"The gift of failure: New approaches to analyzing and learning from events and near-misses." Honoring the contributions of Bernhard Wilpert

Citation: Carroll, John S. and Fahlbruch, Babette. "'The Gift of Failure: New Approaches to Analyzing and Learning from Events and Near-Misses.' Honoring the Contributions of Bernhard Wilpert." Safety Science 49, no. 1 (January 2011): 1–4. © 2010 Elsevier Ltd

As Published: http://dx.doi.org/10.1016/j.ssci.2010.03.005

Publisher: Elsevier

Persistent URL: http://hdl.handle.net/1721.1/108298

Version: Author's final manuscript: final author's manuscript post peer review, without publisher's formatting or copy editing

Safety Science 49 (2011) 1–4

Contents lists available at ScienceDirect

Safety Science

journal homepage: www.elsevier.com/locate/ssci

"The gift of failure: New approaches to analyzing and learning from events and near-misses." Honoring the contributions of Bernhard Wilpert

John S. Carroll [a,*], Babette Fahlbruch [b]

[a] MIT Sloan School of Management, 77 Massachusetts Avenue, Cambridge, MA 02142, USA
[b] TÜV NORD SysTec GmbH & Co. KG, Competence Center Sicherheitskonzepte, Geschäftsstelle Berlin-Brandenburg, Zimmerstr. 23, 10969 Berlin, Germany

ARTICLE INFO

Article history:
Received 24 January 2010
Received in revised form 26 February 2010
Accepted 2 March 2010

Keywords:
Event analysis
Learning from events
Safety management

ABSTRACT

This special issue presents papers from a workshop conducted by New Technologies and Work (NeTWork) to honor the memory of Bernhard Wilpert, the founder and organiser of NeTWork. The papers reflect the theme that undesirable incidents and events, serious and disturbing as they may be, are a "gift of failure." In short, events offer an opportunity to learn about safe and unsafe operations, generate productive conversations across engaged stakeholders, and bring about beneficial changes to technology, organization, and mental models (understanding). Papers in the special issue are organised around three topics: the process of event analysis, the relationship between event analysis and organisational learning, and learning at multiple system levels. In this introduction we describe the workshop, summarize the contributions of Bernhard Wilpert, suggest three themes that emerged from the workshop, and offer our thoughts about the future of event analysis and learning from events.

1. Background to the special issue

The same wondrous technologies that underlie our modern societies, such as air and sea transportation, nuclear power, and health care, also lead to challenges to safety: their innovativeness and complexity makes them difficult to predict and control (Beck, 1992; Perrow, 1984; Rollenhagen, this issue). As well, organizations "push the limits" for greater productivity with more complex, software-intensive systems that require interdependent participation from multiple professionals. The public demands more safety at the same time as it demands more services at less cost, while corporate shareholders demand higher returns. These issues are of great importance in so-called "high-hazard" industries where a rare and surprising event can place hundreds or thousands of people at risk, however, they are also of importance in settings such as health care and ordinary workplaces where undesired events occur more frequently but lives are disrupted one at a time.

Organizations need appropriate structures, rules, and practices to avoid and respond appropriately to safety relevant events, in order to ensure their safety and reliability. These structures and rules are the safety management system that is based on both anticipatory feed-forward models of risk and strategies for feedback control (Rasmussen, 1990). Of course, we cannot completely specify all risks: even if risks are specified within the operating envelope, in real life organizations sometimes operate beyond their operating envelope (some scholars would say, all the time). Therefore, adequate feedback control relies on learning from operational experience. Organizational weaknesses and latent failures (e.g., Reason, 1997) are identified by continual monitoring and systematic analyses of problems, deviations, defects, events, near-misses and organizational surprises. Results of event analyses should lead to new knowledge, new structures, new rules, and new practices with the goal of higher reliability and safety. The systematic analysis of events, using valid and comprehensive methods, is thus a critical starting point for learning with the goal of enhancing safety and reliability.

2. The NeTWork workshop: event analysis and learning from events

NeTWork is an informal group of academics and practitioners focused on New Technologies and Work (hence the acronym). Founded in 1982 by Bernhard Wilpert at the Berlin Institute of Technology (formerly the Berlin University of Technology) with his colleagues and students, NeTWork has held annual workshops on a variety of topics. Bernhard Wilpert was the architect of NeTWork; he guided the special nature of the workshops, in which discussion was central and participants were an engaging mix of workshop veterans and newcomers, researchers and practitioners. He championed the publication of books and special issues to document and disseminate the results of the workshops, which

* Corresponding author. Tel.: +1 617 253 2617.
E-mail address: jcarroll@mit.edu (J.S. Carroll).

0925-7535/$ - see front matter © 2010 Elsevier Ltd. All rights reserved.
doi:10.1016/j.ssci.2010.03.005

ensured the long lasting tradition of more than 26 workshops. His leadership and engagement also attracted support by various foundations.

In 1995, NeTWork convened a workshop on the topic "After the event – from accidents to organizational learning" and published a book with the contributions from the workshop (Hale et al., 1997). However, following more than a decade of experience with various event analysis methods, it seems that the promises of event analysis and organizational learning were only partly kept. We still have to cope with both novel events and so-called recurring events, one recent example being NASA's loss of the space shuttle Columbia, with causes reminiscent of the Challenger disaster. Could it be that our analysis methods do not discover the underlying causes of the events, or does learning from experience not work as it is supposed to do, or is learning happening in the wrong places?

NeTWork, with the generous support of the Fondation pour une Culture de Sécurité Industrielle (Toulouse), therefore held a workshop in August 2008 with approximately 30 participants, including both scholars and practitioners. The title of the workshop was "Event Analysis and Learning from Events." The goals of the workshop were:

- To discuss and reflect on various approaches to event analysis and learning from operating experience that can enhance safety.
- To develop new theory, new testable hypotheses, new policies, and new practices that would advance both safety research and practice.
- To structure a publication (this special issue) based on the presentations and discussion at the workshop that captures the insights from the workshop conversations and sets a bold agenda for future research, management, and policy.
- To honor the memory of Bernhard Wilpert, founder and champion of NeTWork, whose many contributions to human factors and social science research included an enduring interest in event analysis and learning from operating experience.

3. The contributions of Bernhard Wilpert

Bernhard Wilpert was a leading scholar and researcher in applied social science for four decades and Professor at the Berlin Institute of Technology for almost three decades. Among his many contributions as a community builder (along with founding NeTWork), he served as president of the International Association of Applied Psychology and editor-in-chief of its journal *Applied Psychology: An International Review*. His research was always international and interdisciplinary in scope. His early work included path-breaking studies of managerial participative decision making in eight countries and national industrial democracy in twelve countries. In 1990 Bernhard founded the Research Centre for System Safety at the Berlin Institute of Technology and shortly thereafter began work on nuclear power plant safety. He developed and disseminated a holistic socio-technical system approach that extended human factors to comprise human action on all system levels. The Research Centre developed a methodology for the systematic analysis of events (Safety through Organizational Learning, or SOL, see Fahlbruch and Schoebel, this issue) that is widely used in the nuclear industries of Germany and Switzerland.

4. The special issue

This special issue assembles eleven papers derived from the NeTWork workshop and adds two additional papers, one by Michal Tamuz and colleagues on a case study of a hospital trying to learn from a serious incident, and the second prepared by Babette Fahlbruch and Markus Schoebel as a tribute to Bernhard Wilpert, describing the SOL methodology that he developed with his colleagues.

The thirteen papers represent a range of topics and approaches consistent with the theme that undesirable incidents and events, serious and disturbing as they may be, are a "gift of failure." In short, events offer an opportunity to learn about safe and unsafe operations, generate productive conversations across engaged stakeholders, and bring about beneficial changes to technology, organization, and mental models (understanding). We define "events" broadly as occurrences of unexpected, undesirable system states, with or without negative consequences. Thus, "events" include incidents, accidents, near-misses, and other organizational surprises (Koornneef and Hale, 2004).

The special issue organizes the papers into three main topic areas. First, there are papers that primarily focus on the process of event analysis, which is the later reconstruction of the occurrence of the event as well as of its causes, i.e. the identification of WHAT happened, HOW it happened, and WHY it happened. Lin et al. describe the development of an accident model in aviation in several countries; Kirwan describes an air traffic management investigation and the migration of risk following mitigation efforts; Rollenhagen discusses event investigations in the Swedish nuclear power industry; Fahlbruch and Schoebel describe an event analysis method being used in the Swiss and German nuclear power industry; and Jorgensen describes a simple approach to workplace accidents being used in Denmark.

The answers to the WHAT- and HOW-questions require a detailed description of the course of the event, whereas for the WHY-question the analyst has to go beyond the given information, i.e. make causal inferences. As shown in the papers in this issue by Lin et al., Kirwan, and Rollenhagen (among other), in the past few decades event analysis has become increasingly sophisticated and systemic. The MTO (Man–Technology–Organization) framework, for example, encourages a comprehensive approach to investigation and analysis. Similarly, newer frameworks move beyond the classic chain-of-events model to consider the conditions and system factors that underlie these events. Even more recently, system safety models are being developed and applied to examine the entire system from front-line operators and controllers to regulators and legislators (Fahlbruch and Schoebel, Leveson, both in this issue). At the same time, we must remain mindful of the practical concerns of users with limited time and resources and the most effective opportunities for learning. Must every event be analyzed to the same depth, and must every event have recommendations, regardless of the level of understanding of the event? Jorgensen (this issue), for example, sets simplicity and usability as key criteria for use, while directing attention to what can be learned from "simple" workplace accidents that harm far more people than the rare major events; many other papers are explicit about balancing clarity and simplicity with depth and comprehensiveness.

The second set of papers examines the relationship between the event analysis process and organizational learning. Stockholm examines obstacles to identifying and learning from common causal patterns in the refining and chemical industry; Schoebel and Manzey argue that event analysts have a trained incapacity to see the motives of individuals and the workings of social systems; Leveson questions assumptions about reliability and accident analysis that interfere with learning, offering a systems thinking approach to safety as a control problem; Wahlstrom identifies challenges to learning in the nuclear power industry and offers a conceptual model to support improvement and learning; Tamuz et al. examine a single case in detail of how departments within a hospital learned different lessons from an event; and Ramanujam and Goodman describe the mechanisms that share, store, and retrieve learning in organizations.

Although organizations intend to use the results of event analyses to make improvements and avoid further problems, the event analysis process also helps professionals and managers think differently about safety, see differently, and update their mental models (Leveson, Schoebel and Manzey, Stockholm, all in this issue). Further, participation in the event analysis process can provide cross-discipline and cross-organization learning and the development of trustful relationships that build a supportive environment for operations and improvement. However, the transition from written report to organizational learning remains problematic (Carroll et al. 2006). The gap between analysis and implementation is considerable and poorly understood (Rollenhagen, Wahlstrom, both in this issue). When analyses and recommendations are not understood, not implemented properly, or implemented with disappointing or unknown results, there is erosion of trust and commitment to the quality of reporting, analysis, and learning.

The third set of papers extends the concept of organizational learning to multiple levels of learning, including how larger systems and institutions learn. Lindoe et al. show that learning from accident investigations in offshore petroleum, fisheries, and bulk carriers depends on the competence of industrial actors interacting with the characteristics of the regulatory and legal system; and Hovden et al. describe features of the accident investigation, follow-up, and institutional context that allowed learning within and across aviation, marine, and rail transport sectors. Both papers show that it takes years for investigations of major accidents to result in changes at the system level (typically involving the legal, regulatory, and legislative processes). Extending our understanding of learning to encompass individuals, companies, industries, and authorities (even in a global context) is a substantial challenge. One major role of regulators is to encourage learning across organizations in the regulated industry. In nuclear power, for example, industry organizations including INPO and WANO play a major role in disseminating lessons learned, establishing principles and standards, and assisting individual organizations to self-assess and improve. Commercial aviation is another example of an industry that has become expert at collecting information from both near-miss incidents and major events and then transferring knowledge across the entire industry.

5. Themes

The special issue contributions offer a rich set of stories, observations, insights, analyses, hypotheses, and recommendations. The reader can mine these papers for many practical and provocative ideas. We highlight just three of the cross-cutting themes and issues that are discussed in many of the papers.

5.1. Better tools for incident investigation are possible

All too often, incident investigation is informal, ad hoc, and lacking systematic data and analysis. Even worse, our human tendency to blame the guilty and a legal system focused on liability (e.g., Hovden et al., this issue) can inhibit current and future learning. Considerable progress has been made in developing frameworks such as the Man–Technology–Organization framework (Rollenhagen, this issue) and understanding that a chain-of-events analysis is only the beginning to identifying organizational and systemic factors underlying the events (Fahlbruch and Schoebel, Leveson, both in this issue). The "cause" does not lie at the start of the chain of events (if there is a beginning) but rather in seeing the chain of events as a symptom of underlying system flaws. Yet we must contend with the tension between deep and sophisticated tools and the pressures for timely response from the investigators. Hence, papers present both relatively new thinking on system safety (Leveson, this issue) and practical tools emphasizing simplicity and usability (Jorgensen, this issue) as well as those that strike a balance in various ways (e.g., Lin et al., this issue).

5.2. Analysis is not learning

The tools for gathering information and analyzing the what, how, and why of incidents and accidents are but means to the desired ends. The intent of these activities varies among goals of assigning liability, understanding operations, minimizing disruptions, improving productivity, increasing safety, avoiding future problems, developing comprehensive tools and theories, and so forth. Although organizations may choose whatever goals they find consistent with their identity and strategy, we assert in this special issue that learning is of special importance. For us, learning includes both understanding and action. If no one behaves differently, learning has not occurred; yet if new behaviors are not accompanied by new understandings, then learning cannot be robust and sustainable across time and ever-changing circumstances. Tamuz et al. (this issue) relate an example in which separate groups had decided on corrective actions even before the official investigation began. Hovden et al. and Wahlstrom, among others in this issue, discuss the challenges of implementation, that is, turning the lessons of incident investigation into concrete change. Kirwan (this issue) labels the "killer question" as "How do we know our countermeasures are the right ones?" Ramanujam and Goodman (this issue) show that learning requires additional organizational processes to ensure that lessons are stored and retrieved when needed.

5.3. Learning requires new mental models and new conversations

The best investigation tools, guidelines, checklists, frameworks, and routines for training, communicating, and practicing root cause analysis are necessary but not sufficient for learning. As Leveson (this issue) points out, safety is managed by control actions taken by human or technological controllers who must contain a model of the process being controlled. For human controllers, there must be mental models that portray the controlled processes with sufficient fidelity and understanding of feedback to permit control. Leveson, Kirwan, Schoebel and Manzey, and Stockholm (all in this issue) also discuss mental models. In this way of thinking, incident investigations are a form of feedback to managers, regulators, and others about the system. If the audience for this communication is not capable of handling the feedback (too busy, overconfident, fixed ways of thinking, fear of being wrong), then nothing will change. But the audience needs the support of respected peers and champions among senior managers to ensure that learning has high priority and appropriate resources to put the right people on the team and give them the time and tools and the psychological safety to speak up. Lindoe et al. (this issue) show that the internal audience, including senior managers, sometimes requires outside pressure from regulators and policymakers to encourage change. As we look beyond a single organization to the companies, unions, suppliers, contractors, regulators, legislators, and publics that comprise a system (see papers in this issue by Hovden et al., Leveson, and Lindoe et al.), we realize that incident investigation is an opportunity for dialogue and collaborative learning across groups and organizations that are often in conflict yet need to work together more effectively on common problems.

6. The future

The papers in this special issue illustrate the great progress and the enduring challenges in the dozen years since NeTWork first

convened a workshop around incident investigations and learning from operating experience. A dozen years from now, what do we envision? If there were another NeTWork workshop, what would have to happen to make it a celebration of success? First, we believe that industries will increasingly share the knowledge and tools that are being developed. Even the most "advanced" industries (aviation, nuclear power) are still struggling with safety issues, and those that once faced the most obvious safety management challenges (health care, offshore oil and gas, transportation) are learning new lessons daily. Research can accelerate sharing by identifying more effective tools and the principles underlying their success, as well as by developing a shared language to ease transfer of knowledge. Engagement between researchers and practitioners is a continuing legacy of Bernhard Wilpert's work. Second, the concepts and tools of systems safety and systems thinking will be increasingly important as companies and industries identify key hazards and the most effective ways to remove and control risk. Research is needed to develop and operationalize comprehensive systems safety approaches that are practical and usable by diverse users in diverse settings. Third, systems approaches will allow safety management to become increasingly proactive, that is, learning from smaller and more distant incidents and even from system models without having to wait for accidents to provide the "gift of failure." Research must help make the case that safety management is good management, not simply a defense against an intrusive regulator or a misinformed public. Finally, systems approaches will encourage multiple stakeholders in the system (regulators, companies, academics) to understand their interdependent roles and to engage collaboratively in the learning process. Research can help understand how leadership emerges from different stakeholder groups with different amounts and sources of power to guide the whole system.

References

Beck, U., 1992. Risk Society: Toward a New Modernity. Sage, London.

Carroll, J.S., Hatakenaka, S., Rudolph, J.W., 2006. Naturalistic decision making and organizational learning in nuclear power plants: Negotiating meaning between managers and problem investigation teams. Organization Studies 27, 1037–1057.

Hale, A.R., Wilpert, B., Freitag, M., 1997. After the Event: From Accidents to Organisational Learning. Pergamon, Oxford.

Koornneef, F., Hale, A., 2004. Organisational memory for learning from operational surprises: requirements and pitfalls. In: Andriessen, J.H.E., Fahlbruch, B. (Eds.), How to Manage Experience Sharing. From Organisational Surprises to Organisational Knowledge. Elsevier, Amsterdam, pp. 93–108.

Perrow, C., 1984. Normal Accidents. Basic Books, New York.

Rasmussen, J., 1990. The role of error in organizing behavior. Ergonomics 33, 1185–1190.

Reason, J., 1997. Managing the Risks of Organizational Accidents. Ashgate, Brookfield, VT.