



## Editorial

## Foundations of safety science: A postscript



The editors of this special issue on the Foundations of Safety Science have asked me if I would be prepared to write what they have called a postscript to the issue. I assume that the reason was partly that I have been working in the area for so long (48 years) that I have become part of those foundations, or at least was present when they were laid. They have left me free to interpret 'postscript' the way I choose, so this will not be an attempt to summarise or draw together what is said in the papers making up the issue. It will more be an eclectic discussion of ideas and comments, stimulated by reading the issue's editorial and completed papers. It is a confrontation of some of the things said in the papers with my recollections of that stimulating almost half-century of research and teaching.

### 1. Can safety be studied?

Hollnagel (2014) debates the fundamental question of whether safety has a suitable object of study, and whether a 'dynamic non-event' can fulfil that purpose. Aven (2014) also tackles the same issue, rejecting 'lack of accidents' as not offering a stable enough basis of a definition to work on. By and large the rest of the papers sidestep that question and take the pragmatic view that the existence of unsafety is a sufficient justification for attending to and researching it.

Hollnagel's proposal (op cit) of 'safety 2' that should look at how and why things go right, rather than go wrong, is in the first instance an attractive reaction to this dilemma. It seems to provide a clear set of events to focus on, even though those are hard to distinguish from the focus of ergonomics, product engineering and management science, among other disciplines. However, my experience is that this does not make life much easier in the practice of researching or teaching. In her PhD research in a petrochemical company and a steelworks Eve Guillaume (2011) wanted to study such positive phenomena and asked the companies concerned to nominate examples. She was met with incomprehension of what this could mean, apart from things working as had been planned, which didn't help them much as they knew that and that didn't seem to cover the occasions when it still went wrong. Hence she had to fall back on investigating near misses and whether the companies had learned from previous accidents. It appeared that safety only had a meaning when coupled with 'looking as though it was going to go wrong', or in Hollnagel's terms (op cit), the expectation that things could go wrong because the group or organisation was faced with unexpected and unplanned situations they had to react to. It is all very well looking at successes, but they don't seem easy to define without contrasting them with (incipient) failures.

That leads to a strategy that resembles those of epidemiology. However, an epidemiology of accidents has always been problem-

atic, because its central health-inspired methodology does not work well with accidents. Epidemiology's contribution to medical research rests on contrasting groups with a given disease with ones without it, matched for as many already known causal factors as possible, so as to reveal whether the factors under study do or do not differentiate the two groups. Contrasting a group or situation with accidents with one without is not easy because accidents are acute, as opposed to diseases which have a longer lifespan as manifest symptoms. What period with no manifest accidents in a control group or organisation do you have to take to make a comparison with an accident group meaningful? My first experience of a major research study on accidents was one which faltered on this question (Powell et al., 1971); we defined a no-accident control as someone doing the same job on the day of the accident to the victim, but what proof could we have that that person would not be the subject of an accident a few days later? If researchers had been able to study the Titanic on 13th April 1912 compared with the night of 14th to 15th, what would they have learned beyond the danger of sailing fast into an iceberg. The deeper contributory factors would not become evident using that timescale. As Barry Turner (1978) showed, the incubation period for an accident is long, so one might say that all organisations are likely to have embarked at any one moment on a scenario leading to at least one significant accident. How do we know then whether they are successes or incipient failures? The nearest we can get to Hollnagel's plea (op cit) to study things going right is to interpret that as the study of recovery from incipient or anticipated failure. We need to turn the characteristics suspected of facilitating that recovery into an evaluation tool, which we can then use to study organisations proactively and assess how far they are deviating from those putatively desirable characteristics. We can then compare companies with the 'good' characteristics with those with less good or none, to see if our 'good' characteristics do indeed correlate with accident performance over the next period; but again, how long should that period be and how do we keep tabs on whether there are (subtle) changes and deviations happening in them which are changing their susceptibility?

### 2. The scope of safety science

As both Aven (op cit) and Hopkins (2014) say in this issue, some of the important influences on what is seen as a discipline or subject area are the journal or journals that researchers and practitioners publish their work in, and the conferences and workshops they set up and attend. They, together with the courses and teaching establishments which train the future researchers and practitioners, create the community of safety science or whatever other title we choose for that communal effort. In that sense safety

science is clearly a communal construct formed and bounded by who submits papers and on what. That in turn is influenced in great part by what research is funded by government, industry and research councils.

For my valedictory lecture at Delft University of Technology (Hale, 2006) I analysed the content of nine safety journals (Table 1) to track how safety had blossomed as a scientific subject over the 47 years since the first journal began publication.

Journal	Year of first publication	Area of main focus
Accident analysis & prevention	1969	Road safety
Journal of Safety Research	1969	Occupational safety North America
Journal of Hazardous Materials	1975	Technology of safety
Safety Science, previously Journal of Occupational Accidents	1976	Occupational safety, safety management and culture
Journal of Loss Prevention in the Process Industries	1988	Major hazard technology & management
International Journal of Occupational Safety and Ergonomics	1995	Ergonomics and occupational safety
Policy and Practice in Health and Safety, previously Journal of the Institution of Occupational Safety and Health	1997	Policy and regulation
Reliability Engineering and System Safety	1998 <sup>a</sup>	Major hazards and quantitative risk assessment
Journal of Risk research	1998	Risk perception and governance

<sup>a</sup> This is the year that the journal added 'safety' to its title. I did not analyse the 19 earlier years when it was called simply 'Reliability Engineering'.

This list gives an idea of the breadth of the subject and its spread across different activities. The number of articles went in 47 years from around 30/year to well over 400/year, with the focus predominantly on technical aspects of safety, followed by human factors and to a lesser extent organisational and societal aspects. Papers on transport safety dominated, followed by major hazards and occupational safety, with home and leisure safety topics lagging way behind, despite those activities seeing the highest numbers of accidental deaths in developed countries. The analyses of the country of origin of the papers' authors also showed the dominance of the developed world, which had far lower accident rates than the developing world countries. This could be interpreted as an indication that lots of research results in low accident

rates, but the cause-effect could just as well lie differently, that rich countries are examples of Ulrich Beck's (1992) risk societies and pour their wealth into studying a declining problem.

If we take the journal Safety Science as an example of those nine scientific journals we can probe deeper. Safety Science as a journal grew out of the Journal of Occupational Accidents (JOCA) founded in 1976, the first refereed English language journal in Europe dedicated to the topic of safety. Its first editor, Herbert Eisner was head of the Safety in Mines Research Establishment (SMRE) in the UK, part of the research arm of what had then recently become the Health and Safety Executive, after the various independent safety inspectorates and their supporting R&D organisations had been brought together under one body, in the wake of the Robens report (Robens, 1972) and the Flixborough major accident report (Department of Employment, 1975). Its content in those formative years can be seen from the vantage point of the tribute issue of the journal in July 1993, when Eisner retired as chief editor (Safety Science, 1993) and I took over his role for the next 16 years. The issue consisted of state of the art papers by frequent and distinguished authors who had published in the journal over those first 17 years. It fell into 5 more or less equal parts covering 'fire and explosion' (Eisner's personal area of expertise), 'personal protective equipment', 'machinery safety', so-called 'classical accidents' and 'methodological and organisational issues'. As such it was rooted firmly in what Hale and Hovden (1998) called the first and to a lesser extent the second ages of safety, focussing respectively on the technology and human behaviour implicated in accidents. The dawn of the third age of management of safety was only dimly breaking.

Since I was the one who, with Eisner, wrote the new scope of the journal when it changed its name from JOCA to Safety Science in 1991, it may be useful to respond to the points made by Aven, Hollnagel and Hopkins (all op cit) about the scope. The reasoning behind that scope was explained in the editorial to the 1993 tribute volume (Hale, 1993) as follows:

*When the journal began it was the first in Europe to tackle publication at a scientific level in this topic. ... The related areas of occupational hygiene and medicine, of ergonomics and occupational psychology, and the engineering disciplines had established scientific journals in which the occasional paper relating to safety appeared, but most authors then had to tailor their presentation to the interests and criteria of the discipline represented by that journal. Multidisciplinary papers found no easy way to print, being rejected as too shallow in the monodiscipline and having too much irrelevant material outside it.*

This indicates that the scope of the journal was determined as much by what there was not, research which had no clear publishing home, as by any vision of what there should be – a striking parallel with the definition of safety as a lack of risk. It was certainly determined in the subsequent years by the papers submitted to it, which pushed its centre of gravity from the technical to the behavioural and then the organisational, leaving the technical associate editors with relatively little work to do. This formed one basis for the characterisation by Hale and Hovden (1998) of the three ages of safety, in later years extended to a fourth age of interorganisational studies (Wilpert and Fahlbruch, 1999). Those ages do not run in synchronisation across the globe, as is evidenced by the predominance of technical and mathematical papers submitted to the journal from China in the more recent decades (and largely rejected as out of scope – Hopkins op cit), when the number of such papers from Western Europe<sup>1</sup> and North America had become vanishingly small. Hopkins is also right that the avail-

<sup>1</sup> Eastern Europe also produced safety technology papers later than the rest of Europe, as can be seen by the contents of the Working on Safety Conference in 2012 in Poland.

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