Eye tracking and reality: Testing pilot expertise in Visual Flight Rules landing using a flight simulator


The Bio-Inspired Digital Sensing LAB (BIDs) within Media and Communications at RMIT University.
Eye tracking provides for the non-invasive testing of subject attention in subjects that are first calibrated to the system. Advances in eye tracking allow for highly mobile systems that can be used in complex environments.
Mobile app projects with augmented reality for non-profit community and cultural organisations, the education sector, and creative and culture industries (museums, galleries).
Cultural walking trails
We seek to understand how we can design apps and touch screen technology that improves individual engagement with cultural or tourist sites; and/or the design better green spaces?


A new ARC Linkage led by Prof Sarah Bekessy (Global, Urban and Social Studies) at RMIT seeks to design better green spaces in urban environments, incorporating eye tracking to understand user experience.
Developing an Alternative Representation of Geography for Map Illiterate Users: Erin Koletsis

Expertise training. 1993 U.S. Supreme Court decision (Daubert v. Merrell Dow Pharmaceuticals, Inc.) and resulting 'Daubert trilogy' created a statutory obligation to evaluate scientific knowledge in rulings of expert testimony. So how do we test experts?

Led by Dr Mara Merlino at Kentucky State University (USA): Funding by NIJ to test forensic expertise; Collaboration with Victoria Police and RMIT University.


Visual flight rules (VFR) are a set of regulations under which a pilot operates an aircraft in weather conditions generally clear enough to allow the pilot to see where the aircraft is going.

Participants
9 expert pilots (mean age 25 years) and 9 cadet pilots (22 yo) from the RMIT flight school (Melbourne, Australia). Expert group mean flight experience of 1,590 hours. Cadets mean flight experience of 91 hours.

Figure 33 – Recommended allocation time in VFR flight (FAA, 2004). The Airplane Flying Handbook (FAA, 2004) recommends at least 90% of the pilot’s attention outside the cockpit and no more than 10% of the attention to be allocated for the flight instruments scanning.
**Experiment Design Rationale**

During the experiment pilots from each expertise group were asked to perform in a flight simulation a classical VFR landing in:

- Optimal conditions
- Moderate turbulent conditions
- (+ night flying)

All simulated landings took place in visual meteorological conditions at the Point Cook airfield. The landing sequence began at:

- 1,200 ft. above ground level (AGL)
- 3.8 miles out

On each landing event participants performed a direct visual approach to the runway.

Eye movements were recorded for the last 120 s before touchdown. The sequence of the two different scenarios was presented randomly.
Comparison and characterization of the visual scan patterns of expert and cadet pilots in visually guided aircraft landings

With A/Prof. Cees Bil and Jose Martinez at the School of Aerospace and Aviation (RMIT University), we investigated how very experienced and cadet pilots use visual search and attention in a range of flight landing experiments with different conditions like simulated turbulence.

Frasca 242 flight simulator
All subjects could be tracked by the eye tracking technique in the flight simulator, including a capacity to record fixations both within the cockpit (1) as well as to the outside environment (2).

Heat map of expert and cadet groups, showing the total qualitative results for the non-turbulent experiment. (A) Data for the 9 expert pilots. (B) Data for the 9 cadet pilots.
Looking for the wing: evidence of scan path type processing?
Figure 8 – Heat map of four trial flights of an experienced instructor in day and night landings during turbulence and optimal conditions. The fixations show clearly the most important areas of interest inside and outside the cockpit. Fixations outside the cockpit cover the majority of the attention allocation, whereas inside the cockpit the airspeed indicator, the altimeter and the manifold pressure indicator are the most visited flight instruments.
Experienced pilots spend significantly more time (+37%) inside the cockpit in the two flight conditions during a 2-minute landing compared to cadet pilots.
The findings of our research showed significative differences between expert and cadet pilots, where cadets allocated 85.4% of the time outside the cockpit and experts 77.5%.

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Adrian G Dyer: adrian.dyer@rmit.edu.au

Questions?

ARC LE130100112
ARC LP160100324
National Institute Justice: USA
The Ministry of Education: Singapore