

## Can you have a violation in an environment that doesn't have formal rules?

Gareth LOCK, Sarah FLETCHER

*School of Aerospace, Transport and Manufacturing, Cranfield University, UK*

**Abstract.** The use of error identification and classification models has improved safety and performance across multiple domains. The term violation is a special class of error inferring some form of active decision making to defeat or ignore formal rules. This paper will use SCUBA diving as an example to ask whether violations are possible when there are no formal rules. This leads to the point that a social framework is being used to judge violations, but if that social framework is locally, nationally and internationally diverse and there is no common formal regulatory oversight, can a violation truly exist?

**Keywords.** Error, Rules, Violations, Diving.

### 1. Background

Errors are common place, and yet the meaning of the word is not consistently defined with the human factors, human performance and safety communities (Hollnagel, 2007; Woods & Cook, 2003). Reason's 'Swiss Cheese Model' went someway to defining this with active and latent failures, and a subset of the active failures being defined as violations (Reason, 1990). The Collins English Dictionary defines 'violate' as "*to break or fail to comply with (a formal agreement)*" which infers that there is a formal rule or agreement to start with, and comply could infer that there is intent. Within error identification models such as Reason's Swiss Cheese Model (Reason, 1990), and the Human Factors Analysis Classification System (HFACS) (Shappel & Wiegmann, 2000) provide additional granularity with sub-sets of violations defined e.g. routine, exceptional or situational.

### 2. Prevalence of Rule Breaking

In many domains, the prevalence of rule-breaking is a continued frustration for management and regulatory bodies, especially when lives are lost or significant materiel loss occurs. Hudson's 'Sheep in Wolves' Clothing' (Hudson, Verschuur, Parker, Lawton, & van der Graaf, 1998) examines offshore workers and their attitudes to rule breaking: 71% had broken rules or would not have a problem breaking them.

Vaughan (1997, p110) identified violations as being normal within NASA at the time of the loss of the Space Shuttle Challenger, and coined the term 'normalisation of deviance' to describe this. The key point being that small steps were not necessarily seen as violations, but when looking back over time from the current position to the baseline, then there is a major change which, in hindsight, could easily be considered a violation. Aviation and nuclear power, along with many other domains, have formal organisational and regulatory structures in place which define the rules, processes and procedures and, importantly, provide some means of monitoring compliance, deviation or rule-breaking. This monitoring may be effective but it is suspected that routine violations are more commonly identified following an adverse event despite individual or organisational drift being present; maybe due to small changes being hard to detect (Levin, Drivdahl, Momen, & Beck, 2002; Simons & Levin, 1997). After an incident, hindsight and severity

biases are known to play a factor in determining whether the event was an error or a violation (Dekker, 2009; Hugh & Dekker, 2009) and these can have a negative effect on individual and organisational learning (Johnson, 2002).

Reason highlighted that routine violations can be common place if rules appear trivial and transgressions are not routinely addressed (Reason, 1990), but just because a violation has occurred, it doesn't mean an adverse event will. Rasmussen (Rasmussen, 1997) and Cook, (Cook & Rasmussen, 2005) in their model of systems demonstrated this.

### **3. Errors and Violations – A Social Judgement?**

In Dekker's 'Just Culture' (Dekker, 2007), a number of examples are given when 'honest' mistakes have been made by actors within a system but the social judgement determined that a violation took place. This need for someone to blame appears common place within society with many investigations focussing on the individual at the 'sharp end' rather than looking at systemic failures within an organisation.

In his chapter on Human Error, Interaction and the Development of Safety-Critical Systems, Johnson (2011, p100) describes the difficulty in isolating error from violation.

*"The distinction between errors and violations is not always as clear as it might seem...users can unwittingly violate rules if they are unaware of them or the rule is not clearly expressed...it can be argued that an error has occurred rather than a deliberate violation. In other words, it is difficult to distinguish between errors and violations because these two forms of failure stem from different intentions even though the observable actions can be identical."*

The full spectrum of errors to violations is shown in the 'Just Culture' model from the Ministry of Defence (Ministry of Defence, 2015) where a certain number of decisions are made using social or contextual judgements whereby those 'judging' the outcome are required to assess motivation or behaviours of the actor prior to the event.

Following recognition of the difficulties in trying to manage crew errors and how to classify them with a view to improving performance, the United Space Alliance Industrial and Human Element Department used the term 'At Risk Behaviours' for areas which would traditionally come under the heading 'Violations' and removed violations from their taxonomy (Sweeney, 2005).

### **4. SCUBA Diving**

The following part of the paper will briefly outline the sport of SCUBA diving and why it has been chosen as the example for discussion, considering there are very few rules but the terms 'violated' or 'broke the rules' are relatively common.

SCUBA diving is a sport which has a high potential for a fatal outcome if the numerous risks present are materialised. The sport is enjoyed by millions of individuals each year and there are assessed to be approximately 50 000 divers in the UK. Annual global fatality numbers are not recorded by a single organisation but globally are likely to be in the order of several hundred, calculated by extrapolating data from the British Sub-Aqua Club (BSAC) and Diver's Alert Network (DAN). Numbers of non-fatal incidents are not accurately recorded anywhere as these are done on a voluntary basis, but are assessed to be in the order of 5-10 times that reported.

One of the challenges faced when trying to determine whether an error or violation took place is the lack of primary data. Coroners' inquest reports in the UK are only available to 'interested parties' (Ministry of Justice, 2014) and research organisations are not considered 'interested parties'. Non-fatal incidents are not subject to an inquest.

## 5. Organisations and Equipment

Despite the 19 HSE-authorised training organisations operating in the UK, the majority of diving is undertaken without any formal organisational or regulatory oversight. In the UK there is no legal requirement to hold a certificate to go diving nor to purchase diving equipment. In essence, any member of the public could go into a dive shop and purchase diving equipment, including a cylinder filled with compressed air and go diving.

However, this is no different to buying climbing equipment and trying to scale a major mountain climb.

The only exception to the need to show a qualification before purchasing diving equipment is for new closed circuit rebreather (CCR) equipment. The majority of CCR manufacturers will only sell through instructors delivering ab initio or cross-over training on that specific unit, primarily due to the additional and insidious nature of the hazards of CCR diving (Fock, 2013). However, second-hand units are available from online discussion fora and eBay without such restrictions. As there is no requirement to register a unit with the manufacturer, it is sometimes difficult, or near impossible, for the manufacturer to issue recall or important safety notices to all of its users without using social or print media; but this has limited community penetration (Brown, 2013). Fletcher (2010) highlighted in her work for the HSE on CCR safety that there are a considerable number of CCR divers who modify their CCR equipment without necessarily having the equipment to ensure that the system is functionally safe post-modification.

## 6. Individual Responsibility

When diving is undertaken at a dive centre using an instructor or guide, liability waivers are normally required to be signed by students or participants to acknowledge that they accept the risks of the sport. However, there is considerable anecdotal evidence from discussion with dive instructors and personal experience that many participants in such activities may not read or understand the waiver and therefore their knowledge of the specific rules for that location or operation may not be known. Medical declaration forms are also required in most cases, but again, there is both anecdotal and formal evidence that these are not necessarily read or completed truthfully, especially if there is pressure from the dive centre or instructors to write 'No' if it would prevent the client from diving.

As recreational diving has developed over the years, the knowledge of diving physics and human physiology has also improved and equipment has become more reliable with less technical failures (other than misuse). Training has become more standardised in content, but not necessarily in delivery even within an agency as it has moved from 'mentoring and coaching' to mass-marketed programmes conducted on a global scale.

This development has meant divers (and instructors) who used to be coached and mentored now know how to pass a course, but may not necessarily know how to dive - classic examples of the Dunning-Kruger effect (Dunning, Johnson, Ehrlinger, & Kruger, 2003; Kruger & Dunning, 1999). Unfortunately graduates only find out the limits of their knowledge (or sub-standard teaching) once they have crossed the threshold described in Rasmussen's systems model (Cook & Rasmussen, 2005), a threshold which is likely to be unique to each diver and the situation in which they find themselves.

With the exception of a couple of training agencies, none require qualified divers to undertake a minimum number of dives to maintain their qualification status; once qualified, they are qualified for life irrespective of time out of the water. Skills and knowledge maintenance and development are very much down to the attitude of the individual and the peer group(s) they are part of. To a certain extent, the same applies to

instructors, because with the exception of a few smaller agencies, none require their instructors to have a formal assessment by an instructor trainer or similar after a fixed period of time to ensure that standards are being maintained, or if updates have been issued, they have been incorporated.

Knowledge and understanding evolves over time, and training materials should be updated by the training organisations, thereby becoming the 'source of best practice'. However, organisational inertia and costs mean that materials are not necessarily updated in a timely manner. Updated training materials are not normally available to the divers free, therefore knowledge improvement is either by social media, mentor or peer. These methods can have negative implications due to the limited control over what is promoted.

The lack of robust methods to ensure instructors update materials and/or practices means that what is delivered to the student on a course may be out of date and incorrect. Not updating materials or delivering updated skills would be a breach of training agency standards, however such a shortfall would only be discovered if there was an incident or accident that attracted criminal or civil legal interest and a subsequent investigation took place. Behaviours can lead to both individual and organisational (dive centre) drift leading to a *normalisation of deviance*.

## 7. Example of 'Rule Breaking'

For sport diving equipment to be sold in the European Union (EU), it must be certified against a number of European Standards (ENs). However, the CE certification marks only pertain to selling of new equipment and there is nothing to stop divers from modifying their equipment from this standard. In the majority of cases, nothing adverse happens, but when operating in the "corner cases" of certification, their previous experiences may no longer be valid and an incident is therefore more likely. Much of diving is about active risk management but humans are poor at absolute risk assessments and in the main use relative assessments to make decisions easier (Kahneman & Tversky, 1979; Kahneman, 2011). So again, normalisation of deviance comes into play as the delta being compared is the immediate one, not the baseline to current position. Divers are likely to use experience to judge risk, but they will not be able to quantifiably determine what that increased level of risk is.

## 8. What difference does it make if it is classed as an error or a violation?

At the DAN Fatalities Workshop (Vann & Lang, 2011) Watson stated "*that the majority of the fatalities could have been prevented by following BSAC's Safe Diving Practices (SDPs)*". However, despite the BSAC being the United Kingdom's National Governing Body (NGB) for SCUBA diving, the NGB has no formal authority across the multitude of diving agencies operating in the UK. A further issue highlighted is that the SDPs (Watson, 2007) contain contradictions or activities which are considered by some to be violations.

Safety could be considered the antithesis of risk. Considering that risk perception, acceptance and homeostasis are all personal and dynamic, is it even possible to determine 'safe' in an activity which has an inherent risk and no one organisation or body to determine what is acceptable? Unfortunately, uninformed or ill-informed judgements, even from within the diving community, could be used by the non-diving community as existence of rules and therefore violations e.g. "*reckless diving*" (Paras, 1997) or "*never seen a checklist on a dead diver*" (Vann, Denoble, & Pollock, 2013).

If adverse events are classified as violations, there is an automatic stigma attached and

this will have a negative impact on reporting, and the willingness to recount what really happened. There are very few regulations in sport diving but there are a multitude of standards and cultures. Those errors which do occur are very likely to be due to social pressures for conformity, or poor risk perception and awareness, either developed through the training system or the lack of continued personal development and reflection. Given the diverse and incoherent nature of the rules and guidelines available to divers, the attribution of ‘violation’ could be considered predominately a social construct which does nothing to allow the detailed discussion of near misses, incidents and accidents. Consequently, the ability to learn from incidents due to an ineffective ‘Just Culture’ is reduced and therefore attitudes to ‘errors’ and ‘violations’ needs to be modified.

## References

- Brown, A. (2013). RNLI Audience Profiling Research: Leisure Divers. Manchester, UK: Substance.
- Cook, R., & Rasmussen, J. (2005). “Going solid”: a model of system dynamics and consequences for patient safety. *Quality & Safety in Health Care*, 14(2), 130–134.
- Dekker, S. (2007). Just culture : balancing safety and accountability (reprint). Aldershot, England ; Burlington, VT: Ashgate Publishing.
- Dekker, S. W. A. (2009). Just culture: who gets to draw the line? *Cognition, Technology & Work*, 11(3), 177–185.
- Dunning, D., Johnson, K., Ehrlinger, J., & Kruger, J. (2003). Why People Fail to Recognize Their Own Incompetence. *Current Directions in Psychological Science*, 12(3), 83–87.
- Fletcher, S. (2010). Assessment Of Manual Operations And Emergency Procedures For Closed Circuit Rebreathers RR871. Bedford, UK. Retrieved 30 September, 2015, from [www.hse.gov.uk/research/rrpdf/rr871.pdf](http://www.hse.gov.uk/research/rrpdf/rr871.pdf)
- Fock, A. W. (2013). Analysis of recreational closed-circuit rebreather deaths 1998--2010. *Diving and Hyperbaric Medicine*, 43(2), 78–85.
- Hollnagel, E. (2007). Human Error: Trick or Treat? In F. T. Durso, R. S. Nickerson, S. T. Dumais, S. Lewandowsky, & T. J. Perfect (Eds.), *Handbook of Applied Cognition*. Chichester, UK: John Wiley & Sons Ltd.
- Hudson, P., Verschuur, W. L. G., Parker, D., Lawton, R., & van der Graaf, G. (1998). Bending the rules: Managing violation in the workplace. In invited keynote address, Society of Petroleum Engineers International Conference on Health, Safety and Environment in Oil and Gas Exploration.
- Hugh, T. B., & Dekker, S. W. (2009). Hindsight bias and outcome bias in the social construction of medical negligence: a review. *Journal of Law and Medicine*, 16(5), 846–857.
- Johnson, C. (2011). Human error, interaction and the development of safety-critical systems. In G. A. Boy (Ed.), *Handbook of Human-Machine Interaction* (pp. 91–107). Aldershot, England: Ashgate.
- Johnson, C. W. (2002). Reasons for the failure of incident reporting in the healthcare and rail industries. In *Components of System Safety: Proceedings of the 10th Safety-Critical Systems Symposium*. Berlin: Springer Verlag (pp. 31–60).
- Kahneman, D. (2011). Thinking , Fast and Slow (Abstract). Book.
- Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decision under risk. *Econometrica: Journal of the Econometric Society*, 263–291.
- Kruger, J., & Dunning, D. (1999). Unskilled and unaware of it: how difficulties in

- recognizing one's own incompetence lead to inflated self-assessments. *Journal of Personality and Social Psychology; Journal of Personality and Social Psychology*, 77(6), 1121.
- Levin, D. T., Drivdahl, S. B., Momen, N., & Beck, M. R. (2002). False predictions about the detectability of visual changes: The role of beliefs about attention, memory, and the continuity of attended objects in causing change blindness blindness. *Consciousness and Cognition*, 11(4), 507–527.
- Ministry of Defence. (2015). Manual of Air Safety (Issue 5). London, UK. Retrieved 30 September, 2015, from [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/418976/MAS\\_Issue\\_5.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/418976/MAS_Issue_5.pdf)
- Ministry of Justice. (2014). Guide to Coroners and Inquests and Charter for coroner services. London, UK: Coroners and Burials Division, Ministry of Justice.
- Paras. (1997). SCUBA diving: A quantitative risk assessment 140/1997. SCUBA diving: A quantitative risk assessment 140/1997. London, United Kingdom: HMSO.
- Rasmussen, J. (1997). Risk management in a dynamic society: a modelling problem. *Safety Science*, 27(2), 183–213.
- Reason, J. (1990). Human Error. England: Cambridge University Press.
- Shappel, S. A., & Wiegmann, D. A. (2000). The human factors analysis and classification system--HFACS. Washington DC, USA: US Federal Aviation Administration, Office of Aviation Medicine.
- Simons, D. J., & Levin, D. T. (1997). Change Blindness. *Trends in Cognitive Sciences*, 1(7), 261–267.
- Sweeney, G. P. (2005). USA Human Factors: Event Evaluation Model Cause Codes and Definitions USA003628RevC.
- Vann, R. D., Denoble, P. J., & Pollock, N. W. (Eds.). (2013). Rebreather Forum 3 Proceedings (p. 324). Durham, NC: AAUS/DAN/PADI.
- Vann, R. D., & Lang, M. A. (2011). Recreational Diving Fatalities. In Proceedings of the Divers Alert Network 2010 April 8-10 Workshop. Durham, N.C.: Divers Alert Network.
- Vaughan, D. (1997). The Challenger launch decision: Risky technology, culture, and deviance at NASA. USA: University of Chicago Press, 1997.
- Watson, J. (2007). Safe Diving Practices. Ellesmere Port, UK: Diving Resources Department, BSAC HQ.
- Woods, D. D., & Cook, R. I. (2003). Mistaking Error. *Patient Safety Handbook*, 1–14.