tce

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Education reimagined

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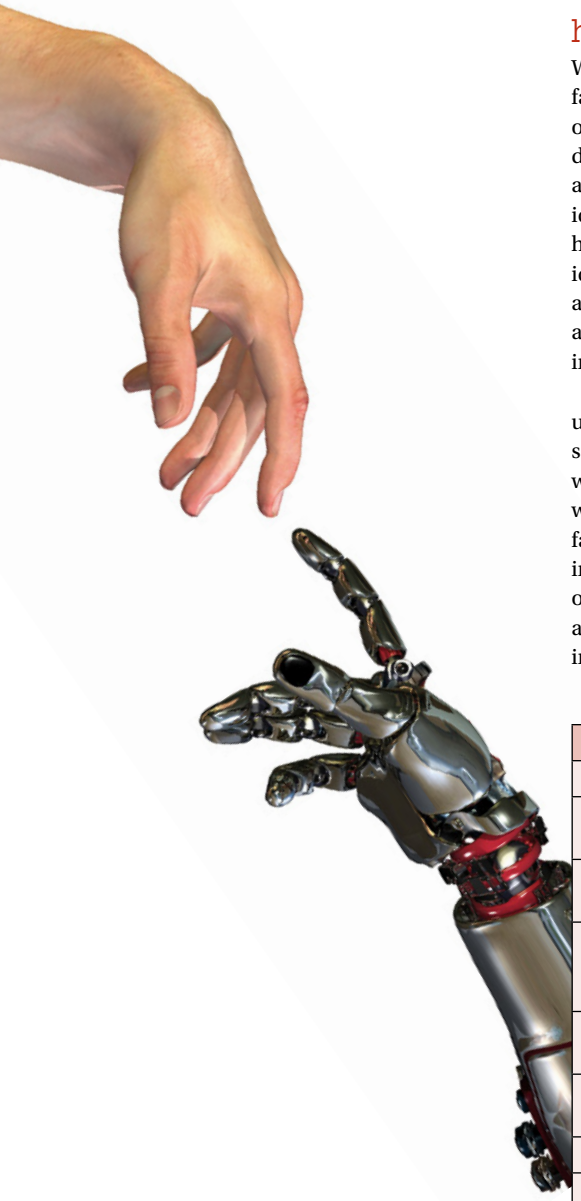
People are people

Ronny Lardner and **Dave Nicholls** discuss the importance of factoring the human element into safety



WHAT do the following major incidents have in common: Piper Alpha, BP Texas City, Buncefield, Esso Longford? Apart from loss of life, cost, environmental impact and damage to company reputation, all cite the "human factor" as figuring largely amongst the underlying causes. But what does this actually mean?

human nature

We all have experience in human factors – a catch-all phrase for a body of knowledge from several scientific disciplines including applied psychology and ergonomics. In the box (right), identify how many of these behaviours you have done at some time in your life. Next, identify the difference between the red and black behaviours (or you can cheat and read the answer). Now identify what influenced each behaviour.

Looking at your own intentional and unintentional behaviour, you can identify some important human factors topics, which are equally relevant to the world of work. These might include the effects of fatigue, the prevailing norms and culture in your peer group, saving time or money, or being distracted or preoccupied. These are examples of important motivators and influences on behaviour.

Have you ever done these things?

- Knowingly broken the speed limit?
- Gone into a room, and forgotten why you went there?
- Stolen something?
- Not seen something you want in the supermarket, even though its right in front of you?
- Done home improvement work, without full personal protective equipment?
- Daydreamed when you should be paying attention?
- Failed to pay your bus or train fare?
- Bumped into things or people?
- Told a 'white lie'?
- Put the right thing in the wrong place (eg milk into oven)?

The behaviours in red are intentional, and involve violation of a rule or social norm. The motivation is often some form of personal benefit, eg save time, money, effort. The behaviours in black are unintentional errors, which even the best motivated and competent person can make. The likelihood of error increases under certain conditions, for example when distracted, in a hurry, working with confusing controls, labelling or displays.

Humans excel in	*Machines excel in*
Detection of certain forms of very low energy levels	Monitoring (of both people and machines)
Sensitivity to an extremely wide variety of stimuli	Performing routine, repetitive, or very precise operations
Perceiving patterns and making generalisations about them	Responding very quickly to control signals
Storing large amounts of information for long periods – and recalling relevant facts at the appropriate moment	Storing and recalling large amounts of information in short time periods
Exercising judgement where events cannot be completely defined	Performing complex and rapid computation with high accuracy
Improving and adopting flexible procedures	Sensitivity to stimuli beyond the range of human sensitivity (eg infrared, radio waves)
Reacting to unexpected low-probability events	Doing many different things at the same time
Applying originality in closing problems	Exerting large amounts of force smoothly and precisely
Profiting from experience and altering course of action	Insensitivity to extraneous factors
Performing fine manipulation, especially where misalignment appears unexpectedly	Repeating operations very rapidly, continuously, and precisely
Continuing to perform when overloaded (not a good idea for long periods)	Operating in environments that are hostile to people or beyond human tolerance
Reasoning inductively	Deductive processes

Table 1: Fitts list – guides where to allocate system functions [Adapted from Department of Defense, (1987), MIL-HDBK-763: Human engineering procedures guide, Washington, DC: DoD]

> *"you cannot change the human condition, but you can change the conditions under which humans work"*

why do we need people at all?

People are good at many things (see Table 1), although some tasks are better left to machines. But when complex systems are designed, successful sharing of function between people and machines increases overall system reliability.

environment shapes performance

It's perhaps more accurate to use the term "human and organisational factors" (HOF), as many of the key influences on human performance aren't found within the individual, but supplied by their organisation. HOF aims to optimise human reliability and performance, and thus improve safety, quality and overall business performance. In the incidents mentioned at the beginning of this article, the HOFs weren't well-managed, leading to people at many levels of the organisation not performing well.

Human performance is very sensitive to the conditions in which we work – the wrong conditions can tempt people to break rules, or lead to increased error. To increase human reliability, it's often said "you cannot change the human condition, but you can change the conditions under which humans work".

defining human factors

In the UK, the government health and safety regulator – the Health and Safety Executive – has provided a working definition of the HOF domain. It has identified the top-ten HOF issues which it often finds are not well-managed when incidents occur, or inspections are found wanting, in hazardous industries (see Table 2).

1. Fatigue & shiftwork	Work patterns designed to prevent / mitigate fatigue, and reduce error
2. Human factors in design of plant, displays and equipment	Ergonomic design principles used for control rooms, human-computer interface, alarm management and lighting, thermal comfort, noise & vibration.
3. Managing human failures	Structured inclusion of influences on human failure (violations and errors) in design, risk assessment and incident investigation
4. Maintenance, inspection & testing eg maintenance error	Structured process to minimise maintenance errors in place – coupled with widespread awareness of risk of maintenance error. Also, the capability of the organisation to have a clear understanding and knowledge of the product or service being supplied. Relevant to use of contractors.
5. Organisational change	Human aspects of organisational change risk-assessed and controlled
6. Organisational culture including safety culture and behavioural safety	Programmes target critical behaviours, and include process & occupational safety. Chronic unease exists, always looking for system causes of failures, and opportunities to learn or improve
7. Procedures	Providing user-friendly procedures, which support error-free performance
8. Safety- critical communications	eg structured process for shift and task handover in place and working as intended, also for permit-to-work.
9. Staffing & workload including supervision and contractor management	Right level of skilled people available for task. Manageable workload, especially during upsets and emergencies. Experienced supervisors regularly present at work-site. Competent contractors, properly-supervised
10. Training & competence	The ability to undertake responsibilities and perform activities to a recognised standard on a regular basis. It is a combination of skills, experience and knowledge.

Table 2: Health & Safety Executive's "top ten" issue topics

A successful manager or engineer in the hazardous process industries must master these so-called softer subjects, as well as their harder counterparts.

step change

In the offshore oil and gas sector, several operators and major contractors have appointed their own HOF champion. The industry's flagship safety organisation, Step Change in Safety (SCIS), formed an HOF workgroup, which recently produced the excellent guide *Human factors: how to take the first steps* (available free at http://stepchangeinsafety.net/stepchange/News/StreamContentPart.aspx?ID=4627).

The guide explains how human behaviour at all levels of an organisation can cause accidents. Investigations from across this industry indicate that HOFs lie at the root of serious incidents. If we can recognise when these factors arise in our activities, we can learn how to manage them and prevent harm to our people.

The guide presents 12 case studies from this industry, but they are equally relevant to other hazardous sectors. They describe the deep-seated HOFs that allowed the incidents to happen and make the link back to the HSE's top-ten HOF topics. Some are incredible, some predictable. All are true.

Each case study is an opportunity for you and your colleagues to recognise how human factors impact on your work and to prevent HOF incidents from happening.

The bottom-line is that people, at all levels within an organisation, have a role to play in managing HOF.

In Table 3 we have suggested ways to use this resource, with a variety of audiences. **tce**

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Audience	*Purpose*	*Activity*
Students, managers	Increase knowledge of the ten HOF subject areas.	Allocate 1 or 2 of the top-ten HOF topics (see p5 of the guide) to pairs of people. Each pair reads relevant case studies, and delivers a short briefing for colleagues on key learning points.
HSE advisors or reps, ops managers, supervisors	Learn and apply relevant lessons from incidents elsewhere.	Allocate 1 or 2 case studies to pairs. Read and present each case study, including (a) why this could not happen here or (b) where we need to strengthen our HOF defences.
All	Make the link between technical and 'soft' subjects.	Use the PDF document search facility to identify key technical words, read the related text, and brainstorm the relevance of the scenario to your operations or studies. Example – try permit or valve.

Table 3: Suggested exercises using the SCIS case studies on human factors