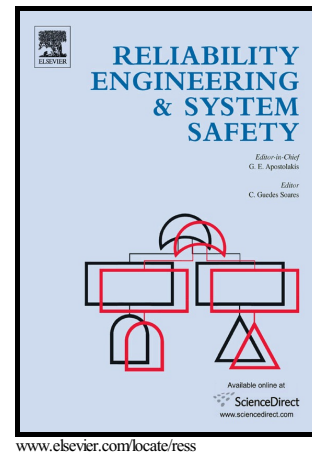


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Supplementing quantitative risk assessments with a stage addressing the risk understanding of the decision maker

Terje Aven



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Supplementing quantitative risk assessments with a stage addressing the risk understanding of the decision maker

Terje Aven, University of Stavanger, Norway

Phone 47832267, fax 4751831750

Email: terje.aven@uis.no

Abstract

A quantitative probabilistic risk assessment produces a conditional risk description given the knowledge of the analysts (formulated to a large extent through assumptions). However, important aspects of the risk may be concealed in the background knowledge of the analyst and the assumptions. This paper discusses this issue, the main purpose being to present a two-stage risk assessment approach where the second stage addresses the risk understanding of the decision maker. This second-stage is to a large extent qualitative. The approach is novel with its separation between the analysts' conditional risk descriptions using probability judgments, and the decision maker's risk understanding. The approach aims at improving the use of risk assessment in practical decision making by ensuring that the results of the risk assessments are properly interpreted and the key aspects of risk, uncertainty and knowledge are brought to attention for the decision makers. Examples are used to illustrate the approach.

Key words: quantitative risk analysis; assumptions; knowledge; uncertainties; decision maker

1 Introduction

Let us consider a hypothetical risk analysis and decision-making context on the basis of the example presented by Kahneman (2011, p. 323), associated with suicide bombings in buses in Israel in the period 2001-2004. Think of a person, call him John, who considers taking the bus one day in 2002. He is informed about the risk by a risk analyst. Following a historical data based approach (as illustrated in Aven 2015), the risk analyst presents the risk through a historical death rate per bus rider, which is denoted r . It is communicated as a death probability due to this type of event.

John is informed by this analyst's risk description. But he finds it insufficient. Risk for him is much more than this rate r . The analyst's probability assessment is conditional on a critical assumption: that the future will show a similar rate to that observed up to that day in 2002. But the future need not be like that. The rate can change, and the way these events are carried out could change, etc. There is uncertainty. This uncertainty represents an important aspect of risk for John, an aspect that he needs to consider when making a decision on taking the bus or not.

Formally, the analyst presents the risk through the conditional probability $P(A|K)$, where A is the event of interest (John being hit) and K is the background knowledge on which this probability is based. This background knowledge covers here the assumption that the future will show a similar rate to that observed up to that day in 2002. John is informed by P but also needs to reflect and make judgements linked to K , the assumptions and the strength of this knowledge. The analyst may be a statistician with no insights on the matter beyond the

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