JAMES REASON

James Tootle Reason

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Summary. Professor James Tootle Reason FBA CBE was an applied psychologist with a lifelong interest in individual cognitive performance and the ways in which the occurrence of simple cognitive slips and errors could impact our health and wellbeing. Jim's major and lasting contribution came in the 1990s in the interdisciplinary area of risk management and organisational safety practice. It is no exaggeration to state that it was his enthusiasm and skill in clearly communicating the application and relevance of his theories in the real world that was to prove transformational for practitioners in the safety profession.

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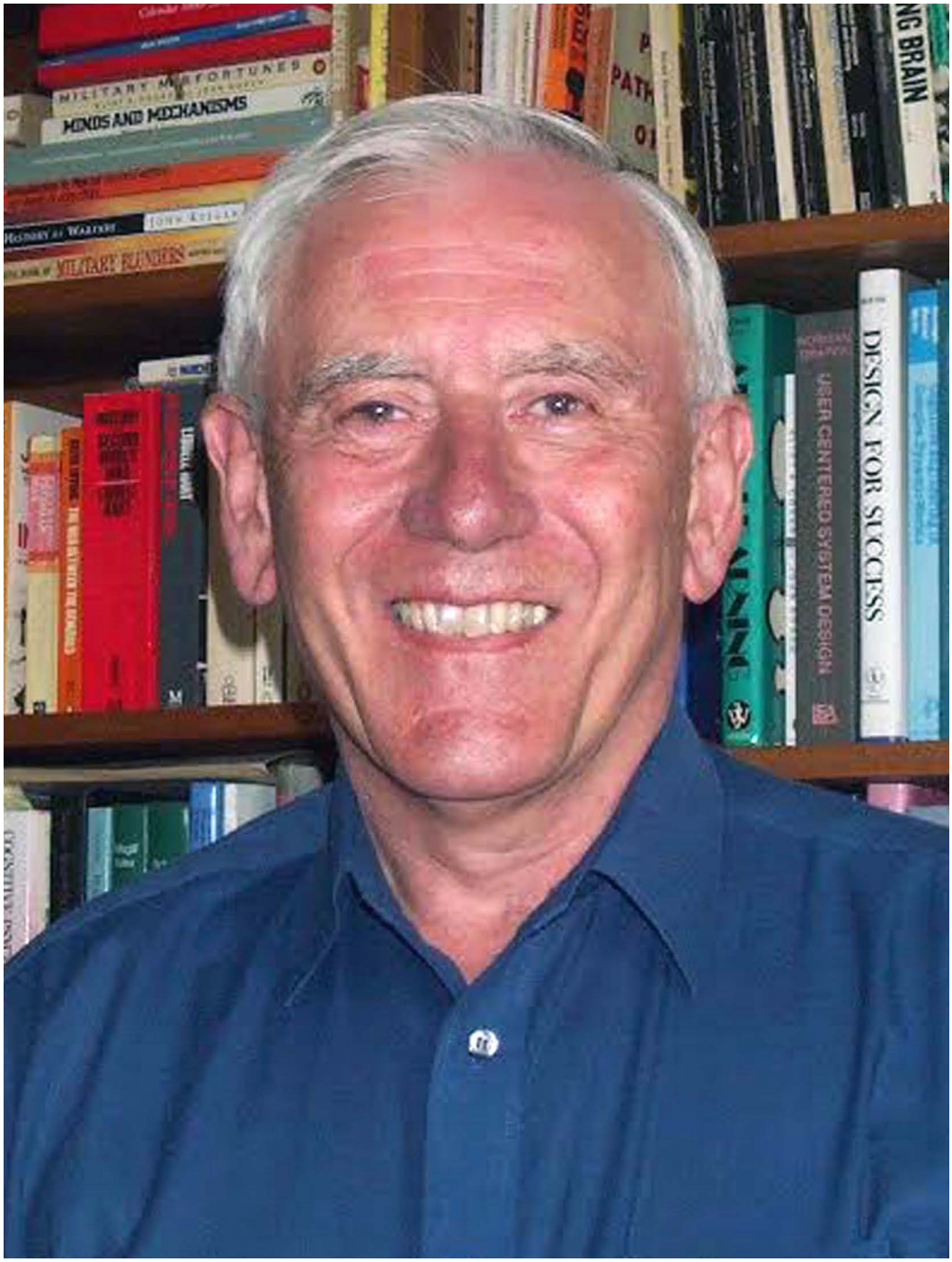
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MILITARY BLUNDERS
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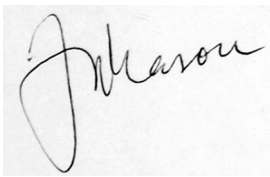
USER CENTERED SYSTEM DESIGN



Professor James Tootle Reason FBA CBE was an applied psychologist with a lifelong interest in individual cognitive performance and the ways in which the occurrence of simple cognitive slips and errors could impact our health and wellbeing. Jim's major and lasting contribution came in the 1990s in the interdisciplinary area of risk management and organisational safety practice. He had begun this journey early in his career when asking the simple question of how and why cognitive errors and slips might lead to unintended behaviours and consequences in our everyday lives. By subsequently transporting this thinking into the novel field of organisational accidents, Jim's work became an integral part of an entirely new way of viewing accidents and safety that was to evolve in the 1980s and 90s in the UK, US and Australasia. It is no exaggeration to state that it was his enthusiasm and skill in clearly communicating the application and relevance of his theories in the real world that was to prove transformational for practitioners in the safety profession. Many across a wide range of different high-risk industries and organisational contexts, both in the UK and elsewhere, would credit this now.

He was born James Tootle on 1 May 1938, and brought up in Watford, Hertfordshire. His father was killed during the Blitz in the Second World War, and his mother died several years later. As a result, he was raised by his maternal grandfather, Thomas Reason, whose surname he adopted. Jim went on to study psychology as an undergraduate at the University of Manchester, and while there met his future wife Rea (née Jaari) who was also studying psychology. Rea Reason herself subsequently became a professional psychologist, specialising in educational psychology and dyslexia.

After graduating from Manchester in 1962, Jim moved to the University of Leicester where he received his PhD on motion sickness in 1967,[1] under the supervision of Sydney Gillmore Lee and in collaboration with the then RAF Institute of Aviation Medicine. The work also took him to the US Naval Aerospace Medical Institute in Pensacola, Florida. At Leicester he went on to commence his lecturing career, and also collaborated with John Brand to come up with what has become one of the most cited hypotheses for the cause of motion sickness – the sensory conflict theory. In their pioneering 1975 book on the topic, Reason and Brand suggested that the condition occurs because of a 'conflict between the senses and stored patterns of motion',[2] a theory with much currency still today given the emergence of virtual reality simulation, autonomous vehicles and commercial space travel.[3] In 1977 Reason moved back to the University of Manchester, where he became Professor and Head of its Psychology Department. As Head he set about rejuvenating the department after the retirement of John Cohen, who had been Head of Department since 1951. In this, he was soon joined by a second Professor,

[1] Reason (1967).
[2] Reason & Brand (1975).
[3] Allred, Gopinath & Clark (2025).

Sebastian Halliday. He is remembered as striking an impressive, sun-tanned and suave figure in the Department by contrast with the usual appearance of UK academics. One early memory of those there at the time was that, as part of his work on the explanation of serious accidents, he recruited members of staff and students to record 'actions not as planned' in memory diaries. Apparently, once respondents understood what was wanted, these came thick and fast and must have provided him with a rich database.

Although Jim himself was a committed experimentalist, he was also an early methodological pluralist, sceptical about the universal applicability of experimentation in psychology and with a strong interest in interdisciplinarity. He admired Freud and kept a framed photo of Freud in his office. He and Halliday decided to keep up with the times by starting an interdisciplinary Masters in Cognitive Science which, although hard work for the staff involved, was highly successful. Although such courses have become commonplace in subsequent years, and are of even greater significance in today's era of expert systems, machine learning and artificial intelligence, at the time this was a ground-breaking development for Manchester to undertake. He was also convinced of the importance of Applied Psychology before the era of 'impact' and when there was something of a snobbish attitude to that branch of the subject. He is remembered as an engaging, tolerant colleague and Head of Department, but one who had a firm grip on the changing realities of the University scene, telling one member of staff 'If you don't write, you don't exist', which was seen less as a threat than an ironic paraphrase of the Cartesian 'Cogito ergo sum'. He was a man of real humanity and many interests which included a profound knowledge of the American civil war, accompanied by a full-scale model of a civil war battlefield in the cellar of his house.

In both his academic and everyday life Jim had a longstanding interest in understanding the generation of everyday human errors and their real consequences – something that he saw as akin to Freud's idea of the 'psychopathology of everyday life'. Jim first identified and labelled crucial distinctions between slips (automatic actions gone wrong), lapses (memory failures), and mistakes (flawed decision-making). The informal memory diaries work was supplemented by grant support from the then Social Sciences Research Council and resulted in him co-authoring with Klara Mycielska the book *Absent Minded?* in 1982, on the psychology of mental lapses in the everyday.[4] Rea Reason is also credited in the introduction to this volume for elucidating the relevance of hypnosis to the theory being developed there, a further clear sign that Jim was unafraid to move beyond the constraints of conventional theory and experimental psychology if the problem and its solutions demanded this. The account in *Absent Minded?* charted the ways in which simple cognitive slips and lapses in performing routine actions might lead us into certain predictable error patterns. For example, struggling to open a friend's door with your own

[4] Reason & Mycielska (1982).

key, absent mindedly putting a spoonful of cat-food rather than tea into a teapot, or squeezing shaving cream onto one's toothbrush in the morning! Much of the book was concerned with describing the different cognitive mechanisms and the science underlying such simple failures, most of which hold little consequence beyond our own personal embarrassment.

As a result of this wide interest in everyday errors and applied cognitive psychology, Jim was around this time invited by Donald Broadbent at Oxford University to become involved in research on human factors in road traffic safety. This initiated a programme of work financed by what was then the Transport and Road Research Laboratory. His collaborators on that work recall appreciating first hand Jim's ability to craft a new psychometric instrument to assess slips, errors and violations while driving. He devised most of the items in what became known as the Driver Behaviour Questionnaire, and he wrote the first draft of the paper that reported the first set of results.[5] This paper is much cited and has had a major impact on driver behaviour research. Although it was something of a disappointment to Jim that cognitive errors and lapses (his real interest) turned out to be less predictive of accidents than rule violations, he remained fully engaged with the work in its early stages and without Jim this line of work would never have happened.

In the 1982 book *Absent Minded?* Jim and Klara had also begun to expand their understandings beyond the cognitive psychology of individual everyday actions, by trying to explain more complex events. In a marker of what was to come in his later career, a final chapter was devoted to elucidating the causes of prominent case-studies of past catastrophes. No doubt reflecting his own interest in historical battle reconstruction, this included an analysis of the ill-fated charge of the Light Brigade in the Crimean War of 1854, but also more contemporary examples such as the 1977 runway collision in poor visibility between a KLM and Pam Am passenger jet at Tenerife airport. In this accident – still the worst in aviation history in terms of fatalities – 583 passengers and crew had died. The overburdening of the Tenerife airport infrastructure by multiple parked aircraft diverted that day from a bomb threat elsewhere, and several communication failures involving both aircraft and the traffic controller, were significant in the run up to the collision. The accident inquiry had found that the final critical moment had come when the KLM pilot erroneously believed that he had received clearance to commence his take off, and that it was safe to proceed. When the Pan Am aircraft taxiing slowly towards the KLM accelerating along the same runway finally came into view it was too late to avoid a collision. The powerful point made in the book was that there was little to distinguish the simple human errors that we encounter in the everyday from some of those occurring in the run up to major disasters and accidents. As a result, psychological knowledge and

[5] Reason, Manstead, Stradling, Baxter & Campbell (1990).

theory could be applied systematically to human error prevention and by extension to the management of safety. This was the main task to which Jim dedicated the remainder of his career.

A gap in this 1982 book was any systematic treatment of the known organisational contributions to disasters. To fully develop his line of analysis Jim needed to incorporate insights that were only just emerging in organisational sociology. The mid–1970s had seen foundational concepts introduced by the British sociologist Barry Turner in his seminal paper in *Administrative Science Quarterly* titled the 'Organizational and Interorganizational Development of Disasters'.[6] Following up with his 1978 monograph *Man-Made Disasters*,[7] Turner revolutionised safety thinking of the time by developing the very first comprehensive organisational theory of how disasters and major accidents occur – in work which remains as relevant to safety science and practice today as it was when first formulated. Turner had conducted close and systematic qualitative analysis of a large corpus of UK major accident inquiry reports from the period 1965–1975. From that analysis Turner was able to demonstrate how large failures arose as an unintended consequence of breakdowns and weaknesses in complex 'organisational-human-technical' systems – such events were neither technological or organisational alone, but were always socio-technical. A key insight here was that multiple pre-conditions interacted, at different levels of organisational and system complexity, and that this lay behind all large-scale disasters and accidents. Such breakdowns were often rooted in communication failures and misunderstandings occurring both within and between the organisations responsible for safety. Turner's insight challenged the then received wisdom that unsafe situations appear out of the blue as 'Acts of God', or as the result of a single final operator or human error. Large accidents occur in already degraded systems, a situation which typically develops over a considerable period of time, as anomalies and information failures interact in unanticipated ways to eventually undermine the assumptions being made about risk and safety, thereby defeating the available safety precautions.

Consider the simple pilot errors occurring in Reason's example of the Tenerife air disaster. Viewing the precursor events in human *and* organisational terms would lead one to ask somewhat different questions about their significance. In what ways had the poor weather conditions that day contributed to stress on the airport traffic management system, as well as the eventual pilot errors? How might the abnormal volume of parked aircraft at the airport, and the need for non-routine ground operations to overcome congestion, have generated an unsafe situation at the airfield as whole? Could the stretched ground movement capabilities have been at fault, including those of the controllers to

[6] Turner (1976).
[7] Turner (1978).

cope with this situation while operating under pressure to deliver multiple (in some cases non-standard) aircraft movements in a timely way? And were suitable contingency plans and protocols in place to deal with such abnormally stressed situations? In Turner's language, the final errors of the KLM pilots could only be understood within an already degraded socio-technical system, and focusing primarily upon this final link in the accident chain as the main cause would almost certainly deflect attention from more important and subtle organisational and environmental pre-conditions to the events which ultimately unfolded. Turner's Disaster Incubation Theory, as it later came to be known, was a considerable break from the conventional safety thinking of the time, and was pivotal in advancing both Reason's and others' theorising in the late 1980s and early 1990s. Jim would not only incorporate a number of these ideas into his own work, but more importantly used his considerable skills of translation to develop a series of key metaphors that both summarised core concepts and proved to be immediately useable for safety and risk management practitioners.

Some six years after Turner, and in a largely separate development, the American sociologist Charles Perrow published an account of the 1979 Three Mile Island nuclear accident sequence, also describing it in terms of a systemic and complex chain of events. In his widely read and highly influential book *Normal Accidents*,[8] Perrow argued that system features, such as the high complexity and tight coupling that are inherent to certain high-risk systems such as nuclear power plants, meant that accidents in these systems were inevitable or 'normal'. While Perrow's 1984 account was essentially pessimistic regarding the possibility of safety intervention for some complex and tightly coupled technologies (in effect, he recommended that some technologies with these properties should not be used at all), both Turner and Reason's work implied the opposite.[9] If disaster pre-conditions and errors had mundane human and organisational causes which built up systemically over time, then one could in principle seek to conduct interdisciplinary inquiry to understand, identify and thereby prevent incubating accidents.

By chance Jim visited the Exeter Psychology Department in January 1987 to give a routine seminar on his cognitive errors and failures work, at a time when Barry Turner was a Reader in the Sociology Department. Following a lively seminar, and later on in discussions in the bar of the Great Western Hotel with Turner and his colleagues, it was suggested to Jim that organisational factors should be incorporated into his account of errors to fully explain his disasters – that he should adopt a systemic and organisationally-focused approach. At the time these suggestions chimed with ideas Reason was himself developing through his longstanding friendship with the nuclear engineer John Wreathall, who he had met at the first NATO-World Bank symposium on accidents held

[8] Perrow (1984).
[9] Pidgeon (2011).

in Bellagio, Italy in 1981 – a meeting now known as the 'Human Error Clambake'.[10] Armed also with the analytical thinking of Turner and Perrow, he went on to write a short account of the 1986 Chernobyl accident in the *Bulletin of the British Psychological Society*. Published in 1987, this think piece was Jim's first to properly incorporate concepts and theories of organisations into an analysis of a major disaster. Turner died prematurely in 1995, but in the short period that he and Jim knew each other well they became collaborators and friends, and they almost certainly would have worked together further had Turner lived. They even shared a work trip that Jim had organised to attend a safety seminar on behalf of the Royal Dutch Shell company, deep in the rainforests of Equatorial Africa. Jim and Shell's thinking had been that, in order to fully appreciate Shell's critical safety requirements, attendees needed to understand the many stresses involved in conducting industrial operations in inhospitable remote environments. It was certainly an unconventional event, as Turner later recalled, since during a field-site visit at the conference participants were required to wade through at least one flooded jungle river!

What is interesting about the convergence of the theories of Reason, Turner and Perrow is what they tell us about the way that a new field of academic and applied knowledge emerges. All began working independently around the same time and at the cutting edge of a new and rapidly emerging societal problem (major technology failures involving people and large organisations) with few easy answers. All came to realise that existing accounts of disasters were wholly insufficient to understand the many problems involved, and that theories and approaches from beyond their own disciplines might also be required. The 1980s had seen a string of high-profile catastrophic events – Chernobyl, but also the King Cross Tube Fire, the Zeebrugge Ferry Sinking, the Challenger Space Shuttle, and the Piper Alpha oil-platform disaster in the North Sea to name but a few – all of which required this new line of thinking and data analysis. In his 1987 piece on Chernobyl, Jim located the concept of 'human error' firmly within a wider account of organisational and system failure. He distinguished between the active frontline operator failures that had occurred at Chernobyl as seen through his earlier cognitive errors work, and what he termed 'latent errors' in design, organisation or management that were incubating unseen to make the Soviet designed reactor system inherently unsafe. In Jim's terms many such high-risk and complex systems could be thought of as containing 'resident organisational pathogens' that would make failure, if not inevitable, then definitely more likely. Adopting this readily understandable analogy from medical science, his idea of a resident organisational pathogen was his first key translation of a critical concept from academic thinking into a language for safety practice.

[10] Larouzée (2017).

The Chernobyl analysis laid the groundwork for much of the thinking in Reason's two hugely influential subsequent books. In the first of these accounts, the book *Human Error*,[11] he began to outline his second, and arguably most influential translational device, now known widely as the 'Swiss Cheese Model of Accidents'. Drawing on his conversations with the engineer Wreathall in particular, Reason started from the observation that by definition major risky systems always have multiple defences in depth, and these can be thought of as a set of layers of thin Swiss cheese. Most of the time an incubating hazard cannot defeat all of the defences, hence major accidents do not often occur. However, unanticipated pathogens and latent errors, including organisational or management weaknesses, poorly drafted or ambiguous safety procedures, and the inevitable occurrence of frontline errors and violations of safety procedures, however rare, mean that each defence layer contained at least one or two potential flaws, which Jim portrayed as the holes in each layer of cheese. Ordinarily accidents could not occur because even if a developing accident pathway were to pass through one hole in one layer, it would typically be stopped by the next layer of defence. Only when holes occurring in all layers were fully aligned could an accident occur – regulatory weaknesses and organisational failures in communication or technology design, combining perhaps with ambiguous operating protocols and a final human operator error. Only then might a failure pathway develop through all of the planned defences. It is hard to overstate the impact on the safety world of this simple Swiss Cheese metaphor, as a means of neatly describing for practitioners the problem of controlling complex high-risk systems. Today it would be rare to encounter a senior manager with any safety interest whatsoever who does not know all about 'Swiss Cheese'. Of course, when pressed they would probably not know exactly where and how this brand of cheese initially came about, but they definitely do know what it means for their safety systems and the company bottom line.

One critical implication of the multiple-barrier thinking inherent to the Swiss Cheese model is that one tries to identify in advance where critical holes in planned defences exist. A second, more subtle point, is that good safety practice involves constant learning and vigilance for situations that have eluded several of the safety barriers.[12] In complex high-risk systems one should *never* allow a situation to degrade to the point where a single barrier gives the sole protection from disaster. The 1990s saw Jim apply some of this thinking to help safety practice in major international corporations and regulatory bodies. These included British Airways and Quantas, the international oil industry, and regulators such as at the Australian Bureau of Air Safety investigation and the International Civil Aviation Organisation. Aviation safety professionals in particular paid attention at the time, recognising the complex and well-defended nature of their systems and the

[11] Reason (1990).
[12] Pidgeon (1997).

value of the barrier-defence-pathogen concept when conducting accident and incident investigations. The Australian Bureau of Air Safety Investigation, for example, adopted Reason's Swiss Cheese model for its inquiry and report into the Monarch Airlines (Australia) accident, in which 7 people had lost their lives in 1993.[13]

Jim was also a diligent and enthusiastic supervisor of early career scholars, to whom he gave unfailing support – and who he would enthuse with his contagious curiosity and enthusiasm for the work. Many opportunities for younger researchers came from working with him and his industry partners. One such project was with British Rail, who wanted to understand why shunters broke rules and (as a result, it was claimed) died far too frequently while doing their job. Jim had the foresight to understand that success depended upon identifying just the right student for this project. He knew that for the British Rail work, which would involve extensive interaction with frontline railway personnel, training as a shunter, visiting shunting cabins and gaining the trust of shunters, the applicant who was most willing to don a pair of steel toe-capped boots and a high visibility vest was the one he was looking for. That this work went on to yield a very successful project and set of conclusions[14] was in no small part because he urged his students to move beyond reductionist interpretations of his work and appreciate the sophistication and nuance of what he was expressing – there was no easy 'find and fix' when approaching safety problems. Jim's ongoing influence on the field today is attested to by the many early career scholars who worked with him or his ideas, and who today are senior academics and safety professionals in their own right.

The work with aviation professionals also helped to develop Reason's own thinking. Following the Chernobyl accident in 1986 there had been much discussion amongst safety professionals and academics about what might constitute a good organisational safety culture. 'Poor safety culture' within Soviet nuclear engineering had been attributed by some Western commentators to the events that had happened there. Eschewing simplistic accounts of this idea, Jim's 1997 book *Managing the Risk of Organisational Accidents*[15] became a best-selling title in safety science for its publisher Ashgate. In this book Jim developed and discussed his own conceptualisation of safety culture in organisations, introducing a third critical translational concept which has stood the test of time – that of a 'just culture'. One way of identifying latent organisational pathogens and the occurrence of partial accident pathways is by analysing safety incident reports. Ongoing learning from such incidents is now accepted as a critical component of safe system operations in complex environments. In the early 1990s both British Airways and Qantas were developing confidential reporting systems to collect critical safety and human

[13] Wilson (2020).
[14] Lawton (1998).
[15] Reason (1997).

factors information from their employees. In this regard British Airways had already realised that in order for these reporting systems to work as intended, and for candid reports to flow readily and promptly between frontline staff and the safety services department, they needed to overcome the perceived problem of blame. Would people freely report their own 'human errors' if they felt they would eventually be held personally liable? Incident reports were known to provide such valuable safety information about resident organisational and other pathogens that any liberal application of blame risked turning off this vital source of intelligence. Accordingly British Airways had instigated very careful internal procedures and tacit agreements with their staff, to ensure that their safety investigators could foster and maintain trust as part of a wide-ranging reporting culture across the airline. This was achieved through careful separation of the critical objective of maximal organisational learning from errors, mistakes and safety violations (where blame would not be laid on particular employees who reported them in good faith and promptly), from the function of instigating sanctions in the very few instances where a very serious and intentional procedural violation had occurred.[16] Reason captured this idea in his concept of a just reporting culture – one where blame was wherever possible not attributed to any individual or group in an organisation provided that honest reporting of errors and mistakes had occurred. A just culture asks 'what went wrong in the system, where are the underlying pathogens, and how can they be fixed?' rather than 'who was to blame, who was in error?' Today one would point to the work of Reason and Turner in the UK, alongside the work in the USA on high-reliability organisations[17] and organisational sensemaking[18] which arose in response to Perrow's normal accidents challenge, as crucial to the later debate in safety sciences about resilience engineering and so-called Safety II. In the face of unpredictable and complex hazards, safety professionals now undertake risk mitigation through safer design and proactive risk assessments (Safety I), but also aim to foster locally embedded safety practices of, amongst other things, ongoing learning, monitoring and procedural flexibility in the search for organisational excellence (Safety II).

Elected to the British Academy in 1999, Jim had by this time begun to extend his work further afield, and into healthcare and patient safety[19] and the work of the National Patient Safety Agency. Thinking about accidents and disasters in systemic terms means that generalisations can be made across different safety contexts if they have similar underlying structures and procedures. In this respect both organisational and human behaviours are social phenomena, which typically operate independently of the underlying risk issue being managed: a known human error or organisational pathogen found

[16] Pidgeon & O'Leary (2000).
[17] Roberts (1993).
[18] Weick & Sutcliffe (2001).
[19] Reason (2016).

in one context (aviation) might reasonably be expected to recur in another (health) if the underlying systems of work were similar.[20] Reason recognised that, although ostensibly different contexts, many situations in healthcare closely resembled those that he had studied elsewhere – for example, at the turn of the millennium processes and work-tasks found in a typical operating theatre bore many similarities to those deployed in an aircraft cockpit.

In patient safety research and practice, Reason is known and revered. He led the way for psychologists in helping healthcare leaders and professionals to understand that the conditions in which people worked, the tools they were provided with to do their work, and the way their work was organised made errors more or less inevitable. In other words, doctors and nurses, like all humans, are fallible. He helped understand that the late lab tests, the computer being unavailable, the consultant on another ward, the inexperienced nurse, the patient just admitted with sepsis, the unapproachable ward manager, the end of a 12-hour shift cannot alone explain why the patient didn't get their antibiotics. It is only the interaction of these multiple events that lead to the accident. This is why, the exercise of analysing and trying to prevent specific patient safety incidents is largely futile, at least from a safety management perspective, referred to by Reason as 'swatting mosquitoes'.[21] If you combine fallible human beings with poor working conditions, you increase the potential for human fallibility. Although not a linear relationship and certainly not entirely predictable, the fundamental idea was that imperfect working conditions led to more errors via distractions, less availability of information, fewer opportunities for developing skills, greater demand on limited cognitive resources, greater fatigue, poorer teamwork, etc. Modern patient safety management frameworks, such as Systems Engineering for Patient Safety are still based on these ideas.[22]

Reason served as committee member on a key inquiry chaired by the Chief Medical Officer into how learning could be fostered in the NHS. The influential report of the inquiry *An Organization with a Memory*[23] highlighted four conditions identified as necessary to ensure a modern and effective approach to learning from error in the NHS:

- unified mechanisms for reporting and analysis when things go wrong;
- a more open culture, in which errors or service failures can be reported and discussed;
- mechanisms for ensuring that, where lessons are identified, the necessary changes are put into practice;

[20] Toft & Reynolds (1997).
[21] Reason (2020).
[22] Vincent, Taylor-Adams & Stanhope (1998); also Carayon *et al.* (2006).
[23] Donaldson (2000).

- a much wider appreciation of the value of the system approach in preventing, analysing and learning from errors.

Reason, like many of those that have come since,[24] saw patient safety incidents as a 'window on the system', an opportunity to learn about how work is done, how different factors interacted to result in errors and poor outcomes. But, taking a look at the language used in his texts you will also see that what Reason had been telling us for 30 years is that humans are also heroes. Yes, they make errors and they deviate from rules, but they also recover, they find innovative ways of achieving the desired outcome – they are adaptive and resilient, and it is these abilities that help to create resilient systems. His loss to the health community is all the more significant because in the years to come, as we battle new challenges and experience new discomforts in healthcare – an underpowered workforce, aging multi-morbid society, precision medicine, machine learning diagnostics – we will need to continue to revisit, re-apply and reinterpret Reason's foundational safety work.

With others Jim helped transform how the medical profession in the UK understood and addressed patient safety, a contribution that was recognised when Queen Elizabeth II awarded him a CBE in December 2002, with the impact of his work here, as in the aviation and industrial contexts, being profound and long-lasting. Above all Jim was a psychologist who prospered academically by looking not inward to his disciplinary roots, but outwards to what psychology and its related disciplines could offer the world. His skill in communicating complex ideas in terms that safety professions could readily grasp was second to none, and set him apart from virtually everyone else in the field at that time. But he was also able in turn to reflect on the constraints and immediate concerns of his non-academic collaborators in ways which helped to enrich and further develop his own academic thinking. He is sorely missed by his colleagues in the British Academy, by all who knew him personally, and by those who were influenced by his work.

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[24] Vincent (2007); also Carayon *et al*. (2006).

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