Why Communication And Interpretation Matters For Safety

Thomas Wold

Nord University, Stjørdal, Norway

Abstract

In high-risk industries, much effort has been made to streamline human action by organizing procedures and checklists in IT-based Safety Management Systems. The tendency has been to regard these systems and the governing documentation as tools. From a tool perspective, is simply a matter of directing the workers to use the tools correctly. The tool perspective underestimates the ambiguities in such systems and does not pay adequate attention to the cognitive processes.

This paper argues that we should regard Safety Management Systems as communication systems. They are designed at an executive level in the organization and communicated to the lower levels in the hierarchy. There is no guarantee that the employees will perceive, understand, and interpret the information as intended. This process is what communication theory with a focus on the individual's interpretation of mediated messages might shed light on and may serve to broaden the perspective on safety.

Keywords: safety, high-risk industries, safety management systems, communication

1. Introduction

In high-risk industries, much effort has been made to streamline human action and decrease risk through governing documentation, like procedures, checklists, rules, and work descriptions. These are often organized in an IT-based Safety Management System, which can contain huge amounts of information. This information is received and, hopefully, understood, by the workers. But is this always the case?

Governing documentation is not always used by the workers as it was intended. There are different reasons for this, but it partly has to do with how the executives and the workers perceive and understand the governing documentation and the Safety Management System in different ways (Dahl, 2013; McDonald et al., 2000; Reiman, 2011; Wold & Laumann, 2015). The tendency has been to regard Safety Management Systems and the governing documentation as tools. From a tool perspective, is simply a matter of directing the workers into using the tools correctly − do this, and accidents won't happen. The tool perspective underestimates the ambiguities in such systems and does not pay adequate attention to the cognitive processes in the individual, which are elements that come into the light from a communication perspective.

This paper argues that we should regard Safety Management Systems as communication systems. The communication perspective has been underdeveloped in the high-risk industries and the safety research and literature. Safety Management Systems and procedures are designed at an executive level in the organization and communicated to the lower levels in the hierarchy. There is no guarantee that the employees will perceive, understand, and interpret the information as intended. What can the management do to ensure that the communicated messages in a Safety Management System are interpreted and understood as intended by the workers? This process is what communication theory might shed light on and may serve to broaden the perspective on safety in this conceptual paper. The paper will focus on the individual's reception and interpretation of mediated messages, using perspectives from reception studies, cognition, and Human Factors.

1.1. What is Safety and Safety Management?

Safety is often understood as a condition where nothing goes wrong (Hollnagel, 2014) or as freedom from danger, risk, injury, or loss (Aven, 2014). Safety science has for the most part been concerned with accidents and mishaps and the events that lead to them (Hollnagel, 2014; Haavik, 2014). Accidents are events involving an unplanned and unacceptable loss, and safety is usually seen as the absence of accidents (Aven, 2014). To focus on accidents makes practical sense but leaves nothing to be measured when safety is present, only when safety is absent (Hollnagel, 2014).

Alternatively, you can see safety as a dynamic non-event: the non-occurrence of accidents, mishaps, and near misses (Hollnagel, 2014). It is difficult to study a non-event, but you can give more attention to why and how things go right. This includes a focus on everyday activities, not just accidents and mishaps. Several approaches to safety involve cultural and technological factors in a dynamic interaction (Antonsen, 2009; Antonsen et al., 2008; Bjerkan, 2010; Fernández-Muñiz et al., 2007). These approaches also involve communicational aspects, but not always explicitly stated. Explicitly focusing on the communicational aspects of safety opens wider perspectives on how safety management can ensure that more things go right.

Safety management relates to the actual practices, roles, and functions associated with remaining safe (Kirwan, 1998). It concerns 'the policies, strategies, procedures, and activities implemented or followed by the management of an organization that concerns the safety of their employees' (Vinodkumar & Bhasi, 2011, p. 2083). A central aspect here is the various management systems, which in this text will be referred to as Safety Management Systems.

Safety Management Systems have been given various names and definitions in the safety literature. They have been called information systems, knowledge systems, management systems, and so on. There are some common features in the various definitions: They are computer or IT-based superstructures, or umbrellas, containing procedures, descriptions, and checklists on how different tasks should be performed, and what kind of safety standards different tasks require. The procedures are disseminated throughout the organization via an internal computer network. The purpose is to code and share best practices and create corporate knowledge directories to avoid incidents and accidents that might harm the worker's health, the environment, and the company's economy, and to meet the regulatory requirements (Antonsen et al., 2008; Bottani et al., 2009; Chen & Chen, 2012).

1.2. Three Phases of Safety Research

Safety research can be divided into three overlapping phases (Hale & Hovden, 1998). In the first phase, there was a technological focus, where developing safer machines and equipment were the focus areas to increase safety. This phase lasted from the 1800s to the mid-1900s (ibid). In the second phase, there was a focus on developing the skills and motivation of the workers, to improve work at the individual level. In the third phase, from around 1980, there was an increased focus on the organizational conditions for safety, for instance, the role of management systems. The safety management thinking here is largely based on the assumption that accidents are mainly caused by human error (Haukelid, 1999). According to this reasoning, safety is increased by a management strategy that specifies objectives, distributes responsibility, and organizes and controls actions according to safety precautions. In this perspective, there is no big difference between safety and other aspects of the organization. Safety can consequently be managed through the same principles as any other organizational function (ibid). Hence, a management system with governing documentation, procedures, rules, and so on can serve to ensure that all work is done according to safety precautions.

These three phases are overlapping. One has not stopped looking for ways to improve the technology, but the focus has been developed to include other parts of the organization. Several researchers have also developed the organizational perspective to include cultural aspects, and this is linked to communication. How we communicate about safety can affect how people understand and participate in the safety process (Vecchio-Sadus, 2007). Training people to work safely is necessary, but not sufficient. We also need to communicate about safety in a way that the staff understands and accepts.

In both the organizational literature and the safety literature the matter of interpretation has often been neglected. Though several authors stress the human component, it is usually from the perspective of how to get the human workers to use the technology in a better way. Interpretation of technology is usually not discussed, and although most authors define the management system as "IT-based", they don`t discuss it as a mediated message that comes to life in the interface between humans and technology.

Any Safety Management System, no matter how it is constructed, is communication. It can be convenient to pretend that this is a linear, one-way communication process, but it's not, because the user interprets the information in the Safety Management System and turns it into knowledge, adding his or her prior knowledge and experience.

1.3. A Cultural Perspective

A cultural approach to safety can be regarded as an extension of the third phase of safety research, as it focuses on the organizational conditions for safety. Traditional safety management has been predominantly oriented towards the formal aspects of the organization, while the cultural approach also focuses on the informal aspects. It is not easy to find a short definition of culture, but it is common to see culture as a set of shared understandings and institutions, material artifacts, value systems, beliefs, world view, and as ways of talking about things (Antonsen, 2009; Guldenmund, 2010). Many traditional definitions of culture focus on traditions handed down through generations, but culture might as well include newer forms of shared understandings (Becker, 1998).

Organizational culture is a complex phenomenon of social groupings with shared beliefs and values (Grytnes et al., 2016). There is a debate about whether culture is something an organization is or has (Sutcliffe, 2011), and it has also been described as the invisible part of an organization and the normative ideas and values that are taken for granted by the members (Bjerkan, 2010). The shared values and forms of expression are just as important to the behavior of the members of an organization as its formal goals, structure, and tasks (Bouwman et al., 2005). In any culture, also a business culture, there will be some values and ideas about the world that are taken for granted and may appear as naturally given and not as cultural constructs (Hall, 2002). But one cannot take for granted that the entire organization shares one cultural understanding. Neither can we take for granted that organizations are fundamentally harmonious and in agreement on how to reach the organization's goals (Rasmussen & Kroon Lundell, 2012). The individuals in an organization are assigned to different roles and positions in a hierarchical structure that roughly consists of a top management, different levels of middle management, and a work floor, with different values, codes, and ways of expressing themselves (Bouwman et al., 2005). The different levels have different authorities and responsibilities, at each level, people are gathered in clusters according to which tasks they perform (Bjerkan, 2010). Norms and values may differ between the levels of the organization and between clusters at the same level. If we analyze an organization as one culture, we may easily overlook that different groups of people in the organization might constitute different subgroups or even subcultures within the organization (Antonsen, 2009; Guldenmund, 2010; Rasmussen & Kroon Lundell, 2012). This can be down to the level of details like they use different types of words, or maybe understand the same words in different ways, but can also relate to substantial background factors, like education, nationality, and so on.

A cultural approach to safety emphasizes a holistic approach, where the informal aspects of the organization are regarded as just as important as the formal aspects. Safety culture is the underlying nature of an organization's approach to safety (Hughes et al., 2015). Safety culture is the beliefs, attitudes, and values of the organization's employees regarding safety focus (Nævestad et al., 2018) and is shaped by people through social relations and organizational structures (Şimşekoğlu & Nordfjærn, 2017).

One of the informal aspects is cultural knowledge, and/or the tacit knowledge. Not everyone shares the same background and experience, and in the same way, not everyone shares the same tacit knowledge. There's an analytical distinction between explicit, cultural, and tacit knowledge in an organization. Explicit knowledge refers for instance to the governing documentation and the organization's defined goals. Cultural knowledge is unwritten but still shared by all or most members of a given culture or organization. Tacit knowledge refers to unwritten knowledge that is shared only by certain members of a group.

Individuals in a large organization will develop different kinds of tacit knowledge, depending on their different tasks and work context experience (Almklov et al., 2014; Sohlberg & Sohlberg, 2009). Getting the job done in a local and situational context fosters a local and situational experience. Over time, this can develop into a feeling of 'the way we do things around here'. Such a development is usually not wanted, as it makes it difficult to account for how work is done and can cause the organization to go into an operational drift. On the other hand, one can say that the worker over-develops a feel for how to make intuitive judgments on how to perform a specific task. This is local and situational knowledge that can be very valuable. If the organization manages to account for this tacit knowledge and bring it forward to other workers who lack the same experience, it can strengthen the organization's performance significantly (Haavik, 2010).

It is, however, possible to establish a corporate culture where there is little or no division between common sense and governing documentation. In a study of aerial maintenance workers, they found that the workers were constantly willing to revise and develop their competence, and they both valued and questioned formal work descriptions and adjusted them to the immediate situation (Reiman, 2010). They valued practical experience and saw that using the governing documentation effectively and adjusting it to the task at hand was part of this experience (Reiman, 2010).

Safety Management System aims to collect, formalize, and disseminate the tacit knowledge and experience in an organization. In this process, feedback from the lower to the upper tiers of the organization is essential, so that procedures can be adjusted according to the experience of the ones who use them (Antonsen et al., 2008; Bourrier,

2005). If successful, the procedures will be based on a combination of standardized theoretical knowledge and practical experience. This is relevant also for small adjustments, such as grammar, abbreviations, and phrases used.

2. Communication and Safety

Regular communication about safety issues between executives, supervisors, and the workforce is an effective management practice to improve safety (Cox & Cheyne, 2000; Mearns et al., 2003; Vredenburgh, 2002). Take for instance natural accident theory (NAT), high-reliability organization (HRO), resilience, Turner's concept of man-made disasters, and drift into failure. These are five well-known approaches to safety and safety management, and they all have communicational aspects embedded in them. Although not always explicitly stated, many of the main characteristics include communication.

All five approaches stress that executives should engage with front-line staff to obtain the bigger picture of operations and update procedures in line with the organizational knowledge base. They also advocate a just culture, where near misses and accidents can be reported without fear of punishment, and stress that all warning signals must be systematically collected and that one should openly communicate the outcome of any mishap or accident investigation (Lekka, 2011). This involves a learning culture where information is communicated and shared effectively across different departments or shifts, and hierarchical levels within the organization (Lekka, 2011; PSA & Norway, 2004). This must involve a healthy dose of two-way communication. A sound communication climate is important for working towards establishing HRO and resilience principles in an organization, and to avoid drifting into failure, and avoiding accidents just happening naturally.

2.1. What is Communication?

Locke argued that we cannot take for granted that people ordinarily understand each other (Locke, 1690/1979). Many communication scholars since Locke have tried to figure out why. The research field of communication is rich with a wide range of ideas that fall within its nominal scope, but there is no canon of general theory to which they all refer. Communication has been described as something impossible to not perform; one cannot communicate (Watzlawick et al., 1967). However, there is no real consensus on how communication should be defined, and the concept is used differently in various disciplines. For example, Anderson (1996) analyzed the contents of seven communication theory textbooks and identified 249 distinct "theories," 195 of which appeared in only one of the seven books.

The incoherence of communication theory as a field can be explained by communication theory's multidisciplinary origins. There are so many theories on communication that communication might be better theorized as a "family" of related concepts rather than a unitary concept. Most of the theories do however address the fundamental problem of communication: that of reproducing at one point either exactly or approximately a message selected at another point.

When a message passes through a medium, whether it is text or images, sounds or video, there is always a fundamental difference between the sender and the receiver; they are divided by time and/or space. The basic difference between the various definitions of communication is where they locate meaning (Krauss & Fussell, 1996). Some definitions of communication are concerned mostly with the intention of the sender. Art students often struggle to figure out "What was the artist thinking when he made this piece of art", while others might question whether the artist was thinking at all. Other definitions place meaning as something inherent in the message, and the medium is just a vessel. This is a tempting perspective for managers in organizations because it implies if they are thorough when constructing the message, everything will be understood as they intended. However, philosopher and media theorist McLuhan (1964) argued that the medium itself is the message. This is relevant for the theories that put emphasis on the receiver of the message, and regard meaning as something that occurs in the meeting between the message and the receiver (Krauss & Fussell, 1996; McQuail, 2010; Morley, 1992). And that's the interesting bit when it comes to the communicational aspects of safety management. In our everyday lives, we are aware that some conversations are not suited to do over the phone; some messages need to be delivered face-to-face. Other messages can be delivered via e-mail. This is because we know that the mode of delivery influences how the message is perceived by the receiver. Likewise, what the worker thinks, knows, and believes about the Safety Management System will influence how he or she receives the messages communicated through this system.

2.2. Communication in Organizations

Communication in large organizations involves a great deal of top-down communication. They have a hierarchical structure, which roughly consists of a top management level, a staff, a middle management level, and a work floor, and messages are being formulated at the upper levels and delivered to the lower levels.

It can be tempting for any organization to imagine a linear communication model, where every message is simply transferred from one level to another and understood as intended. This linear transfer model does not match real life, because everyone will interpret the communication and accept, negotiate, or reject it (Hall, 2002; McQuail, 2010; Morley, 1992). Sometimes the staff members will interpret the message as the management intended, and sometimes not.

There are various reasons why employees might interpret the message in a different way than the management expected. Different levels in the organization might have different social and educational backgrounds and tend to use different words and grammar. It is also relevant to which extent the staff see the information as important and relevant. We tend to think "Does it matter for ME right NOW" and may ignore information that does not seem immediately relevant.

These are only a few of the common context factors one should be aware of when it comes to communication in an industrial organization, where information travels between different levels in a hierarchy, and between people with different educational, professional, and cultural backgrounds, and have very different work contexts, for instance in a geographically dispersed organization.

When the worker uses the Safety Management System, he or she interprets the message according to his or her prior knowledge and experience. This is a cognitive process, and we must be aware of the cognitive characteristics of humans and how people interact with technology. Reception studies offer some interesting perspectives when analyzing this communication and interpretation process.

2.3. Reception Theory and Semiotics

Reception theory is a media and communication theory that emphasizes that the meaning of a mediated message is never entirely inherent in the message itself, nor in the sender or the receiver, but comes to life in the interface between humans and technology (Morley, 1992). The main concern is what types of meaning and understanding people extract from a mediated message, and why exactly these meanings and understanding are extracted instead of others (Corner, 1991).

A central assumption in reception theory is that all information and mediated messages must be interpreted by the receiver for them to make sense, and the receiver will interpret them according to his or her experience, knowledge, and values (McQuail, 2010; Morley, 1992). There is an analytical distinction between three ways of interpretation; preferred reading, negotiated reading, and oppositional reading (Hall, 2002). Preferred interpretation means that the receiver interprets the message pretty much as the sender had intended. Negotiated reading means that the receiver rejects part of the message and accepts other parts of it. Oppositional interpretation means that the receiver rejects all or most of the message (Hall, 2002). This is a theoretical and analytical distinction, and in most cases in real life, most interpretations are likely on a continuum of negotiated interpretation.

In this interpretation process, not only the sender, the receiver, and the message matter, but also the context in which the interpretation takes place: Both the macro-context, like the culture in which it takes place, or the business culture, also the micro-context, like the immediate surroundings, if you're alone or together with someone, mood, type of media and so on (McQuail, 2010; Morley, 1992). We also utilize our prior experiences and knowledge to interpret the new information (Corner, 1991).

Reception theory has a constructivist perspective, meaning that we can only know the world through language and that individuals are not passive receivers of information, but are active participants in the interpretation of new information and creation of knowledge (Schunk, 2014; Vygotsky, 1978). It is also rooted in the semiotics, the study of signs. In the semiotic tradition, communication is typically theorized as the mediation by signs between different persons (or institutions). Problems of communication in the semiotic tradition are primarily problems of representation and transmission of meaning using shared systems of signs. Semiotic theory commonly asserts that media technology is not just a channel for the transmission of meanings but has sign-like properties of their own; the medium itself becomes a part of the message (McLuhan, 1964), so a mediated message can represent a potential for various interpretations.

Two things are particularly important here. Different people may interpret the same piece of information differently, and meaning structures constructed by the receiver are not necessarily the same as the meaning structures intended by the sender (Hall, 2002; Morley, 1992).

The sender of a message will try to anticipate the interpretations of the receivers and will try to guide the interpretation in a desired direction (Schrøder, 2000). A central question is to what extent it is possible to control this interpretation, as the mediated message is always polysemic and must be interpreted to make sense to the receiver (Corner, 1991; Schrøder, 2000). It is debated to which extent this interpretation can be directed by guidelines that the sender has embedded in the message, how much of the interpretations are guided by the structures in the message itself, and how much is guided by the receiver's prior knowledge, experience, and attitudes (Corner, 1991; Schrøder, 2000).

2.4. Reception Theory in Organizations

The theoretical and analytical framework of reception studies might not intuitively seem useful to study communication on safety in industrial organizations, but it deals with the same problem as John Locke addressed; that the production of a message can't give any guarantee that the receiver will interpret it as intended.

Internal communication in an organization is largely based on various media, so there is a distance between sender and receiver in time, place, and position in the organization, and it would therefore be fruitful to use perspectives from reception theory to conceptualize how and why different interpretations and even misunderstandings arise.

When it comes to internal communication in a professional organization, we deal with communication to an intended audience, where there is (or at least should be) no doubt what the preferred meaning of the mediated text is. Even so, the management often experiences that the responses and reactions from the staff indicate unexpected interpretations, or that the communication was ignored (Bouwman et al., 2005). Procedures and other governing documentation in a company are designed and formulated at an executive level, and disseminated to the lower levels, where there is no guarantee that the workers will interpret this information as it was intended.

In our everyday lives, it is quite common for us to send out a message in the belief that it is crystal clear and unambiguous, but then we experience responses that indicate that people perceive the message completely differently than we had intended. This happens in professional organizations as well. Reception theory focuses on how those who receive the media-transmitted information interpret it in the same way or differently from those who produced the information (Hall, 2002; McQuail, 1997; Shore, 1998). In the communication process, there can be different degrees of understanding or misunderstanding. This will, among other things, depend on the relationship between sender and receiver.

This is why reception theory can be useful for analyzing communication in a large organization. The communication between different levels of a professional organization often uses different types of media, so reception theory will be useful in researching how and why different interpretations and even misunderstandings occur (McQuail, 2010; Morley, 1992). Reception studies are concerned with the production of messages and with the interpretation of those messages by different individual receivers, intended or otherwise (Shore, 1998). From a reception theory perspective, one would emphasize how safety management is decided at an executive level in the organization and then communicated to the lower levels in the organization`s hierarchy, where it is interpreted in different ways by different people. This interpretation is not random but happens according to the values, experience, knowledge, and attitudes of the individual. This is relevant in large organizations, where communication often relies on different types of media and often involves people with different backgrounds, experiences, and knowledge. The interpretation is guided by structures of knowledge, or frames of references, where memories about persons and episodes are gathered and organized. Frames of reference are complex cognitive structures that represent the individual's collected social experience and cultural knowledge. They are personal, but very influenced by the culture we live in. They are relatively stable structures, but as they are formed by experience, they can also be adjusted by new experiences (Shore, 1998; Waldahl, 2001). Sometimes we may exceed the available information and rather interpret the message in line with our existing frames of reference, or understanding of the world (Hall, 2002; Morley, 1992). We can talk about the potential for meaning in the message and the potential for interpretation for the individual.

Misunderstandings arise from the lack of equivalence between the two sides in the communicative exchange (Hall, 2002). In internal communication in a professional organization, there is (or at least should be) no doubt what the preferred meaning of the mediated text is, but still, the meaning structure constructed by the receiver of the message is not necessarily the same as the meaning structure intended by the sender (Hall, 2002; McQuail, 1997). In a professional organization, it is plausible to assume that there will be asymmetry between the codes of source and receiver. The people at the executive levels of the organization might not share the same codes as the people at the lower levels, or the lower level might understand and interpret these codes differently. This can be something as banal as that they understand the same words differently, or they use different kinds of words unfamiliar to each other, but there are also more profound background factors. For instance, Antonsen (2009) has shown how seamen often interpreted attempts to govern work by formal rules as a negation of the seafarer's

professional expertise. This will affect their respect for formal procedures and their motivation for using them. In addition, formal procedures have their origin in onshore organizations, like regulatory authorities and oil companies. This is outside the seafarer community, or the ones doing the practical work, and this influences how the seamen interpret the formal procedures. The seamen in Antonsen's study saw the procedures as based on the theoretical knowledge of some office workers, and not as based on the practical knowledge possessed by competent seamen, and for them this undermined the legitimacy of formal procedures (Antonsen, 2009).

When workers interpret a message differently than the executives had intended, it is partly because of the structural difference between sender and receiver (Hall, 2002). The executives might not share the same ideas, values, attitudes, and language as the lower level, or the lower level might understand and interpret these codes differently. The workers might also have very different work contexts, especially in geographically distributed organizations, so they do not have the same sensory experience.

In addition, organizations are not necessarily in perfect harmony, and all members of the organization do not necessarily share a common belief about how the organization's goals should be reached (Rasmussen & Kroon Lundell, 2012). For instance, if the workers have a resentment towards the leadership, this will influence their interpretation.

If a group of individuals should reach the same understanding of a piece of data or information, they must have some frames of reference in common. Not necessarily all references, but they need some common ground of references. Frames of reference can both be abstract ideas about the world, and more practical ideas, for instance, how to log on to a computer system, shut down a piece of industrial equipment, or deal with a crisis at work (Wickens et al., 2004).

Organizations have often tried to create a corporate identity to unify the workers at the different levels in the organization, and to create a common sense shared by everyone in the organization. One must still consider that while some frames of reference are shared by the entire organization, different levels of the organization might have specific frames of reference that are unknown at the other levels in the organization, and there might also be different subcultures within the organization who operate with different frames of references.

Frames of reference are similar to the concept of schema and mental models in Human factors. In Human Factors, schemas are understood as associative networks created through experience and can, like frames of reference, be changed by new experiences (Wickens et al., 2004). People have schemas about all aspects of their world, for instance, equipment and systems that they use, or dealing with a crisis at work (Wickens et al., 2004). This helps the individual organize knowledge and use knowledge when facing new situations. Like frames of reference, they can be personal, existing in this exact shape only in the mind of a single individual, or cultural, shared by many people within the same culture (Wickens et al., 2004). Human factors put emphasis on the user of the equipment and aim to enhance performance, increase safety, and increase user satisfaction (Wickens et al., 2004). This includes the communication and cognitive processes involved in using a computerized management system. This is a human factor issue because it relates to the interaction between humans and the system. The precise boundaries of the discipline of human factors cannot be tightly defined but are closely related to ergonomics, engineering psychology, and cognitive engineering (Wickens et al., 2004). Human factors have often been concerned with the physical aspects of work, but the scope also includes cognitive thinking and knowledge-related aspects, and mental interactions with the system (Andersen, 2013; Stanton et al., 2005; Wickens et al., 2004). If human factors methods and principles are applied in the development and use of a system, many of the human factors deficiencies will be avoided before they are inflicted on systems design (Wickens et al., 2004).

Human factors have some overlapping perspectives with cognitive psychology. Both perspectives stress that new information we receive is not simply stored in our long-term memory like files in an archive. Rather, we store pieces of information together with related information, in associative networks (Wickens, 2004). New information is actively processed and combined with prior knowledge and is sometimes organized around central concepts or topics.

3. Implications for Safety

With the notion in mind that one cannot avoid communicating because everything is communication (Watzlawick et al., 1967), the use of an IT-based Safety Management System also constitutes a form of communication. The message is constructed at an executive level and transferred to the lower levels of the organization. It is insufficient to see this communication as a mere transmission of information, as the information is not always received or understood as intended. According to semiotic theory and reception theory, the message must be perceived, and interpreted by the workers, and there is no guarantee that they will interpret the message.

Many researchers have stressed the human component in safety management, but usually from the perspective of how to get the workers to use the technology in a better way. The social and cultural facets of

safety management should be given more attention because it is a cognitive process, not a mechanical one. The cognitive strengths of humans must be emphasized, but also how operators interact with management systems and procedures. Machines must be designed to suit the physical abilities of the expected user, but also instructions and procedures must be designed to fit the cognitive, informational, and emotional processes of the human being. Procedures and work descriptions must be organized in a manner that makes it easy for the workers to find the procedures and checklists that they need when they need them.

This also relates to an ongoing discussion on how rigid or flexible the procedures should be. It is argued that rigid procedures can be a constraint on human action and that more flexible procedures can facilitate individual decision-making (Antonsen et al., 2008; Dekker, 2003; T. Haavik, 2010; Reiman, 2011). This also depends on what tasks the procedure is for. Procedures for complex tasks, or tasks that are rarely performed, or require coordination between several units, need to be rigid (Dekker, 2003). Other procedures may be more flexible and leave more room for the worker to make a professional evaluation about how to adapt the procedures to the immediate situation (Dekker, 2003; Reiman, 2011). For this adaption to work, it is crucial that the operators know and understand the basis and the purpose of the procedures (O'Hara, Higgins, F., & Kramer). Otherwise, they won't be able to know which procedures to adopt, or when.

The technology itself can also have an impact on how a piece of information is received and interpreted. This is a context factor that must be considered, even in technology-rich environments: how do the workers relate to technology? New technology in the workplace might be someone be seen as something interesting to learn, and as something that will make their job easier and safer, while others might feel that it just adds to the workload (Haddon, 2004). Even in technology-rich workplaces, workers will need time and training to adjust to new technologies. Studies have shown that while workers in mechanical professions are familiar with computers, it is not their favorite tool, and they tend to emphasize the importance of practical experience, rather than more computer and office-oriented type of competence (Antonsen, 2009; Dahl, 2013; Reiman, 2011; Wold & Laumann, 2015b). Staff training can help to create schemas or frames of reference that are common for the entire staff models so they share common ideas for how work should be done. Staff training should also establish an understanding of what the Safety Management System is, and what the purpose of it is.

Safety Management Systems cannot be regarded as tools. It is too simplistic and ignores the cognitive processes that are in play when people are using the system. One aspect is that they are IT-based and are accessed through computers, but the computer is not merely a tool that you operate, nor is it a model of the human mind. Rather, the computer is a medium that the user – knowingly or unknowingly – communicates with the software through.

Safety standards and work procedures should be analyzed as a part of the communication within the organization, not just as a tool. Executives and workers relate to the management system very differently, and this affects the communication. Distortions or misunderstandings' arise from the lack of equivalence between the two sides in the communicative exchange (Vecchio-Sadus, 2007).

The communicative challenges cover a wide area of topics: the use of computers, the level of detail in the procedures, information overload, informal procedures, ideals of professionalism, feedback, language, and the context in which the communication takes place. A communicative perspective allows for a stronger emphasis on the social and cultural facets of information management, and to identify the various understandings or misunderstandings that might occur. This includes how the workers interpret and understand the procedures, and how their interpretation affects how they use them. Reception theory can provide valuable perspectives here and can be combined with Human Factors, which also focuses on the importance of the user, including the cognitive aspects of using a Safety Management System.

References

Almklov, P. G., Rosness, R., Størkersen, K. 2014. When safety science meets the practitioners: Does safety science contribute to marginalization of practical knowledge? *Safety Science*, *67*, 25-36. https://doi.org/10.1016/j.ssci.2013.08.025

Andersen, S. 2013. Using human and organizational factors to handle the risk of a major accident in integrated operations. In D. Besnard & E. Albrechtsen (Eds.), *Oil and gas, technology and humans: Assessing the human factors of technological change*. CRC Press.

Anderson, J. A. 1996. *Communication theory: Epistemological foundations*. Guilford Press.

Antonsen, S. 2009. *Safety culture: theory, method and improvement*. Ashgate.

Antonsen, S., Almklov, P., Fenstad, J. 2008. Reducing the gap between procedures and practice lessons from a successful safety intervention. *Safety Science Monitor*, *12*(1).

Aven, T. 2014. What is safety science? *Safety Science*, *67*, 15-20. https://doi.org/10.1016/j.ssci.2013.07.026

Becker, H. S. 1998. *Tricks of the trade. How to think about your research while you are doing it*. The University of Chicago Press.

Bjerkan, A. M. 2010. Health, environment, safety culture and climate – analysing the relationships to occupational accidents. *Journal of Risk Research*, *13*(4), 445-477. https://doi.org/10.1080/13669870903346386

Bottani, E., Monica, L., Vignali, G. 2009. Safety management systems: Performance differences between adopters and non-adopters. *Safety Science*, *47*(2), 155-162. https://doi.org/10.1016/j.ssci.2008.05.001

Bourrier, M. 2005. The Contribution of Organizational Design to Safety. *European Management Journal*, *23*(1), 98-104.

Bouwman, H., Hooff, B. V. D., D., W. L. V., Dijk, J. V. 2005. *Information & communication technology in organizations*. Sage Publications.

Chen, C. F., Chen, S. C. 2012. Scale development of safety management system evaluation for the airline industry. *Accid Anal Prev*, *47*, 177-181. https://doi.org/10.1016/j.aap.2012.01.012

Corner, J. 1991. Meaning, Genre and Context: the problematics of 'Public Knowledge' in the New Media Studies. In J. Curran & M. Gurevitch (Eds.), *Mass Media and Society* (pp. 267-285). Edward Arnold.

Cox, S. J., Cheyne, A. J. T. 2000. Assessing safety culture in offshore environments. *Safety Science*, *34*, 111-129.

Dahl, Ø. 2013. Safety compliance in a highly regulated environment: A case study of workers' knowledge of rules and procedures within the petroleum industry. *Safety Science*, *60*, 185-195. https://doi.org/10.1016/j.ssci.2013.07.020

Fernández-Muñiz, B., Montes-Peón, J. M., Vázquez-Ordás, C. J. 2007. Safety management system: Development and validation of a multidimensional scale. *Journal of Loss Prevention in the Process Industries*, *20*(1), 52-68. https://doi.org/10.1016/j.jlp.2006.10.002

Grote, G., Weichbrodt, J. C., Günter, H., Zala-Mezö, E., Künzle, B. 2008. Coordination in high-risk organizations: the need for flexible routines. *Cognition, Technology & Work*, *11*(1), 17-27. https://doi.org/10.1007/s10111-008-0119-y

Grytnes, R., Shibuya, H., Dyreborg, J., Grøn, S., Cleal, B. 2016. Too individualistic for safety culture? Non-traffic related work safety among heavy goods vehicle drivers. *Transportation Research Part F: Traffic Psychology and Behaviour*, *40*, 145-155. https://doi.org/https://doi.org/10.1016/j.trf.2016.04.012

Guldenmund, F. W. 2010. (Mis)understanding Safety Culture and Its Relationship to Safety Management. *Risk Anal*, *30*(10), 1466-1480. https://doi.org/10.1111/j.1539-6924.2010.01452.x

Hale, A. R., Hovden, J. 1998. Management and Culture: The Third Age of Safety. A Review of Approaches to Orgnanizational Aspects of Safety, Health and Environment. . In A. R. Hale & J. Hovden (Eds.), *Occupational Injury: Risk, Prevention and Intervention.* (pp. 129-165). CRC Press.

Hall, S. 2002. Encoding/Decoding. In S. Hall, D. Hobson, A. Lowe, & P. Willis (Eds.), *Culture, Language, Meaning* (pp. 128-139). Routledge.

Haukelid, K. 1999. *Risiko og sikkerhet: forståelser og styring. [Risk and safety: understanding and management]* Universitetsforlaget.

Hollnagel, E. 2014. Is safety a subject for science? *Safety Science*, *67*, 21-24. https://doi.org/10.1016/j.ssci.2013.07.025

Hughes, B. P., Newstead, S., Anund, A., Shu, C. C., Falkmer, T. 2015. A review of models relevant to road safety. *Accid Anal Prev*, *74*, 250-270. https://doi.org/10.1016/j.aap.2014.06.003

Haavik, T. 2010. Making drilling operations visible: the role of articulation work for organisational safety. *Cognition, Technology & Work*, *12*(4), 285-295. https://doi.org/10.1007/s10111-010-0139-2

Haavik, T. K. 2014. On the ontology of safety. *Safety Science*, *67*, 37-43. https://doi.org/10.1016/j.ssci.2013.09.004

Kirwan, B. 1998. Safety management assessment and task analysis - a missing link? In A. Hale & M. S. Baram (Eds.), *Safety management: The challenge of change* (pp. 67-92). Elsevier.

Krauss, R. M., Fussell, S. R. 1996. Social psychological models of interpersonal communication. In E. T. Higgins & A. Kruglanski (Eds.), *Social psychology: A handbook of basic principles* (pp. 655-701). Guildford.

Lekka, C. 2011. *High reliability organisations A review of the literature*. HSE Books.

Locke, J. 1690/1979. An essay concerning human understanding. In P. D. Nidditch (Ed.). New York: Oxford University Press.

McDonald, N., Corrigan, S., Daly, C., Cromie, S. 2000. Safety management systems and safety culture in aircraft maintenance organisations. *Safety Science*, *34*, 151-176.

McLuhan, M. 1964. *Understanding media: The extension of man.* . McGraw-Hill.

McQuail. 2010. *Mass Communication Theory (6th edition).* SAGE publications Ltd.

McQuail, D. 1997. *Audience analysis*. SAGE.

Mearns, K., Whitaker, S. M., Flin, R. 2003. Safety climate, safety management practice and safety performance in offshore environments. *Safety Science*, *41*(8), 641-680. https://doi.org/https://doi.org/10.1016/S0925-7535(02)00011-5

Morley, D. 1992. *Television, Audiences and Cultural Studies*. Routledge.

Nævestad, T.-O., Hesjevoll, I. S., Phillips, R. O. 2018. How can we improve safety culture in transport organizations? A review of interventions, effects and influencing factors. *Transportation Research Part F: Traffic Psychology and Behaviour*, *54*, 28-46. https://doi.org/https://doi.org/10.1016/j.trf.2018.01.002

PSA, Norway, P. S. A. 2004. *HSE and culture. Retrieved from.* Retrieved from http://www.psa.no/getfile.php/z%20Konvertert/Products%20and%20services/Publications/Dokumenter/hescultureny.pdf

Rasmussen, J., Kroon Lundell, Å. 2012. Understanding "communication gaps" among personnel in high-risk workplaces from a dialogical perspective. *Safety Science*, *50*(1), 39-47. https://doi.org/10.1016/j.ssci.2011.06.009

Reiman, T. 2010. Understanding maintenance work in safety-critical organisations – managing the performance variability. *Theoretical Issues in Ergonomics Science*, *12*(4), 339-366. https://doi.org/10.1080/14639221003725449

Reiman, T. 2011. Understanding maintenance work in safety-critical organisations – managing the performance variability. *Theoretical Issues in Ergonomics Science*, *12*(4), 339-366. https://doi.org/10.1080/14639221003725449

Schrøder, K. C. 2000. Pionerdagene er forbi! hvor går receptionsforskningen hen [The pioneering days are over. Where is reception research headed?]. *MedieKultur: Journal of media and communication research*, *31*, 74-88.

Schunk, D. H. 2014. *Learning Theories: An Educational Perspective* (6th ed.). Pearson Prentice Hall.

Shore, B. 1998. Models theory as a framework for media studies. In B. Höijer & A. Werner (Eds.), *Cultural cognition. New perspectives in audience theory*. Nordicom.

Şimşekoğlu, Ö., Nordfjærn, T. 2017. The role of safety culture/climate and social cognitive factors for driving behaviors of Turkish professional drivers transporting petroleum products. *Journal of Risk Research*, *20*(5), 650-663. https://doi.org/10.1080/13669877.2015.1118150

Sohlberg, P., Sohlberg, B. 2009. *Kunskapens former: vetenskapsteori och forskningsmetod [The Shapes of knowledge: Scientific theory and research methods]*. Liber.

Stanton, N. A., Salmon, P. M., Walker, G. H., Baber, C., Jenkins, D. P. 2005. *Human factors methods. A practical guide for engineering and design*. Ashgate Publishing Group.

Sutcliffe, K. M. 2011. High reliability organizations (HROs). *Best Pract Res Clin Anaesthesiol*, *25*(2), 133-144. https://doi.org/10.1016/j.bpa.2011.03.001

Vecchio-Sadus, A. M. 2007. Enhancing safety culture through effective communication. *Safety Science Monitor*, *11*(3).

Vinodkumar, M. N., Bhasi, M. 2011. A study on the impact of management system certification on safety management. *Safety Science*, *49*(3), 498-507. https://doi.org/10.1016/j.ssci.2010.11.009

Vredenburgh, A. G. 2002. Organizational safety: Which management practices are most effective in reducing employee injury rates? *Journal of Safety Research*, *33*(2), 259-276. https://doi.org/https://doi.org/10.1016/S0022-4375(02)00016-6

Vygotsky, L. S. 1978. *Mind in society: The development of the higher psychological processes*. Harvard University Press.

Waldahl, R. 2001. *Mediepåvirkning*. Gyldendal Norsk Forlag.

Watzlawick, P., Bavelas, J. B., D, J. D. 1967. *Pragmatics of human communication. A study of interactional patterns, pathologies and paradoxes*. W.W. Norton & Company.

Wickens, C. D., Lee, J. D., Liu, Y., Becker, S. E. G. 2004. *An introduction to human factors engineering*. Pearson Education.

Wold, T., Laumann, K. 2015. Safety Management Systems as communication in an oil and gas producing company. *Safety Science*, *72*, 23-30. https://doi.org/https://doi.org/10.1016/j.ssci.2014.08.004