CULTURAL DIVERSITY AND CREW COMMUNICATION

Ute Fischer, LCC, Georgia Institute of Technology, Atlanta, GA 30332-0165, USA
Judith Orasanu, NASA-Ames Research Ctr., MS 262-4, Moffett Field, CA 94035-1000, USA

Abstract Four studies were conducted to identify effective communication strategies for calling attention to problems and getting action on them from other crew members who differ in rank, culture, and gender. Cross-cultural differences concerned the extent to which status was emphasized in pilots' responses. But all pilots, irrespective of nationality and gender, relied on one, status-consistent strategy to request action of another crew member. Captains generally preferred commands while first officers predominantly used hints. However, when asked to rate the effectiveness of various strategies, US captains and first officers favored communications that appealed to the crew concept rather than to any particular status-based model.

INTRODUCTION

Long duration space missions will include more diverse crews than present missions, both in terms of native cultures and gender. While communication is crucial to any successful team work, its importance is even more heightened in multi-cultural teams. Members of different cultures have been found to vary in their attitudes toward leadership[1] and to follow distinct conversational norms[2,3]. Differing conceptions of the organization and structure of professional interactions may lead to conflicts and misunderstandings, in particular when problems arise that threaten safety or that result from errors or oversights on the part of a crew member. Maintaining safety in high risk engineered environments like space or aviation is a team effort which depends crucially on the team members' ability to monitor and, if necessary, to challenge each other's performance. However, failures to provide critical redundancy and intervention are not infrequent, even in culturally homogenous teams. For instance, analyses of aviation accidents have found that lower-ranking crew members are frequently unsuccessful in getting the attention of a higher status crew member or in getting senior crew members to change their decisions or actions in safety-critical situations[4,5]. Findings like these indicate that we need a better understanding of how crew members could intervene effectively when others have made some mistake. The goal of our research was to identify effective communication strategies for calling attention to problems and getting action on them from other crew members who differ in rank, culture, and gender.

STUDY 1

The aim of this study was to determine which communication strategies captains and first officers would use to mitigate errors by another crew member. Previous analyses[6,7] of crew discourse during simulated flight found that captains were more direct in addressing first officers than first officers were in addressing captains. However, for both crew positions communications were more direct during problem and emergency situations than during normal flight segments. In addition to risk we suspected that pilots' communications would be sensitive to the degree to which an error implied a threat to the professional "face" of a crew member. If others have made an obvious error, calling it to their attention may involve a direct challenge to their status, judgment or skill. According to politeness theory[8], in situations like these speakers will seek to protect their addressee's face and use more indirect speech as compared to situations that are less face- threatening; i.e., when errors consist of oversights.

Method

Male pilots (n = 157, 69 captains and 88 first officers) from three major US airlines received eight short descriptions of aviation incidents and were asked to state how they would correct various pilot errors. For participating first officers, low- and high-risk incidents were described from the perspective of the first officer and involved errors or oversights on the part of the captain, the pilot-flying. For captain participants, incidents were identical except that they described first officers making errors and oversights. For instance, captain participants saw the following problem description.

> While cruising in IMC at FL 310, you notice on the weather radar an area of heavy precipitation 25 miles ahead. First Officer Henry Jones, who is flying the aircraft, is maintaining his present

* Paper presented at the 50th Astronautical Congress in Amsterdam, Oct. 1999.

course at Mach .73 even though embedded thunderstorms have been reported in your area and you encounter moderate turbulence.

You want to ensure that your aircraft will not penetrate this area. Please write out verbatim what you would say to F/O Jones.

Pilots' responses were assigned to eight classes of communication that differed in terms of their focus, explicitness and directness[9]. Other-directed communications or requests referred to an action the addressee was to perform, while speaker-centered communications specified an action by the speaker. Both types of communications could vary in the extent to which speakers were direct and explicit about what action to take and who is to do it. Overall six classes of other-directed communications, and two classes of speaker-centered communications were distinguished, as shown in Table 1.

Table 1. Classes Of Communications

REQUESTS (= OTHER-DIRECTED COMMUNICATIONS)	
Commands	*Turn 30° right.*
Crew Obligation Statements	*I think we need to deviate right about now.*
Crew Suggestions	*Let's go around the weather.*
Queries	*Which direction would you like to deviate?*
Preferences	*I think it would be wise to turn left or right.*
Hints	*That return at 25 miles looks mean.*
SPEAKER-CENTERED COMMUNICATIONS	
Self-Directives	*I am going to get a clearance to deviate around these storms.*
Permission-seeking Questions	*You want me to ask for clearance to deviate around this weather?*

Responses were also coded in terms of their structure. Simple communications involved only a request or a speaker-centered communication. Complex communications in addition provided reasons for the request or speaker-centered communication. An example of a complex communication is *"I see we have some cells painting on radar. I think we should turn left about 30°."*

Results and Discussion

As can be seen in Figure 1, first officers most often used hints to get action from the captain. That is, first officers preferred statements such as *"That return at 25 miles looks mean"* that did not specify any corrective action, but instead pointed to a problem or reminded the captain of a previously established goal. Captains, in contrast, predominantly used commands to correct first officers. This pattern of findings indicates that while pursuing identical communicative goals, captains take a more direct route than first officers. As expected, captains were more likely than first officers to specify the action that should be taken. Moreover, in issuing more commands and fewer hints than first officers, captains expressed their intentions more forcefully than first officers; i.e., there was a stronger obligation for first officers to comply with captains' requests than vice versa.

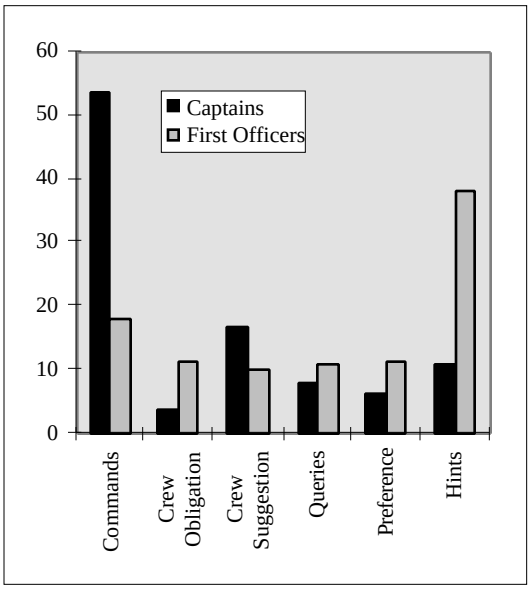

Figure 1. Distribution Of Captains' And First Officers' Request Strategies (In Percentage Of All Other-Directed Communications)

Similar status differences were observed for communications that concerned actions by the speaker. First officers were likely to assure that the captain agreed with their planned action as in *"Do you want me to ask ATC if they still want us on this heading?"* Captains, on the other hand, almost never used permission-requests relying instead on self-directives such as *"I'll*

call ATC and find out if he still wants us on this heading."

In addition to status, request strategies were also influenced by the risk level inherent in a situation. As predicted both crew positions became more direct when risk increased. Nonetheless status differences persisted. Captains adjusted to higher risk mainly by issuing even more commands (63%) than in low-risk situations (47%). First officers, in contrast, quadrupled their use of crew obligation statements (from 4% to 16%) as risk increased. However, hints remained their predominant strategy, even in high risk situations.

Pilots' responses to face-threat were not consistent with the predictions made by politeness theory. Pilots did not generally shift to more indirect request strategies when they had to correct highly embarrassing mistakes. Instead, captains used more hints but also more commands in high face-threat situations while first officers were likely to increase commands, crew suggestions and crew obligation statements. Captains apparently focused either on the face-threat implied in the incident thus preferring indirect interventions for high face-threat errors, or they responded to the magnitude of the error correcting major errors more decisively than minor ones. First officers seem to have appreciated either aspect depending on the risk level. In low-risk situations, they became more direct when they challenged major rather than minor captain errors. However, when risk levels were high, errors judged to be highly embarrassing to the captain were handled more indirectly than errors assumed to involve less face-threat.

Concerning the structure of pilots' communications we found that for both crew positions, more direct requests were usually (63% of the time) accompanied by justifications as in the following example: *"We are too far left of centerline for parallel approaches - correct right immediately!"* Similarly, captains and first officers supported speaker-centered communications with problem or goal statements. Supportive statements may serve social as well as cognitive purposes. In providing a justification, speakers may decrease the imposition of their communication[9]. Moreover, they may also facilitate the crew's shared problem solving[10].

STUDY 2

This study was conducted to examine the effect of culture on pilots' preferred communication strategies. According to cultural anthropologists and psychologists, cultures differ in the extent to which they stress the individual rather than the group and accept power distance between group members[11]. Surveys of pilots' attitudes toward preferred leadership and communication styles revealed that pilots from Anglo cultures tend to prefer leaders who are consultative rather than authoritarian. In emergencies, even junior crew members expect to contribute to the decision making. Pilots from non-Anglo cultures tend to prefer leaders who are authoritative, take command of the aircraft in emergencies and tell the other crew members what to do. These findings suggest that pilots from different cultures may also favor distinct communication strategies.

Method

Pilots from three European countries (EC-1, EC-2, and EC-3) participated in a study identical to Study One (n = 376, 180 captains and 196 first officers). All captains and 192 first officers were male; there was one female first officer each from EC-1 and 2, and two female first officers from EC-3. Pilots who were non-native speakers of English received translated versions of the incident descriptions and task instructions.

Results and Discussion

Analyses revealed that while European pilots showed status-consistent preferences similar to their US counterparts, some cross-cultural variations were also apparent. Most notably, status-differences between European captains and first officers were less pronounced than those observed for US pilots. European captains were more likely than US captains to correct a first officer's action by simply pointing out the problem to him or by reminding him of a goal. Conversely, European first officers were more likely than their US counterparts to issue commands and to use self-directives.

These findings contrast with previous research on pilots' attitudes towards leadership. These surveys revealed low power distance between US captains and first officers, whereas a more hierarchical crew structure was observed for European pilots[12]. Given their attitude data, we expected US and European pilots' communications to differ in the opposite direction than we found. Differing methodologies may account for the discrepant results. Attitudes are inferred from the extent to which pilots agree or disagree with generic statements such as "Crewmembers shouldn't question the captain unless the safety of the flight is threatened." Responses to statements like these may reflect pilots' assessment of

how likely it is that they would display the behavior mentioned. Or, the responses may indicate pilots' judgments of the appropriateness of the behavior. Moreover, attitude studies do not specify how pilots would go about "questioning the captain." Our study, on the other hand, addressed exactly this issue by investigating what specific strategies pilots say they would use and how their strategies correlate with specific aspects of situations.

Cross-cultural differences were also found concerning first officers' responses to varying levels of risk and face-threat. European first officers' responses to high-risk situations can be summarized in three distinct models. The first one replicates the response pattern of US first officers and entails an increase in crew obligation statements while leaving the preponderance of hints intact. The second model involves no significant changes from low- to high-risk situations, with hints as predominant strategy. The third model is characterized by a switch to a more captain-like request style in high-risk situations, as commands become the dominant strategy. Varying degrees of face-threat again yielded two distinct responses from first officers. For two groups request strategies were not significantly affected by the face-threat implied in a pilot error. The remaining group increased their use of hints and of commands in response to major highly-embarrassing mistakes of the captain; unlike US first officers, they did so across risk levels.

STUDY 3

This study examined whether male and female pilots in the US prefer distinct communication strategies to correct an error or a problem on the flight deck. Sociolinguistic studies on gender differences in discourse strategies have consistently found men to be more dominant than women; i.e., men tended to talk more, interrupt more often, and were likely to ask more questions and to challenge and disagree with another conversant[13,14]. More importantly, American women of Anglo-Saxon descent were found to favor an indirect conversational style while their male counterparts preferred a direct style[15,16]. The present study was conducted to examine whether female pilots would use more indirect communication strategies than male pilots to mitigate pilot error.

Method

Female participants consisted of 31 US pilots (12 captains and 19 first officers). They participated in a task identical to Study 1. Male pilots matching the female sample in terms of years and type of aircraft experience were selected from the participants in Study 1 as a comparison set. Coding of the female pilots' communications followed the procedure employed previously in Studies 1 and 2.

Results and Discussion

Analyses indicated that status rather than gender influenced pilots' communication strategies. Captains, regardless of gender, were more direct in addressing first officers than first officers were in addressing captains. Male and female captains predominantly issued commands to correct the first officer, while first officers generally preferred hints; i.e., problem or goal statements, to get action from the captain. Similar status differences were observed for communications that concerned actions by the speaker. All captains preferred self-directives to permission-requests while first officers showed no particular preference.

Analyses examining the relation between gender, position and structural complexity of a response revealed that female pilots were more likely than their male counterparts to support requests and speaker-centered communications with problem or goal statements. Specifically, 64% of their requests and 81% of their speaker-centered communications were of this kind. Male pilots, in contrast, showed no significant preference.

At first sight these results appear consistent with the view that women are less domineering in social interactions. Accordingly, female pilots' preference for supportive statements is seen to reflect women's inclination to soften the imposition of their communications. Recall, however, that the larger sample of male pilots in Study 1 also preferred complex communications to simple responses. While a gender-specific interpretation of our results thus seems unfounded, it is still possible to argue that supportive statements are mainly politeness devices that serve to downgrade the effect of an utterance[9]. The argument is that speakers who motivate self- and other-directed communications with some problem or goal foreground the objective event and thus minimize their role in initiating a corrective action. On the other hand, supportive statements may not only be a sign of politeness. They also may provide the broader context necessary for a crew's joint problem solving and decision making[10]. By placing self- and other-directed communications into a context, speakers ensure that other crew members are able to see

why a particular corrective action is required. In addition, crew members are then in a position to verify for themselves that the speaker's problem understanding is appropriate, and that the intended action is indeed the best response.

While supportive statements may well have both social and cognitive benefits, either function may be more salient to listeners. In Study 4 we therefore investigated how pilots perceive supported communications.

STUDY 4

This study had several objectives. We wanted to determine which of the communication strategies discerned in the previous studies would be effective in mitigating pilot error, and whether supporting statements would enhance the effectiveness of strategies. Moreover, we wanted to see whether the perceived effectiveness of strategies varied for captains and first officers, as well as with the risk level and degree of face-threat inherent in an incident.

Method

63 pilots (31 captains and 32 first officers) from a major US airline received the incident descriptions used in Studies 1 and 3 and one example for each of the communication strategies listed in Table 1. Participants were asked to rate how effective each communication would be in getting them to carry out the speaker's intent. Effectiveness was defined as "highly appropriate to the problem while maintaining a positive crew climate." In a second task, participants were asked to rate how direct each communication type was; i.e., "how clear it was what the speaker wanted done and how much pressure he put on the addressee to act." The order of effectiveness and directness ratings were counterbalanced across participants.

Participating captains were told that the communications were from first officers. First officer participants received the same communications and were told that these were captains' communications. Half of the participants in each pilot group received communications unsupported by a problem or goal statement, while the remaining participants received communications with supporting statements.

Results and Discussion

Analyses revealed the following statistically significant effects: (1) Communications that were supported by a problem or goal statement received higher effectiveness ratings than unsupported communications. Complex and simple communications, however, were perceived as equally direct. (2) Strategies judged to be most effective by both crew positions were neither too direct (i.e., commands) nor too indirect (i.e., permission requests). Captains judged first officers' crew obligation statements, preference statements and hints to be significantly more effective than their commands, self-directives and permission requests. First officers thought that captains were significantly more effective when they used crew obligation statements rather than commands, queries, hints, self-directives and permission requests. (3) In high-risk as compared to low-risk situations, the effectiveness rating of more direct communication strategies increased, while it decreased for less direct strategies. However, even in high-risk situations crew obligation statements were rated as more effective than commands. (4) Hints were judged to be more effective when used to correct highly embarrassing mistakes rather than minor errors. In high face-threat situations pilots rated this strategy to be as effective as crew obligation and preference statements, and considered it to be more effective than the remaining strategies.

GENERAL DISCUSSION

The present research revealed that cross-cultural differences concerned the extent to which status was emphasized in pilots' responses. But all pilots, irrespective of nationality and gender, relied on one, status-consistent strategy to request action of another crew member. Captains generally preferred to use commands while first officers predominantly used hints. However, when asked to rate the effectiveness of various strategies, US captains and first officers favored communications that appealed to the crew concept rather than to any particular status-based model. Crew obligation statements and preference statements were judged to be highly effective request strategies by both captains and first officers. Moreover, both pilot groups rated crew obligation statements to be significantly more effective than commands, even in high-risk situations. Common to these strategies is that they address a problem without disrupting the team context. Like commands they explicitly state what should be done. But unlike commands they do not rely on status differences to assure compliance.

Effective communication strategies thus appeal to a crew's shared responsibility for coping with problem situations. This characteristic is again reflected in pilots' judgments of complex communications. Requests and speaker-centered communications that were supported by

problem or goal statements were rated as more effective than communications without supporting statements. Both constructions, however, were judged as equally direct. That is, pilots did not think that complex communications were less forceful than simple statements but rather they perceived them to foster a positive crew climate.

If we assume that pilots' effectiveness ratings reflect a valid model of crew discourse, then it is surprising that their communications in studies 1-3 did not follow this model more closely. Specifically, our studies show that while pilots upheld a crew-oriented discourse model in their evaluations, they maintained a status-based discourse model in their productions. This discrepancy may indicate that crew members find it difficult to overcome ingrained norms for interacting with superiors and subordinates and to translate an abstract notion like "crew concept" into specific communication strategies. Consequently, crews may benefit from training initiatives that facilitate this translation process; i.e., training approaches that provide examples of crew-oriented communication strategies and that coach individual members in these strategies.

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