Event Prototypes in Airline Transport Operations

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1. Introduction

In June 2009 an Airbus A330 crashed into the Atlantic Ocean 4 minutes and 23 seconds after the first indications of a technical problem. The report states that the crash resulted from a succession of events, including:

> The crew not making the connection between the loss of indicated airspeeds and the appropriate procedure…the crew not identifying the approach to stall, the lack of an immediate reaction on its part and exit from the flight envelope… the crew's failure to diagnose of the stall situation and, consequently, the lack of any actions that would have made recovery possible. (BEA, 2012, p. 17).

This narrative suggests that particular categories of event (e.g. loss of reliable indicated airspeed data) demand particular responses, if safety is to be maintained. Pilots must determine whether a new encounter with a cluster of information features belongs to a known category, before organising and executing a response. Evidence from aircraft incident and accident reports (e.g. BEA, 2012; NTSB, 2012) indicate that the perceptual environment is not always structured such that categories are obvious to the crew. Situation prototypes (Cantor, Mischel, & Schwartz, 1982) could influence the encoding and interpretation of categorical information features.

Humans reduce sensory experiences into equivalent groups, or categories (Pothos & Wills, 2011). The prototype view proposes that category judgements are influenced by the clearest and best cases of category membership (Rosch, 1978). This view accommodates the graded structure principle that some category members are better, more typical, than others (Barsalou, 1985). The degree to which an event is a good, central member of its category could be an important influence on pilot response (e.g. checklist selection; motor response).

Pilots are required to determine the *specific* category of system failure in order to match the appropriate procedure. Specific category distinctions are known as subordinate category members. Given that real-world events exhibit loose sets of features that are imperfectly correlated to category membership (Cantor et al., 1982), it is possible that subordinate category judgements may account for differences in the selection and speed of response. This category uncertainty is a possible source of event complexity.

2. Research outline

Our interest in the present research is focussed on the categorical properties of events and situations encountered in airline transport operations. This aligns well-established cognitive theory on categorisation with important aspects of pilot performance, such as delayed or inappropriate response.

We are adapting the prototype analysis of situations (Cantor et al., 1982) to investigate event prototypes and typicality effects in airline transport operations. Features and attributes of eight categorical event types will be elicited from current airline pilots. Events have been selected to represent the wide range of operational and technical situations faced by flight crew and are based on safety occurrences concerning public transport aircraft. These are: unstable approach, engine failure, air data/instrumentation malfunction, auto-flight malfunction, flight control malfunction, electrical malfunction, navigation malfunction, and low speed encounter. Each of these events has associated provisions designed to guarantee the safety of the aircraft (e.g. emergency checklist procedures).

The category prototypes will become the unit of analysis to further investigate the effects of typicality, frequency of occurrence, similarity, subordinate judgements, feature weighting, systematic variations in prototype strength and opportunities to acquire event knowledge. This will lead to better explanations of event judgements amongst flight crew under conditions of complexity and uncertainty.

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