

Chapter 8

Stories and Standards: The Impact of Professional Social Practices on Safety Decision Making

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Abstract Organisational influences on safety outcomes are the subject of much attention in both academia and industry with a focus on how workplace factors and company systems, both formal and informal, influence workers. Many individuals who make important decisions for safety are not simply employees of a particular firm, but also members of a profession. This second social identity is little studied or acknowledged and yet is it critical for safety. This chapter addresses two key social practices that influence safety outcomes. The first is professional learning for disaster prevention. Research has shown that much professional learning is profoundly social including sharing stories and using stories directly as an input to key decisions. Another critical professional activity is development of standards. Standards are seen as authoritative sources and so ‘called up’ in legislation and yet the processes by which they are developed are opaque to those outside the small group of professionals involved. Again, this important social practice of groups of professionals remains little studied. Professional social practices such as these are worthy of much more attention from both academia and industry.

Keywords Professional · Safety imagination · Technical standards · Storytelling

8.1 Introduction

Many individuals working in industries with the potential for disaster such as offshore oil and gas, chemicals, aviation and nuclear power make decisions that can ultimately have a major influence on safety outcomes. Making good safety decisions is significantly reliant on technical skills and knowledge and, for any complex

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technology, safe operation requires expert knowledge in a wide range of specific fields to be brought together. Safe operation of commercial aircraft, for example, requires expertise in various engineering disciplines to design the aircraft in addition to expert pilots, aircraft maintainers and air traffic controllers etc. to ensure safety once any aircraft is in service. Each of these specialisations can be seen as a profession, built around a particular body of expert knowledge that is strongly linked to one or more aspects of safety performance.

When things go wrong, investigations into the causes of major disasters rarely reveal new technical knowledge but rather show that existing knowledge was not applied. The reasons for this are invariably social (Weick and Sutcliffe 2001). Preventing accidents in all cases requires that those who are making safety related decisions are aware of the potential consequences of their actions and so make choices in that light. This attitude to work, having a safety imagination (Pidgeon and O’Leary 2000), is the opposite of complacency and is reflected in another quality of the professions—a sense of being worthy of public trust (Middlehurst and Kennie 1997).

Professionals learn in formal settings as they gain formal qualifications and attend training courses throughout their career. Critically, key professional knowledge also originates from on-the-job working with other members of their professional group. Some technical tips are learned this way but learning to have a safety imagination in particular takes place in a group integrated with daily activities in a ‘community of practice’ (Wenger 1998).

In contrast, key technical knowledge is often recorded and communicated in a very different form—that of technical standards. Such standards are important for professional learning, although those with a good safety imagination understand that compliance with standards alone is not an adequate safety strategy. Professional groups also have a key role in technical safety assurance as custodians of the content of key technical standards. Whilst standards often have pseudo-regulatory status, processes of standard formation have been little studied and are often opaque. Since some influential standards are produced by organisations that have a primary function as industry lobby groups, this area also deserves further study and critical attention.

This chapter explores the links between professionals and learning for safety. In organisations under increasing cost pressure, time for professional activities is often seen as not a core part of company activities and yet organisations rely critically on professional judgement to ensure that operations continue safely. Many organisations fail to recognise this and instead see safety as grounded in company systems, rather than professional practice.

Drawing on previously published research across a variety of industrial domains, key points are highlighted regarding how professionals make safety-related decisions, the role of experts and professional societies in standard formation and the implications for organisations and safety decision-making.

8.2 Expertise, Professionals and Learning in the Context of Disaster Prevention

The starting point for this chapter is that for lessons of past accidents to be learned, i.e. taken into account in future decision-making, experts must maintain a ‘safety imagination’ (Pidgeon and O’Leary 2000). A lack of safety imagination is linked to a psychological rigidity that restricts decision makers in their ability to link their work to the possible consequences. The question is therefore how a safety imagination can best be fostered. Researchers in the field of naturalistic decision-making (e.g. Klein 1998) have identified stories as an effective knowledge source for decision-making in critical contexts, because they are a powerful tool in pattern matching and mental simulation. Stories convert experiences into memorable, meaningful lessons (Klein 1998; Polkinghorne 1988). As Schank (1990) puts it,

We need to tell someone else a story that describes our experience, because the process of creating the story also creates the memory structure that will contain the gist of the story for the rest of our lives.

Storytelling is fundamentally a social practice. Table 8.1 contrasts social learning with more traditional learning approaches linked to formal training. Social learning, which includes attitudes and behaviours as well as facts, is ongoing, action-oriented and collaborative.

Experts keep their knowledge up to date by ongoing social learning from professional peers (Dreyfus and Dreyfus 1986). In an occupational sense, expertise is one of a number of qualities displayed by a professional. Others include exercise of trust as the basis for professional relationships, adherence to defined professional ethics and independence (Middlehurst and Kennie 1997). Other authors (Friedson 2001; Sullivan 2005) expand on these ideas to describe the strong sense of responsibility held by professionals for the public good. Professions have strict entry standards in the form of long training in both theoretical and practical considerations and often licensing arrangements. This training and induction into the

Table 8.1 Models of learning

Traditional	Social
Individual	Group/organisation
Isolated from workplace	Integrated with daily activity
About facts	About attitudes and behaviours, as well as facts
Collaboration is cheating	Working together is key
Teacher/student	Collaboration
Absolute	Context-dependent
Has defined beginning and end	Ongoing
Knowledge-oriented	Action-oriented

Adapted from Wenger (1998)

culture of the profession engenders members of this exclusive group with loyalty to their peers, rather than to their employers.

These links between safety imagination, learning and professionalism have an impact on safety outcomes but go largely unrecognised in organisations that see all their employees as simply that, rather than members of a profession. This has important safety implications as described below.

8.3 Professionals at Work

Most modern organisations are highly bureaucratised. Management is the dominant profession and the most senior managers, i.e. those at the top of the organisational hierarchy, set the goals of the organisation and the methods by which those goals will be achieved. Top managers are very powerful and the role of other members of the organisation is simply to implement strategies that are determined at the top—essentially, to follow instructions.

For organisations that operate hazardous technologies and have a high level of safety performance, this is only a partial view of the way power is distributed. In such organisations, professional groups other than managers also have significant power and authority when it comes to safety decision-making. Think of an airline pilot in the cockpit. A professional who holds this role operates within company systems, but also holds the ultimate decision-making authority for the safety of the aircraft. The most senior professionals in many organisations hold similar levels of power within their own particular domain. Expert design engineers, for example, hold significant authority and can exert it informally or by formal systems such as sign off of drawings and specifications that is required for projects to proceed. The question then arises as to how professional judgements are formed.

In our research, we have found senior operational staff sharing stories of their experiences in order to support professional judgements in three key ways (Hayes 2013a; Hayes and Maslen 2015). The first was directly linked to the concept of safety imagination. These are stories of past events where the moral of the story is the uncertainty of the technology and the need for vigilance to ensure that workers and the public are protected. We found people in fields as diverse as air traffic control, nuclear power station operations and chemical production telling similar tales to their colleagues. Less predictably, perhaps, was the fact that such stories did not always involve a major catastrophe (or a near miss). Some stories were simply about the significant unpredictability of the way the system behaved at some given point in time. After the event, such an experience is shared by telling and retelling. Weick calls such an event a cosmology episode,

A cosmology episode occurs when people suddenly and deeply feel that the universe is no longer a rational, orderly place. (Weick 1993, p. 633)

Such incidents may be professionally life-changing for the person involved and of great interest to fellow professionals but possibly insignificant for non-experts.

Stories such as these are very popular within a specific community of practice. We have found that they are used by individuals to develop and reinforce their own safety imagination but also to foster such attitudes within less experienced members of the professional community. As we found one senior design engineer asking his much younger colleagues as he set out to check their calculations,

who have you killed today? (Hayes 2015b)

Story-based tests such as these were used by technical professionals when coming to a decision in the design office and also in an operating environment. Experts make decisions intuitively and one way to tap into their intuition is to imagine themselves in such situations as:

- walking into the plant following a proposed change with their young child in their arms,
- having to call someone's family to explain why they are injured if the planned work were to go ahead and then something went wrong,
- seeing their decision published in the media.

These methods sit alongside formal company systems such as risk assessment and influence outcomes, yet they are not acknowledged.

The third way in which we found professionals sharing stories was directly in the form of technical lessons learned about the system that they operate. Even these stories are not what organisations typically think of as incidents to be reported, recorded in a database and analysed for future learning. Rather, they are stories of small anomalies in system behaviour that are of particular interest to a specific group of people.

In all three cases it is clear that a story is much more than simply an accumulation of facts. Stories link human actions and events into an integrated composite (Polkinghorne 1988). As such, they have protagonists, a narrative and causal relationships. These features assist both senior operating professionals and design engineers to develop and maintain a safety imagination. More than that, sharing such stories is a profoundly social practice which gives them the professional courage to deliver bad news upwards, knowing that it may not be well received. As one design engineer told us,

[Senior management] will support the calls I've made. They are disappointed and I'm not always popular but they see the importance. (Hayes 2015a)

Senior operating professionals and expert discipline engineers in a design office may have a high degree of informal influence with senior management but this is often not visible in formal organisation charts. They have all chosen what Zabusky and Barley (1996) call a 'career of achievement'—where status and seniority is judged by others based on professional skills and knowledge. Whilst they are at the top of their chosen profession, they may only appear in the middle levels of the formal organisation chart. In contrast, those higher up the organisation chart with a greater level of seniority in strict hierarchical terms have chosen a 'career of

advancement', but likely they have left their chosen profession behind and become primarily managers instead.

It might be challenging for organisations to acknowledge that their key technical staff have an allegiance to their profession which is at least partially independent of their allegiance to their employer. Nevertheless allowing time for, and engaging more directly with, professional activities is an untapped mechanism by which companies can influence safety outcomes.

8.4 The Role of Standards

Another key facet of technical professionals' practice is a high degree of respect for technical procedures and standards, along with an awareness of their limitations. Particularly in the field of engineering design, key information is often found in technical standards. Main and Frantz (1994) found that 87% of the design engineers they surveyed cited standards and codes as a key source of safety information (more than any other source). When it comes to excellence in safety outcomes, this raises important questions regarding how standards are used by engineers in making judgements that impact outcomes and also about the source of the information contained in standards.

Compliance with industry standards is a common legislative requirement. This makes sense when standards are 'experience carriers' (Hale et al. 2007). Compliance with rules (of which standards are one kind) is a well-recognised strategy for both constraining and supporting decision makers (Hale and Borys 2013a, b) but in the end if standards are not applied mindfully (Weick and Sutcliffe 2001) then safe outcomes cannot be assured.

A case in point was the failure of Enbridge's oil pipeline at Marshall, Michigan which caused the largest onshore oil spill in US history (Hayes and Hopkins 2014). The pipeline that failed was known to be severely cracked and yet engineers had put significant effort over years into demonstrating that the cracks did not meet the requirements laid down in the relevant standard that would have triggered repair. The standard specified requirements for pipeline cracks and different requirements for corrosion-related defects. Enbridge chose to treat the more than 50 inch long crack as a corrosion defect because it was initially caused by corrosion. This determination led them to use a different (less conservative) method to estimate the remaining strength of the cracked pipeline. They also embedded several other optimistic assumptions in their calculations. If they had treated the fault as a crack, calculations would have led to a different result and the line would have been excavated for physical inspection and likely repair. Instead, the line remained in service for an additional five years before it eventually failed with severe environmental consequences. Most relevant to our considerations here, the official investigation (NTSB 2012) came to the conclusion that company engineers had put

significant effort into ensuring that the line complied with the standard, rather than considering whether the line was safe to leave in operation. These two issues are not identical.

In summary, whilst compliance with standards is important, if users lose sight of the reason for the requirements in the standard and come to see compliance as an end in itself, then safety is compromised. For complex systems, standards cannot cover every eventuality. Application of standards requires judgement and experience. As one design engineer told us,

[For the younger engineers], experience is lacking and sometimes when they read the standard, they don't see the reason behind the requirements. They apply the standard just like a cook book. (Hayes 2015b)

This assumes of course that the requirements of the standard are adequate at least within the intended scope. Following any disaster, the relevant standards come under a great deal of scrutiny and yet processes of standard formation are little studied by safety researchers. In theory at least, standards are not driven by the interests of any individual operating company or by government. In practice, oil industry standards in the US have been criticized strongly by the Presidential Commission investigating the causes of the Deepwater Horizon incident. Their criticism relates specifically to the standards of the American Petroleum Institute (API). They report,

As described by one representative, API-proposed safety standards have increasingly failed to reflect “best industry practices” and have instead expressed the “lowest common denominator”—in other words, a standard that almost all operators could readily achieve. Because, moreover, the Interior Department has in turn relied on API in developing its own regulatory safety standards, API's shortfalls have undermined the entire federal regulatory system. (National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling 2011, Chap. 8)

At least in this case, standards produced by an industry lobby group have been found wanting. Other standards are produced by professional associations such as the American Society of Mechanical Engineers (ASME). A comparison of the way in which API and ASME see themselves and their role is pertinent. According to their web site,

API is the only national trade association that represents all aspects of America's oil and natural gas industry.

In addition, the stated mission of the organisation is,

to influence public policy in support of a strong, viable U.S. oil and natural gas industry.¹

On the other hand ASME,

¹<http://www.americanpetroleuminstitute.com/GlobalItems/GlobalHeaderPages/About-API/API-Overview>.

is a not-for-profit professional organization that enables collaboration, knowledge sharing and skill development across all engineering disciplines, while promoting the vital role of the engineer in society

and their mission is,

to serve diverse global communities by advancing, disseminating and applying engineering knowledge for improving the quality of life; and communicating the excitement of engineering.²

Clearly API is an industry lobby group whereas ASME is a professional society. The two organisations have significantly different interests which could be expected to be reflected in the documents that they produce and yet both API and ASME standards have pseudo-regulatory status in many jurisdictions. This blurring of distinction between professional societies and industry associations seems to be another way in which the value of professionals and professionalism is underestimated. Professional judgement is involved in both the production and use of standards.

8.5 Standards as a Social Construct

It may seem at first glance that these two influences on safety decision making are in conflict. Written material in a technical style in the form of a standard perhaps sits uncomfortably alongside oral traditions of story-telling as alternative sources of knowledge but in fact both standard production and use are also profoundly social activities.

Standards, along with other kinds of rules and procedures, have been subsumed by bureaucracy. They are perhaps mostly thought of in isolation, as dry but authoritative text used by a solitary individual. In fact, as touched on above, standards are written by groups of people who have specific interests and the details are subject to significant negotiation. Standards are not written in a narrative style. This makes the protagonists in the story of their creation invisible but they are no less influential in the ultimate outcome.

Use of standards is also a social process—they can be used and abused. As described above in the case of the Marshall pipeline failure the social norms at the company meant that the requirements of the standard were applied in a particular way that was ultimately catastrophic. Standards are not often used by individuals in isolation but rather by members of a professional group who interpret the requirements in their own idiosyncratic ways.

The clear implication of the social nature of standards is that professional values in general and safety imagination in particular have a direct impact on both the

²<https://www.asme.org/about-asme/who-we-are/mission-vision-and-strategic-focus>.

content and use of standards. Given the link between safety imagination and story-based learning, the theoretical gap between stories and standards is not as great as it might first appear.

8.6 Conclusions

This chapter has made the case that professionalism is more than just expertise in a technical sense. Professional attitudes (or lack of them) already impact safety outcomes but companies and researchers have paid this aspect of organisations very little attention. In the interests of safety, we should make this invisible work, visible.

There are several ways that organisations could do more to promote excellence in technical professionalism:

- Reward professional expertise by providing improved professional career paths. Many organisations claim to have a both technical and managerial promotion streams recognising the distinction between a ‘career of achievement’ versus a ‘career of advancement’ as discussed earlier, but few really deliver.
- Allow time for professional activities, including mentoring of younger professionals and involvement in standards development activities. ‘Professional development’ has become a euphemism for more formal training courses. As described earlier, professional learning is a profoundly social activity. Many organisations are reluctant to allow time for such activities.
- Ensure that learning from incidents includes story-based learning, not just recording facts in a database. Storytelling and action-oriented social learning are key factors in identity construction. What we do is who we are. As Gautherau and Hollnagel (2005) describe it,

becoming an expert is not only about learning new skills ... it is also about constructing an identity of a master practitioner.

- Give senior technical professionals more formal access to senior levels of management and reward bad news. In this chapter, we have focused primarily on decisions made by professionals that they then have the power to enact. Another key role of technical professionals is to advise more senior managers. Accident investigations have often shown that the failures that ultimately led to disaster were known about by some people but that the message was not transmitted upwards to those with the necessary power to intervene.

When organisational actors who should be professional fail to act in an appropriate way, the consequences can be literally disastrous. In the lead up to the

Montara blowout, drilling engineers who should have been providing professional oversight instead took a managerial approach to their role and left the technical details to the offshore crew (Hayes 2012, 2013b). This discussion is not meant to portray technical professionals as “white knights” and managers as “black knights”. The interaction between these different professionals is more subtle than that. Finding the right balance between conflicting organisational goals—costs, schedule, safety—is difficult only because these are *all* legitimate concerns. Organisations can cope with some degree of cost overrun or production loss, and so, to some extent, these issues can be managed by trial and error, but when it comes to public safety, the challenge is to get the decision right every time. This requires the imagination to see what might go wrong and the foresight to see how it might be avoided without becoming so conservative that nothing is achieved.

The practical implications of the social side of standard formation are more difficult to comment on in a generalised sense because of the lack of research in this area. Standards tend to be seen as authoritative sources and in many ways they are but each one is also the product of a workplace. Given that we know how much the social and organisational aspects of work influence outcomes in other settings it is essential that processes of standard formation in particular receive further research attention.

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