Studies of Culture and Pilot/ATC Communication

The following sections describe ten research projects that examined culture and the communication of pilots and/or air traffic controllers. For some of the studies, communication was the main focus; for others, communication was just one aspect of the behaviour that was examined. A range of methodologies were used. The first four studies conducted large-scale surveys based at least partly on Hofstede's methodology and test items. The rest used a range of methodologies including mixed methods (surveys, interviews and focus groups), ethnography, speech act coding and scenario-based analysis.

1. Attitudes of Airline Crews in Multiple Countries

Using test items and methodology adapted from Hofstede, a team led by Robert Helmreich at the University of Texas conducted a series of surveys of the attitudes of airline crew. The surveys involved more than 15,000 airline pilots and cabin attendants in over 20 countries, and were supplemented by observations and interviews (Helmreich & Merritt, 1998; Merritt, 2000). Two instruments were used for the surveys: the Cockpit Management Attitudes Questionnaire (CMAQ) and the Flight Management Attitudes Questionnaire (FMAQ). The CMAQ included questions about briefings, communication styles, decision making, crew coordination, authority, monitoring, fatigue and crew experience. Merritt and Helmreich (1996, p. 23) noted that this tool, having been "designed by American researchers and psychometrically refined for American pilots", was not suitable for detecting differences in national culture. In order to remedy this deficiency, they developed the FMAQ, which incorporated items from Hofstede's Work Values Survey and the CMAQ, as well as other questions designed to "capture Hofstede's dimensions within the aviation environment" (Merritt, 2000, p. 285).

This large-scale research project generated a range of findings. Using FMAQ survey data, the researchers were able to replicate two of Hofstede's cultural dimensions: **power distance** and **individualism-collectivism**. There was also a weak correlation with **uncertainty avoidance**, but the **masculinity-femininity** dimension failed to replicate (Helmreich & Merritt, 1998). The research team concluded that "national culture exerts an influence on cockpit behavior over and above the professional culture of pilots" (Merritt, 2000, p. 283). It is important to note, though, that the replication study was based on a restricted set of responses: only airlines with a dominant national culture were used and all of the participants were male pilots of the same nationality as their airline.

Another notable finding from this project was that, for almost all countries studied, the pilot scores were higher for the power distance and individualism dimensions than the country scores originally reported by Hofstede (Helmreich & Merritt, 1998). In addition, hierarchical cluster analyses were conducted to discover which countries formed clusters. One of these analyses revealed a tight cluster of "Anglo countries" (including the United States, Australia and New Zealand) that were characterized by low scores for power distance and uncertainty avoidance combined with high individualism. A looser cluster included several countries in South America and Asia (such as Argentina, Taiwan, Brazil and Malaysia) that shared high power distance scores (Merritt, 2000).

The main focus of the project was **national culture**, but the studies also provided insight into **organizational culture** and **professional culture**. Illustrating how organizational culture varies between companies in the same industry and country, Helmreich and Merritt (1998) presented survey data from pilots at two US airlines. For one organizational climate item, 87% of pilots at one airline agreed that "Pilot morale is high", compared with only 3% at the second airline. Regarding perceptions of management, 84% of respondents at the first airline agreed that "Management never compromises safety for profit", compared with 12% at the other carrier. The data provided fewer insights into professional culture, but one noteworthy conclusion was that pilots (and also doctors) have unrealistic attitudes towards stressors. For example, a majority of pilots said that their decision making was as good in emergencies as in routine situations, and that personal problems did not affect their performance (Helmreich, 2000).

Many aviation researchers were influenced by the studies conducted by the University of Texas Human Factors Research Project and their use of Hofstede's tools and techniques. The project findings fed directly into airline crew resource management (CRM) training programmes in the 1990s (Maurino & Murray, 2010).

2. Attitudes of Airline Pilots and Managers in Taiwan

In the 1990s, Professor Hung-Sying Jing surveyed approximately 1,000 pilots and managers at airlines in Taiwan, including a significant number of foreign pilots. He used a modified version of the FMAQ instrument developed by Helmreich (which was based in turn on Hofstede's dimensions). The results highlighted differences between Chinese and foreign pilots in attitudes to interpersonal relations and authority. Jing believed that these differences could not be adequately explained by uni-dimensional concepts such as power distance, and he therefore developed a framework to account for interpersonal relations and authority in Chinese culture (Jing & Batteau, 2015).

Drawing on research by the scholar Fei Xiao-Tung, Jing created a "differentiated order model" with four intimacy levels: kin, acquaintance, fellow and alien. According to this model, Chinese pilots consider that: close family are kin; Chinese pilots are acquaintances; Chinese workers in the same company are fellows; and foreign workers in the same company are aliens. The structure is not fixed and individuals can change level, for example by marriage or a serious falling out. Jing added a description of the Chinese concept of authoritarianism, which is dominated by the father-son relationship, to this model of interpersonal relations.

Jing's model has been used to analyse accidents involving Asian airlines, such as the 1995 crash of a TransAsia Airways ATR72 aircraft in Taiwan. In this accident, the first officer was pilot flying (PF) and the captain was pilot not flying (PNF). Just before the crash, the captain was talking to a cabin attendant in the cockpit. This distracted him from monitoring the aircraft status and communicating with air traffic control (ATC). In their analysis, Jing and Batteau (2015, p. 30) suggested the captain regarded the cabin attendant as an acquaintance but considered the air traffic controller to be a stranger, adding that "Every Chinese person would be inclined by instinct to attend to a friend first, not the stranger".[1]

[1] The context of the accident was unusual: it occurred on New Year's Eve; the plane was not carrying passengers; and the captain was junior to the first officer in terms of previous air force service. The

Western pilots may consider such behaviour to be a blatant dereliction of duty, but Jing's work highlights the impact that cultural factors can have on cockpit interactions and flight crew communications. Interestingly, it echoes Hall's description of the emphasis placed by **polychronic** people on personal relations. Jing and Batteau also commented on ways in which cultural differences impact flight procedures. Chinese pilots are conditioned by the non-linear ideographic Chinese language and therefore have difficulty following sequential SOPs. The researchers see this as one manifestation of a systematic problem whereby Chinese pilots are not culturally programmed to use commercial aircraft or an air transport system that have both been largely designed by Westerners.

3. Attitudes of Airline Pilots in Norway

In Norway Mjøs (2004) conducted a survey of pilots at three airlines and received 242 usable responses. The variables included cultural indices (based on Hofstede's four original dimensions), social climate, barriers to communication, and operational problems experienced in the previous year. This survey identified differences between the airlines. The pilots of one company, who were almost all from a military background, were more experienced and scored higher on power distance and masculinity. Furthermore, the pilots of all three airlines had higher mean scores for individuality and masculinity than the national scores reported by Hofstede, indicating that cultural dimensions for a professional group within a country may differ from national characteristics. This led Mjøs to caution against applying national cultural dimension data to research comparing aviation safety records in different countries.

4. Pilot Decision-Making in a Large Multicultural Airline

Scott (2013) conducted a mixed methods investigation of the influence of national culture on pilot decision-making on the flight deck. The study was conducted at a major airline in the Middle East that has a large, multicultural workforce. It included individual interviews, focus group interviews and a survey of pilot attitudes. A 40-item questionnaire was used for the survey, covering decision-making, culture, language and behaviour. Some questions were taken from previous studies by Hofstede (2001) and Helmreich and Merritt (2000). The survey of pilot attitudes produced 613 usable responses and 66 countries were represented.

Some of the survey findings related to specific aspects of language use on the flight deck. Approximately 60% of participants thought that communication problems occur as a result of culture, with pronunciation cited as an example. More than 70% of respondents reported that, when starting conversations with individuals from other countries, it sometimes took time to understand their English pronunciation. Scott (2013, p. 261) concluded that communication was a "major factor on the flight deck, especially if pilots were from different cultures". In addition, the interview data indicated that "pilots from non-English speaking cultures often struggled with communications in an English-driven aviation world", and it suggested that "pilots from Asia, the Far East, parts of Europe and South America sometimes did not have sufficient command of the English language" (Scott, 2013, p. 262).

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accident underlines the importance, even in unusual circumstances, of following regulations such as the **sterile cockpit rule**, which prohibits non-essential speech below 10,000 feet.

In another interesting survey finding, echoing Dahlstrom and Heemstra (2009), more than 80% of participants said that pilot professional culture was for them a stronger influence on the flight deck than national culture. Just 18.5% of participants said that their national culture was not overridden by professional culture. Scott (2013, p. 259) noted that these pilots were "from areas that were of mostly of Islamic religion", such as Algeria, Egypt, Malaysia, Pakistan and the United Arab Emirates (UAE).

5. Cockpit Communication in Airlines in the Asia-Pacific Region

Hutchins et al. (2006) carried out an ethnographic study that examined the impact of culture on cockpit communication and interaction at three airlines in the Asia-Pacific region. The study included flight deck and simulator observations, as well as interviews with airline personnel. An interesting aspect of this research is that it identified specific differences in cockpit practice between airlines in different countries. These differences included how checklists and charts were actually used. However, since only a limited number of airlines were studied it is not clear to what extent the variation was due to national culture as opposed to organizational culture. For instance, Japanese pilots in the study annotated their charts whereas pilots from New Zealand were not allowed to do so, but it is possible that other New Zealand airlines permit chart annotation. Difficulties posed by this kind of ethnographic research include the need to gain access to flight decks and the requirement for expertise in a range of fields such as piloting, human factors, anthropology, language and culture.

6. Communication between Korean ATC and Foreign Pilots

Kim and Elder (2009, 2015) reported on a mixed methods research project that examined the construct of radiotelephony communication in the Korean aviation context. Data collection took place between 2007 and 2009. Data were collected using a variety of methods: observations of ATC centres, audio recordings of radio communications between Korean ATC and foreign pilots, surveys of Korean pilots and controllers, and interviews and focus groups with Korean pilots and controllers.

Although not explicitly addressing national culture, this research project has significant implications for intercultural communication between pilots and controllers from different countries. One clear finding was that participants did not accept that limited English proficiency of non-native speakers was a main contributing factor to accidents. Instead they believed it was "one of a complex array of factors contributing to problems in radiotelephony communication" (Kim & Elder, 2009, p. 23.2). The authors also described communication problems exhibited by native English speakers (NES) and non-native speakers (NNS). Problems of NES included: non-adherence to **standard phraseology**, excessive use of **plain language**, a range of accents and expressions, and a fast rate of speech. The main problem for NNS was first language (L1) interference with accents, although there was a tendency for some proficient English speakers to overuse plain language (Kim, 2013; Kim & Elder, 2009).

Kim and Elder (2009, p. 23.14) concluded that "communication in the aviation context is a complex matter and that responsibilities for its success (or failure) are shared across participants, regardless of their language background". In order to promote greater communicative responsibility by all pilots and controllers, they advocated thinking of aviation

English in terms of a lingua franca. Drawing on English as a lingua franca (ELF) research, they recommended training for both NES and NNS in specific communicative strategies such as simplifying speech, avoiding redundant information, and paraphrasing problematic utterances.

7. Use of Mitigated Speech by Flight Crews in the USA

Linde (1985) drew on Brown and Levinson's **politeness theory** to investigate the use of **mitigated speech** in intra-cockpit communications. This was part of a larger study that used speech act coding to analyse transcript data from accidents involving American airlines in the 1970s and 1980s (Goguen, Linde & Murphy, 1986). A mitigated form of speech was defined by Linde (1985, p. 4) as "one which expresses a given propositional content in such a way as to avoid giving offense". The main thrust of the research concerned how the use of mitigated speech varied with social status (eg: captain versus first officer) or operational context (eg: emergencies or other in-flight problems). Linde developed a scale for quantifying mitigation, which a group of airline pilots and non-aviation analysts applied to the transcripts.

Some of the findings related to national and professional cultures. Firstly, the results suggested that regional dialects within the United States might be associated with significant differences in the use of mitigated speech. In other words, there was empirical evidence, albeit limited, for variation within a national culture. Secondly, there were systematic differences in the rhetorical conventions of pilots compared with non-aviation analysts. Linde (1985, pp. 9-10) cited examples of indirect requests using "want", such as "You want me to fly it Bob?" Such expressions were considered less mitigated by the pilots than the non-aviation analysts. Linde inferred that within pilot professional culture this strategy had become conventionalized to the point that its social force was direct, while it was interpreted as indirect and mitigated within the academic professional culture of the analysts.

Linde (1985, p. 8) concluded that "the use of indirect speech acts for mitigation is extremely complex", and she emphasised the importance of understanding the context in which communications are situated.

8. Intra-Cockpit Communication Strategies in the USA and Europe

Fischer and Orasanu (1999) reported on a series of studies of the intra-cockpit communication strategies that are used by pilots to mitigate errors made by other pilots. Participants were given different flight scenarios in which either the captain or first officer had made an error. They were asked what request they would make to resolve the problem. The studies examined the effect of two variables on the communications: (1) the level of risk inherent in the scenario, and (2) the level of face-threat involved in resolving the error. One study investigated the influence of national culture on communication strategies by comparing pilots from the USA and three European countries. The number of participants was 533, of whom 249 were captains and the remainder first officers.

The findings indicated that for captains, both American and European, the preferred communication strategy was to give a command, while first officers preferred using hints. The status difference between captains and first officers in the US was more pronounced. Compared with their American counterparts, European captains were more likely to give hints

and European first officers were more likely to issue commands. This finding was unexpected and at odds with previous research on attitudes towards leadership. The authors suggested it was due to differences in methodology between their scenario-based studies and earlier research, such as that reported by Merritt (2000), which used surveys to elicit pilot attitudes (Fischer, 2000; Fischer & Orasanu, 1999).

9. Characteristics of ATC Radiotelephony in Malaysia

Mohd (2007) carried out a study of ATC radiotelephony (RT) in Malaysia. Two methods were used for data collection: (1) a survey of air traffic controllers with 188 respondents, and (2) recording of 73 hours of ATC audio. This study is valuable for the information it provided about RT communication in a location where air traffic controllers are not native speakers of English.

The survey of controllers collected extensive demographic data. This included information about: English language proficiency test results, aviation English and ATC communication training, problems in RT practices, and communication-related safety occurrences. One of the interesting findings was that the use of English varied depending on the ATC working environment. Among terminal approach radar controllers, 70% reported that English was their most frequently used daily language. For tower controllers, the figure was only 28%.

The ATC audio data were transcribed and then coded using the Aviation Topic and Speech Act Taxonomy (ATSAT). Analysis of the ATC recordings revealed a very low level of **code switching** from English to other languages. Overall, about 0.2% of the total number of words were non-English. These words were all greetings and courtesies, such as “selamat pagi” (“good morning” in Malay).

10. Use of Phraseology by Pilots and Air Traffic Controllers

The International Air Transport Association (IATA) conducted a worldwide survey to investigate safety threats related to communication with a narrow focus on the use of standard phraseology. Separate questionnaires were devised for pilots and air traffic controllers. A total of 2,070 responses were collected from pilots (86% of whom operated international flights) and 568 from controllers. Since there was a lack of responses from countries in which English is not the main language, Russian and Chinese versions of the pilot questionnaire were also distributed. The survey was carried out in collaboration with the International Federation of Air Line Pilots’ Associations (IFALPA) and International Federation of Air Traffic Controllers’ Associations (IFATCA).

The findings were published as a report in 2011. The study concluded that the use of non-standard phraseology was “a major obstacle” to effective communications between ATC and pilots (IATA, 2011, p. 53). A high rate of speech and lack of harmonization were other factors that increased the risk of communication errors. One problem with the survey was ambiguity in the expression “non-standard phraseology”. For example, question 9 in the pilot survey asked, “Is there an airport(s) where ICAO standard phraseology is not used? If yes, please specify airport code(s)”. The report noted that Paris Charles de Gaulle Airport was the most common response “but in almost all cases it was because of the use of both English and

a local language in Pilot communication and not specifically for non-standard phraseology" (IATA, 2011, pp. 17-18).

Although the focus of the study was on phraseology, respondents made numerous comments about plain language. The following factors were reported as contributing to pilot-ATC communication errors: use of plain English instead of phraseology, use of slang, and ambiguity in plain language. These findings underscore the difficulty of separating standard phraseology from plain language. Other factors found to "compromise human communication" included pronunciation problems of NNS, accents, and NNS-NNS communication (ie: code switching between English and other languages) (IATA, 2011, p. 53).

The IATA phraseology study provides a useful model for the construction and delivery of an online survey of pilots. It was designed to be completed in a short time (10 minutes) but allowed respondents to enter detailed information about specific procedures or practices that they perceive to be a threat.

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