



A new perspective on how to understand, assess and manage risk and the unforeseen [☆]



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ABSTRACT

There are many ways of understanding, assessing and managing the unforeseen and (potential) surprises. The dominating one is the risk approach, based on risk conceptualisation, risk assessment and risk management, but there are also others, and in this paper we focus on two; ideas from the quality discourse and the use of the concept of mindfulness as interpreted in the studies of High Reliability Organisation (HRO). The main aim of the paper is to present a new integrated perspective, a new way of thinking, capturing all these approaches, which provides new insights as well as practical guidelines for how to understand, assess and manage the unforeseen and (potential) surprises in a practical operational setting.

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1. Introduction

In recent years, several perspectives on risk have been developed that replace probability with uncertainty in their definition, see Aven [4,5] and a brief summary in the Appendix. The motivation is that probability is just one tool for describing uncertainty and the concept of risk should not be limited to this tool. These new perspectives mean that more weight is given to the knowledge dimension, the unforeseen and potential surprises than the traditional perspectives allow for. There is an increasing number of researchers and risk analysts (e.g. [31,29,11]) who find the pure probability-based perspective on risk too narrow, ignoring and concealing important aspects of risk and uncertainties. A summary of some of the problems with the probability-based perspective is provided by Aven [4]. A key point is that the probabilities could be the same in two situations, but the knowledge – and the strength of knowledge – supporting the probabilities, is completely different. In one case, the probability could be based on a lot of relevant data and knowledge about the phenomena studied, whereas in the other, hardly any data or knowledge could be available. Describing and making judgements about risk based on the probabilities alone could thus seriously misguide decision makers, as the strength of knowledge is obviously important for the way we should use the probabilities in the risk management. A closely related point is the

fact that the probabilities are always conditional on a number of assumptions, and these assumptions could conceal important aspects of risk and uncertainties. An example of such an assumption could be that an operational procedure is followed (for example no hot work on an offshore oil and gas installation), but of course in practice this may not be the case. For most accidents, it turns out that some procedures have been violated.

The assumptions could be more or less explicitly formulated. An assessment could be based on some prevailing explanations and beliefs, which are not considered subject to uncertainties. For example in the case of the sinking of the Sleipner platform under a controlled ballasting operation during preparation for deck mating in the Gandsfjord outside Stavanger, Norway on 23 August 1991, the issue of a serious error in the finite element analysis combined with insufficient anchorage of the reinforcement in critical zones (the causes of the sinking, according to the investigation [36]) was not questioned before the operation. The event was not foreseen – it came as a surprise, it was a so-called black swan [38,6] (see also Section 3).

As another example, think about the Fukushima Daiichi nuclear disaster in Japan in March 2011. Aven [6] refers to risk analysts stating that “until this event, no one had conceived it a possibility that a tsunami would simultaneously destroy all back-up systems as well as prevent outside support from reaching the site”. This statement sounds somewhat strange in the view of the investigation committee, which concluded that the government and the operator TEPCO failed to prevent the disaster, not because a large tsunami was unanticipated, but because they were reluctant to invest time, effort and money in protecting against a natural disaster considered unlikely [40]. In other words, the risk was

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found acceptable; the utility and regulatory bodies were overly confident that events beyond the scope of their assumptions would not occur [41]. Hence, the event came as a surprise for many people, although it was not unforeseen or unthinkable in the strict sense of the words.

We find similar types of judgements in relation to the Piper Alpha accident in 1988 and the Macondo accident in 2010: a set of conditions and events, which prior to the accident is judged as “unthinkable” or having a negligible risk.

The assessments of risk may completely ignore a risk event or make a judgement on the basis of assumptions/beliefs that it is so unlikely that we can judge it as negligible. In both the cases we may consider it as unforeseen and as coming as a surprise. To assess and manage such events, we need to see beyond probabilities and adopt a broader risk perspective as outlined above. We need concepts that are suitable for this purpose, and it has been shown in several publications that the new risk perspectives give a solid basis for the conceptualisation of such events and situations [4,9]. We also need methods that can be used for the practical assessment and management of these types of events and situations. This is a huge research challenge. The present paper aims at contributing to this end by providing some fundamental ideas for how to think in this context. There are obviously many possible routes for the developments to be obtained; the present paper addresses one that is based on the following four basic pillars:

1. A suitable risk conceptualisation for the understanding, assessment and management of risk, in line with the ideas outlined above and summarised in the Appendix (first part on conceptual framework).
2. Basic theory, principles and methods for risk assessment and management in line with this conceptualisation, covering for example methods for quantifying risk and principles for the treatment of uncertainties such as the precautionary principle.
3. Concepts and ideas from the quality management, relating to various types of variation and highlighting the importance of continuous improvement.
4. The concept of (collective) mindfulness as interpreted in the studies of High Reliability Organisations (HROs), capturing the five characteristics: preoccupation with failure, reluctance to simplify, sensitivity to operations, commitment to resilience and deference to expertise.

The third pillar refers to the quality discourse, as already initiated by Shewhart [33,34], where the issue of predictability and unpredictability was a main topic, see also Deming [15] and Bergman [12]. Here the terms ‘common-cause variation’ and ‘special-cause variation’ are used [15]. They refer, respectively, to variation that is predictable in the view of the historical experience base and to variation that is unpredictable and outside the historical experience base (it always comes as a surprise). In addition, the quality discourse emphasises the plan-do-study-act management method used in the business for the control and continuous improvement of processes and products [15]. We highlight the improvement dimension, as much of the basic thinking in risk assessment and management presumes stable processes (represented by probability models) [12,7]. A stable process is a problematic premise for an analysis of risk, when concerned about the unforeseen and surprises.

The (collective) mindfulness concept has been intensively studied in the literature (see e.g. [18,24,42–44]). It is argued that the five main characteristics of this concept referred to above, explain HROs well and that the mindfulness concept thus can be used as an effective instrument for managing risks, the unforeseen and potential surprises. Although it can be difficult to prove that these five characteristics are generally the key for obtaining high

reliability and avoiding accidents, we find that the documentation showing the importance of these characteristics is overwhelming and convincing. Based on empirical evidence, theoretical considerations, as well as our own managing experience, we believe that the mindfulness concept with the five characteristics represents sound and useful principles for managing risks, the unforeseen and potential surprises, when used together with the other pillars of our framework. As for the quality management, the ideas and concepts of mindfulness fit nicely to the new risk perspectives outlined above and described in more detail in the Appendix (see also [23]).

The present paper is organised as follows. Firstly, in Section 2 we describe the problem we are facing and provide some simple examples for illustration purposes. Section 3 presents the announced integrated perspective and the new way of thinking about risk, based on the four pillars mentioned above, and using the examples of Section 2. The perspective and thinking of Section 3 are then discussed in Section 4. Section 5 provides some conclusions.

2. Characterisation of the setting with examples

We consider an activity, for example the operation of an oil and gas installation offshore, the lives of the habitants of a specific country, and conducting a talk for a professional audience. The activity is real or thought-constructed and is considered for a period of time from d_0 to d_2 , where main focus is on the future interval D from d_1 to d_2 , see Fig. 1. The point in time s refers to “now” and indicates when the activity is to be assessed or managed, what is the history and what is the future. If d_1 equals s , attention is on the future interval from now to d_2 .

Consider for example the operation of the offshore installation. We may focus on the operation of the installation over its entire production period, or we may be only interested in the execution of a specific drilling operation at a specific period of time. Before the activity, at time s , we need a concept of risk expressing in some way what could happen in the interval D that was not as intended for this activity. A fire and explosion event may occur on installation and the drilling operation could lead to a blowout. In the example of the lives of the habitants of a specific country a terrorist attack may occur, leading to many injuries and fatalities. In the third example, the talk, the audience may find the speaker boring and lack enthusiasm, and they could miss the speaker’s main message.

Based on this concept of risk, we will make assessments to support decision making on how to treat the risk and obtain desirable outcomes from the activity. The speaker would not only like to avoid “catastrophes” but also to have a successful talk, may be even a brilliant one. Similarly, people in the country would not focus on the avoidance of terrorist attacks. They seek a “good life”

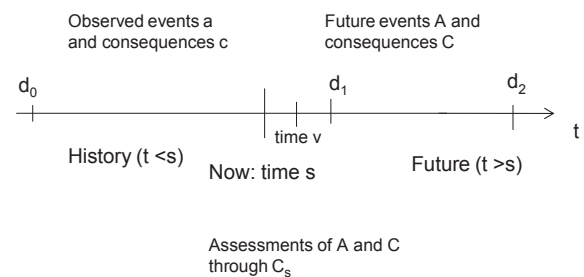


Fig. 1. A schematic illustration of some of the fundamental components of the risk concept in relation to the time dimension. Here C_s refers to a set of quantities that is introduced to characterise the events A and consequences C in the period of interest, i.e. the interval D from d_1 to d_2 .

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