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Commentary

Determinants of Subjective States in Combat Aviation

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Abstract

Combat pilots are responsible for ensuring the best they can towards their service and mission accomplishment. The operation of key cognitive determinants mediates between antecedent processes including actual abilities and anticipated fulfilment of future outcomes. In assessing the vocational development construct of combat pilots, we have underlined the limitations of their perceived abilities and belief enacting self-efficacy and response to relevant task information from the environment, both spatial and temporal. The appraised cognitive determinants engaged in information processing were essentially tied for expressing subjective states of knowledge, feelings, emotions and health threat perceived with a conscious experience. We externalized their subjective states by showing mental health difficulties in the demanding high-stakes environment of air combat.

Keywords: *Cognitive load theory, Self-efficacy, Emotions, PTSD, PTSS*

Introduction

The journey of the heroic Airman begins through the unbreakable commitment to a cause, nurturing the legacy of past comrades and personal conduct to promote a leader of character, courage and competency. This calls on the vital role of a cognitive oriented career development in ensuring combat effectiveness rigorously tied to the mission success. Cognitive factors such as mental workload and human performance are crucial to the pilot's survival and recovery process. While, subjective states can materially contribute to accidents, much of the accident causation is attributed to suboptimal performance to various categories of errors associated with the increased level of automation complexity in the cockpit. Although aviators are selected on factors that are highly correlated with cognitive ability, thoughts and feelings maybe controlled but not eliminated.

The Vocational Journey

Probably the great battle of all for combat pilots begins with the conscious trained mind and the subjective psyche to hold the high standards interwoven in the creation of professional airmen. Accordingly, the vocational nature of airmen evolves with discipline correlated with perceived abilities, expected mission success and the innate desire to anticipate great achievements. This triangulation of cognitive determinants is continuously shapes the psychological construct of pilots' recovery chances in any survival situation. The perceived ability of pilots to be maintained through continuous improvements, the expected fulfilment of a mission and the anticipated outstanding achievements are experience and knowledge acquired and stored in terms of building blocks known as schemas. Schemas are generalized knowledge structures of the Cognitive Load Theory that are renewed every time new information is ingested [1]. In underpinning the state of technology that the mission requires a pilot conversely trigger automated schemes and induces automatic responses [2]. Moreover, internal representations are continuously seeking internal cognitive consistency and validation against one another [3]. While the three determinants are highly correlated and augmenting the cognitive processing resources, they diverge with the mission situational factors. In particular, pilot's effort and attention are devoted to the constant fluctuations of task demands [4]. Therefore, on assessing and interpreting this change, "There is evidence that people can fall into a trap of executing habitual schema, doing tasks automatically, which render them less receptive to important environmental cues" [5]. This dynamic process is highly dependent on pilot-aircraft-environment interaction. From a cognitive viewpoint the pilot attribute a certain degree of confidence towards the validity of information regardless of their source. This increases the odds of a pilot making errors or create biases [6]. While the basis for automating the cockpit was to reduce cockpit workload by off-loading many of the duties performed by the pilots to digital processors, it increased the pilot's beliefs of imagined success and satisfactory performance [7]. Similarly, they perceived higher cognitive abilities consistent with their vocational background. In this position, the effects of career self-efficacy generated distortion mechanisms of their cognitive schema. It should be kept in mind that automated systems characterized by their authority, autonomy and complexity has continuously expanded interaction from individual (one pilot, one aircraft) to local interactions (one team, one squadron, ground control staff), then to organizational interactions (one nation, Air Force personnel) to global interactions (inter-nation deployment).

Subjective State of Knowledge

Self-efficacy belief hypothesized by pilots to attain specific

performance goals is highly prone to bias since it influences their behavior and interactions. This condition is mostly evaluated with a degree of confidence influencing behavioral intentions rather than actual behavior along the temporal dimension of a flight sortie, or the whole mission. This favorable attitude and the subjective norm (professional expectations) leads to a targeted and improved behavior. However, when focusing on the inner experience, subjective states are challenging to decipher and separate from objective knowledge. Nonetheless, the pilot must "Stay ahead of the airplane" and anticipate future events [8]. More specifically, pilots are not passive spectators and must rely on their expectancy of recovery to determine the outcome of future events, not only with the conscious trained mind but also with the subjective psyche. Expectancy do not always come true and play a fundamental role in the accident causation, which is attributed to suboptimal performance and is prone to various categories of errors. This is determined by how a pilot approaches a situation and the relevance of cues adopted for the formation of a situation assessment [9]. The integration of expectancy into situational attributes and elicited degree of belief overestimates the confidence of pilots' capability in the use of automation. Such a degree of confidence is seen as restraining factor in tactical situations which tend to "over generalize, over summarize and over rationalize" past mental events [10]. Subsequently, the fact that situation awareness represents a mixing of prior knowledge and current perception creates challenges for pilots' recovery acts in emergency situations, in which stress affect the pilot's working memory through provoked perseveration. This repetitive behavioral state along with difficult-to-control thoughts can have dramatic consequences during safety-critical tasks or progress towards goals [11].

Subjective State of Feelings and Emotions

The essence of the problem in many accidents involves difficult-to-control thoughts resting on emotions that won out over good sense. Emotions are just as important as cognitive abilities since emotional reactions during human-computer interaction have induced psycho-physiological conditions eliciting engagement, relaxation and stress that can alter a pilot's arousal level [12]. Emotions are normally well controlled but not eliminated; increased emotional imbalance requires self-control and an effective attitude driven by personally relevant goals [13]. Any intense emotional reaction can blur a task activity with a lapse in control [14,15]. This sense of rapture, probably the sharpest of subjective feelings would steam a feared outcome lacking a time and context perspective [16]. The stimulus of fear ruminating with anxiety would affect the pilot's arousal level in a threatening situation with a sense of escaping dangers. However, such a natural instinct remains controllable when pilots are willing to take part in combat and face an emergency. Fear opts the course of accident sequences while anxiety echoes a combat harrowing experience that is more intense than the situation at hand. This allows to elevate a priori the panicky avoidance (phobia) of a complicated situation [17]. In such a case, adaptation to flying is seen as a positive form of denial without experiencing fear [18]. Additionally, pilots who develop "fear of flying" might result from the breakdown of their defense mechanisms [19]. This is particularly true for pilots exposed to emergency scenarios seeking to reconstruct their fear defense. On the other hand, there are those willing to push the flying envelope with challenging physical demands and high information loads prone to potential stress. In this setting, counterphobic attitude to react to stress and emotional control are essential factors for distinguishing combat pilot aces from average combat pilots [20]. One emotion worth considering is a sense of resignation, the very absence of fear, pride or anger. Such a passivity state is a personal emotion, grounded partly in automation set to transform the pilot into a passenger who feels powerless to alter the course of events. However, pilots' intension to resign from a encourage reengagement of new goals [21]. After all, humans are capable of maintaining the big picture and still need to be aware of what is happening when something goes awry.

Subjective State of Suffering

One of the most extreme human emotions is the occurrence of a major depression disorder (MDD) with the risk of suicide [22]. This symptom is usually well hidden amongst military and civil pilots and can have devastating effects on the population when pilots deliberately perform this act employing aircraft. During the last war, this risk foresaw a strategy for diagnosis of significant mental disorders of pilots suffering from psychological and psychoneurotic conditions. These states were strongly correlated with personality traits, and the interaction with stress and neuroticism decay over time [23]. In other circumstances, the mind gags (more akin to phobia) where the awareness of extreme detachment known as the breakaway phenomenon has been seen most likely attributable to the pilots' insistence in pursuing an action against all the odds of survival. This separation transcends a profound sense of loneliness, typically occurring at high altitude. Although reassurance and resolution occur through the descent and approach phase, often it sensitizes the pilot and can recur. In extreme cases, especially after an accident signs of Post Traumatic Stress Disorder (PTSD) may develop with depression and abusive behavior, nightmares and phobic avoidance of flying. While the implication of problem-solving, attention and working memory are closely linked to traumatic experiences associated with post-traumatic stress symptomology (PTSS) [24]. Adverse mental states have been also associated with the analysis of physical/mental limitations and perceptual errors. On the former, this indicates that highest levels of exhaustion/fatigues as causes of that burnout negatively affect pilots' performance. Moreover, emphasis has been placed on their working conditions and the lack of professional advancement [25]. On the latter, a common manifestation of perceptual errors relates to the profound disconnect from reality. This disentanglement is manifested through altered perception of time and space most commonly induced by Gravity-Induced Loss of Consciousness (G-LOC). Whereas pilots' perceptual errors in the position, motion and attitude of the aircraft have been included spatial disorientation episodes and the concept of situational awareness (SA). G-LOC and spatial disorientation are the results of human sense organs adapted to the earthly life and a stable 1-G environment. This adaptation is highly disrupted when pilots are exposed to motion stimuli of different magnitude, frequency and direction than those practiced on the ground [26].

Conclusion

Technological advances have shaped human-systems interaction and contributed to improved SA. However, it is a paradox that when the workload is very high the pilot reverts to a more manual role. The people who report losing self-control over intense or unwanted emotions much of the time are subjected to some conscious overriding. While flying a pilot should ponder the implausible separation from the objective truth and subjective knowledge. Conversely, subjective processes can enhance the objective comprehension of the world. On fifth-generation combat aircraft, the visual intake is displayed on the helmet's visor and therefore subjected to the pilot's active scan and selection until a stimulus to prioritize the most relevant input for the immediate task. This capability entails to processing enough information to solve the problem through a "window of consciousness" as James W. (1890) prophesied, rather than become caught in a catch-up game. The psychological discern yearned to conquer the air ex-ante still provides room of an active topic in contemporary ex-post research.

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