse experiences of risk and the others.

No matter what scope we give to the definition, culture appears as one of the major sources of bias in judgements and explanations of accidents. Clearly, it is by way of interactions and shared experiences that individual members of the same group or community gradually elaborate a common culture of risk. According to Pidgeon (1991), the culture of any given group represents a natural, evident and incontestable way of acting. As such, it serves to elaborate a particular version of risk, danger, and safety. It is through culture that people build and internalize a system of beliefs that is inseparable from their vision of the world and that influences their interpretation of natural phenomena (Dake, 1992). Culture defines acceptable and intolerable risks for a given group at a given time.

This view of risk is based on explanatory schemas capable of accounting for accidents and explaining how and why they happen. Among these schemas are ways and customs, beliefs, and religious or animistic practices passed on from generation to generation. However, the deep-rootedness and persistence of certain beliefs can lead to systematic judgement errors that may cause any new contradictory information to be overshadowed (see Kruglanski and Ajzen, 1983; Tversky and Kahneman, 1974). Such biases influence risk perception on both the individual and collective levels. Certain beliefs tend to banalize risk, whereas others tend to exaggerate it. Some beliefs lead people to acknowledge the unavoidability of risk; others, on the contrary, cause them to take risks or to think that certain more or less ritual practices can ward off fate or help one face dangerous situations (Kouabenan, 1998).

5.2. Societal cultures and judgements of risks and accident causality

Studies have shown that people of different countries have different perceptions and attitudes toward risk which reflect to varying extents the ways of thinking and lifestyles unique to their cultural environment. Vaughan and Nordenstam (1991) formulated three hypotheses to explain this: differences in exposure to and past experience with risks, general beliefs with regard to risk, and uncertainty. The common history of peoples faced with calamities, natural disasters or other life challenges can aid in forging among them a "collective ideology" or "common culture" of risk. Such groups may have a tendency to integrate "disaster" into their lifestyle and view of life. We can expect workers coming from countries that endure extreme hardships to tend to underestimate risks and engage in more dangerous behavior.

While cultural categorizations can be touchy, one of the distinctions mentioned the most in explanations of events is the contrast between collectivist cultures (Asia, Africa, Latin America) and individualist cultures (North America, Western Europe) (Hofstede, 1980). An individualist culture

revolves around the individual and looks upon social behavior as the expression of internal, stable, and global dispositions. A collectivist culture centers on the situation and believes that behavior is shaped by relationships, roles, and environmental pressures. These viewpoints appear to be capable of influencing the attitudes and behaviors of workers in organizations. Morris and Peng (1994) showed that the Chinese (collectivists) are less subject to the "fundamental attribution error"[1] than are Americans (individualists), but only for explanations of social events, not physical events. This was confirmed by Hewstone (1994), who observed that adults who came from non-occidental cultures generally accorded less importance to dispositional explanations than did adults from American or European cultures.

5.3. Organizational values and practices and risk perception

Perception of risks and safety procedures can vary greatly according to company cultures and even according to subcultures of different occupations within an organization. Members of certain corporations generally highly exposed to risk have a tendency to minimize it, while others overestimate it. In discussing chemical workers, Duclos (1987) wrote, "Workers in the chemical industry seem to be those who at the same time have some of the best knowledge of risks (...) and whose talk denies the danger of their activity the most." (p. 247). Acts of bravery and risk defiance are also found in certain occupational sectors such as construction and public works or the iron and steel industry (mines), which involve not only major, but particularly catastrophic, risks (Kouabenan, 1990; Duclos, 1987; Dupont et al., 1993). In these trades, risk-taking seems to be part of the job. Furthermore, workers' perception of risks and relationship to risk can vary quite notably according to the organization's safety culture. The "safety culture" appears to be a heuristic for conceptualizing the way in which risk is treated and managed in an organization. It is the "set of beliefs, norms, attitudes, roles, and social practices and techniques intended to minimize the exposure of workers, managers, customers, and the public to situations considered dangerous or harmful" (Pidgeon, 1991, p. 134). According to Pidgeon (1991), a "good" safety culture rests on three basic elements: norms and rules for managing risks, attitudes toward safety, and reflexivity regarding safety-related practices. Norms and rules, whether implicit or explicit, tend to be based on perceptions and actions of individuals in the organization, defining what ought or ought not to be considered a major risk and what the appropriate behavior is. Attitudes about safety stem from the entire set of individual and collective beliefs regarding risk and the importance of safety, as well as from motivation to act upon those beliefs. Reflexivity regarding common practices and beliefs can be described

as a learning process, and as such, it involves a search for new meanings in the face of the uncertainty and ambiguity that surround risk. "Employees in a safety culture are more than just a group of individuals enacting a set of safety guidelines. They are guided in their behaviour by an organization-wide commitment to safety which is premised on trust and the shared understanding that every member upholds safety norms and supports other members to that end" (Helmreich and Merritt, 2001, pp. 175–176).

5.4. Fatalistic beliefs and perceptions of event causality

In an era characterized by rising rationalism, one is tempted to say that fatalistic beliefs are something from the past or from less-developed countries. However, some authors (Morris and Peng, 1994; Hewstone, 1993, 1994) noted that the practice of ascribing events to unseen causes is found, in various forms, in traditional African societies as well as in modern Western cultures. They reported that in both occidental and non-occidental societies, negative events and catastrophes – even natural disasters – were explained away by witchcraft, conspiracy, or persecution, or are blamed on a scapegoat. Whether or not fatalism is invoked to explain accidents can depend on educational level, but even more on how a person relates to accidents. Frequent and repeated exposure to catastrophes and social distress can reinforce such beliefs. Our studies (Kouabenan, 1998, 1999) showed that such beliefs are very often found among subordinates or less-educated persons, but also among persons involved in accidents or negative events. According to Shaffer (1984), fatalists favor personal over impersonal causality in their explanations, and believe that, regardless of the actions one might take, events are inevitable. For fatalists, the fact that there might be survivors of a serious accident or catastrophe lends credence to the idea of personal causality. The causal attributions made by fatalists reflect their lack of control over risks (Kouabenan, 1998).

These fatalistic or superstitious explanations fulfil an important social function – that of restoring the social order and regaining control. Hewstone (1994) asserted that magical or superstitious beliefs regarding causality, whether in the Third World today or the West in past eras, largely stem from a need to not submit passively to natural and social disasters. By favoring personal over situational attributions, such explanations – despite their mysterious nature – mainly seek control. The fatalist imagines that the situation can be controlled once the guilty person has been discovered. Such a belief sometimes engenders recourse to mystical-type practices to unmask the guilty or to deter fate (some examples are prayers, consultations with seers or marabouts, various sacrifices, protective medals such as a St. Christopher medal in the West). Beliefs and practices like these, which vary in intensity across cultures and eras, can unfortunately have a negative impact on safety-conscious behaviors in organizations.

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[1] Tendency to favour dispositional explanations over situational explanations.

6. Beliefs, safety diagnosis, and preventive measures

The importance of beliefs in safety matters has been emphasized by many researchers who assert that representations and causal inferences influence behavior. In this vein, Heider (1958) remarked that "if a person believes that the lines of his palm foretell his future, this belief must be taken into account in explaining certain of his expectations and actions" (p. 5). For their part, Slovic et al. (1981) consider that "subjective judgements, whether by experts or laymen, are a major component in any risk assessment. If such judgements are faulty, risk management efforts are likely to be misdirected" (p. 17). It has even been contended that in reality, preventive actions are based more on casual inferences than on the real causes of accidents (Dejoy, 1994).

6.1. "Defensive" beliefs and prevention

Beliefs underlying defensive explanations have a definite impact on safety-related attitudes (see Kouabenan, 1999, 2000b, 2003). Such beliefs determine the individual's relationship to risk, decisions about whether or not to comply with protective measures, as well as involvement and commitment to safety-oriented actions. They can also cause conflicts among the concerned actors about the actual causes of accidents and the most appropriate preventive measures. Such conflicts lead to a "pass-the-buck" mentality where no one feels responsible for safety. The stakes involved in accident analysis (particularly in terms of cost or responsibility, etc.) are such that people often tend to confuse a search for causes with a search for the guilty. This contributes to the exacerbation of biases and a temptation to conceal things or minimize the role of factors perceived as incriminating, along with the reverse temptation to stress external factors that may play a role in causing an accident but are not necessarily critical. All this serves to diminish the quality and reliability of causal diagnoses and of safety expertise, and means that the objectivity and neutrality of eyewitness accounts made by people involved in an accident should be assessed in the light of who is speaking and in what context. The existence of these biases makes it all the more important to be careful when collecting data on accidents, and to take into account both the source and the destination of the available data about the accident. It can be helpful to gather data from several witnesses and to cross-check data sources. Likewise, when utilizing the available data, one should keep in mind that their origin and destination (Commission on Health, Safety, and Working Conditions, an insurance company, social security, work inspectorate, etc.) can greatly influence data quality and reliability.

In addition, defensive explanations may lead one to look upon safety campaigns as mostly aimed at others and not oneself, and to see accident prevention as somebody else's job. For this reason, defensive or fatalistic explanations can lead to the playing down of one's personal role and thus to inaction, copping-out, negligence, or careless risk-taking. In this way, biased explanations can represent an obstacle to prevention. Conversely, "correct" inferences can translate into relatively well-adjusted behavior and a greater commitment to preventive actions. It would therefore be worthwhile in safety training programs to provide the various actors in a work situation with an awareness of the existence and nature of the biases found in accident explanations, to offer a means of overcoming them, and to enhance their feeling of personal control by promoting explanations that take the entire accident situation into account.

Furthermore, involving ordinary workers in accident analysis not only increases their knowledge of accident causality, but also improves their understanding of safety measures and promotes greater adherence to those measures. In fact, operators exhibit better adherence to safety measures when they see them as effective and relevant, and they will be more likely to do so if they coincide with their own causal analyses of accidents. Thus they will be motivated to implement them.

Finally, taking naive explanations into account can help improve the information and communication network affecting accident analysis and prevention. When descriptions of different perceptions of accident causality are made known, the various members of the organization are informed of what they can expect from others and what others can expect of them. Knowledge of biases helps to resolve ambiguities, increases the credibility and representativeness of information, dissipates fears, and appeases conflicts. Conducting accident analysis in a dispassionate climate, with the collaboration of everyone involved – including managers – creates a better understanding of occupational risks and fosters greater trust. We showed in a previous study that having operators participate in safety planning contributes positively to the development of ergonomic improvements that are not only more suitable but also better accepted (for a pharmaceutical industry example, see Kouabenan, 1999).

6.2. Illusory beliefs and prevention

Representations and their underlying beliefs can clarify the causality of certain accidents, in that they help us understand the behavioral choices of individuals confronted with risks. "Contrasting sets of beliefs about what is perceived to be safe and efficient generate subtle but conspicuous differences in how the business of safe and efficient transportation of humans and merchandise is conducted in different contexts" (Maurino, 2001). Indeed, biases and illusions in people's perceptions provide insight into the causes of non-adherence to some safety procedures, neglect of certain precautions or involvement in risky behaviors, and indifference to prevention campaigns, in sum, why certain safety awareness and accident prevention programs fail. However, opinions on how such beliefs

affect safety-related behavior vary widely across researchers.

Some authors assert that such illusory beliefs can have beneficial effects (Taylor and Brown, 1994; Weinstein, 1987). For example, it has been hypothesized that "unrealistic" optimism can be positive because it aids workers in developing and maintaining a sense of control and mastery over events and safety. It enhances motivation and perseverance in the face of threats, and at the very least, helps maintain hope that expected results will be obtained. It reinforces belief in the effectiveness of preventive measures, as well as a belief in one's own capacity to implement those measures (self-efficacy). Pessimism, on the contrary, is thought to involve an absence of control, a feeling of helplessness and thus passivity.

Other authors (Colvin et al., 1995; Perloff, 1983; McKenna, 1993) take the opposite view – that illusory beliefs have negative effects on safety-conscious behavior and can account for some accidents or risk-taking. In one study (Kouabenan, 1998), we showed that fatalistic beliefs and the mystical practices that sometimes accompany them influence risk perception and cause workers to take risks or neglect safety procedures. By giving the illusion of protection, magical or mystical practices (protective medals, objects like rabbit's tails and luck charms, prayer, sacrifice, etc.) can lead to passiveness and neglect of protective measures. Likewise, unrealistic optimism often engenders a feeling of being invulnerable. This can cause the person to take risks due to a false idea that he/she will be able to control the situation. Furthermore, persons who are overconfident about their own abilities and personal qualities typically do not pay much attention to safety procedures, which they feel are mainly directed at other less careful or less skilful individuals than themselves. From this perspective, optimistic beliefs can create indifference to safety procedures as well as greater exposure to accidents. In a study conducted following the nuclear accident at Chernobyl in the Ukraine (about a week later), Dolinski et al. (1987) found that Polish people who saw themselves as relatively invulnerable to radioactivity sickness were less likely to take precautions than those who felt they were no more exposed than others. By contrast, pessimistic individuals for the most part took more self-protective precautions than realistic and optimistic individuals, and showed more motivation to seek information on the dangers of exposure to radiation. It is one thing to believe oneself more in control than others, and another to effectively exercise that control. When people perceive themselves as vulnerable, they are motivated to search for ways to protect themselves (see Kouabenan, 1999, pp. 223–224).

Studies on the process leading to the adoption of safety-conscious behavior have been based mainly on the idea that individuals' attitudes and beliefs can be major determinants of their behavior (Kouabenan, 1999, 2000a,b). These studies suggest that the less biased or erroneous the perception of risks, the more the individual will adopt safe behavior. For example, according to Janz' and Becker's *'Health Belief*

Model' (1984), a person will be more apt to be cautious when perceiving risk as serious, him/herself as vulnerable, and the perceived cost-benefit trade-off of safety-conscious behavior as low." These models can be applied to the prevention of all types of risks (see Kouabenan, 2003).

7. Conclusion

The research reviewed in this paper has undeniably practical implications for risk management and accident prevention in a context of globalization. Such a context is characterized by the development of the organisations, mergers and buying out, relocations of companies, exportation of production systems and machine-tools, but also characterized by a great mobility of workers, managers as well as employees. That means that nowadays we face large and large organisations in which people from different cultural backgrounds work together with tools or machines designed with different "philosophies" or cultural standards. As a consequence, norms and values are "travelling" as well as factories and technologies. All this make it essential to take into account beliefs in the management of organizations in general and especially, when transferring hazardous technology and managing risks.

As we have seen, individuals' beliefs and representations regarding risks, and also regarding the target of the risk, affect their attitudes on safety issues at various levels. These perceptions determine the amount of risk individuals are ready to assume, as well as their attitudes on safety and risk prevention. Beliefs regarding the target of a risk, his/her need for safety, and his/her value (whether or not the target person can be replaced), as well as the perceived utility of taking risks, must also be considered when motivations behind safety-related behaviors are being evaluated. With regard to globalization and accident prevention policy, this implies that managers and employers must be attentive and value in the same way the need for safety of all their workers, regardless of their national or socioeconomic origin and of their hierarchical position in the organisation. Conversely, employees must be informed of the risks they are exposed to (personal vulnerability) and trained to avoid them. Mostly, they should learn to give up held and false beliefs by giving them the right information about their actual exposition and the limits of their beliefs.

We also placed considerable importance on cultural beliefs, which derive from and are reinforced by the social group's norms and values, or are rooted in shared group experiences in coping with risks. Whether found on a national scale or at a trade or occupational level, these beliefs greatly influence safety-related attitudes and protective behaviors. For the social group, they define the level of risk considered acceptable and tolerable and they determine group attitudes toward catastrophes, but they also generate biases in judgements of risk. Regarding accident prevention in a context of globalization, such results help understanding the diversity of attitudes and behaviours people from different social backgrounds could exhibit in

a work setting. Such knowledge is helpful for an effective occupational socialization. It also appeals for adapting preventive messages to the way of thinking of people and to prefer preventive actions tailored to a target group or organisation than more general preventive actions.

Furthermore, we showed that, depending on the situation, beliefs can act either as factors that contribute to safety, or factors that jeopardize it. Beliefs about control are at the heart of the analysis. Defensive explanations resulting from such beliefs lead to conflicts during accident analyses, which are too often based on a search for responsibility and not often enough on a search for causes – a fact which can diminish the effectiveness of potential preventive measures. In this respect, one way to achieve a somewhat more objective and less defensive analysis of an accident is to implement a team work, that is, to involve in the analysis people from different backgrounds (persons from different hierarchical levels, different occupations, different national origins, different sex, age, different experience, different factories, etc.). Finally, we think that by gaining insight into such beliefs and taking them into account, we can enrich risk accident analysis and design preventive measures that are more suitable, in addition to being followed more closely because they are understood by those who must implement them.

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