Effects of Operator State on Pilot/ATC Conflict

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ABSTRACT
Motivation - Operator state factors can influence the quality of situation assessment, information processing, and decision-making (Peters et al, 2006). Originality/Value – It is critical in aviation to ensure shared situational understanding and cooperative problem solving between aircrews and ATC. In NDM research, we must identify situations likely to elicit particular operator states and evaluate their potential impact on decision processes. Research approach – Using ASRS reports, we coded phrases associated with three types of conflict: operational, informational, and cognitive (Bearman et al., 2005), as well as operator state words referring to the reporter or to another party. Findings – Results will be presented at NDM9. Limitations – Characteristics of the ASRS database guarantee that it is a rich source of data, but also impose inherent limitations with respect to generalization. Take away message - This research will enable us to better predict aircrew/ATC communication breakdowns and conflicts resulting from specific operator states.

Keywords
Operator state, communication breakdown, affect, conflict, pilot/ATC conflict

INTRODUCTION
Empirical laboratory research has shown that a number of operator state factors may influence the quality of situation assessment, information processing, and decision-making behavior (Peters et al, 2006). This has implications for NDM processes during high-risk decision making in computer-aided environments such as aviation, in which the quality of these processes is critical. The influence of operator state may manifest itself in several ways. First, it may limit—and thus bias—information search. Anger, for example, is consistently linked with heuristic processing (e.g., Lerner & Tiedens, 2006). This tendency may impact operational phenomena such as automation bias (Mosier, Skitka, Heers, & Burdick, 1998) and automation-induced complacency (Parasuraman, Molloy, & Singh, 1993), which entail curtailed information search in decision-making when operators are aided by computers. Operator states that foster reliance on heuristics may exacerbate these phenomena. Stress and anger may lead pilots or controllers in the high-tech environment to information blindness and/or premature closure on a decision option. In contrast, anxiety or worry has been associated with systematic information processing and may moderate automation bias, but may also lead to hypervigilant attention to all available data, whether relevant or not, and delay of action (e.g, Loewenstein & Lerner, 2003). Operator state may also influence risk perception and risk-taking behavior. Anger is associated with risk-seeking behaviors, while positive affect as well as fear and anxiety are associated with risk-averse choices (Isen, Nygren, & Ashby, 1988; Lerner & Keltner, 2001).

Operator state may also set a frame for coherence, and thus guide the integration of information and cues for situation assessment. That is, pilots or controllers may examine most or all of the information available to them, but the interpretation of information and situations in the operational context, the rationale for their decisions, and perceptions of risk will be impacted by state (Lerner & Keltner, 2001). Anger has consistently been associated with the perception of personal control over a situation, whereas fear and anxiety are associated with the perception that a situation is not under one’s control. Anger may encourage a ‘blame’ mode, in which operators focus on responsibility and retribution rather than problem solving. Fear or anxiety, in contrast, may elicit an almost hypervigilant concern for self-protection and safety. Influential operator states may be induced by the conditions of operational situations themselves such as information overload, frustration, or fatigue. Conflict within a flight crew or between flight crew and Air Traffic Control can both exacerbate these states and be affected by them. As we move into NextGen airspace, it becomes critical to NDM processes to ensure shared situational understanding and cooperative problem solving between aircrews and ATC.
will include identifying the kinds of situations that are likely to elicit particular operator states, as well as evaluating the potential impact of specific operator states on decision processes.

METHOD

Our data consisted of a set of ASRS (Aviation Safety Reporting System) incident reports that had been identified as involving communication breakdowns or conflicts between controllers and pilots, and in which weather contributed to the conflict (Bearman, Paletz, Orasanu, Farlow, & Bernhard, 2005). A team of coders reviewed these reports and picked out precise phrases that were associated with each of three types of conflict: 1) operational conflicts, which concerned a mismatch between either the actions or the plans that each party has about the physical operation of the aircraft; 2) informational conflicts, which involved a difference in the information held by each party; and 3) cognitive conflicts, which entailed a difference in the evaluation or interpretation of commonly held information (Bearman et al., 2005). A separate team of coders identified operator state words that were present in the reports, either referring to the reporter (typically a pilot) or to another party (e.g., ATC). The list of operator state words was compiled from measures of state and trait affect such as the PANAS (Positive and Negative Affect Scale; Watson, Clark, & Tellegen, 1988).

RESULTS

Coding is still in process and will be completed by the time of presentation at NDM9. Our intent is to address four research questions: 1) How are different types of aircrew/ATC conflict (operational, informational, cognitive) associated with words indicative of operator state? 2) In which type of conflict are operator state terms most likely to be in the narrative? 3) What operator state terms are associated with appropriate vs. inappropriate (e.g., social pressure) conflict resolution strategies? 4) When/what type of conflict situation is associated with differences in risk perception between pilots and ATC? What operator states are involved or inferred?

DISCUSSION

This is the first of a series of studies that will investigate the relationship between operator state and dependent variables such as communication breakdowns, information use, and diagnosis and decision processes. Characteristics of the ASRS database (anonymous, voluntary, benefits to pilots for filing a report) guarantee that it is a rich source of data, but also impose inherent limitations with respect to the generalization of results. Particular operator states, situations, and differences in risk perceptions may impact naturalistic decision making in highly-automated aviation operations. This research will enable us to better predict aircrew/ATC communication breakdowns and conflicts resulting from specific operator states.

REFERENCES


