Using our brains – the future of safety in forestry

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Abstract

Despite advances in safety, our forestry workers are still getting hurt or killed. The main threat these men face is the complex, unpredictable and unforgiving environment. Until recently, research has focused on critical thinking, risk assessment and structured problem solving. Because of this, for years we have formed our safety systems on the theory that the more information and time a person has, the better their decisions and responses are. But in highly complex, unpredictable environments, we often don't have the luxury of time or mountains of data to analyse. Humans are the most adaptive species on the planet. We have been exploring new approaches based on neuropsychology that work with, rather than against, the brain's natural mode of functioning to protect our workers and to enhance their ability to respond, monitor, anticipate and learn in a high-risk environment.

Current safety challenges

Approaches to health and safety have typically had a heavy focus on process and compliance (Reason, 1990). Systems using these principles have seen some safety improvements in the New Zealand forest industry. However they are not working in a continuous, consistent way – operations improve, reach a plateau, then incident rates start to rise again. Workers are still getting hurt or killed despite advances in safety science.

Traditional safety systems focus on using critical thinking, risk assessment and structured problem solving. This approach is based on the assumption that all human thought processes, and therefore behaviours, are affected by the Accuracy-effort Trade-off theory (Gigerenzer & Gaissmaier, 2011). That is, the more information and time a person has, the better their decisions and responses are. This type of analytical process is typically methodical and time-consuming, and only successfully describes how humans function in well-defined situations where all consequences and probabilities are known. However in dangerous and fast-paced work environments, workers often do not have the time or information to analyse and address sudden safety challenges.

The New Zealand forestry industry is a good example of the impracticality of applying the Accuracy-effort Trade-off principle. The main threat faced by the forestry workforce is the complex, unpredictable and unforgiving environment. A safety procedure applied in one context may not necessarily work when conditions change in the forest. It is not practical to produce a procedure for every eventuality encountered in forestry, so what do we do when we cannot control or even predict changes in the environment? What do we do in situations where we need more than the current health and safety systems can offer us? The physical demands faced by forestry workers on the steep slope terrain typical of New Zealand logging conditions are increased by the complexity of the working environment and there is very little margin for error. If something bad is going to happen to a tree faller or breaker out, it will happen fast. A worker does not have time to consider and assess solutions. They only have to react.

New direction – harnessing our brainpower

Humans are the most adaptive species on the planet. The capacity to adapt and even thrive in almost any environment is a hallmark of our species. Our brains are the product of centuries of evolution, honed perfectly to be able to keep us alive in an unpredictable, uncontrollable and inherently hazardous environment. We are able to quickly interpret our surroundings based on limited information and observations. It is this ability, enabled largely by our skill at exploiting cognitive biases, which has permitted our survival. Demystification of the human mind has progressed, with scientists challenging conventional theoretical frameworks on human cognition. Headway is now being made in optimising decision-making, accelerating and enhancing learning, and improving and sustaining performance in uncertain, risky environments.

Two distinct means of processing information – implicit and unconscious versus explicit and consciously controlled – comprise the dual process theory commonly described in psychology. These two types of processing are often translated into two separate reasoning systems within our brain. This view that humans have two ways of thinking – System I and System II – has gained traction in recent years (Kahneman, 2011):

- System I thinking is characterised by fast, unconscious processing in which simple patterns and relationships are identified within the surrounding environment (Evans, 2003)

Tree faller. Source: FISC

- System II thinking involves controlled and deliberate analytical reasoning that is much more demanding on cognitive capacity and therefore slower than System I.

System I appears to have natural application to the time-pressured, information-limited environment forestry workers face each day, yet our safety systems are essentially founded in System II. While the excessive biomechanical workload and unforgiving topography likely contributes to the elevated injury rate endured by the New Zealand forest industry, it could be said that our safety systems are ill-suited to the environment and may be an influencing factor in accident statistics.

A practical example of the limitations of applying System II thinking to safety in forest operations is the notion of situational awareness. A commonly-heard phrase during current safety training and risk assessment is 'expect the unexpected'. This statement is, at best, nonsense. It is impossible to literally expect the infinite number of unexpected events that could occur in any given situation. Since unexpected events are not part of any internalised mental model, an individual is incapable of automatically accessing such information in an effort to manage the risks (Green et al., 2008).

Individuals in our forestry workforce are doing their best as part of a complex system, given the intricacies, compromises and ambiguity surrounding them (Conklin, 2012). Ultimately, a worker's decisions and actions are products of their environment, focus of attention, knowledge of the circumstances, and balance of goals. Workers' knowledge and experience gained working within a system allows them to compare different system states to better predict risk and engage in necessary avoidance behaviours (Adams, 1995). That is, expertise is a refined ability or 'intuition' to recognise the potential harm-causing conditions of a system and build a margin to decrease exposure to those risks, rather than committing fewer errors (Pupulidy, 2015).

What is 'intuition'?

Intuition can be thought of as an individual's capacity to obtain direct knowledge and/or immediate insight without observation or reason (Perrig, 2000). Unconsciously perceived through sight, sound, touch

Breaker outs. Source: FISC

or even smell, intuition is a rapidly processed cue to the existence of meaningful information in a dynamic, unpredictable situation (Luu et al., 2010). The information is automatically structured in milliseconds by established knowledge and experience, causing a feeling or giving an inkling of a solution before the conscious mind has time to react (Evans, 2008). A forestry worker's intuition and ability to detect minute variations within the changing environment may be the only barrier between safety and serious harm or death. The application of System I over the traditional structure of System II is being explored in industries where speedy, accurate decisions are required for survival. The US Office of Naval Research is investigating ways to enhance intuitive decision-making (System I) through implicit learning.

Implicit learning

Until recently, it was believed that the ability to successfully employ intuition required considerable expertise in a specific field to effortlessly select a suitable response (Kahneman & Klein, 2009). Yet accumulating evidence suggests that extensive expertise may not be necessary for effective intuitive decision-making (Lieberman, 2000; Jung-Beeman et al., 2004; Luu et al., 2010). Studies have shown the process of intuition shares the same underlying cognitive mechanisms as those utilised in implicit learning (Frensch & Runger, 2003; Lieberman, 2000, 2007). Implicit learning is the natural acquisition of understanding of a complex environment through repeated interactions (Reber, 2013). Individuals who have absorbed knowledge through implicit learning are unaware of the process and are unable to verbalise how it was attained. It has been argued that knowledge in a field obtained through implicit learning may automatically strengthen intuitive decision-making.

There are several ways of enabling implicit learning. Using immersive environments as a means of creating opportunities for implicit learning, we hope to help workers enhance their unconscious responses. Simulation, scenario-based training and virtual reality technologies enable users to artificially experience the risks of the forest environment while performing tasks without fear of hurting themselves. Workers can be exposed to any number of scenarios to fine-tune their intuition for when conditions change in the forest and/or teach them to respond to a stimulus without thinking. Consider learning to speak French. It could take years if you try to learn it from a book. However if you go to Paris and live there immersed in the language, you are likely to pick it up in a fraction of the time.

Looking forward

Scion has begun to explore new safety and performance approaches based on psychology that work with, rather than against, the brain's natural mode of functioning to protect our workers and to enhance their ability to respond, monitor, anticipate and learn in a high-risk and ever-changing environment. The primary aim of the research is to develop a feasible model for safety that focuses less on System II thinking and more on utilising our adaptive capacity as humans to survive and thrive in uncertain settings.

Understanding how and why workers make intuitive decisions in the forest work environment will help to improve their safety beyond the structure of the legislation. Workers regularly have to make fast decisions under variable conditions with incomplete or uncertain information. This situation may be further complicated by the increasing requirement for less experienced workers to make ever-more complex decisions; a situation paralleled anecdotally by disempowerment of more experienced workers. Switching the paradigm to align with the way we actually think is one possible way to address these issues. Intuitive decision-making (System I thinking) offers distinct advantages when operating in the dynamic forest environment compared to current safety approaches reliant on System II thinking. Robust research methodology enhancing intuition will allow forest workers to rapidly recognise risks at work and provide practical problem-solving approaches that may not be perfect, but are sufficient for the immediate goal of stopping an individual getting hurt or killed.

Conclusion

Our vision for the future of safety in forestry and harvesting relies on tapping into the adaptability of the human mind. The forestry industry has been limited by the traditional health and safety systems based on concepts that are impractical to apply in the forest. We aim to investigate and understand how evolutionary cognitive constructs like intuition, instinct and adaptive unconscious can lead to improved performance and safety in New Zealand forests. Our planned research will lead to new insights into intuitive decision-making and develop new approaches for enhancing this process. This is a step beyond current health and safety systems. Radical change can be a challenge for any industry to navigate, but it is necessary to foster continuous worker resourcefulness in response to ongoing and ubiquitous risk and to ultimately improve forestry's safety record.

The timing of this shift is critical to achieve lasting change. The New Zealand forestry industry is presently in a prosperity period – elevated safety awareness, resource abundance, driven collaboration and a strong motivation to establish a robust way forward. It is imperative we, as an industry, exploit this prosperity to ensure transformative change to address the existing limitations in the way of long-term health and safety advancements.

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