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# Risk profiling of airline pilots: Experience, temperamental traits and aggression

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ABSTRACT

It has been assumed that the greater the number of flying hours, the better the pilot is at solving problems. The studies suggest, however, that this issue is more complex. What is important is not only a pilot's experience but also their personality traits such as temperament, aggression, and risk-taking tendencies, which all influence how the pilot reacts under stress. After examining 112 pilots of passenger planes, we found that individuals characterized by a high need for stimulation seek situations, consciously or not, of excessive or unnecessary risk to achieve the right level of stimulation. In terms of their psychological characteristics, the study also revealed that some pilots are less predisposed to be airline pilots.



The connection between effectiveness of action and the personality and temperament of pilots was first identified in the 1940s (Humm, 1948; Mitchell, 1942). Subsequent research studies, which proliferated in the 1990s, produced several beneficial results, e.g., the number of mistakes made by pilots decreased. Among other things, the investigators used the Temperature Structure Scales to explore personal traits such as extraversion, domination, achievement motivation, and aggressive behavior (Hörmann and Maschke, 1996). In 2004, Schutte used the NEO-PI-R[1] to examine 93 pilots flying commercial planes and concluded that the pilots were emotionally stable and manifested low levels of anxiety, impulsiveness, and aggression. In this study, 95% of the participants were male and the mean age was 42 (ranging from 23 to 65 years). These pilots were employed by 14 different commercial airlines, ranging from small to very large (Schutte, 2004).

On the Neuroticism scale, over 60% of the pilots scored low or very low. Only 13% reported a high level of neuroticism. This indicates that as a group, pilots tended to report being emotionally stable. For the Extraversion scale, 42% of the pilots had high scores, whereas 23% had low scores. There was a trend towards higher scores, but it was not as strong the trend for the Neuroticism scale. For the Openness scale, the distribution was near normal, with 29% of the pilots scoring high and 37% scoring low on this dimension. The Agreeableness scale mimicked the Openness scale, with 27% of the pilots scoring high and 32% scoring low. Finally, on the Conscientiousness dimension, there was an overwhelming trend towards high scores, with 58% of the pilots scoring high or very high and only 7.5% of the pilots scoring low on this dimension.

Boyd et al. (2004) aimed to determine whether there were any significant psychological differences that would allow them to predict what type of planes a given pilot should fly (a fighter plane: $N = 870$, a bomber $N = 159$, or an airlift/tanker: $N = 1076$). For this

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[1] The NEO-PI-R questionnaire consists of 240 statements, and a respondent indicates if these describe him/her on a 5-point scale ranging from "I fully agree" to "I completely disagree". The items are classified as 5 major factors (scales), and each of those can be further divided into 6 smaller components (subscales) as follows: Neuroticism (Anxiety, Hostility, Depression, Self-Consciousness, Impulsiveness, and Vulnerability to Stress), Extraversion (Warmth, Gregariousness, Assertiveness, Activity, Excitement Seeking, and Positive Emotion), Openness to Experience (Fantasy, Aesthetics, Feelings, Actions, Ideas, and Values), Agreeableness (Trust, Straightforwardness, Altruism, Compliance, Modesty, and Tendermindedness), and Conscientiousness (Competence, Order, Dutifulness, Achievement Striving, Self-Discipline, and Deliberation). Although the NEO-PI-R questionnaire is a very precise tool, it takes a long time to complete due to the large number of items. This is why in 1989, its authors designed a shorted version consisting of 60 items (12 per scale). It is known as the NEO-FFI (NEO-Five Factor Inventory) and is based on the Five Factor Personality Model by Costa and McCrae (1985). This tool explores 5 personality factors: Neuroticism, Extraversion, Openness to Experience, Agreeableness, and Conscientiousness.

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purpose, they used the NEO-PI-R questionnaire. The results showed that, when compared with the other groups, jet fighter pilots scored, on average, lower on the Agreeableness scale and higher on the Conscientiousness scale.

Currently, particular attention is paid to effective teamwork of the plane crew. After studying 292 pilots that fly for European airlines, a moderate correlation was found between some personality traits (communication skills, cooperation, and leadership). Based on these findings, it was suggested that personality questionnaires should be used as a pre-selection tool to screen candidates for piloting roles (Hörmann and Goerke, 2014). It was argued that this strategy would contribute to the long-term success of the pilots in their professional careers (Martinussen and Hunter, 2010).

Few studies have investigated how personality and experienced stress may influence task performance in civil aviation. These studies suggest that some aspects of personality can contribute to safety issues (aviation incidents; Dillinger et al., 2003; Ganesh and Catherine, 2005; Martinussen and Hunter, 2010; King, 2014; Wilson, 2013; Yamamoto et al., 2015). Most often, the five-factor personality model developed by P. Costa and R. McCrae is used to test pilots' personality (Campbell et al., 2010a, 2010b; Chappelle et al., 2010; Khorramdel et al., 2014).

The strongest relationships between temperamental traits and choosing an occupation or practicing sports have been observed in areas where a substantial physical threat was present (e.g., piloting, mountain climbing, race car driving, or parachute jumping; Studenski, 2004; Terelak and Jońca, 2008). Many studies have found that low reactive individuals engage in high-risk sports and jobs because they function better when the level of stimulation is higher (Eliasz, 1982; Gracz, and Sankowski, 2000; Klonowicz, 1984; Studenski, 2004). The study by Glenc (2006) supports these findings; pilots scored lower on the Emotional Reactivity scale than the control group. Other studies show that, when in danger, low reactive pilots make decisions faster and are more stress-resistant. Conversely, highly reactive pilots obtain higher results on the Neuroticism and Anxiety scales (Maciejczyk, 1974).

Analyses of temperament conducted by Makarowski (2013) confirmed that professional pilots and parachute jumpers had high levels of strength of excitation, which suggests that they prefer risk taking to risk avoiding. High strength of excitation corresponds to low emotional reactivity and low trait anxiety. Even a short review of existing studies justifies further examinations of pilots of passenger planes and supports the view that these examinations should be based on a temperament theory. One temperament theory, widely known in Europe and beyond, is J. Strelau's Regulative Theory of Temperament, which was derived from Pavlov's temperament typology. This theory defines one's temperament as a set of basic, relatively stable personality traits that, above all, describe formal (energetic and temporal) characteristics of one's reactions and behaviors. These features become apparent even in early childhood, and their equivalents are found in the animal world. Temperament, although naturally conditioned by inborn neurobiochemical mechanisms, slowly changes during maturation (and aging) and is also influenced by some specific interactions between one's genotype and the environment (Strelau, 2008, 2015).

Human temperament largely determines one's need for stimulation in different situations. This need can be satisfied in various ways such as risky or aggressive behaviors. Temperamental traits influence one's inner aggression motivation by modulating one's need for stimulation. Temperamental traits act as moderators, which suggests they precede acts of aggression or risky behaviors. Therefore, it seems justified (and is our goal for this paper) that studies of pilots should take into account selected temperamental traits and their connections to aggressiveness and risk-taking.

Referring to the dual-process models widely used in social and personality psychology, Slovic et al. (2004) proposed to distinguish between two types of risk: risk as analysis and risk as feelings. The terms proposed by P. Slovic are somewhat simplified since the risk itself is not an emotion but can trigger intense emotional excitement.

Apter (1984) assumed that instead of only one level of arousal there are two and that these two levels are optimal for one's functioning to be effective. The first level, the telic state, is connected to a situation in which an individual's main focus is on attaining a particular goal. The second level, the paratelic state, involves orientation towards the activity itself, not towards its instrumental character that serves the goal (Apter and Batler, 1996; Kerr, 1991; Kerr and Svebak, 1989).

Similarly, Zaleśkiewicz (2005a, 2005b) proposed to distinguish between the stimulating and instrumental motivations behind risk taking. When an individual undertakes risky behaviors to experience pleasant physiological arousal, it is called stimulating risk and involves pleasures such as sex, taking drugs, or engaging in extreme sports. Whether someone takes these risks depends mainly on how great one's need for stimulation is, and decision making is not preceded by an analysis of possible losses. Taking stimulating risks is impulsive and characterized by a low level of self-control. In this case, emotional information processing prevails. It is the desire to experience positive emotions that leads to risk taking. The second type of motivation for risk taking is needed to fulfill an intentional goal. Any risk involved is considered to be merely a tool—a means to an end. Here, there is no place for emotions or pleasure; the risks are reasonable and calculated. For this to be the case, the risk-taking individual needs a high level of self-control. With instrumental risk, a person's focus in on possible losses and the main goal is to achieve positive results (Zaleśkiewicz and Piskor, 2007).

There are many areas where we can observe differences between pilots and engineers. Examples include coping with stress and risk assessment. Makarowski (2013) compared the anti-health risk levels in engineers (air mechanics), helicopter pilots (soldiers), and pilots of tourist planes. He found significant differences between these groups. The lowest risk level was reported by engineers (air mechanics) and the highest was reported by the army helicopter pilots.

According to the Federal Aviation Administration (FAA, 2008), there are five attitudes that—when manifested by pilots—may result in making dangerous decisions:

1. Anti-authority (relying on your own assessment of the situation).
2. Impulsivity (excessive need for activity).
3. Invulnerability (excessive faith in one's strengths and skills).
4. Resignation (avoiding difficulties and lacking self-confidence).

The French IFSA (Institute Francais de Sécurité de Aeriene) reports that according to its observations, attitude no. 1 was found in approximately 15% of cases, attitude no. 2 in approximately 20%, no. 3 in approximately 43%, no. 4 in approximately 14%, and attitude no. 5 in approximately 8% of cases where pilots made a dangerous decision (Makarowski and Smolicz, 2012).

## 1. Objectives

The presented theories and selected findings justify the research project presented in this paper. We wish to single out distinct groups of pilots on the grounds of different constellations of the following three variables: temperament, aggression, and risk.