

Professor Reason – Radio Interview

*James Reason is a World leader in error and accident causes, safety and safety systems. In this radio interview he makes a series of statements on those Human Factors vulnerabilities that **Red Flag** sets out to control (if not abolish). **Reason’s comments lend authoritative support to every design principle and criterion adopted by Red Flag.***

Absent-mindedness – Risk Management - Radio National Summer

19 December 2005

Norman Swan (a qualified medical practitioner as well as a radio show host) talks to James Reason, Emeritus Professor of Psychology, Manchester Uni. Professor Reason has written books on absent-mindedness, human error, aviation human factors and on managing the risks of organizational accidents. This program was first broadcast on 16th May, 2005.

Program Transcript (lightly edited)

Interviewer/Interviewee	Red Flag Comments
Norman Swan: Hello and welcome to The Health Report with me Norman Swan. Today (I conduct) an interview in our summer series with enormous implications beyond health to almost any walk of life and industry.	
Norman Swan: 2005 unfortunately was a big year for light plane crashes in Australia, at least some of which were alleged to be the result of pilot error.	Not quite true. <ul style="list-style-type: none">• In 2005 there were 13 fatal accidents and 34 fatalities. (<i>One accident caused 16 deaths.</i>)• In 2004, the numbers were 11 and 23 respectively.• However, the 16 year averages are 20 (accidents) and 40 (deaths) PA.• So, although 2005 was “worse” than 2004, it was, statistically, significantly “better” than the 16* year average.
Red Flag Note: Dr Swan has evidently heard or read public statements by commentators on aviation safety. As noted, the comments were a tad inaccurate. (It was these statements that prompted the ATSB study.) “ <i>Use best evidence</i> ” is a Red Flag principle. In this case, some evidence is available from an Australian Transport Safety Bureau report . Whether it is, indeed, <i>best evidence</i> is moot. It’s a 16-year study, commencing in 1990, <i>a year with a very high number of fatal accidents</i> . A 10-year baseline shows a lower improvement trend gradient. The 10-year average is 17 (the 16-year average was 20). Over the last 4 years, the average was 12 . The year 2005 (13) was “worse” – but just. Statistically, a 4-year average is insignificant. However, stats alone hardly paint the picture. There are fewer weather-related accidents in drought years, for example. * Why a 16 year study period? Why not 15? The year 1990 was a bad year, with 30 fatal accidents. In 1991 there were 21. Big drop. Start there and the improvement gradient isn’t quite as steep.	

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<p>Norman Swan: (2005) was also a big year, again unfortunately, for injuries to people in hospitals from doctors' and nurses' mistakes.</p> <p>This is a special feature on this very human frailty, error.</p> <p>We all make mistakes, but in some jobs, like piloting an aeroplane, or surgery, mistakes can be fatal; why do they occur? What's going on in our heads and around us when disaster hits?</p> <p>In aviation, errors are accepted as inevitable, so planes and cockpit routines are designed to minimise the impact of mistakes when they occur. Sadly, hospitals haven't often learnt these lessons, which means that the human factors in health care have either been ignored, or seen as too hard to deal with.</p> <p>The result is unnecessary injuries to patients, unsafe systems with needless harm.</p> <p>But slowly, human factors are being acknowledged, and that's due in no small part to one of the gurus in this field, psychologist Jim Reason, who's Emeritus Professor at the University of Manchester in the UK.</p> <p>He was in Australia, in Perth, earlier this year at the Annual Conference of the Royal Australasian College of Surgeons. He told me that his journey in this field started with his own error-prone absentmindedness. I asked him for examples.</p>	<p><i>“According to the World Health Organisation's 2002 Report:</i></p> <ul style="list-style-type: none"> • <i>Australia has the highest rate of medical error in the world.</i> • <i>16% of our hospitalised patients will suffer a significant adverse event that is totally unrelated to their original medical condition. This translates as 1 patient in 6, four times the reported occurrence of medical error incidents in the United States, and a full 6% higher than Britain's 10% error rate.</i> • <i>18, 000 Australian patients die each year as a direct result of avoidable injuries and complications.</i> • <i>Another 50,000 Australian patients per year are left with permanent disabilities, and hundreds of thousands more are avoidably injured to some greater or lesser degree.</i> • <i>80,000 Australian patients per year are hospitalised due to medication errors, syphoning a massive \$350m from the Federal Health Budget annually.</i> • <i>These figures do not take into account the recognised errors which take place in other clinical outpatient settings such as GP surgeries, radiology suites, and other outpatient clinics where the error rate has been found to be at 23% in one Sydney study.”</i> <p>Quoted from ABC radio re: the WHO Report.</p>
<p>Jim Reason: Goodness: getting into the bath with your socks on, saying 'Thank you' to a stamp machine, and on one occasion putting cat-meat into the teapot. So you begin to see the kinds of conditions that create it, where you have for examples two objects, like a teapot, and a cat's bowl, which are for putting in, you just get the wrong ones in.</p>	<p>As is his habit, the Professor is being remarkably open and candid, here.</p> <p>He’s also acknowledging the reality of the Error-Prone Type. Some people are more that way than others.</p>

<p>Norman Swan: And you collected those stories?</p>	
<p>Jim Reason: I collected them from other people; people really quite enjoyed doing this, and I watched, for example, a mate on one occasion. He was making tea and he reached down not the caddy but the Nescafe jar, and put three teaspoonsful of Nescafe, and then screwed on the jar and put it back.</p> <p>Now that's pretty trivial – however, it struck me that his hand knew what it was handling, in other words not the lid of the tea caddy, which slid on and off, but a screw-top jar.</p> <p>And the whole pointer for my early interests, was that it tells you a great deal about how you control your automatic actions.</p> <p>You have an intention to act, which you then delegate to various routines, and if you don't check on the progress at certain choice points, then there is a strong possibility that you'll go trundling down the wrong route, the one that you most usually, most familiarly, do.</p>	<p>Case Studies <i>Things that happen in real life provide the indicators for “What goes wrong” analysis.</i> In this case, actions are being performed automatically. Red Flag identifies auto-behaviour as hazardous.</p> <p>Automatic (routinised) function may be a safety threat, but it can also appear to be intelligent – while it is anything but. Red Flag’s Tools section explores auto-behaviour controls.</p> <p>In Red Flag terms, the <i>intention to act</i> is a <i>decision prompt</i>. We memorise long strings of decisions – such as your daily ablutions, making a pot of tea – and perform these routines automatically (without thought).</p> <p>Red Flag advocates exercising decision skills by regular practice at <i>thinking through</i> decisions. In Reason’s words, that’s “checking on progress”.</p>
<p>Norman Swan: And did your earlier research tell you why people go down that track?</p>	
<p>Jim Reason: There are two parts to the answer.</p> <p>The first part is the conditions under which absentmindedness occurs. They tend to be in very familiar, very routine settings.</p>	<p>As above, you have automated many common functions such as the daily ablutions, making the tea.</p>
<p>Red Flag Notes: Professor Reason is famous for his Swiss Cheese model – and evocative terminology – <i>Pathogens</i> for accident causes, and <i>Defences</i> for preventive measures.</p> <p><i>Automaton behaviour</i> is identified by Red Flag as a serial accident cause. Error Management (EM) is, in Reason’s terms, a defence against that <i>pathogen</i> – and others he describes later. The key concepts to EM are: <i>Mistakes are inevitable; we are all error-prone to a greater or lesser extent (short- as well as long-term); training will reduce personal potential for error; and that when the inevitable accident occurs, the EM-trained person is better able to cope with the adverse consequences (ie, EM training improves stress-resilience).</i></p>	

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<p>Jim Reason: Next, they often involve preoccupation or distraction, so your <i>limited attentional capacity</i>* is tied down either by some worry or by something going on around you, and there's almost always some change either in the plan or in the circumstances.</p> <p>So you might, for example, get up in the morning and say, 'I'm not going to put sugar on my cereal because I want to lose weight'. But of course unless you attend exactly at that moment when you pour out the cereal, you'll put the sugar on. Similarly, on one occasion we swapped the knife and fork drawers around and it took us three or four months actually, to get back to a correct, error-free performance.</p>	<p>When you are operating one set of skills automatically – walking may be the commonest example – you can do other things – talking, for example.</p> <p>If the conversation becomes intense, you'll stop walking, needing all of your attentional capacity for the discussion.</p> <p>Equally, the conversation might be halted by a trip and stumble – you've got to think about recovery actions.</p> <p>* <i>Fit to Fly</i>, pages 62 to 64, deals with <i>attentional capacity overload</i> – and enables design of exercise prescriptions to improve <i>cognitive fitness</i> (or, <i>defences against error</i>).</p>
<p><u>Red Flag Notes:</u></p> <p><u>Sugar Error.</u> Not sticking with the “no sugar” plan, as described, is the result of <i>automaton behaviour</i>. As noted, it's a common accident cause. Prevention of the error – a defence – relies on your ability to operate <i>habit pattern interrupts</i> – aka the <u><i>speed bump effect</i></u>.</p> <p><u>Cutlery Habit Change.</u> Learning a new routine involves <i>overwriting</i> its predecessor. Your brain classifies earlier learning as higher priority than subsequent learning. Learning a new skill is a major – and daunting – challenge, needing lots of trial-and-error and repetition.</p> <p>And it never works completely. Under stress, <i>you will revert to the earlier routine</i>. In safety-critical functions (unlike managing the cutlery), that's an obvious hazard. A defence is a <i>high level of cognitive fitness that permits you to think through complex actions under stress</i>.</p> <p style="text-align: center;"><i>Fit to Fly</i> is about cognitive fitness.</p>	
<p>Norman Swan: Particularly absentminded family?</p>	
<p>Jim Reason: Well, yes. I am the most absentminded person.</p>	<p>Once again, Reason affirms the “error-prone person” type (though there's no sign it's a career threat). <i>Note that the personal attribute involved is a function of personality, with hereditary origins.</i></p>

Norman Swan: Health care has benefited from this absentmindedness.	
Jim Reason: Well, yes, health care benefited from that and it also benefited in fact that I didn't pass first MB in Medical School, so that's my greatest contribution to patient safety really.	James Reason is more than just your average professor. His self-effacing open-mindedness is on display here. <i>People who can't (even gently) mock themselves tend to be in the high-risk-of-error category.</i>
Norman Swan: And you found this problem of (automaton behaviour) is a common problem not just in health care but in industry?	
Jim Reason: It's a universal problem. Little slips of action like that can create big disasters. It's the context that determines the disaster. Say you're driving a double-decker bus. It's unusual – you normally drive a single-decker bus. You come to a low bridge that you used to go under with your single-decker, then you sweep off the top of the bus and kill six passengers. It's a terrible result from a very obvious, very routine slip of habit.	As well as aviation, James Reason has been influential in nuclear power generation, petrochemical, and (indirectly) most other industries. Piper Alpha (North Sea gas rig fire), Three Mile Island (nuclear power station problem) Chernobyl (nuclear power station meltdown), Bhopal (cyanide gas disaster)... and on and on. All exemplify disasters triggered by minor lapses at the routine level. This is a chilling example. And you can imagine yourself as the driver, reverting to earlier-learned auto-behaviour. A defence? Constant cognitive alerts (wake-up calls). <i>Red Flag</i> does that.
Norman Swan: So you fall back to what you know most.	
Jim Reason: You fall back – one way of demonstrating this, and the thing I used to do, is to try to create certain kinds of errors in people, and if you can do that of course, you can then get them to begin to understand error mechanisms.	He puts it so mildly. This is a critical issue, so often neglected in safety training. You need to induce error in people for them to understand error potential. EM training must be <i>experiential</i> to have any effect, and <i>repetitive</i> for lasting effect. See: Learning

<p>Jim Reason: One of the devices was to ask <i>Who said?</i> questions.</p> <p>An example is: “Who said the lamps are going out all over Europe and we shall not see them lit again in our lifetime?”</p> <p>90% of English speaking people say Churchill. That is wrong.</p> <p>But you know why they say Churchill. First of all, if you ask <i>Who Said</i> questions, it's got to be somebody famous. Next, the lamps going out suggests the eve of some cataclysmic European event. And finally, who is the gabbiest, the most vocal, the most conspicuous figure at that time of the eve of war – Churchill.</p> <p>It was actually Sir Edward Grey on the eve of the First World War who said it. Nobody remembers Sir Edward Grey now.</p>	
<p>Jim Reason: But you can set up traps that people fall into. Get them guessing, for example. It's a form of frequency gambling. First of all you match similarity to the question to what you know, and then if there are lots of candidates there, so you tend to pick the one which is the most frequent, the most salient, the most dominant.</p>	<p>Professor Reason is laying out a strategy for training design that might work in one culture (a British audience imbued with respect due an eminent teacher). In other cultures, different strategies will be needed to achieve the same (and necessary) learning effects. See: Red Flag Transition</p>
<p>Norman Swan: And in the whole area which is slightly different from what we're talking about, the whole area of risk perception is if the media are talking about something all the time, like the dangers of being mugged, or pesticides, you think that's more important than the risks of smoking for example.</p>	
<p>Jim Reason: Yes, there are so many things that will make memory traces more vivid: frequency is one, the fact that it has a big emotional charge, or the recency is another, they combine to make certain action programs or speech or thought programs grab the controls unwittingly.</p>	<p>These are observations from pedagogy – the science of learning.</p> <p>Again, check: Learning.</p>
<p>Norman Swan: And what you're saying here is when it comes to your job or things that you do routinely, you fall back on what you know most?</p>	
<p>Jim Reason: One rarely thinks of an automatic task. One of the great virtues of delegation (or routinisation, or automatisation), is it leaves the mind free to think of all kinds of other stuff. So when you're vacuuming the floor, your mind is free to do all kinds of other things.</p>	<p>The talking-while-walking example supports the point. For as long as one task is automated, you can think of other things (in your <i>virtual channel</i>). If primary task demands increase, the virtual channel becomes intermittent,</p>

	and may even shut down.
<p>Jim Reason: As well, there are certain tasks whose nature is such that if you did attend to them too closely, you would disrupt them.</p>	<p>There are some skills that cannot be performed on the thinking through basis. There simply is no time for the necessary Information Processing. See: Information Processing</p>
<p>Jim Reason: If you try to <i>run down stairs two at a time</i> and think what you're feet are doing, that'll be a charter for disaster. Or if you're typing, and you think what your little finger of your left hand is doing, it'll disrupt.</p> <p>So you can have too much attention and too little attention, it's just the right amount that's necessary.</p>	<p>This is an exercise you should try.</p> <ul style="list-style-type: none"> • Think safety, first – anticipate some difficulty. • Get ready, inter alia by noting your resting pulse rate. • Do the exercise, calling out the steps – left, right, etc – to ensure you're thinking it through. • Check your pulse after. • Make a diary entry with comments.
<p><u>Red Flag Notes:</u> Other examples of things you <i>can't do while thinking through the component simple skills</i>:</p> <ul style="list-style-type: none"> • The golf swing. • Touch typing. • Hovering a helicopter. <p>You learn these complex (chains of simple) skills <i>heuristically</i> – through trial and error.</p>	
<p>Norman Swan: Let's take an environment which people have tried to automate as much as possible and regularise. The aircraft, when people are piloting a plane. Now it strikes me that what they've tried to do is remove all influence of humans there, in fact you're almost lulling people into an absentminded situation.</p>	
<p>Jim Reason: Automation in, for example, a modern aircraft, tends to take away the slips and lapses. In other words you don't push the wrong lever, or press the wrong switch, which used to be the case, or turn off the wrong engine. These are all slips.</p> <p>But it does leave you in positions where you have to make quite challenging cognitive decisions, perform under heavy cognitive processing loads at times of maximum demand.</p>	<p>Automation is a mixed blessing. The more the computer is running things, the less control authority is available to the human. Accidents have occurred – notably in Airbus airliners – when the pilots failed to understand what the plane was doing – or inappropriately programmed the computer. In addition, reduced physical handling time means less time practising valuable skills.</p>
<p>Norman Swan: Give me an example where for example, things have gone wrong with aircrew, which are an example of this inattention to task.</p>	
<p>Jim Reason: If you take an event like Teneriffe. (Two jumbo jets collided on the runway. KLM & PanAm.) In '78 I think. (27 March 1977, in fact.) It's still the worst air disaster. (582 deaths. 62 on the PanAm aircraft survived.) There were several causes, several factors combined.</p>	

<p>Jim Reason: The Captain of the Dutch aircraft was the Senior Check and Training Captain at KLM. He received what he thought was take-off clearance.</p> <p>It was like releasing a coiled spring in him, and it triggered the reaction that he then rushed off down the runway.* That was Part 1 of the disaster.</p> <p>* Adding to the pressure to go – the coiled spring effect – was this: The <i>length of the planned flight</i> (back to Amsterdam) on top of <i>present time</i> meant the crew was approaching their duty time limit. <i>Get airborne within a few minutes or wait 24 hours. Objective fixation</i> (or <i>destination obsession</i>) is a common accident cause.</p> <p>Meanwhile of course at the right-hand seat, the young 1st Officer was saying, 'But, but, I didn't hear them say it'.</p>	<p>The so-called <i>authority gradient</i> features here. A Check and Training Captain – especially in the 70s and in a Teutonic culture – was an awesome figure. His status was supreme.</p> <p>There were reasons for the <i>coiled spring tension</i>. <i>Dramatic circumstances</i> had set the scenario – a bomb exploded in the Las Palmas terminal so flights were diverted to Tenerife. Aircraft were on and near the runway preparing to depart when thick fog settled.</p> <p>To be fair to the Professor, he's going by recall here. It was the <i>Flight Engineer</i> who queried the take-off clearance – and he's even <i>further down the status gradient than the co-pilot</i>. The Captain ignored his concern.</p>
<p>Meanwhile, the PanAm aircraft had got lost in the fog. They did not take the exit they were told to take by the controller, and so they were still on the runway through error. So you have a concatenation of errors.</p> <p>And this is when you start to think beyond slips and lapses, beyond absentmindedness, beyond mistakes, beyond the single person, it doesn't take you very far, and if you've got a complex system like aviation, where you have many, many automated defences, many barriers, many safeguards, no one error, no one technical failure can usually achieve a disaster, it takes an often diabolical combination of factors coming together, often with tiny windows of opportunity for these defences to be penetrated, and for hazards to come in damaging contact with victims and environment and so on.</p>	
<p>Norman Swan: Which is why people such as you say that it's easy to blame the individual for the lapse, but the system has got to have gone wrong usually for a disaster to happen?</p>	
<p>Jim Reason: Well if you blame the individual, lots of bad things follow really .</p> <p>I must first of all say that blaming is something that's a delicious emotion. We all enjoy it. There's an enormous number of psychological factors which lead you to blame, particularly if there's been a bad outcome, you know, there's a thing that children believe, the <i>just world</i> hypothesis, that bad things happen to bad people and so forth. So blaming itself is a very satisfying emotion, but there is no remedial benefit from it.</p>	<p>This is the first mention of the <i>no blame doctrine</i>.</p> <p>Sounds reasonable – and it is – only it may have been taken too far.</p> <p>See: No Blame</p>

Norman Swan:

You might feel better for a moment, but nothing positive happens.

Jim Reason:

Judges like it of course, because they can separate an individual, an erring individual from the system, and they can uncouple the responsibility and put the blame onto the individual.

Reason mentions, above, children’s *Just World* hypothesis. In his (most recent) work he elaborates on the **Just Culture** thesis: While we agree that “no blame” facilitates accident investigation – people involved feel more free to say what happened – there are some things that are so bad they do warrant penalty.

Lawyers like it because at least in the UK, it's very hard to prosecute organisations or their management.

That’s not so in Australia. The trend in OH&S law is to facilitate prosecution – of Board members and CEOs.

Red Flag Note:

There is a tendency to regard OH&S legislation as an entity to itself. Nothing could be further from the truth. Safety factors are pretty much the same in every walk of life, professional or recreational. Boundaries between industries and occupations are equally transparent both to accident causes, defences and safety needs (and laws and prosecutions).

See: [Integration](#)

Jim Reason:

However, the real problem lies in the fact that (and this is the essence I think of Error Management) is that the same situation keeps on producing the same error in different people.

Again, the relevant Error Management (EM) ideas are:

Now if you isolate the person from the context within the system, the workplace, the environment in which the error occurred, you will never recognise the error prompt.

- Error is inevitable. People do leave papers in photocopiers.
- Training (based on accurate diagnosis of error causes) will reduce the likelihood of error, in both the short and long-term. In this case, diagnosis reveals automated behaviour – habit pattern as the cause. The remedy is to think through even mundane tasks – or at least, some of the parts of the overall task. Speaking the steps out aloud will help there (even though you might feel like a dill doing it).
- People who are EM trained are better able to cope with the negative consequences of error when the inevitable occurs.

One classic error prompt is if you're using a desk photocopier, the simple one, and you're just copying a few sheets, then the most likely error you're going to make is to leave the last page of the original behind under the lid, and to march off with a copy and not take away the original.

There are so many factors that combine to make that probable. The most irresistible error prompt is that it's out of sight, under the radar, there's no particular cue, you're not putting it down and taking it out. The goal of the task is manifestly over, you can see the copy there, and you're always likely to be thinking of getting on to the next task and not the end of the last task.

Jim Reason:

But when this is translated into something like, for example, the inadvertent injection of the drug Vincristine.

Norman Swan:

An anti-cancer drug.

Jim Reason:

An anti-cancer drug ... and it must be administered intravenously. But on more than 30 occasions, in several countries, it has been administered intrathecally – spinally. And it has dreadful consequences, as you know. It destroys the nervous system, the child – it’s usually a child – dies very painfully. This is a classic error prompt.

There are many circumstances that lead people into exactly the same kind of error.

We're not talking about error-prone people, we're talking about error-prone situations, and the real essence of error management is to identify those recurrent events in your system and try to do something about them.

Often people say it's impossible to do something about it, but it would be so easy to prevent the Vincristine tragedy by making it impossible for an intravenous needle to go into a luer.

Perhaps not, but some people are more likely to make the error than others.

More to the point, even the *least error-prone* person will be more likely to get something wrong when highly fatigued. It’s the same as being affected by drugs or alcohol – and doctors have been known to be expected to work well into the high-risk fatigue zone.

Norman Swan:

A luer is a connection which is going into the spinal canal.

Jim Reason:

But of course that requires all kinds of manufacturing changes. So they try other means of prevention, which is to say never give intravenous and intrathecal drugs on the same day. Never deliver them to the ward in the same package. Make sure the colour-coding is very distinct, all kinds of procedural ways.

But in one particular tragedy in the UK back in 2001, in a major hospital in Nottingham, a boy died because the defences failed. Two junior doctors were left with the task of what they thought was delivering two intrathecal drugs.

The defences failed because people were trying to be helpful. The pharmacy, for example, delivers the drugs together in the same package so that the patient is not inconvenienced, so that the nurses are not inconvenienced. People want to do the best job and they try to be helpful.

The young doctor in this case, the Registrar, should have been simply shadowing. It was only his third or fourth day on the job. He should have been shadowing, not doing anything. But the consultant was away at the time, the ward sister had gone home, the boy in question had come into the hospital at 4 o'clock in the afternoon unexpectedly – he hadn't come for his appointment on time. All of these things came together to create this awful concatenation of these various factors, simply diabolically coming together.

Norman Swan:

But where the first take would have been 'You idiot', as a junior doctor for doing this thing.

Jim Reason:

Yes, certainly, that was the way parents and relatives felt.

But in this instance, the Chief Medical Officer actually set one of my colleagues, an accident investigator, on to this issue. He wrote a very, very good report. It details something like 40 to 50 system failures which combined – failures of defences, the barriers, the safeguards – which combined to create the event. And the report completely exonerated the junior doctors, they were victims, they were inheritors of something.

Norman Swan:

They were the end of the line.

Jim Reason:

They were the end of the line.

Norman Swan:

Professor James Reason, one of the world's leading authorities on human factors in safety, especially in health care, and especially when it comes to errors.

Now while Jim Reason has spent most of his career shifting the focus from blaming individuals to examining what goes wrong in systems, he does think there are limits to that approach.

Jim Reason:

It's all very well to say 'It's the system'. But health care is a peculiarly personal business.

Norman Swan:

The cop-out is limited.

Jim Reason:

What we need to do is to give junior doctors and nurses skills that allow them to be error-wise, to allow them to recognise situations with a high potential for causing adverse events.

So these young men could have said on that particular day, when they were poised to give the drugs intrathecally, they could say, 'Hold on, *alarm bells**, we're not going to do this.'

That kind of skill doesn't take a lot of giving actually. It's attitude of mind. It requires using ratings and using assessments of situations, how do I feel? Do I feel I'm having a bad day? What's the context, is it a shift hand-over? Is there no supervision around? Alert prompts.

Great doctors are not necessarily the ones who don't make errors, because errors are being made all the time. Great doctors are the ones who recognise error-prone situations, detect their errors. They have considered the possibility of what can go wrong in these circumstances and have contingency plans in place. They can compensate for error.

Excellence is a very interesting thing, actually much more interesting than error. We often regard the human factor as simply equated to hazard, whereas I think the human factor is not so well recorded when it is at the "heroic competence" end of the spectrum.

* *Red Flag* emphasis. (It is radio.)

<p>Jim Reason: There are a lot of heroes in aviation for example, who are much more interesting than the ones who caused adverse events. There was one instance of the so-called “Gimli Glider”. An aircraft, a 767, was flying across Canada when it ran out of fuel.</p> <p>They ran out 60 miles from Winnipeg and there wasn't a way of getting to Winnipeg without fuel. But two things happened.</p> <p><u>One:</u> The 1st Officer recognised that down there on the edge of the lake was a deserted airstrip, a former Air Force base he'd flown from when he was a National Service pilot, and;</p> <p><u>Two.</u> The Captain happened to be a champion glider pilot.</p> <p>Between them, they steered towards this tiny airstrip. High on glideslope, the Captain said to the 1st Officer, 'Shall I sideslip?' A 767, is a big a wide-bodied jet.</p> <p>In typical Canadian laconic fashion, the incident is described in 100 pages, mentioning all of the things that went wrong, system failures and the like – which is of course what the investigators should do. But the report had only a single paragraph on the pilots actions.</p>	<p>A classic error. It was the day Canada switched from Imperial units to Metric. The fuel load amount would have been correct had the units been Litres. But it was pounds (roughly half a litre).</p> <p>Incredibly, both the refueller and the flight crew member checking his work made the same mistake.</p> <p>The airfield was Gimli (and the name has stuck). (You never forget the place you learned to fly.) It was not a long runway, and had been made even shorter by assigning one end to Go-Kart racing – that was underway on the day.</p> <p>Very handy. A day of coincidences.</p> <p>A sideslip involves banking the plane as if entering a turn, but then using rudder to counter the turn. The extra drag causes a higher rate of descent.</p> <p>It's a manoeuvre typically used in small planes, not big passenger jets.</p> <p>The bemused Go Karters look up to see the behemoth stop right at the fence.</p>
<p>Jim Reason: There are many occasions now where heroic actions on the part of pilots, as in United 232, the Sioux City disaster when they lost all their hydraulics. It was a one in 10-million probability failure in a very well-engineered aircraft. They had 3 redundant systems – but all got cut through when the No.2 engine (in the tail) exploded.</p> <p>The Captain, Al Haynes, said to the Engineer, 'What's the procedure for this?' 'There is no procedure for this.'</p> <p>The aircraft then started to roll, to turn over. It could have been fatal, but he realised that he could manipulate the two remaining engines – No.1 and the No.3 engine – and control the aircraft that way.</p>	<p>It was a DC-10, a three-engine plane. When the centre engine exploded, fragments sliced through the hydraulic lines and all of the fluid leaked out.</p> <p>No hydraulic power meant no means through which to control – fly – the aircraft. The triple redundant systems had all been disabled.</p> <p>“Roll” – the aircraft banks, turns. Two engines were functioning. Adjusting engine power <i>asymmetrically</i> gives a measure of roll control. IE, increase power on the left engine, the plane rolls to the right.</p>

<p>Jim Reason: There was a crash at the end. There were something like 300 people on board, and more than half of them were saved when in reality they were all doomed.</p> <p>The interesting thing was that Captain Haynes maybe made an error, a kind of conventional, conservative, familiar kind of error, where he came over the threshold too fast, and it had to be, because they were keeping the orientation with the throttles. And he said to the Captain, the Captain who'd come up from first class, who was handling the throttles, and said, 'Shut the throttles', and he thought, 'I can't do that because we'll go over on our side', but he wasn't going to argue, so he did. But if they had continued and over-run the airfield, it was Iowa, you know, filled with huge Indian corn, they could have got away with it. They could have, but it was just pilots, just like surgeons say about sepsis, pilots hate too much speed, they hate over-runs. So the old habits kicked in.</p>	<p>Changing power on the engines together provided pitch control. Increase throttle – nose-up (climb), reduce the power settings – nose-down (descend).</p> <p>By chance there was another DC-10 on board as a passenger. He'd come up to offer to help, and got the job of managing the throttles.</p> <p>When the throttles were closed as the plane neared the ground, it rolled to the right, the wingtip dug into the ground, and the aircraft crashed.</p> <p><i>Reversion to old habit under stress?</i> Probably not – certainly, reports* don't support the notion. They'd run out of control options and had to get the thing on the ground.</p> <p>185 survived.</p> <p>*See: Sioux City DC-10 crash</p>
<p>Norman Swan: So you were looking at this, and in fact, your research team looks at aviation human factors.</p>	
<p>Jim Reason: I got drawn into that actually. There's an interesting progression from looking at errors, so it would tell me something about the “human black box”, what goes on between the ears, how we manage our actions.</p> <p>Gradually I got lured out into the real world, first of all into nuclear power at the time of Three Mile Island and Chernobyl, and also into aviation and eventually into all kinds of hazardous activities. And there the aim was to prevent or at least to manage error.</p> <p>But then more and more I became interested in the system and the fact that it's human and organisational factors that combine, and that the real key, and my breakthrough as it were, my claim to fame, was the Swiss Cheese model, which argues that when you build defences against known hazards, you try to do the best you can but you build them in layers, but they're never perfect. They're like Emmenthal, they're like Swiss cheese, they've got holes in. And so you can have several layers of cheese.</p>	
<p>Norman Swan: But there's still a way through if you work hard enough.</p>	
<p>Jim Reason: It's like Sod or Murphy and the malign furies with a knitting needle trying to find a way through. They very rarely do, but the holes opening and shutting and moving around, they're not really like cheese, they're being opened or shut by people at the sharp end who may be making errors or by designers who fail to anticipate this particular trajectory of accident.</p>	

Norman Swan:

And you obviously moved into health.

Jim Reason:

I got drawn into surgery, cardio-thoracic surgery, the arterial switch operation on neonates. It corrects congenital defects, which would otherwise kill the child. And it's a very challenging operation. I was written to by perhaps the most distinguished paediatric cardio-thoracic surgeon of Great Ormond Street, and he told me that he'd had in a series of 100 procedures, the first 50 had gone rather well, and then in the next 20 he'd lost 7 children.

So being a man of great humility he went and re-trained with his best student, who had very good results. And then he, as it were, regained his nerve.

We then started to look at all the arterial switch operations that were done in the UK in the mid to late '90s. There were, on average, 7 adverse events, one of them major, that's to say life-threatening, and six minor in each procedure, on average.

So they all made errors. And they all made life-threatening errors as well. It's because it takes the surgeon to the edges of their (human) psychomotor performance capacity. It's very challenging something to a 2 millimetre coronary artery, which is friable and very difficult to stitch, and so on and so forth. Anyway, they make errors. But the real virtuosi were the people who successfully compensated. In their case, half of the major events were successfully compensated for.

Norman Swan:

When you say compensated for, this is the analogy to the Sioux City aircraft where the surgeon finds a way through.

Jim Reason:

He finds a way through. It often requires going back on by-pass, maybe several times. This is something they hate to do, as is opening the chest again. But they'll persist until they're correct, and when they've corrected the adverse event, the risk of mortality is exactly as it was before the event happened.

Norman Swan:

What was the feature of the compensator?

Jim Reason:

The compensations took many different forms. Sometimes it was the team, but often it was the surgeon's mental readiness, flexibility, optimism, faith, and hypothesis testing – on their good days. And they are never good all the time.

They were able to be flexible, to come up with the right answer, and to continue optimistically looking for the right answer, whereas the lesser surgeons might for example get tunnel vision. They get stuck with the first hypothesis, and of course it's the wrong hypothesis, and it doesn't get better.

Tidiness, surgical tidiness even, a lot of things characterise the excellent surgeons, but most interestingly, excellence has root causes in the same way as failure has root causes. In other words, there are organisational and team factors which contributed to the excellent surgeons.

Jim Reason:

For example, many cardio-thoracic surgeons like to work with the same team. They like to have a paediatric anaesthetist who specialises. They like their own scrub nurses. They like the familiarity.

And efforts were made in those organisations to keep the team together. Efforts were made in those organisations to stop distractions, to prevent interruptions in the operating theatre, to allow the consultant to schedule meetings so that the consultant could be in the theatre throughout the entire procedure. A whole lot of organisational systemic factors combine to make excellence possible.

Norman Swan:

But for those who lack the cognitive flexibility, their thinking ability, could that ever be trained into them?

Jim Reason:

Oh yes, even the best ones have bad days.

It's really quite hard to be good all the time. But yes, one of the things that perhaps is lacking in surgical training is the mentor who hopes that you'll make a mistake across the table, and say, 'Ah, I'm glad you did that; now I can tell you how to fix it'. In other words, to watch people make errors, then to teach them how to repair, to compensate. People who will tell you the ways of error.

Norman Swan:

Tell me about the application then of human factor analysis, what they call root cause analysis, that you've been involved with as well. It basically says that when something has occurred, you actually go in and do what you would do as if it were an aviation accident.

Jim Reason:

Let me say at the outset that I think the term 'root cause analysis' is an unfortunate one. It implies that there's some real root, there's some cause back there that set the whole thing going like a chain reaction.

But of course, there's never one cause. So I don't really like the term. But I do like what it implies, which is to go back from the immediate sharp-end people, from the immediate things that went on, and ask questions: 'What was it that provoked this person to do this particular unsafe act?

‘And what were the decisions upstream from that, that left those people for example, short-handed, or with inadequate tools or equipment? What decisions were going on? say on the Board level, in the tension between protection and production.’

But it's a finite process. You simply can't keep on going back.

Take, as an example, the Columbia accident report. The Shuttle crashed on re-entry over Texas. The Accident Investigation Board went back through all the decisions that were made to send it off. They suffered from, I think, a kind of outcome bias. Because there was the terrible loss – 7 astronauts – somehow there must have been a blunder to have sent them off.

<p>Jim Reason: But actually, if you go back to the things that determined the decision, it was the decision which I'm sure we'd make again. Namely, there had been 113 shuttle flights. All of them had had foam damage of the kind which penetrated the wings of the Columbia spacecraft and caused the burn-out.</p>	<p><i>Adaptation</i> played a role. On the first shuttle missions, the ice damage was regarded as a serious hazard. After repeated damage and no consequences the sense of danger abated.</p>
<p>They were under schedule pressure. (<i>Objective fixation.</i>) It was a low-level scientific mission, but there was no good reason not to fly it. And once they realised that the wing had been hit, there was not an awful lot you could do about it.</p> <p>But my point is this, that investigators had the hindsight bias, because to us in retrospect, a particular event seems like an inevitability, but to those who are engaged in it, those who only have foresight, they didn't see the convergence at this particular event.</p>	
<p>Norman Swan: So how should the technique be applied in health care?</p>	
<p>Jim Reason: There are many ways of doing it, but what one does is to look at latent conditions, factors that are present all the time, in all situations.</p>	
<p>Norman Swan: These are commonalities, they could lead to errors in other situations as well?</p>	
<p>Jim Reason: Poor design, time pressure, under-manning, inadequate tools and equipment.</p>	
<p>Norman Swan: Generic problems.</p>	
<p>Jim Reason: Every organisation has them.</p> <p>Communication difficulties are absolutely universal. These are the things that we can address now, and actually these are the things that managers are paid to manage.</p> <p>When you talk about safety, it sounds like an add-on, whereas in fact what you're really trying to do is say, look, take periodic measures, checks on the health of your system, and fix that which you can reasonably fix in a given time.</p>	
<p>Norman Swan: I will ask you a question that doubtless you've been asked millions of times before, which is: If we were to put you in charge of the health care system, what fundamental things would you do to minimise the number of errors in the system?</p>	
<p>Jim Reason: Well I think I'd start with training and education and culture. I mean one of the problems with the health care culture is that it's the culture of perfection, it's not a culture of sharing error.</p>	

<p>Norman Swan: So only the best is good enough.</p>
<p>Jim Reason: Only the best is good enough, and also there's a huge amount of shame associated with causing harm to patients, through error, and it's not readily confessed.</p> <p>This is in stark contrast for example, to aviation, where the whole aviation system was predicated on the assumption we will screw up. In health care the assumption is that I've done 14 years of expensive, arduous training, and everyone's led me to believe that I'll get it right.</p> <p>But in fact, the truth of the matter is, there's only two kinds of health care professional really: those who have done harm to the patient, and those that will do harm, unwitting harm, to a patient. And unless one starts with that premise ...</p>
<p>Norman Swan: What you're saying is, as in aviation, there should be an opportunity to learn, so it doesn't happen again.</p>
<p>Jim Reason: They should be taught about fallibility. They should be taught about ways of correcting problems.</p> <p>Pilots were not allowed to fly and go solo, I wasn't allowed to go solo, until I'd cocked up a landing.</p> <p>It doesn't matter how many good ones, they're not interested in that, it's when you cock one up and correct, the ability to correct, the ability to compensate.</p> <p>Patient safety is still the biggest problem. Then I would have some kind of adverse event reporting system, the close calls, the near misses.</p> <p>We need to know where the edge is between safety and disaster.</p> <p>But then I would try proactively to carry out measures of the processes that underpin safety. A high reliability organisation is chronically uneasy. It knows things will go wrong, and a safe culture is one that's constantly reminding you to be afraid, to be wary.</p>
<p>Norman Swan: To another error to organisation.</p>
<p>Jim Reason: And it's streetwise, error-wise. What one's looking for is a system that is not necessarily free of error or free of adverse events, but as resilient as it still can be, and still do its business.</p>
<p>Norman Swan: James Reason, who's Emeritus Professor of Psychology at the University of Manchester. I'm Norman Swan, and you've been listening to The Health Report.</p>

Guest on the program: James Reason, Presenter: Norman Swan, **Producer:** Brigitte Seega