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New models for new times. An anti-dualist move

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ABSTRACT

This paper describes a 'déjà vu' experience from the first decade of the 21st century. It shows that, 20 to 30 years apart, one can single out from history two waves of major accidents across safety–critical systems. This new series of major accidents of the 21st century challenges the field of safety. Considering the situation, the paper first argues that models that have been prevalent or the most popular in the field need to be looked at critically and questions whether they still remain appropriate to sensitise the current situation and the trends in safety research. Secondly, based on a list of eight attributes (including the ability to provide appealing graphical representations), three popular models are selected, then analysed in terms of their strengths and weaknesses: Reason's Swiss Cheese Model, Rasmussen's migration model and socio-technical view, and Weick's (and colleagues) collective mindfulness. A fourth approach case, resilience engineering, is also reviewed as a more recent and collective endeavour. Finally, the paper argues that current models and their associated graphical representations supporting safety management practices should not only incorporate advances in managerial, social and political sciences but also in epistemological and philosophical areas in order to reflect the body of knowledge available in the field of safety today more effectively. A set of two graphical representations are then offered as alternatives, promoting anti-dualist metaphors (e.g. constructivism, complexity, networks), and their implications explored.

1. Introduction

1.1. A 'déjà vu' experience?

In the past decade, many accidents have occurred in different high-risk (or safety–critical) industries, creating a sense of 'déjà vu'. This feeling is now more extensively presented than in an earlier contribution dedicated to some first 'post-disaster reflections' (Le Coze, 2013a). At the end of the 1970s and in the 1980s, several disasters in the nuclear, chemical, offshore drilling, railway, aviation, maritime and aerospace industries followed each other within a relatively short period of time, a period of about 10 years (Table 1). Twenty to thirty years on, in a similar time span of around 10 years, one can also contemplate and select high profile disasters in almost every high-risk industry (this table excludes areas such as the military or the medical sector).

One could argue that this is a simplified and partial vision of history. Indeed, in each of these safety–critical areas, in different parts of the world, there have been a large number of incidents, accidents and disasters. Quite clearly, many detailed lists of accidents are available (for example, on Wikipedia) for the railway, aviation and nuclear industry, going back for some of them to the early days of the industrial revolution in the 19th century. They offer a wide perspective that to some extent challenges the contents of Table 1. Indeed, these lists reveal instead a constant 'background noise' of incidents, accidents and sometimes disasters across nations and companies in each of these industrial sectors. For some of them, this background noise is more intense than others. Further analysis would reveal several layers of issues which help to explain the variations between sectors. They would include dimensions related to the level of (international) cooperation between industry in learning, the level of regulation by states, technological and economical constraints exerted on these systems, and the intensity of the sector (e.g. more flights than nuclear power plants).

As a consequence, some could argue that the pattern of Table 1 is therefore a bit misleading. It leaves aside too much information related to the specific situation of each of these high-risk sectors. This, to a certain extent, could be a valid criticism. However, it would also miss the point. First, Table 1 does not deny the specific history of each of the many safety critical systems in the various countries. But any account of the history of accidents is established from the specific point of view of one (or more) observer(s). The fact that it is 'biased' is intrinsically part of any retrospective process. Second, the table seeks to emphasise and single out a unique situation, described above as a 'déjà vu' type of experience. One can indeed put together, 20 to 30 years apart, within a similar

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Table 1
A 'déjà vu' feeling 20/30 years apart.

High-risk industries	Period	
	1970s–1980s	2000–2010
Nuclear	Chernobyl, 1986	Fukushima, 2011
Offshore drilling	Piper Alpha, 1988	Deepwater Horizon, 2010
Fuel storage	Port Edouard Heriot, 1987	Buncefield, 2005
Aerospace	Challenger, 1986	Columbia, 2003
Aviation	Tenerife, 1977	Rio Paris, 2009
Chemical – petrochemical	Flixborough, 1976, Bhopal, 1984	Toulouse, 2001, Texas City, 2005
Railway	Clapham Junction, 1987	Ladbroke grove, 1999
Maritime I	Zeebrugge, 1987	Costa Concordia, 2012
Maritime II	Exxon Valdez, 1987	Erika, 2003
Air Traffic Management	Zagreb, 1976	Umberlingen, 2002

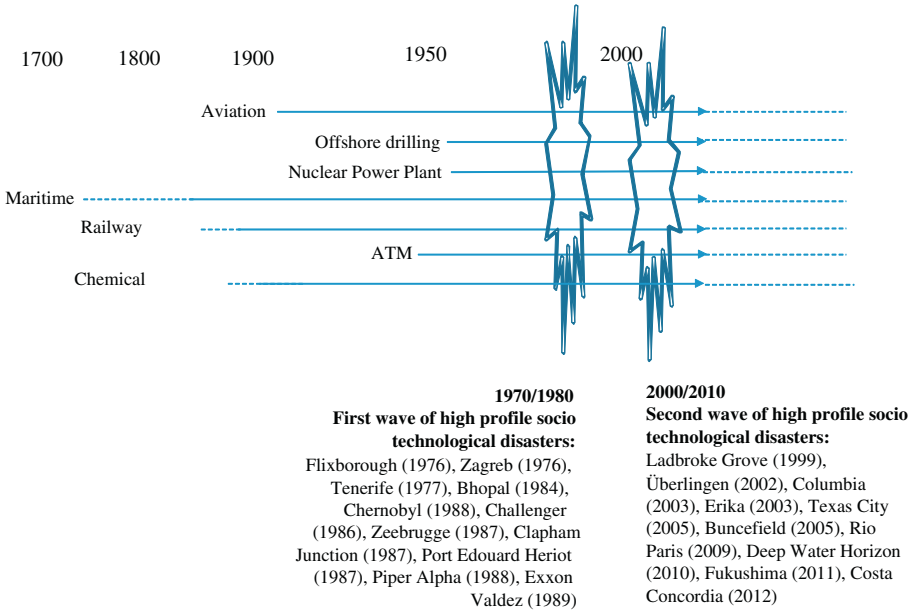

Fig. 1. A 'déjà vu' experience.

restricted time span of around 10 years, a new series of events. These events all come under the same intense national and often also international interest and scrutiny by the media, justice systems, civil society, states, financial markets, industry and professions. They have a strong symbolic component, where each time, and probably at Fukushima more than elsewhere, a belief about the safety of these systems that had previously been taken for granted has seriously been undermined (Fig. 1 illustrates this alternative view to Table 1).

What to think then about this pattern? The first thing that comes to mind is that safety has not made much progress if accidents keep on repeating. But one could advocate immediately a different interpretation. First, it could be countered that safety has been improving, but not enough so as to keep up with the increase in activities observed: there are more and more nuclear power plants, more offshore platforms; more planes flying, etc. From a purely (and abstract) mathematical standpoint, for the same likelihood of events, more operating systems mean more accidents. So, despite improvements in safety, the number of accidents increases as a function of the increase in activities, not as an indication of less safety. Second, one could also argue that times have changed and that you cannot compare events that took place 30 years apart. It would be difficult to make a comparison between these accidents and to consider whether safety has progressed because in between, many of the operating constraints of these high-risk systems have evolved, and accidents never re-occur in exactly the same way.

1.2. Have 'old' models expired?

Along this last line of interpretation, one is entitled therefore to wonder whether the safety models that we have inherited from the past no longer capture what needs to be more explicitly grasped to conceptualise accidents, in these new times. As Teemu Reiman suggested it (personal communication): '*Should models come with an expiry date*?'.[1] Another way to put it is: '*Are models that have been used in the field of safety in the past two decades able to reflect on the growing body of literature since this first wave of disasters?*' or '*Are current models up to date?*' The answer to this question is not straightforward. One could contend for instance that what is needed from safety–critical industries is to take on board more of the insights of the existing models to help them to develop safe operations (this would leave the translation process aside, which is arguably one of the most difficult tasks to carry out). Instead of developing new models, existing ones could still influence more industry practices.

[1] This is what Reason has for instance expressed about his own model '*Is Swiss Cheese past its sell-by dates?*' (Reason et al., 2006).