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OPTIMISTIC AND ABILITY BIASES IN PILOTS' DECISIONS AND PERCEPTIONS OF RISK
REGARDING VFR FLIGHT INTO IMC

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ABSTRACT

Aircraft accidents resulting from attempted visual flight rules (VFR) flight into instrument meteorological conditions (IMC) continue to be one of the leading causes of fatalities in aviation. The aim of this study is to determine the role which two decision biases—optimistic bias and ability bias—may play in pilots' decisions and perceptions of risk regarding VFR flight into IMC. A questionnaire designed to test for the presence of these biases was administered to 57 pilots enrolled in a university flight-training program and 103 general aviation pilots attending two FAA aviation safety seminars. Respondents were asked to rate their chances of experiencing an accident due to inadvertent VFR flight into IMC and their ability to avoid or successfully fly out of such conditions. Results indicate that VFR pilots are overly optimistic regarding their chances of experiencing a VFR-into-IMC accident, and are overconfident in their ability to both avoid and successfully fly out of IMC.

INTRODUCTION

Aircraft accidents resulting from attempted visual flight rules (VFR) flight into instrument meteorological conditions (IMC) continue to be one of the leading causes of fatalities in aviation. In spite of a gradual decline in the percentage of general aviation (GA) weather-related accidents, VFR flight into IMC is still the leading cause of fatal GA weather-related accidents, and continues to be one of the most frequent causes of all fatal GA accidents in the United States (Aircraft Owners and Pilots Association Air Safety Foundation [AOPA], 1996; 1999). Even though a variety of factors such as mountainous terrain and darkness play a role in many of these accidents (Transportation Safety Board of Canada [TSBC], 1990; Wilson, 1999), investigators consistently cite errors in planning, judgment, and decision making as reasons pilots initiated or continued VFR flight into unsuitable weather (AOPA, 1999; Mortimer and Hanson, 1993; TSBC, 1990).

The goal of this study is to determine the role which two decision biases—optimistic and ability bias—may play in pilots' decisions and perceptions of risk

regarding continued VFR flight into IMC. Evidence for these two biases has been shown in a variety of contexts. For example, when Rutgers University students were asked to rate the likelihood of owning their own home, obtaining a good job after graduation, and living a long life, almost all of them believed they had a greater chance than their classmates (Weinstein, 1980). Most also believed they had a lower chance than their peers of having a drinking problem, getting divorced after only a few years of marriage, and being fired from a job. Because it is impossible for the majority of students in a given group to have a greater (or lesser) chance of experiencing a positive (or negative) event than the average of the group, an optimistic bias is assumed to be at work. Unrealistic optimism is also evident when the majority of people believe they are less likely than others to develop health-related problems such as influenza (Larwood, 1978), mental breakdown (Perloff & Fetzer, 1986), and AIDS (Hoorens & Buunk, 1993). McKenna, Warburton, and Winwood (1993) even discovered that the majority of cigarette smokers believe they are at less risk of developing smoking-related health problems than the average smoker. Most drivers also believe they are less likely than others to be involved in an automobile accident (McKenna, 1993; Perloff & Fetzer, 1986; Robertson, 1977), and most GA pilots believe they are less likely than others to experience an aircraft accident (Wichman & Ball, 1983). When O'Hare (1990) asked GA pilots to rate their chances of being involved in an aircraft accident, over 95% of respondents indicated probabilities that were considerably lower than actual objective values.

Research also indicates that most people believe themselves to be superior to others when it comes to their own virtues, skills and abilities. Alicke (1985) found that most college students identify such positive traits as responsibility, resourcefulness, self-discipline, and kindness as more applicable to them than the 'average college student.' Most business people see themselves as more ethical than other business people (Brenner & Molander, 1977), and most Americans believe they are more intelligent than their fellow citizens (Wylie, 1979). This 'above average effect' (Dunning, Meyerowitz, & Holzberg, 1989) also extends to people's judgments of their own skills and

abilities. For example, 94% of U.S. college professors think they do 'above average' work (Cross, 1977), while both managers and students of management rate their managerial skills as higher than their respective peers (Larwood & Whittaker, 1977). Dunning et al. (1989) reported the results of a College Board survey of one million students. Predictably, most rated themselves as above average in athletic ability and leadership, but when judging their ability to get along with others, no one rated themselves below average, and 60% and 25% of responses were in the top tenth and first percentile respectively. Over-assessment of one's abilities and skills has also been discovered in drivers and pilots. For example, in both Sweden and the United States, automobile drivers believe they drive better and are less risky than their fellow drivers. Ninety-three percent of U.S. drivers rated themselves as more skillful, and 88% rated themselves as safer, than the median driver (Svenson, 1981). Most GA pilots also believe they are safer, are less likely to take risks in flight, and possess greater flying skill than their peers (O'Hare, 1990; Wichman & Ball, 1983).

The primary purpose of the present study is to determine if the optimistic and ability biases evident in pilots' evaluations of risk and skill discovered in the research of Wichman and Ball (1983) and O'Hare (1990), extend to pilots' decisions and perceptions of risk regarding continued VFR flight into IMC. A secondary goal is to determine if age or flight hours are related to these two biases. We expect that not only are VFR pilots overly optimistic regarding their chances of experiencing a VFR-into-IMC accident, but are also overconfident in their ability to both avoid and successfully fly out of IMC.

METHODS

Participants

Fifty-seven pilots (53 male, 4 female) enrolled in Central Washington University's (CWU) four-year flight officer degree program in Ellensburg, WA, and 103 GA pilots (94 male, 9 female) attending two FAA aviation safety seminars held in and near Seattle, WA, participated in this study. CWU participants ranged in age from 18 to 29 ($M = 20.88$, $SD = 2.33$) and consisted of 17 student pilots, 38 private pilots, and 2 commercial pilots. FAA seminar participants ranged in age from 20 to 78 ($M = 49.12$, $SD = 13.52$) and consisted of 8 student pilots, 73 private pilots, 17 commercial pilots, and 5 airline transport pilots.

Materials

A questionnaire consisting of three questions

designed to test for the presence of optimistic and ability biases was used. Three questions regarding flying qualifications and experience, and two demographic questions were also included. To test for the optimistic bias, one question asked respondents, "In comparison to other pilots with similar flight background and experience as yourself, what do you feel are your chances of experiencing an accident due to inadvertent flight into instrument meteorological conditions (i.e., cloud or fog)?" To test for the presence of the ability bias, one question asked, "In comparison to other pilots with similar flight background and experience as yourself, how would you rate your ability to avoid inadvertent flight into instrument meteorological conditions (i.e., cloud or fog)?" and another question asked, "In comparison to other pilots with similar flight background and experience as yourself, how would you rate your ability to successfully fly out of instrument meteorological conditions should inadvertent flight into cloud or fog occur?" All three questions used a 7-point Likert scale, anchored at 1 for "less than average" and 7 for "more than average," with 4 designated as "average."

Procedure

To eliminate possible order effects, the three questions designed to test for these two biases were systematically counterbalanced. The resulting six versions of the questionnaire were randomly distributed to CWU participants attending a commercial pilot ground school class and an aviation history class, and to FAA seminar participants attending an aviation safety seminar in Everett, WA, and to a different group of participants attending the same seminar held in Seattle, WA, the next evening. The same instructions were read out to each group before distributing the questionnaire, and were also included in written form on their questionnaire.

RESULTS

Comparing themselves to other pilots with 'similar flight background and experience as themselves,' it is expected that the mean of a non-biased group of pilots would be 4 on the 7-point Likert scale. A significant difference between the sample mean and the mean of the hypothetical non-biased group ($\mu = 4$) is evidence of possible bias.

Optimistic and ability biases

Flight hours was significantly positively skewed ($z = 16.67$, $p < .0001$) so was transformed using a logarithmic transformation. All analyses using flight hours were therefore based on the transformed scores.

Despite the fact that the FAA participants were significantly older than the CWU participants ($t(158) = 15.62, p < .001$) and had significantly more (log) flight experience ($M = 2.51, SD = .58; M = 1.99, SD = .33$, respectively; $t(158) = 6.203, p < .001$), there were no differences in responses depending upon groups, so data were analyzed collapsed over groups. Because of multiple tests, alpha was adjusted to .01.

Results indicate that participants believed they were less likely than others to experience a VFR-into-IMC accident ($M = 3.01, SD = 1.41, t(159) = -8.89, p < .001$), and believed they were more capable than average at avoiding inadvertent flight into IMC ($M = 5.21, SD = 1.17, t(159) = 13.14, p < .001$) and being able to successfully fly out of IMC ($M = 4.93, SD = 1.22, t(159) = 9.62, p < .001$). Thus, the hypotheses that VFR pilots are overly optimistic regarding their chances of experiencing a VFR-into-IMC accident and are overconfident in both their ability to avoid IMC and successfully fly out of IMC, were confirmed.

Are (log) flight hours or age related to optimism and ability biases?

It may be that (log) flight hours and/or age are related to the response pattern seen in the above questions. Perhaps the younger pilots are still in the “immortal” stage of adolescence, and therefore are skewing the data because of that belief. Perhaps the more one has flown, the better one knows their limitations. Or, perhaps the more one has flown the more overconfident one becomes. In order to answer that question, age and (log) flight hours were used as predictors of responses to the three questions.

Table 1 shows the correlation and standard regression results for the three questions, using (log) flight hours and age as predictors of responses. The correlation between (log) flight hours and age was .56, $p < .001$, indicating they are, not surprisingly, related. There was, however, no evidence of multicollinearity (tolerance = .69).

With regard to question 1 (Part A of Table 1), neither age nor (log) flight hours were significantly correlated with optimism bias, as measured by this question. In addition, neither reliably predicted response choices ($R = .12; F(2, 157) = 1.19, p > .05, MSE = 1.97$). Neither experience in flying or life (as reflected by age) appears to be related to the optimism bias.

As for question 2 (Part B of Table 1), (log) flight hours was marginally, but statistically significantly correlated with responses while age was not. (Log)

flight hours and age significantly predicted estimates of ability to avoid inadvertent flight into IMC ($R = .22; F(2, 157) = 3.93, p < .03, MSE = 1.32$). However, only number of (log) flight hours significantly contributed to the regression equation. It appears that greater experience in flying contributes to one’s ability estimates when it comes to avoiding IMC, leading participants to overestimate their ability. Age, however, did not contribute to the equation.

(Log) flight hours (Part C of Table 1) was also significantly correlated with responses to question 3, but age was not. Though both variables predicted ability estimates with regard to successfully flying out of instrument conditions once inadvertently entered ($R = .41; F(2, 157) = 15.55, p < .0001, MSE = 1.25$), (log) flight hours was positively related, while age was negatively related. It appears that the effect of flying experience as measured in (log) flight hours may be tempered somewhat by life experience (as reflected by age).

DISCUSSION

Both hypotheses were confirmed. Relative to other pilots with similar flight background and experience as themselves, participants underestimated their likelihood of experiencing an accident due to inadvertent flight into IMC, and overestimated both their ability to avoid, and their ability to successfully fly out of, IMC. The number of flight hours reported was significantly skewed, so was logarithmically transformed, so all analyses were in terms of the transformation. In addition to the biases being in the predicted direction, neither age nor (log) flight hours were related to the participants’ likelihood estimates. However, (log) flight hours was a significant predictor of their ability to avoid inadvertent flight into IMC, and (log) flight hours and age were significant predictors of their ability to successfully fly out of IMC, though age was negatively weighted relative to (log) flight hours.

It is not particularly surprising that likelihood estimates of experiencing a VFR-into-IMC accident were unrelated to experience, either in terms of life experience (age) or flight experience (number of hours). The plethora of research on participants’ tendency to underestimate the probability of negative life events bears out that prediction. What is surprising is the effect of experience on ability biases. One would think that as experience increases, a person would gain a more realistic appraisal of their abilities. Instead, it appears that flight experience may lead to overestimates of one’s ability to both avoid and successfully fly out of IMC. Admittedly, as flight experience increases, both skills may also increase.

However, ability-biased pilots may be putting themselves at risk if they are relying on their flight experience to help them avoid or successfully fly out of adverse weather conditions. It should also be noted that estimates of the chances of successfully flying out of IMC appear to be mediated by the wisdom of age, albeit to a fairly small amount, as evidenced by the beta scores. We could only wish that the estimates of being able to avoid the situation in the first place were also mediated by age. Were that the case, perhaps there would be fewer poor decisions which seem to lead to these types of accidents.

Consistent with the general findings of Wichman and Ball (1983) and O'Hare (1990), these results support the notion that optimistic and ability biases are also involved in pilots' decisions and perceptions of risk regarding VFR flight into IMC. If VFR pilots are overly optimistic regarding their chances of experiencing a VFR-into-IMC accident and are overconfident in their ability to avoid or successfully fly out of IMC, they may not see the need to take the appropriate preventive measures to reduce this risk. Therefore, pilots need to be made aware of these cognitive risks to safe flight, either through new or existing flight safety education efforts.

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Table 1

Correlations and Regression Results for the Three Questions, Using (log) Flight hours and Age as predictors.

A. Question 1: ...what do you feel are your chances of experiencing an accident due to inadvertent flight into instrument meteorological conditions (i.e., cloud or fog)?

	<i>r</i>	<i>B</i>	standard error	Standardized \exists	<i>t</i>
(log) Flight hours	-.06 (ns)	-0.33	0.24	-0.13	-1.37 (ns)
Age	.06 (ns)	0.001	0.008	0.13	1.34 (ns)

B. Question 2: ...how would you rate your ability to avoid inadvertent flight into instrument meteorological conditions (i.e., cloud or fog)?

	<i>r</i>	<i>B</i>	standard error	Standardized \exists	<i>t</i>
(log) Flight hours	.20**	0.23	0.20	.26	2.74*
Age	.05 (ns)	-0.006	0.006	-0.10	-1.02 (ns)

C. Question 3: ...how would you rate your ability to successfully fly out of instrument meteorological conditions should inadvertent flight into cloud or fog occur?

	<i>r</i>	<i>B</i>	standard error	Standardized \exists	<i>t</i>
(log) Flight hours	.32**	1.06	.19	.49	5.56***
Age	-.03 (ns)	-0.002	.006	-.30	-3.44**

* $p < .01$

** $p < .001$

*** $p < .0001$