

Human Error Accidents in Adventure Activities: Cause and prevention



by Marcus Bailie

“The biggest threat to the future of adventure activities”. (Chris Loynes, circa 1999)

“ whilst accidents, and especially serious accidents, in the Adventure Activity sector are thankfully very rare, they represent a disproportionate threat to it. Moreover, when we scrutinise those which do occur we find a number of common threads. Mechanical failure is seldom a significant cause of accidents. Nor does lack of knowledge feature highly, nor inappropriate operating procedures. Very occasionally, Risk-Benefit expectations go wrong, the Likelihood and Consequence considerations do not pan out as expected, or all the Lemons finally line up. Given the high rate of participation there are very few of any of these types of accidents. The majority of accidents, some of them serious, are those which simply should not happen, but do. The silly, easily preventable ones. The ones which were just plain dumb! And this leads us to the study of errors. ”

Accident Investigation and Hindsight Distortion

Surprisingly, accident investigations do not always focus on the cause of the accident. In some cases the investigation focuses on whether there was a breach in some regulation, or failure to follow an agreed procedure, even if this was not the principle or underlying cause of the accident.

The way our brains work does not help us to get at the truth of what actually happened. There is lots of research about hindsight distortion; the tendency to inaccurately remember unpleasant past events. Events at an accident don't usually unfold in a narrative form. Things happen simultaneously. Different witnesses are aware of different details. The shock of the event will distort our memory of the sequence of it, and even significant details are recalled incorrectly. This all obscures the truth and so the reason that we don't always learn the right lessons from past accidents is that we often failed to find the real cause.

Worse, we think we have solved the problem, and stick to that belief right up until exactly the same accident happens again.

Most troubling is the tendency for an investigation to **end** with the conclusion that the cause was human error, and there they leave it. I argue that this should be the start of the investigation, not the end. Human errors have causes too, as I hope to explore.

Aviation and Medicine

Not all professions experience similar accident rates, or even similar accident patterns. Because of the level of risk involved it is not surprising that farming, forestry, fisheries and construction have higher rates than office work and many service industries. What is more surprising is where there is a significant difference in rates and patterns with no obvious explanation. Comparing the medical sector (and in particular surgeons) and the aviation sector (and in particular pilots) in North America produced some very revealing results. Whilst human error is the major cause of accidents in both sectors, pilots had a much better record than surgeons. Indeed the safety culture within aviation paid more attention to detail than that within medicine. Disentangling why this was has helped to make surgery safer in North America. The process revealed some of the characteristics of what they refer to as High Reliability Organisations, although it is acknowledged that we are only just beginning to understand the complexities of this crucial field.

This has some important lessons for our sector which I will come to shortly, and I believe the adventure activity sector is more towards the surgeon's end of the spectrum than the pilot's.

You disagree? Well... that would be the characteristic response from North American surgeons too as on the whole they tend to overestimate their own abilities, and also their own safety record!

Problems in Tandem with Solutions

As well as trying to explore some of the basic concepts of this comparatively new study, sometimes referred to as 'error-nomics', it is possible to also look at solutions for the narrow sector of outdoor and adventurous activities. There are no universal solutions to the problem of Human Error Accidents, but one effective approach is to think small, and act in a sector specific context.

So let's leap from the observation that over-confidence kills, to an example of an adventure activity specific solution.

The literature claims that when it comes to memory 'context is king'. This is why inspired managers and inspired regulators are critical of an approach which requires their staff "to read the latest risk assessments and sign them as an indication that they have done so and undertake to abide by them".

I remember what I did, as a keen but impatient young instructor, when dossiers of this sort were pinned on the staff notice board. Like most of my fellow instructors I signed the front cover and went climbing, having read none of it!

Now let's assume (!) that today's instructors are much more professional and conscientious than I was. And let's assume they sit down there and then, or take it home, and read it cover to cover. How much will they learn? I argue, and the research supports me, that they probably won't learn much. Have you ever tried to work through the manual for a new computer programme without sitting in front of your computer and working through the various stages? You soon find out how much you have learned, or not, the first time you try to run the programme.

Worse, not only have these conscientious instructors not learned much **they think they have!** Worse still, their bosses think they have as well.

The only way to go through written procedures is in context. Managers need to provide instructors with work time to go through the procedures, and to go through it with them, **in context**. That means if you are looking at

high ropes procedures you do it out there at the ropes course, or those for the gorge you go to the gorge.

Because many issues transfer from one activity to another not only will you have 'covered' high ropes or the gorge, but you will have improved safety awareness, all those important little details, across the board. Trying to review all of your procedures in one go is therefore less likely to be as productive as spreading them out, in some cases over several months, and in other cases perhaps over several years.

Walking the Floor

It is now widely recognised that it is important for managers in adventure activities to get out of their offices and go and see what is actually being delivered in their name. This serves several functions. One of these is to ensure that staff are actually doing what they should be, but this is only a small part of it. Monitoring activities, or walking the floor as it is called in industry, is more about educating management



than educating staff! It is not unusual for a manager, after a very infrequent session looking at what actually happens on the crag, to return to their office white and slightly shaking, muttering something about "I didn't know we did **that**".

Not knowing what is being delivered in your name, and how, leads to serious management errors, and consequential accidents.

What you do is Important

Monitoring also tells staff that their work is valued, and this is crucial for the safe delivery of activities. It is not a big leap from staff feeling that their boss doesn't care about the quality of their work to **them** not caring either. And when we don't care we make mistakes, and when we make mistakes we have accidents.

Staff need to be nurtured. Newly Qualified Instructors (NQIs) in particular need to know that what they are doing in practice is both satisfactory and important. Looked at in the other direction, more experienced instructors need the opportunity to feed back to their boss, **in context**, the success or otherwise of both



new and well established approaches. "X would work better if we did Y and Z." This keeps both parties focused.

Random monitoring also keeps all staff focused, and this is the single most important aspect in human error accident prevention.

What Sign?

Have you ever inadvertently driven past a motorway junction at which you had planned to exit? Yes?

How did you manage to miss those two **enormous** blue signs, the massive road markings, and the approach of a huge concrete fly-over?

Explanations commonly cover a wide range of irrelevant, implausible, self-protecting, and bizarre excuses. The truth, of course, is usually "My mind was somewhere else!"

Best practice in swimming pools is that the life-guard does not sit on the big high chair watching the swimmers for more than 20 minutes or so. Otherwise their concentration tends to go, and their minds wander. Rotas are designed so as to prevent this.

If the same climbing instructor runs nothing but single pitch climbing sessions, at the same crag, with similar clients, all day, every day, it is asking the impossible to expect them to stay 100% focused on each and every climber. The mind wanders and accidents happen!

Telling instructors that they must stay focused is unlikely to be enough to ensure that they do.

The Myth of Instructor Infallibility

Sooner or later we all make mistakes. The secret of survival is to ensure that no single error causes a catastrophe. (What HSE call a single point failure.) This is one of the reasons why in North America pilots made fewer mistakes than surgeons. At least two sets of eyes and minds are focused on any safety critical action. **Check? Check!**

Let's consider an example. Is it safer for a climber's harness to be attached to the rope by tying the rope directly to it or by attaching it via a karabiner? The clip on or tie on dilemma.

Tying on means fewer links in the chain and less chance of the climber being hit in the face with a big lump of metal. Conversely, tying on is much slower, even if the instructor does all the tying. Worse,

evidence from climbing wall accident investigations in the UK tells us that sooner or later an instructor will do it wrong. Attaching to a non-structural part of the harness is the most common.

Clipping on with a karabiner not only has the advantage of speed but crucially, the climber can do it and the instructor can check it is done correctly. Two sets of eyes and two minds. **Check? Check!**

Overall, I believe that clipping on will result in fewer catastrophic errors, provided that the duality principle is applied.

Take this one stage further. An instructor attaches the belay rope to the back attachment on a full body harness before the student leaps from a high platform to a trapeze bar, some metres out from the platform, and some tens of metres in the air. Now you would think that a very experienced and highly qualified instructor would **never** fail to make that all important attachment, but you would be wrong. The impossible happened and the adult who fell is likely to spend the rest of their life in a wheelchair.



What you know is not as important as what you do with it!

Learn from the mistakes of others - you won't live long enough to make them all yourself!

Experience is the knowledge that enables you to recognise a mistake when you make it again!

*One problem is a problem.
Two problems is a hazard
Three problems create accidents!*

There are no new accidents, only people with short memories!

In this case we may never know why the instructor failed to make the crucial connection, but we come across too many accidents where the instructor's mind was simply somewhere else.

For this reason I personally prefer the krab to be attached to the front of a conventional sit harness, which has been properly sized and properly fitted. (I know of no single case of anyone, young or old, fat or thin, shapely or waist-less, who has ever completely fallen out of a properly sized and properly fitted sit harness. I would be grateful to hear from anyone with evidence to the contrary.) The jumper is shown where and how to attach the krab, does so (probably before climbing to the platform) and the instructor checks it (again) before the jumper jumps.

Interestingly this is exactly what scuba divers do, not only as novices but throughout their diving careers. They call it the Buddy System. *I check your gear before we dive and you check mine.* If only climbers did that there would be a lot fewer accidents, without detracting one iota from the ethics of the sport.

The Myth of Multi-tasking

Evidence now tells us that most of what we call multi-tasking is a myth. Even early computers, where the phase originated, didn't multi-task. They switched from one task to another, and back again, in nano-seconds. The human brain simply is not designed to do this. Try having a conversation with someone who is also working out the shared bill in a restaurant. Either the conversation or the mathematics (or indeed both) will suffer. One or both tasks **always** suffers.

We could apply this to our example of clipping on versus tying on. The instructor **cannot** tie on the climber **and** continue to supervise the rest of the group without one (or both) tasks suffering.

Loading more and more responsibility onto the instructor not only leads to task overload, but a misplaced faith in multi-tasking by both the instructor and managers means that the instructor is likely to try. And not surprisingly, accidents happen.

Variety is the Spice

If you have a number of comparatively inexperienced instructors, and each is given their own highly repetitive session to run all day, every day, the odds are stacked that at least one of them will have an accident or a near miss at some stage during the season.

You will recall that the swimming pool managers solution to this problem of loss of concentration was

to rotate the staff onto different tasks, even if each of the tasks is equally repetitive in nature.

We can transfer that solution into an introductory level multi-activity centre, for example, with good effect. Many of the instructional demands on an individual instructor in this setting are not high. (Often much narrower, for example, than the skills and experienced required for the relevant NGB award.) By 'up-skilling' the instructor through further training, it is perfectly possible to develop the climbing instructors to the point where they can lead the high ropes sessions, the zip wire, the big swing, and probably more. Similarly there are a lot of benefits to developing paddle-sport instructors who can manage the sit on top kayak sessions, the open canoe sessions, the dragon boating, and the improvised rafting.

Then rotate the staff.

We can develop this idea further, and move away from single-activity instructors altogether.

Group Instructors versus Single-Activity Instructors

A single-activity instructor, as discussed above, stays with the same activity as different groups rotate around the different activities. The advantage of this is that the individual has to have experience and training, and been assessed as competent, in only one activity. Multi-disciplined instructors are harder to come by, and harder and more expensive to train. Ironically, Licensing in the UK may have inadvertently made this situation worse because many employers assume that their instructors must all hold NGB qualifications in all the activities they instruct. They don't. The Licensing regulations merely state that they must be **competent** in the tasks they are asked to do.

The disadvantage, as discussed above, is that single activity instructors risk losing concentration and enthusiasm. There have been several accidents in recent years in the UK which occurred because the instructor was adding additional 'thrills' designed, at least in part, to keep themselves entertained as well as the participants.

By contrast a group instructor keeps the same group of participants and takes them through the range of activities. Group instructors, therefore, are always doing something different, and are therefore more likely to remain focused.



Errors are Made by People, not Things

Secondly they get to know their group in increasing detail as the course develops. Who is trustworthy, who is rash, who needs encouragement, who needs watching, etc. By taking an interest in the individual's progress the group instructor is more likely to remain focused on the session, and in particular on those components which are most likely to make errors. People!

This regime benefits from having in-house staff with sufficient experience and qualifications to carry out in-house training and assessment in most if not all of the activities offered. (External courses are very expensive and disruptive to programming.) It is crucial that these trainers are as aware of the techniques of error avoidance, as of the technical skills they are imparting.

It also requires careful management. At least some introductory-level multi-activity centres in the UK with high annual turnover of staff find enormous benefit in having a dedicated member of the management team coordinating staff development. They have an activity manager who ensures that each session is staffed by suitably experienced and competent instructors, and a training manager who ensures each member of staff is teased, coaxed, supported, and given opportunities to develop basic instructional skills in a range of new and varied activities.

This may sound excessive but junior staff are a lot less expensive than an accident!

In some cases, and in particular in traditional outdoor education centres, this model not only encourages staff to have basic instructional skills in a wide range of activities, but thorough Continuous Professional Development, to gain NGB qualifications as well. In centres where staff may remain for many years it is every bit as important to keep them focused and enthusiastic.

Completing the Circle

From senior management through to the newest Newly Qualified Instructor, and from introductory level recreation to in-depth Outdoor Education, systems should focus on people not just mechanical procedures.

"Whether a procedure is likely to be followed or not is as important as considering the technical merits of the procedure".
HSE ■

Post Script

In October 2010 Lord Young proposed, as part of a wide-spread review of HSE, that the Adventure Activities Licensing scheme should be abolished. Exactly what will replace it will soon be a matter of consultation. I am hopeful that issues such as the actual causes of accidents in this sector, as opposed to the regulation of it, will not be lost in the mist. Much may fall to individual providers, and individual National Governing Bodies to make their own evaluation of the issue of human error in adventure activity accidents and determine how best to move forward.

Marcus Bailie
29 October 2010



A short reading list:

Joseph T Hallinan 2009 Error nomics. This book, or at least the first half of it, will completely change the way you look at accident avoidance.

Pratt J.M. 2003, Human Factor Flight Safety. This is written for pilots, but in language which is very accessible and informative to anyone involved in risk management. Very funny and with great photographs this makes the message even more easy to remember. He also has a host of great one-liners such as "Flying isn't dangerous. Crashing is!"

Bailie M.H. (2008) Horizons 42 Bet your life
Bailie M.H. (2008) Horizons 43 Language of Change

Taleb N.N. 2007 Black Swan Not so much about errors as about why we do things the way we do.

Association of Mountaineering Instructors Newsletter. Various.

Fiona Brindley HSE. Human Factors in accident investigation. A Power point presentation.

The Energy Institute, May 2008 Guidance on investigating and analysing human and organisational factor aspects of incidents and accidents.

HM Treasury 2005: Managing Risks to the Public.

Author's Notes

I have now been involved professionally with adventure activities for 30 years, as an instructor (including being in charge of the mountain leadership department at Plas y Brenin, the national mountaineering centre) as a manager (including Director of Tiglin, the National Adventure Centre of Ireland), and as a regulator. The views expressed here, therefore, are a summation of what I have learned over that time, and from others, and are not necessarily the views of TQS (my current employer) or HSE (to whom we are currently contracted).

Photos: Title image by Low Bank Ground