“Are squirrels as fluffy as they look?” A study of the emergence and relevance of mind wandering in cockpit applications

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Aim of this research

Piloting an aircraft during long-haul flights requires pilots to remain vigilant over extended periods of time. Performing such tasks can induce mind wandering. Mind wandering is defined as the emergence of thoughts that are unrelated to the task[1]. This includes stimulus-independent thoughts and unintentional drifting from task-related thoughts[2], such as thinking about squirrels instead of monitoring one’s primary flight display. The resulting loss of attention[3] has implications for aviation safety. Nevertheless, this concept has not been studied much in aviation research.

In the present study, we assessed the emergence of mind wandering during a piloting task with low but constant cognitive demand over the course of 90 minutes. This analysis is part of a larger study on mental fatigue in the cockpit[4].

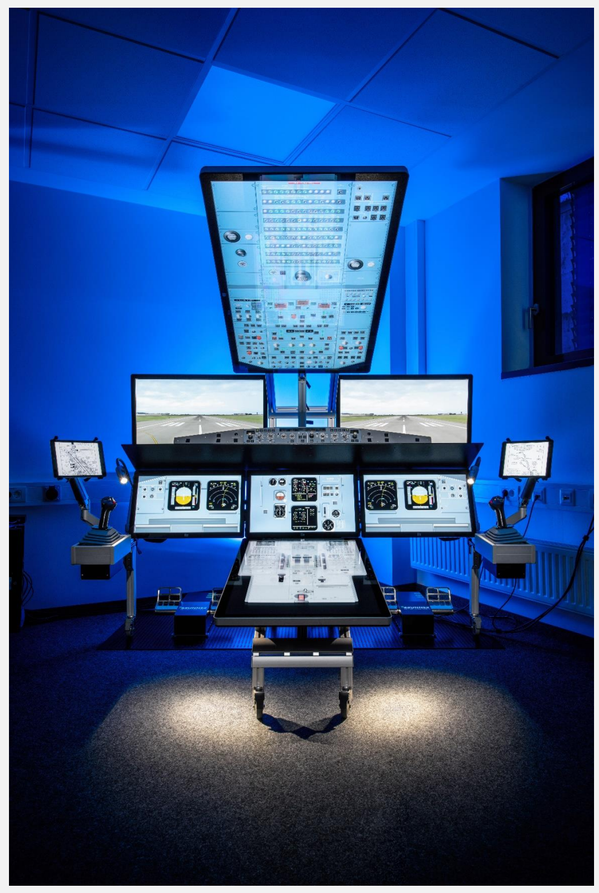

Figure 1. The DLR flight simulator used for the experiment, configured as an Airbus A320 cockpit. Photo: DLR.

The experiment

N = 31 students without prior flying experience, aged 19 to 33 years (*M* = 24.1, *SD* = 3.4).

90-minute simulated flight task: 16 blocks of an adapted auditory 1-back task (changing the course of the aircraft in accordance with the 1-back) and a monitoring task (monitoring and correcting the altitude of the aircraft). All other functions were controlled by the autopilot. The flight simulator is depicted in Fig. 1.

Mind wandering assessment: subjective rating after each block, on a sliding scale from 0 to 100 with the verbal anchors “attention completely on the task” to “attention completely away from the task” (anchors in German), see Fig. 2. The direction of the scale was balanced between participants.

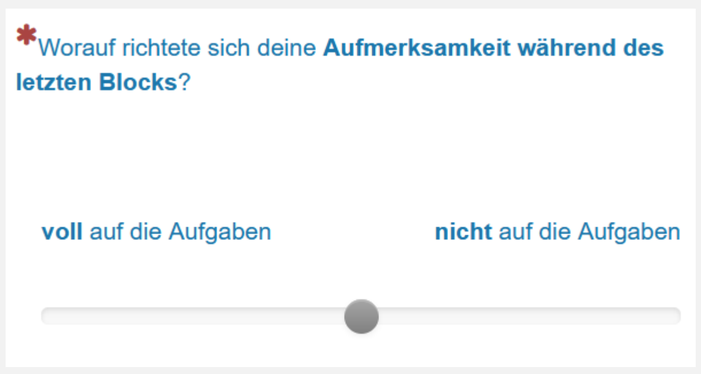

Figure 2. Mind wandering scale used in the experiment, built in LimeSurvey.

The results

Mind wandering increased significantly with increasing time on task, from 11% (*SE* = 3) in block 1 to 29% (*SE* = 4) in block 16, $F(4.68, 140.47) = 12.40$, $p < .001$, $\eta^2_p = .29$, see Fig. 3. This increase had a strong linear trend, $F(1, 30) = 33.80$, $p < .001$, $\eta^2_p = .53$.

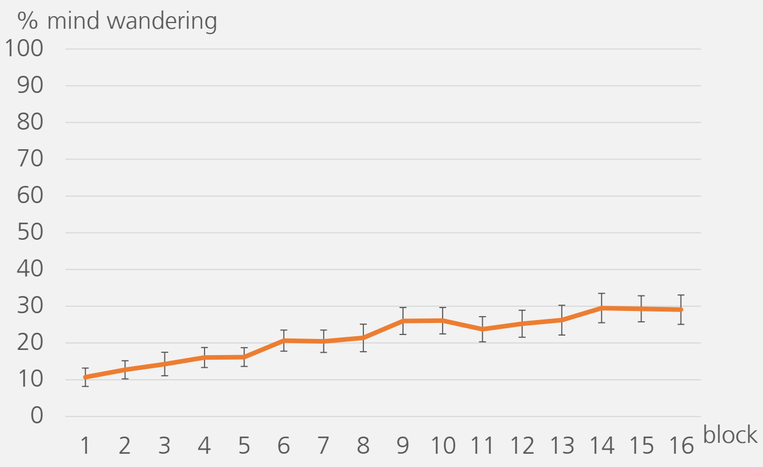

Figure 3. Mind wandering across blocks (*M, SE*).

Bonferroni-Holm corrected post-hoc t-tests for the blocks 1, 4, 8, 12 and 16 (i.e. start, ¼, ½, ¾ and end of the experiment) revealed significant differences for all comparisons except for block 8 vs. 12, and block 12 vs. 16, all *p*s ≤ .014.

Moreover, the number of participants who reported ≥ 25% mind wandering increased from 13% (*n* = 4) to 52% (*n* = 16) of the sample.

Discussion and implications

Mind wandering increased constantly during the simulated flight. At the end of the experiment, participants indicated that approx. one third of their attention drifted away from the task. Moreover, the number of participants who mind wandered 25% of their time quadrupled towards the end of the experiment. This means that the participants spent a substantial part of the time not focusing on the task. Considering the strong linear trend, it would be interesting to see if mind wandering increases even further with longer experiments.

Our results indicate that mind wandering indeed plays an important role for pilots when executing tasks that require continuous information processing, memory retention and manual input. These findings also imply that mind wandering will likely play an even bigger role with increasing levels of automation as the role of the pilots change from actors to mostly passive observers who monitor and supervise the systems in the unlikely event of automation failures. In light of these considerations, mind wandering should be researched further.

References

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Squirrel cliparts taken from Freepik.

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