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Francesca Pellegrino

The Just Culture Principles in Aviation Law

Towards a Safety-Oriented Approach

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Dedicated to my sister Elvira

Preface

Safety is an essential part of aviation.

Aviation safety means the condition of a system or organization in which risks associated with aviation activities, related to or in direct support of aircraft operations, if not eliminated, are reduced and controlled at an acceptable level.

Measures that improve aviation safety include, in particular, accident investigations, mandatory and voluntary reporting schemes and data analysis programs: they are all instruments of a 'just culture'. This culture recognizes that aviation personnel should freely share and disseminate safety information on deficiencies without fear of punishment.

Therefore, in the last few years, there is an increase of criminal prosecutions against professionals involved in aviation accidents or incidents.

In fact, in the aftermath of several recent disasters, pilots, air traffic controllers or others involved in them have been charged with criminal offenses.

This tendency to criminalize the actions or omissions of professionals depends on the need to find a scapegoat in the face of media pressure and with particular regard to the alleged deterrent nature of penalties. But punishment of pilots or controllers has no demonstrable rehabilitative or deterrent effect.

This trend has increased the fear among aviation professionals that routine operational actions, omission or decisions could become the criminal prosecution ground.

The consequence of this situation is that front-line operators are deterred from reporting deficiencies for fear of being sanctioned for their errors.

Generally, the term 'error' is used in a wider sense, covering both 'gross negligence' and violations. In a technical sense, within the field of aviation safety, human error is an unintentional action or decision, while violations and 'gross negligence' are intentional failures. In turn, there are many types of human errors, intended in a strict sense: slips, lapses, mistakes, which can happen to even the most experienced and well-trained operators.

In the context of a 'just culture', it is certain that prosecution will be limited only to intentional acts which must be suitably sanctioned.

On the contrary, professionals should not be punished for excusable and honest errors that result from ordinary negligence, other than ‘gross negligence’.

Nowadays, the challenge in this approach consists of dissuading prosecutors from filing criminal charges against front-line operators for their unintentional acts or omissions.

Messina, Italy Francesca Pellegrino

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Chapter 1
Origin and Development of a 'Just Culture'

1.1 From Human Error to a 'Safety Culture' and a 'Just Culture'. Reason's Model

According to an ancient, well-known Latin phrase, *errare humanum est,*[1] *i.e.* to err is human. In fact, people make errors, whatever their level of skill, experience or training.[2]

Actually, accidents and incidents form part of our daily life.

When society became industrialized, technology and system complexity[3] generated an increased risk of employee carelessness.[4]

In theory, lapses or weaknesses do not cause a risk to materialize.

In practice, human errors[5] can lead to major accidents[6] or other adverse events. Indeed, human error is considered as a primary contributing factor in disasters and risk events.

The majority of all aviation accidents are attributed to human error,[7] and this is often interpreted as evidence of lack of skill, vigilance or conscientiousness of people at work.

Then we need to ask ourselves a very important question: why does all this happen?

[1] Kohn et al. (2000), p. 1 ff., asserts that the problem is not bad people in health care, but it is that good people are working in bad systems that need to be made safer.

[2] Kim (1989), p. 301 ff.

[3] Marti et al. (2011), p. 2 f; Contissa et al. (2012), and Contissa et al. (2013), p. 79 ff.

[4] Pidgeon and O'Leary (2000), p. 15 ff., Reuter (2013), p. 49 ff.

[5] For this concept, see Rasmussen et al. (1987); Shappell and Wiegmann (1997), p. 269 ff.

[6] Anderson (2015).

[7] Johnson (1995), p. 121 ff.

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There has been a considerable amount of research into the causes of human error,[8] many of these have stressed the physiological influences that shape operator performance.[9]

Especially in a complex system, disasters are due "to the adverse conjunction of a large number of casual factors, each one necessary but singly insufficient to achieve the catastrophic outcome".[10]

In this kind of system, competing task demands and organizational pressures[11] interact with cognitive processes to make people vulnerable to many forms of error.

Therefore, accidents and incidents very often occur as a result of a series of events that lead to disastrous results.

The 'man-machine-environment' theory[12] analyses these three factors capable of causing negative results.

The relationship between man, machine[13] and environment are well known.[14] A 'man-machine-environment' safety system depends not only on the safety training of the staff, but is also closely related to the safety of machinery and equipment and operating locations. In this context, the term environment includes both the physical environment and interpersonal environment. Workplace environment directly affects workers' safety.

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[8]See Hollnagel (2009). The ETTO principle refers to the fact that people and organisations, as part of their activities, frequently have to make a trade-off between the resources they spend on preparing to do something and the resources they spend on doing it. The trade-off may favour thoroughness over efficiency if safety and quality are the dominant concerns. It follows from the ETTO principle that it is never possible to maximise efficiency and thoroughness at the same time. At this purpose, efficiency means that the level of investment or amount of resources used or needed to achieve a stated goal or objective are kept a slow as possible. Thoroughness means that an activity is carried out only if the individual or organisation is confident that the necessary and sufficient conditions for it exist so that the activity will achieve its objective and not create any unwanted side-effects. See website erikhollnagel.com'.

[9]So Johnson (2005).

[10]Reason (1990b), p. 475 ff.

[11]Hale et al. (1997); Arnesen (1995).

[12]For example, in the USAir Flight 427 disaster, the NTSB concluded that the accident was due to mechanical failure: it determined that the probable cause was a loss of control of the airplane resulting from the movement of the rudder surface to its blowdown limit. USAir Flight 427 was a scheduled flight from Chicago's O'Hare International Airport to Pittsburgh International Airport, with a final destination of West Palm Beach, Florida. On Thursday, September 8, 1994, the Boeing 737 flying this route crashed while approaching runway 28R of Pittsburgh International Airport, located in Pennsylvania. All 132 people on board the aircraft were killed. See Byrne (2002).

[13]For the design of man-machine interface Reason mainly refers to improper allocation of man-machine functions and unreasonable engineering design that can induce man to error easily. See Suchman (1987); Summerton and Benner (2003).

[14]Man-machine-environment system engineering is a new developing synthesis frontier science. It analyses three factors for man, machine and environment of system and the relationship among them to make the system become "safety, cost-effective and highly efficient". So Song and Xie (2014), p. 87 ff. See Yang et al. (2005), pp. 50 ff.; Liu and Zhang (2007), pp. 107 ff.; Piao et al. (2009), p. 44 ff.; Long and Dhillon (2016).

Usually, hazards are prevented from causing human losses by a series of barriers.[15] According to the 'Swiss cheese model'[16]—originally developed by James Reason, a world leading expert on human error, and by Dario Orlandella, both academics of the University of Manchester—each barrier can be represented by a slice of cheese. Each slice has holes in it: they are preconditions, failures that can lead to an accident. This model of accident causation,[17] used in risk analysis and management, demonstrates that, although there are many levels of defense between hazards and accidents, nevertheless often active or latent failures exist in each level and they, if aligned, can allow the disaster to occur. If you can break the chain, you can prevent the accident.

Active failures are errors and violations having immediate negative results and are usually caused by an individual while latent failures refer to less apparent deficiencies in the design of organizational systems or in the environment and are caused by circumstances such as scheduling problems, inadequate training, fatigue, ambiguous communication, organisational influence etc.

Latent failures are usually hidden within an organization until they are triggered by an event likely to have serious consequences, while active failures have an immediate impact on the adverse situation and are usually made by front-line people such as machine operators.

Reason described three levels of human failure that fall within the concept of latent failures.[18] The first refers to the condition that affects front-line operator performance (preconditions for unsafe acts) and involves human biological conditions, such as mental fatigue and stress and also poor communication, coordination practices and frequent interruptions. This failure can lead to errors (skill-based errors, decision errors or perceptual errors)[19] or (routine or exceptional) violations.

'Unsafe supervision' or 'supervisory level' is the second level of human failure. This was identified as an error from lack of sufficient supervision by the organisation's management[20] itself.

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[15]Hollnagel (2004).

[16]See Reason (1990b), p. 475 ff. See McGrath (2015), model 67, p. 184 f.; Manners-Bell (2014), p. 14 f.; Davina et al. (2016), p. 31.

[17]This model, that has been called 'cumulative act effect' and is considered to be a useful method to understand accident causation, has been subject to criticism.

[18]Reason (1990a), p. 173 f., p. 188 and p. 208 ff.

[19]Human Factors Analysis and Classification System (HFACS), in https://www.skybrary.aero/index.php/Human_Factors_Analysis_and_Classification_System_(HFACS) one can find these clear definitions: "Skill-Based Errors: Errors which occur in the operator's execution of a routine, highly practiced task relating to procedure, training or proficiency and result in an unsafe situation (e.g., fail to prioritise attention, checklist error, negative habit). Decision Errors: Errors which occur when the behaviors or actions of the operators proceed as intended yet the chosen plan proves inadequate to achieve the desired end-state and results in an unsafe situation (e.g, exceeded ability, rule based error, inappropriate procedure). Perceptual Errors: Errors which occur when an operator's sensory input is degraded and a decision is made based upon faulty information".

[20]For more on this topic, see Nordby et al. (1995), p. 33 ff.; Glendon et al. (2006).

Finally, causal factors within the 'organisational level'[21] must be addressed to identify the root cause of any accidents or incidents. They refer to organisational decisions and rules that govern the everyday activities within an organisation and the organisational-level decision making regarding the allocation and maintenance of organisational assets,[22] as well as the working atmosphere within the organisation.

The Reason Model inspired the Human Factors Analysis and Classification (HFACS),[23] a human error framework that was originally used by the US Air Force[24] to investigate and analyze human factor aspects of aviation.

Despite the number of main studies carried out in this field, the traditional culture, aimed at blaming the people involved,[25] without regarding the type of error, is widespread even today. Moreover, in all complex organisational systems,[26] the fault is often not of an individual, but of the system (systemic fault).

However, although errors are involved, they can often be considered 'honest' mistakes that should not be qualified as criminal behaviour.

Therefore, we need to know what a human error is, why people make errors, how many types of errors exist, how errors cause accidents, etc.

Since the 1940s,[27] human factor engineers and psychologists have asked 'what' is responsible for errors, instead of 'who' is responsible.

Contemporary human error theorists catalog errors when examining them.

Several main studies on human errors were carried out by Donald Norman,[28] a well renowned American psychologist and engineer, who differentiated between two types of errors: slips and mistakes.

As Norman stated in his book: "Slips are defined as errors in which the intention is correct, but a failure occurring when carrying out the activities required [. . .]. Mistakes, by contrast, arise from an incorrect intention, which leads to an incorrect action sequence, although this may be quite consistent with the wrong intention".

Therefore, slips are action errors or execution errors "that are triggered by schemas, a person's knowledge, memories and experiences".[29] They are unintended failures of action or execution that occur almost every day because attention is not

[21] See Caldwell (2018), Chapter 2, in particular para. 2.3.2.

[22] Cromie et al. (2013).

[23] "The Human Factors Analysis and Classification System (HFACS)" Approach, July-August 2004, developed by Scott Shappell and Doug Wiegmann. See Shappell (2000), Wiegmann and Shappell (2003), Shappell and Wiegmann (2001), p. 59 ff. See also Leplat (1982) and Ford et al. (1999), p. 343.

[24] HFACS Analysis of Military and Civilian Aviation Accidents: A North American Comparison, ISASI, 2004. See also Li and Harris (2005), p. 67 ff.

[25] In contrast, the United States does not criminalize operators involved in controversial circumstances after aviation accident, but the penalties are primarily financial. See Lintner and Dunlap (2013), p. 52 ff.

[26] Scholtze (2014), para. 1.

[27] Festinger (1957); Johnston et al. (1994).

[28] Norman (1988, 2013).

[29] So Strauch (2017), p. 19.

fully applied to the task in hand. Mistakes are errors of thought in which a person's cognitive activities lead to actions or decisions that are contrary to what was intended. They are errors in choosing an objective or specifying a method of achieving it, whereas slips are errors in carrying out an intended method for reaching an objective.

According to Sternberg's opinion,[30] "slips are most likely to occur (a) when we must deviate from a routine, and automatic processes inappropriately override intentional, controlled processes; or (b) when automatic processes are interrupted - usually as a result of external events or data, but sometimes as a result of internal events, such as highly distracting thoughts".

Jens Rasmussen,[31] a system safety[32] and human factors professor at the University of Risø (Denmark), expanded the classification that Norman described, defining three different types of errors made by the operators, associated to three types of operator performance: 'skill-based', 'rule-based' and 'knowledge-based'.

In his view, the operator acts at one of these levels depending on the nature of the task and the level of experience required in the particular situation.

He defined the skill-based behaviour as a 'sensory-motor performance during acts or activities which, following a statement of an intention, takes place without conscious control as smooth, automated, and highly integrated patterns of behavior'.[33]

Therefore, skill-based performances are routine, highly practiced tasks that we do in almost automatic fashion. Any human error that occurs at this level is most often due to attentional lapses.

A rule-based error is more advanced than skill-based. It applies rules to situations that are similar to those that operators have encountered through experience and training. Therefore, it results from the inability to recognize or understand the situations or circumstances encountered. Errors made at this level often result from a misclassification of the situation and a consequent application of the wrong rule.

Rasmussen believed that the highest level of performance is knowledge-based. Knowledge-based performance takes effect when, rather than applying simple tasks and rules to situations that are similar to those previously encountered, the operator applies information formerly learnt or obtained through past experiences.[34] In this case, errors result from shortcomings in the operator's knowledge or limitations in his ability to apply existing knowledge to new situations.[35]

These and other main studies created the basis for the elaboration of 'just culture' principles.

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[30]Sternberg (1996). Robert Sternberg is an American psychologist and psychometrician. He is Professor of Human Development at Cornell University.

[31]Jen Rasmussen was senior member of IEEE, institute of Electrical and Electronic Engineers, New York. See Rasmussen (1982, 1983), p. 257 ff.

[32]McDonald et al. (2002), p. 205 ff.; Catino (2013).

[33]Rasmussen (1983), p. 258.

[34]*Ibid*., p. 259.

[35]See also Wickens et al. (1998).

In the 1990s, James Reason defined error[36] as "a generic term to encompass all those occasions in which a planned sequence of mental or physical activities fails to achieve its intended outcome, and when these failures cannot be attributed to the intervention of some chance agency".[37]

He stressed that human errors can be addressed in two different ways: the person approach and the system approach. The first one concentrates on the errors of individuals, blaming them for inattention, moral weakness or forgetfulness. According to this approach, punishing someone's misbehaviour encourages conformity to a rule and urges people to take precautions to reduce the risks accompanying inadvertent behaviour. The second approach focuses on the conditions under which individuals work and tries to find out if obstacles had been in place to avoid errors or mitigate their effects.

The first scenario is attributable to the so-called 'blame (or blaming) culture", while the second one is referred to as the 'just culture' or 'no blame culture'.

The two equivalent expressions 'no blame culture' and 'just culture' have been used by Reason in his well-known book "Managing the Risks of Organizational Accidents",[38] in which "engineering a 'just culture'" is considered the most important early step that aims to overcome the traditional and wide-spread 'blaming culture'.[39]

Looking at the events in detail, Reason believes that all human actions involve three basic elements: an intention that specifies an immediate goal of a future behaviour; the actions triggered by this intention and the consequences of these actions, which can or cannot achieve the desired objective.

In Reason's opinion, it should be considered that only a very small proportion of unsafe human actions are deliberate and a large part of them consists of honest errors (*e.g.* slips, lapses, mistakes etc.). Lapses[40] are actions resulting from plain forgetfulness and occur more frequently in maintenance or installation procedures, where an omission of a single task can be critical.

In addition, Reason sub-divided mistakes into two categories: 'knowledge-based mistakes' and 'rule-based mistakes'. The first ones are the kinds of errors that would occur during the failure to correctly appreciate a situation or make the appropriate

[36]Senders and Moray (1991), p. 25, defined error as "something that has been done which was not intended by the actor, not desired by a set of rules or an external observer, or that led the task or system outside its acceptable limits". See also Woods et al. (1994), p. 2, defined error as "a specific variety of human performance that is so clearly and significantly substandard and flawed when viewed in retrospect that there is no doubt that should have been viewed by the practitioner as substandard at the time the act was committed or omitted". More recently, Strauch (2004), p. 21 defined error as "an action or decision that results in one or more unintended negative outcomes".

[37]Reason (1990a), p. 5.

[38]Reason (1997). See also Reason (2000a), p. 768 ff.

[39]See Pepe and Cataldo (2011), p. 56 f.

[40]Otherwise, Wickens et al. (2016) say that "whereas slips represent the commission of an incorrect action, different from the intended one, lapses represent the failure to carry out an action at all" (see chapter 7, par. 5.1).

decision.[41] It is due to the lack of knowledge or expertise[42] to understand the situation. 'Rule-based mistakes' are made with confidence, but by choosing a different procedure or a wrong action because of a lack of situational assessment.

These two categories of mistakes do not differ from those of Rasmussen's model.

He believes that it is unfair to indiscriminately sanction every possible unsafe conduct following a 'blame culture' approach.

If the large majority of unsafe acts are 'honest errors', it means that they should be reported without fear of sanction. To this end, a crucial trust is required.

However, a "no-blame" culture *per se* is "neither feasible nor desirable", because it would leave unpunished deliberate behaviour, such as 'willful misconduct'. In addition, blanket amnesty on all unsafe acts would cause a lack of credibility in the public eye.

In his view, "a safety culture depends upon first negotiating where the line should be drawn between unacceptable behaviour and blameless unsafe acts".[43]

It is true that the civil aviation system should promote a 'safety culture'[44] facilitating the spontaneous reporting of occurrences and thereby disseminating an informed culture, but therefore an effective reporting culture depends on how the single organization handles and balances blame and punishment.[45]

In other words, an effective reporting culture is underpinned by a 'just culture', in which the culpability[46] line is more clearly drawn.[47]

Synthetically, according to the Reason model,[48] a 'safety culture' has the following characteristics:

(a) it is an 'informed culture'[49] in which those who manage a complex system or operate in it have detailed and current knowledge about technical, organizational, environmental and human factors that determine the entire safety system;
(b) it is a 'reporting culture' in which people are willing and prepared to report their errors and near-misses, in an atmosphere where they have confidence to report safety concerns, without fear of blame;

[41] Woods (2017).

[42] See Dismukes et al. (2017), and Flin et al. (2008).

[43] GAIN (Working Group E. Flight Ops/ATC Ops Safety Information Sharing) (2004), A Roadmap *to a* Just Culture*:* Enhancing the Safety Environment, 1st edition, vi.

[44] The term was first applied in 1986, with respect to the Chernobyl disaster. See Carnino and Weimann (1995); Wiegmann et al. (2002).

[45] See Johnson (1995), p. 15, p. 33 ff., Pellegrino (2004), p. 83 ff.

[46] Cromie and Bott (2016), p. 258 ff.

[47] Reason (1998), p. 293 ff. See also Hudson (2003a), p. 7 ff. and Hudson (2003b), p. 27 ff.

[48] See also Reason (2000b), p. 3 ff. See also Pidgeon and O'Leary (1994), p. 21 ff., where they suggested that a good safety culture's concern for safety is distributed and endorsed throughout the organisation; Pidgeon (1998), vol. 12, issue 3, p. 202 ff.; Guldenmund (2000), p. 216 ff.; Cooper (2000), pp. 111 ff.; Wiegmann et al. (2002); Harris and Li (2006), p. 345 ff.; Morley and Harris (2006), p. 3 ff.; Cooper and Findley (2013).

[49] Ferguson and Fakelmann (2005), p. 33 ff.