Flights into Deteriorating Weather Conditions: Investigating Cognitive Biases in Weather-Related Decision Making

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Abstract

In this thesis, the author's aim was to investigate whether the use of three cognitive heuristics may lead to systematic biases leading visual flight rules (VFR) qualified pilots to make inappropriate or ineffective decisions when faced with adverse weather and fly into instrument meteorological conditions (IMC). Although heuristics may reduce cognitive workload in weather-related decision making, they may lead VFR pilots to judge weather conditions as being better than they are in reality and continue flight into IMC conditions, when diverting or turning back would be the judicious choice.

Three cognitive biases that may potentially occur in pilot decisions to fly from VFR into IMC were identified: anchoring effect, confirmation bias and outcome bias. Three vignette-based studies found that pilots tended to anchor and under-adjust on initial information (n = 201), favour a confirmatory strategy when testing a hypothesis (n = 278) and evaluate judgments by the outcome rather than the decision process (n = 300).

Three intervention studies tested whether encouraging pilots to consider additional information rather than focusing on a narrow set of evidence when making judgments could reduce the impact of the three cognitive biases. Although a 'consider the alternative' strategy is sometimes effective, it was largely unsuccessful in reducing all three cognitive biases (n = 101). The perseverance of the biases in all six empirical studies is discussed in relation to the extant literature, as are the implications for flight-training and general aviation pilots generally.

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Glossary

The following terms and their corresponding definitions are used in the context of this thesis:

Term	Definition
ATPL	Air transport pilot licence: the highest level of aircraft pilot licence. Those certified are authorised to act as the pilot-in-command on larger aircraft that require two pilots to operate.
CAA NZ	Civil Aviation Authority of New Zealand: the regulatory authority of civil aviation in New Zealand.
CASA	Civil Aviation Safety Authority: the Australian national aviation authority (i.e., the government statutory authority responsible for the regulation of civil aviation).
CPL	Commercial pilot licence: a qualification that permits the holder to act as a pilot of an aircraft and be paid for his/her work. The pilot may also act as a co-pilot (first officer) of an aircraft that requires two pilots to operate.
FAA	Federal Aviation Administration: the regulatory authority of civil aviation in the United States.
GA	General aviation: aircraft operating on non-commercial flights. Aircraft of a variety of sizes can operate in GA, with four- to six-seater aircraft (e.g., a Cessna 172 with four seats) being a relatively common aircraft type
IFR	Instrument flight rules: regulations and procedures for flying aircraft by referring only to the aircraft instrument panel for navigation.
IR	Instrument rating: the qualifications that a pilot must have in order to fly under IFR.
IMC	Instrument meteorological conditions: meteorological conditions expressed in terms of visibility, distance from cloud and ceiling less than the minima specified for visual meteorological conditions.

NTSB	National Transportation Safety Board: an independent United States government investigative agency responsible for civil transportation accident investigation.
PIC	Pilot-in-command: in relation to any aircraft, means the pilot responsible for the operation and safety of the aircraft
PPL	Private pilot licence: a licence that permits the holder to act as the pilot-in-command of an aircraft privately (not for pay).
SP	Student pilot: someone who does not hold a pilot licence but is often in the training phase under supervision. They may fly solo without passengers provided they meet the required criteria (e.g., a valid medical certificate).
TSB	Transport Safety Board of Canada (officially the Canadian Transport Accident Investigation and Safety Board): the agency of the Government of Canada responsible for maintaining transportation safety in Canada.
VMC	Visual meteorological conditions: the meteorological conditions expressed in terms of visibility, distance from cloud and ceiling equal to or better than specified minima:
VFR	Visual flight rules: a set of aviation regulation under which a pilot may operate an aircraft in weather conditions that are sufficient to allow the pilot, by visual reference to the environment outside the cockpit, to control the aircraft's attitude, navigate and maintain safe separation from obstacles such as terrain, buildings and other aircraft.