by Captain Hans-Joachim Ebermann

BLACKOUT

new findings regarding decision-making

A 747 en route from Germany to Los Angeles. The Captain takes the final crew rest break. The plane had been a little heavier than usual on departure. En route, the winds are somewhat stronger than expected and the planned eventual flight level is not achieved. Nearing Las Vegas, the two First Officers on the flight deck decide to call the Captain back from his break, because they believe that on arrival in LA they will no longer have minimum diversion fuel on board and want to recommend a fuel stop in Vegas. The Captain initially wants to fly on but the First Officers' manage to convince him that they should land and refuel. Reluctantly and still tired, the Captain initiates an en-route diversion to an airport which is unknown to all three of them.

Las Vegas is extremely busy and is situated in a valley that does not allow long radar vectors. The approach is steep and, as the aircraft joins the final approach track with a very high crew workload, it is travelling much too fast. So fast that later in the subsequent interview with his flight safety manager, it becomes clear that the aeroplane may well have failed to stop on the runway had a landing been attempted. Although this must have been more or less clear to each of the three pilots on board, nobody at first said "go around" even after the 1000ft gate was passed. It was not until very late, close to touchdown, that one of the two First Officers finally said "go around" and thus prevented the certain crash.

How could this almost fatal blackout have occurred? Was the crew totally incompetent?

While they may have been incompetent, research reported by Etienne Koechlin, Head of the Cognitive Neuroscience Laboratory at the ENS (Ecole Normale Supérieure) in Paris to a recent Conference suggests a more likely scenario.

One third of the entire brain looks after decision-making in the prefrontal cortex. Three areas of the prefrontal cortex can be distinguished: the middle sector controls motivation, the lateral area controls the selection of action options and the lower area processes emotions, personal preferences, etc. All three areas work independently, but communicate with each other constantly. But the brain can only ever make one decision at a time even though two or three situations needing a decision can be monitored simultaneously and the actions initiated after a decision can be monitored to see whether the desired outcome is achieved.

Translated into the FORDEC decision-making model, this means that steps F, E and C (Facts, Execution and Check) will be processed in parallel, while

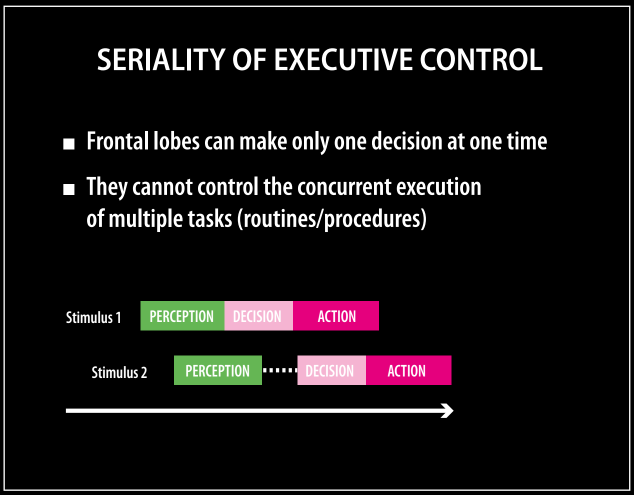

Figure 1: The brain can only make one decision at a time.

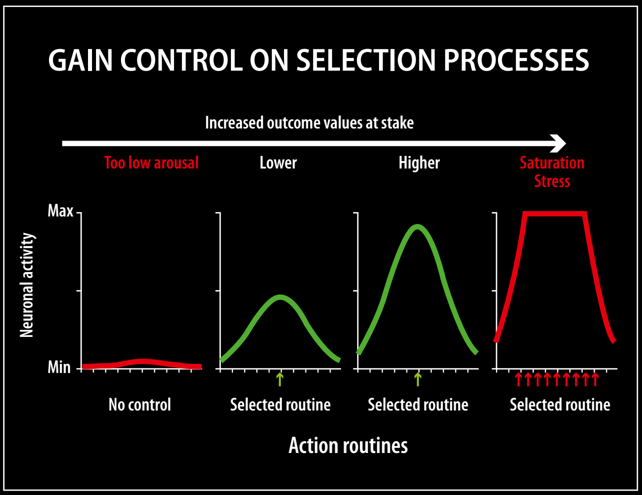

Figure 2: An overload may temporarily prevent the brain from taking any decisions whatsoever.

steps O, R and D (Options, Risks and Decision) will only be processed in succession. These are physiological laws which cannot be influenced by training (see figure 1).

To speed up and simplify decisions, after each decision with a satisfactory outcome the brain stores a routine or strategy to which it will refer in a similar future decision-making situation.

Therefore experienced pilots are able to take decisions more quickly and with greater certainty. On the other hand, if objectively dangerous situations such as unstabilised approaches have been individually found on several previous occasions to be manageable, this can be critical. The brain then stores the "continue instead of go-around" routine and modifies this routine only after a failure. In this case, after a landing overrun. This appears is a somewhat unsuitable learning process. Which is why our SOPs and limits are so important, because only they define the boundary between safety which is objectively necessary and safety which is individually (and wrongly) perceived as manageable.

Equally important here is our training, for example in the simulator, where by handling as many different problem situations as possible, routines and strategies are stored in the brain, to be relied on in an emergency. Savings in training, such as shortened transitions and only three instead of four recurrent simulator events per year, are therefore potentially unsafe.

It is obvious from what has been said so far that the brain cannot deal adequately with situations where it is overloaded. Too many stimuli and/or too many tasks to be handled in parallel place us under excessive strain. Enormous stress is generated particularly where serious consequences are likely - an accident such as an overrun, but also "just" a failed competency check. Such overload can lead to a situation where the brain is temporarily no longer capable of taking any decisions (see figure 2).

This brings us back to the example at the beginning: there was no motivation on the part of the Captain to make an en-route diversion; the crew did not know Las Vegas; the aggressive radar vectoring was a surprise; the plane was allowed to fly too fast; the go-around was difficult; ATC and traffic monitoring also played a part, etc. It is therefore highly likely that while the flight crew involved were "knowingly" clear about the consequences to be expected, they were for a short time unable to decide to abort the approach.

This is a possible explanation of the concept of target fixation: temporary overload leads to this state of "inability to take a decision". People knowingly rush headlong towards an accident and if they survive are subsequently unable to explain their behaviour. It is therefore obvious that overload situations should wherever possible not be allowed to arise in the cockpit because they cannot be managed with a sufficiently high probability that a safe outcome will result.

There are several ways of preventing overload situations arising, or mitigating the consequences if they do:

- Staff selection: the individual resilience and ability to cope with stress of those applying to be pilots should be as great as possible at the time of their selection.

- Training: four recurrent simulator events are the industry standard. Initial training should have an empirical basis in terms of scope and quality. Making cuts with no thought for the long-term effects spells suicide for airlines.

- Better individual stress and fatigue management

- Active intervention in overload situations to rectify matters:

  In the latter respect, accident review shows that whilst intervention is usually very good from the Captain to the First Officer, but it is often poor where the Captain is the person who is overloaded. Particularly where he is the also PF and the First Officer is the Pilot Monitoring (PM, a more recent alternative designation for the PNF). After a significant deviation from an SOP in particular, the First Officer may no longer be sure when he should intervene. Such significant deviation from an SOP can be a consequence of an overload but it can be difficult to judge if it is. Captains who routinely fail to follow SOPs (keywords: private procedures, operational pressure) are liable to discourage intervention from their First Officer at precisely the time when they might really need it as they find themselves in overload.

  This alone is a pretty convincing argument for adhering to SOPs.