Online Ethics Center
FOR ENGINEERING AND SCIENCE

Risk, Catastrophes, Hazards, and Disasters Subject Aid

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Description

A short guide to some key resources and readings on the topic of Risk, Catastrophes, Hazards, and Disasters.

Body

The term “risk" is used in numerous ways in everyday language, from the idea of taking a chance on a negative outcome to the possibility of being personally harmed by a danger that arises unpredictably, such as being struck by a car. Sometimes it is used for the likelihood of a particular danger or hazard or disaster, as when someone says, "You can reduce your risk of being hit by a car by crossing at the crosswalk." or “We can reduce our risk of home catastrophe by not building in the floodplain.”

Used in technical contexts such as "risk assessment" or "risk management," the notion of risk is the probability or likelihood of some resulting harm (such as the likelihood of being killed by being struck by a car) multiplied by the magnitude of the harm. Notice that a comparatively rare event can be of a great magnitude and vice versa. “Risk comparison” may involve comparing such different kinds of events, and finding they receive the same quantitative score; but non-experts may rank these

risks quite differently and find a similar rating for them quite unsatisfactory, even arbitrary.

In engineering, a property of a device or process is safe insofar as it limits the risk of accident or harm below some specified acceptable level. Acceptable levels of risk can change over time. Safety innovations can arise from public outrage about an accident such as from a gas leak in a stove or fire in a theater, independent of any quantitative risk assessments or rankings. In all these contexts, degrees of risk and of acceptability need identification and negotiation. Identifying and quantifying risks, for instance of workplace - including laboratory - accidents, and defining the risk parameters of interest require expertise. Data collection and classification is important, as is the availability of information to interested and affected parties. Analysis of trends in such data may provide a basis for corrective action.

Today, science and engineering are often called on to make risk judgments and to advise public and private organizations as to the probability and magnitude of harms, including all kinds of catastrophes, hazards, and disasters. The type of ethical framework often brought to bear in these situations is utilitarianism, an approach that often tries to quantify costs, risks, and benefits and select the alternative with the highest positive score; a good discussion of the strengths and weaknesses of this ethical theory and others is found in the Occidental Engineering Case Study (http://www.onlineethics.org/26869.aspx). As can be seen there, a utilitarian approach to risk communication may prove problematic since audiences are often concerned with fairness or human rights, issues that may not be addressed in a utilitarian approach.

- **See the extensive discussion in Hansson, Sven Ove, "Risk", *The Stanford Encyclopedia of Philosophy* (Spring 2014 Edition), Edward N. Zalta (ed.), http://plato.stanford.edu/archives/spr2014/entries/risk.**

There is a large literature on risk identification, assessment, management, and communication. Initially, much rested on distinguishing between technical and value dimensions, with the technical being focused on assessment or analysis; however, more recent contributions recognize an appropriate role for values in risk analysis.

- **Material above expanded from Online Ethics Center for Engineering and Science entry “Risk.” In "Glossary." Contributed 1/31/2006. Accessed: May 11, 2016. www.onlineethics.org/glossary.aspx**

See also OEC subject aid on “Safety.”

Subject Overviews

Risk Identification

Shrader-Frechette, Kristin. 1986. “The Conceptual Risks of Risk Assessment.” *IEEE Technology and Society Magazine* 5(2): 4-11.

> A variety of value judgments are inherent in methods of risk identification and estimation; and three ethical problems require risk assessors or policy makers to make normative decisions. This essay outlines these ethical and methodological difficulties and closes with two suggestions to improve risk assessment and render explicit its evaluative components.

Risk Assessment

Petrenko, Anton and Dan McArthur. 2010. “Between Same Sex Marriages and the Large Hadron Collider: Making Sense of the Precautionary Principle.” *Science and Engineering Ethics* 16(3): 591-610.

> The Precautionary Principle as a guide to coping with scientific uncertainties in the assessment and management of risk has recently become a key normative tool in policy discussions in such diverse areas as medical and scientific research, health and safety regulation, environmental regulation, product development, international trade, and even judicial review. Critics claim that the principle is incoherent and too vague to guide policy, and makes demands that are logically and scientifically impossible. This paper answers these criticisms by formulating guidelines for its application that ensure its coherence, and provides analyses of cases that demonstrate how the principle can function in practice.

Risk Management

Hansson, Sven Owe. 2009. “From the Casino to the Jungle: Dealing with Uncertainty in Technological Risk Management.” *Synthese: An International Journal for Epistemology, Methodology and Philosophy of*

***Science* 168(3): 423-432.**

This article takes the view that uncertainties undermine many cases of probability-based decision making. It calls this mistake the tuxedo fallacy and argues that traditional engineering practices such as safety factors and multiple safety barriers avoid this fallacy and therefore manage uncertainty better than probabilistic risk analysis (PRA). PRA is a useful tool, but it must be supplemented with other methods in order not to limit the analysis to dangers that can be assigned meaningful probability estimates.

Mayo, Deborah and Rachelle D. Hollander, eds. 1991. *Acceptable Evidence: Science and Values in Risk Management.* New York: Oxford University Press.

Instead of focusing on acceptable risk, this volume "concentrates on the entry of values in collecting, interpreting, communicating, and evaluating the evidence of risks; that is, issues of the acceptability of evidence of risk."

Risk Communication

Herkert, Joseph R. 1994. Ethical Risk Assessment: Valuing Public Perceptions. *IEEE Technology and Society* 14(10): 4-10.

Engineers are confronted with many moral issues as the complexity of modern technology results in equally complex efforts to assess the accompanying environmental and safety risks. The ethical responsibilities of engineers and the need for the workable solutions to technological controversies dictate that engineers be able to discuss technological risk with the public. Some suggestions are made for transforming the engineering culture in a manner conducive to more meaningful discussion

Thompson, Paul B. 1999. "The Ethics of Truth-Telling and the Problem of Risk." *Science and Engineering Ethics*. 5(4): 489-510.

Attempts to communicate risk can easily mislead the public. To account for this challenge requires communicators to recognize how two specific features of the concept of risk play a role in managing daily affairs. First, evaluating risk always incorporates an estimate of the reliability of information, so audiences will incorporate their assessment of the reliability of the risk communicator

into their assessment of the risk. Second, the concept of risk arises when an experience is non-routine or demands further deliberation - the whole point of calling something a risk can be to distinguish it from phenomena that need no further attention. Risk communications that compare measured probabilities and expected utilities can be inconsistent with both features and even undermine society's capacity to cope with risk. Technical experts should bear these difficulties in mind when communicating with the broader public.

Policy and Guidance

National Research Council. Committee on Improving Risk Analysis Approaches Used by the U.S. EPA. 2009. "Summary." ***Science and Decisions: Advancing Risk Assessment.*** **3-14. Washington D.C.: National Academies Press.**

The summary presents the committee's recommendations to EPA to improve environmental decision making and policy. Of note is its emphasis on tailoring risk assessment through "careful evaluation of the options available to manage the environmental problems at hand."

Office for Human Research Protections. 2015. http://www.hhs.gov/ohrp/humansubjects/anprm2011page.html#. Accessed May 10, 2016.

Revisions to the Federal government's regulations concerning research on human subjects are under consideration, particularly for the social and behavioral sciences. The Federal register information about this effort is found here.

Society for Risk Analysis. 2015. http://www.sra.org/about-society-risk-analysis. Accessed May 10, 2016.

The SRA statement of ethical priorities for risk analysis is available on the Society's "About" page. The SRA "is a multidisciplinary, interdisciplinary, scholarly, international society that provides an open forum for all those who are interested in risk analysis."

Bibliography

“Engineering Ethics and Risk Bibliography.” In Online Ethics Center for Engineering. https://onlineethics.org/cases/engineering-ethics-and-risk. Last updated by Kelly Laas January, 2012. Accessed May 10, 2016.

> Since analytical approaches to risk often involve methods from the social and behavioral sciences as well as the natural and physical sciences, this bibliography includes a number of references to the scientific literature from these fields.

Notes

Reviewed by R. Stephen Berry on November 21, 2016.

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Resource Type

Bibliography

Parent Collection

OEC Subject Aids

Topics

Risk

Discipline(s)

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