Cross Recurrence Analysis as a Measure of Pilots’ Coordination Strategy

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Improving Safety
About 80% of aviation accidents are related to human error. As a consequence, crew resource management is part of pilots’ training since the late 1980s. In pilot teams, coordination plays a major role. (Gontar, Fischer, & Bengler, 2016)

Measuring Joint Attention
We suggest cross recurrence quantification analysis to model joint attention. Thereby each recurrent state (both pilots fixate on the same area) is plotted as a black dot. The density of black dots is called the recurrence rate (Marwan & Webber, 2015).

Research Questions
(1) Is there evidence for coordinated gaze behaviour between pilots in the cockpit?
(2) Does the degree of joint activity change with different tasks?
(3) Can one of the pilots be identified as the leading pilot?

Method
We conducted a full-flight simulator experiment (two abnormal events) with 120 certified pilots in two different aircrafts (Airbus A320 and A340). Gaze data was recorded using a head-based eye-tracker.

Results
The crews’ gaze behaviour was significantly coordinated (α-level = .05) about 17% of the time (bootstrapping). Furthermore, the recurrence rate changed with the task pilots’ were involved into.

Conclusion
Cross recurrence analysis is a valuable tool to measure pilots’ coordination strategy based on eye-tracking data. The introduced method can help instructor pilots to objectively assess pilots’ gaze interaction.

We are looking forward to your comments and further ideas:

References