Predicting Pilots’ Risk-Taking Behaviour

Brett Molesworth (UNSW - Sydney) PhD
Betty Chang (UNSW - Sydney) PhD
Objective

Big Picture
• Develop a comprehensive model of individual risk management.
  – Identify the predictors of pilots’ risk-taking behaviour.

Specific
• To develop and test a newly created Implicit Association Test
• Test the predictive validity of existing risk-taking scales employed in general aviation (predominantly).

Important
– Identify pilots who may be considered at-risk of being involved in an incident/accident,
– Target these pilots in an attempt to improve their risk management skills
Risk Management

- Defined - class of behaviour that encompasses a choice between two or more options, where one of the options has the probability of producing adverse effects that are not fully known to the person at the time (Lane & Cherek, 2000).
  - OHS commonly refer to this as ‘likelihood and severity’ (Sibinga, 2001)

- A bad reputation
  - Living life = risk (i.e, death itself)
  - When managed successfully, rewards are forthcoming (WOW shares, Red Bull Air Race, driving, parachuting, medical procedures...)

- Although when mismanaged...
  - Failure is almost guaranteed (ABC shares, QF1 – Bangkok, Challenger 1986, ......)
Predictors of Risk-Taking Behaviour

- Gender (DeJoy, 1992)
- Age (Reason et al., 1997)
- Desire for Sensation (Zuckerman, 1983)
- Intelligence (Cocolas & Sleath, 2000)
- Risk Perception (Hunter, 2006)
- Extroversion (Loo, 1978)
- Attitude (Rundmo, 2000)
Attitude

• Definition – A psychological tendency that is expressed by evaluating a particular entity with some degree of favour or disfavour (Eagley & Chaiken, 1993).

  – Psychological tendency = state that is internal to the person
  – Evaluating = all classes of evaluation responding (covert, cognitive, affective, or behavioural)

• Quite simply = a way of thinking or feeling displayed through behaviour.
Attitude and Behaviour: The Link

- Attitude influence/predicts Behaviour

- Behaviour influence/changes Attitude

Factors?

- Attitude mutual influence/reinforcement Behaviour

- Attitude Behaviour
Aviation Research: Attitude

- Attitude – Attitude towards safety related issues (self-confidence) (Aviation Safety Attitude Scale – ASAS)
  - the belief in one’s ability or skill has found to be positively related to incident involvement ($r = .208$; Hunter, 2005),
Aviation Research: Risk Perception

• Definition – recognition that adverse outcome (likelihood) and consequences (severity) may result.

• Risk Perception (RP – Other)
  – pilots rate the level of risk present in normal flight situations (Nominal Risk) for a third person has shown to be related (negatively) to incident involvement ($r = -.168$; Hunter, 2006).

• Risk Perception (RP – Self)
  – pilots rate the level of risk that applies to self in high-risk flight conditions has shown to be related (negatively) to incident involvement ($r = -.123$; Hunter, 2006).
Aviation Research: Risk Tolerance

• Definition – trade-off between risk and the amount of ‘gain’ associated with an activity (Sokolowska & Pohorille, 2000; Hunter, 2002).

• Risk Tolerance (Hunter, 2002)
  – focus on the amount of risk a pilot is willing to accept during the course of his/her operation – no prediction (Hunter, 2002)
Limitation of Existing Research

• Hunter’s scales use self-reported behavioural data
• Data captured through Hazardous Event Scale (HES)
  – How many a/c acc have you been involved in?
  – How many times have you inadvertently stalled a/c?
  – How many time have you had a mechanical failure which jeopardized the safety of your flight?
  – How many times have you flown inadvertently into IMC?

• Argument for
  – very few incidents,
  – even less accidents.
Limitation of Existing Research

- Psychometric scales (attitude, risk-perception, etc) use self-report data

- Self-report data subject to self-report problems of biases
  - In other words, can be manipulated by individual completing scale.
Implicit Association Test

- An alternate to existing self-report attitudinal scales
- Implicit Association Test (IAT) measures reaction time to paired stimuli and infers that this reaction time relates to attitude
- IATs widely used within social science
  - Weight,
  - Food preference,
  - Skin tone,
  - Religion,
  - Age, etc
- Attitude vs. association.
Learning Style

- Implicit vs Explicit learning
- Note response to task
- Since we can learn implicitly, it is thought that we can be measured/assessed in the same way.
Implicit Association Test

5 classification tasks in the IAT

1. a target classification task (high flight vs. low flight),
2. an attribute classification task (pleasant vs. unpleasant),
3. a target and attribute combined classification task,
4. a target classification task with reversed response assignment, and
5. a target and attribute combined classification task with reversed pairings.
## IAT Stimuli

<table>
<thead>
<tr>
<th>High Flying</th>
<th>Pleasant</th>
<th>Unpleasant</th>
<th>Low Flying</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cheerful</td>
<td>Bad</td>
<td>Wise</td>
<td>Cold</td>
</tr>
<tr>
<td>Ethical</td>
<td>Cold</td>
<td>Witty</td>
<td>Crude</td>
</tr>
<tr>
<td>Generous</td>
<td>Crude</td>
<td>Nasty</td>
<td>Mean</td>
</tr>
<tr>
<td>Lovely</td>
<td>Mean</td>
<td>Rude</td>
<td>Mean</td>
</tr>
<tr>
<td>Loyal</td>
<td>Nasty</td>
<td>Angry</td>
<td>Nasty</td>
</tr>
<tr>
<td>Wise</td>
<td>Mean</td>
<td>Nasty</td>
<td>Rude</td>
</tr>
<tr>
<td>Witty</td>
<td>Nasty</td>
<td>Rude</td>
<td>Rude</td>
</tr>
</tbody>
</table>
IAT Stimuli

• Safe (risk adverse) Condition (quick reaction time)
  – High Flying with Pleasant word, or
  – Low flying with Unpleasant word

• Risky (Risk-taking) condition (quick reaction time)
  – High flying with unpleasant word, or
  – Low flying with pleasant word

• Mean reaction time in risky condition subtracted from mean reaction time in safe condition
Present Research

- **Aim** - Examine the accuracy in which existing scales and the newly created IAT predicts pilots risk-taking behaviour

- **Participants** - 35 (27 males) pilots

- **Procedure** -
  - Simulated flight involving spotting task
  - IAT
  - Battery of tests (IAT and tests reversed for half of participants)

Risk Management (DV) - Min alt, fuel exhaustion, dist from threshold, speed at touchdown (Nall, 2006).
Results - Data Reduction & Analysis

- Flight performance measure (32 pilots) - z score for all 4 measures
  - Higher score = Riskier behaviour
  - Cronbach’s alpha .68 (acceptable for exploratory research – Nunnaly & Bernstein, 1994)

- Larger IAT effect = stronger preference for low flying (riskier flight behaviour)

- Correlation Analysis (19 variables) - 2 statistically significant results
  - Everyday Risk (RP - self) $r = .353, p = .047*$
  - IAT Effect $r = .422, p = .018*$
Results - Data Analysis

Multiple regression

- 2 predictors accounted for 30.3% of the variance in flight behaviour \( (R^2 = .30) \), which was a significant fit, \( F(2,28) = 6.39, p = .005 \).

- Everyday Risk was a significant predictor of flight behaviour \( (B = .053, t(28) = 2.35, p = .026) \), and accounted for 12.5% of the variance in flight behaviour.

- The IAT effect was also a significant predictor of flight behaviour \( (B = 1.15, t(28) = 2.69, p = .012) \), accounting for 17.8% of the variance in flight behaviour.
Results - Summary

The result from the multiple regression indicate

- Pilots whose flight behaviour was more risky, accurately judged the risk in everyday scenarios (Risk Perception – Self).

- The more participants preferred high flying to low flying (IAT Effect), the safer their behaviour was in the flight simulator.
Limitations

Task involved:
• Examining pilots risk-taking behaviour in the safety of a flight simulator, and
• Relatively small number of participants (35 pilots) for a multiple regression
Discussion

- Hunter’s ‘Everyday’ risk scale (RP - Self) is a better predictor of pilots risk-taking behaviour than other risk perception scales.

- The IAT is a better predictor of risk-taking behaviour than existing attitudinal scales (ASAS, New HAS).

- Employing IAT to aid in training
  - If risk-taking is viewed as decision-making under uncertainty, being able to identify those individuals who are likely to be riskier will permit more targeted training.
Future Research
Future Research

Risk Management

- Risk Perception
- Attitude
- Opportunity
- Social/Peer Pressure
- Self-Censoring bias
- Consequences
- Physiological and Psychological
- Fun
Thank You

b.molesworth@unsw.edu.au