
Analysis of Aviation Miscommunications based on Grice's Conversational Maxims: The Case of Iranian Aviators

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Abstract

Miscommunication has been reported as a major contributing factor to aviation mishaps. About 70% of the first 28000 reports to NASA Aviation Safety Reporting System were related to communication problems (Sexton, 1999). According to Chaparro and Groff (2002), the most frequent human errors in aircraft maintenance, is supposed to be information misinterpretation. The movement area of an airport is typically the place where a single misunderstanding may have serious and adverse effect on flight safety. Furthermore, Eadie (2000) puts emphasis on conducting research on applied communication related to real phenomena in the real world. Therefore, the current study aims to investigate miscommunication among aviation personnel. To this end, first, a corpus of 31 authentic audio records and reports of aviation mishaps was analyzed based on Grice's maxims. Consequently, the findings of the study revealed that teaching Grice's (1975) Maxims needs to be taken into account in verbal communication. The findings of the research have implications for curriculum designers, pilots, and air traffic controllers.

Keywords: Aviation Communication, Misunderstanding, Air-incident, Grice's Maxims

Introduction

Research in Aviation communication has acquired a significant place in aviation safety (Estival et al., 2016). From aviation safety viewpoint, communication plays an integral role and is essential for flight safety (Krivonos, 2007). There is a large database that illustrates how communication is critical in aviation personnel interactions since a high percentage of the incidents reported to Aviation Safety Reporting System (ASRS) are concerned with communication problems (Krivonos, 2007). In this case, Scheglof (1991) believes that communication is a social activity. In addition, according to Nevile (2006), it is typically through communication that other human factors such as information gathering and sharing, identification and management of errors and decision making are realized.

It has long been recognized that mechanical failures were the main source of air accidents. Although, the advance of technology declined the number of air mishaps caused by mechanical failures, some other factors resulted in catastrophes emerged due to human failures. According to International Civil Aviation Organization (ICAO) (2006), three out of four accidents occur due to human errors and up to 70% of human errors are related to problems with communication directly or indirectly (Kanki & Palmer, 1993; Tompkins, 1991).

Despite the pivotal role of communication, no single and inclusive definition of the term and its dimensions has been presented. Dance (1970) claims that “we are trying to make the concept of communication do too much work for us” (Litlejohn & Foss, 2008; p. 11). Moreover, a definition should be based on how well it satisfies different researchers and scholars to fulfill their needs (Litlejohn and Foss, 2008; p.11). Morrow (1994) defines communication as "an act of collaboration between two or more people" (Cummings, 2013, p. 1). Likewise, miscommunication is an umbrella term encompassing a range of subtopics: misunderstanding, mishearing, failure in interpersonal communication, code switching, and so on (Rubenbauer, 2009).

Furthermore, with the advent of the concept of Crew Resource Management (CRM) in the late 1970's as a practical step in recognition of various aspects of ‘Human Factors’ aiming at reducing human errors in the cockpit and emphasizing interpersonal and cognitive skills, miscommunication studies have been used in aviation branches such as Air Traffic Control. It is identified as both Team Resource Management (TRM) and Ramp Resource Management (RRM) for ground service providers at the airports, and Maintenance Resource Management (MRM) for aircraft maintenance engineers. Consequently, CRM has been currently embraced

safety management to improve communication among the team members and efficiency of flight operations (Skybrary, 2020).

Applied linguists such as Brumfit (1997) and Larsen-Freeman (1997) call for the investigation of language in 'real-world problems', and Sarangi and Roberts (1999b) argue for an 'ethics of practical relevance of studies of communication. Linguistically, Grice (1975) puts forward the concept of implicature and develops a set of maxims or rules effective in cooperative communication. They include the maxims of quantity, quality, relevance and manner (Munday, 2001). These maxims have been applied to cooperate with other speakers and to make sense of what has been expressed (Munday, 2001). Violating those maxims causes implicature, and can cause unsuccessful communication. Therefore, the aims of the current study are twofold: 1) analyzing miscommunication cases among aviation personnel based on the maxims of Grice, and 2) proposing a linguistic solution to minimize misunderstandings.

The current study aims to address the following research questions:

Based on Grice's (1975) Conversational Maxims, violation of which maxims has caused misunderstanding among Iranian aviators?

Literature Review

Communication and Aviation Safety

According to Rifkind (1996), communication refers to a dynamic process in which we need to interpret messages considering the situation and context. He believes that communication process draws us to the interpretation of messages; therefore, the message of the sender needs to be interpreted by the receiver. Ma, Drury & Marin (2010) distinguish synchronous from asynchronous communication. They put forward that synchronous communication in aviation maintenance refers typically to verbal communication (e.g. conversation) and asynchronous communication refers to written aspect (e.g. placards). Taylor and Patankar (2000) also claim that the most frequent studies in the aviation maintenance, in particular, has been allocated to communication.

As Kanki & Smith (2001) state, the main function of communication is delivering the message, and it plays a main role in aviation to accomplish a task. They propose a model for communication composed of different parts including the sender/receiver, the message, the medium, barriers and feedbacks. In addition, there are some other factors such as fatigue, gender bias, standard phraseology, workload, personality, language and cultural varieties which have great impact on communication (Fegyveresi, 1997). Merritt & Ratwatt (1997) state that if the participants in the conversation

are not native speakers at the aviation maintenance, there would be distortion in the process of encoding/ decoding, and the feedback may not be delivered and received as efficiently as possible.

Cockpit Resource Management in Aviation

According to Caro (1988), the trainings related to the cockpit resource management is a matter of safety in most airlines. CRM trainings refer to aircrew accompany and team work, the way of their interaction and how they use the resources (Duncan & Feterle, as cited in Blickensdefer et al., 2005). Lauber (1984) stresses that CRM has changed the earlier thought of counting pilot as “God” that his decisions were always the “Right” ones in the cockpit. It is worth noting that CRM training programs have been trimmed based on the organization, culture and equipments (Driscoll, 2002). Kanki (1995) points out that CRM trainings emphasize the communication skills and propose the guidelines respecting the communication as the most significant skill in the cockpit and as an effective instrument in all aspects of CRM. In this respect, the pivotal role of communication in aviation has been stressed by many researchers such as Nevile (2006). He refers to the point that human factors such as information gathering, decision making, management of errors and leadership are realized through communication. In addition, Vieira, Santos, and Renato de Morais (2014) state that the process of a safe communication depends on minimizing and declining misunderstandings.

Furthermore, based on Cox (2010), the programs related to CRM would be executed by simulator based training programs. Eadie (2000) also urges to conduct studies on practical phenomena in real life cases. In this regard, Robertson, Schumacher and Petros (2005) propound that teaching in a real situation can improve learning. In such a complex context, training is of pivotal importance which is identified as the top intervention for risk reduction (FAA, 2014). Thereby, the FAA (2014) proposes “scenario based training” (SBT) which refers to learning in context, and is important for CRM trainings (Cox, 2010). Besides, according to FAA (2008), Scenario Based Training (SBT) is based on the concept of situated cognition which is based on the belief that knowledge and its context are inseparable.

It is worth noting that RRM trainings succeed the CRM trainings. The main objectives of the RRM training programs provide effective practices in performing team work trainings to improve communication, safety and effective and efficient work among aircraft ground handling personnel (Skybrary, 2020). RRM trainings have been provided for ramp personnel including permanent and temporary staff group. The research and studies conducted in ramp handling area have indicated that individual factors

such as stress, fatigue, time pressure, etc. are significant items in occurring accidents and incidents (Skybrary, 2020).

Grice's (1975) Maxims

Baker (1998) asserts that the impact of implied meaning can be understood in interactions and evaluation of the level of ambiguity proposed in Grice's (1975) maxims. In this regard, Grice (1975) proposes the notion of "cooperative principle" based on four maxims consisting quality, quantity, relation and manner which violating them can lead to implicature.

Grice's (1975) maxims are mentioned as follows:

1. Quantity: Make your contribution as informative as is required;
2. Quality: Try to make your contribution one that is true, Do not say that for which you lack adequate evidence
3. Relevance: Be relevant
4. Manner: Avoid ambiguity, Avoid obscurity of expression, be brief, be orderly.

The cultural aspects of Grice's (1975) maxims have been taken into consideration as well in the studies conducted by Baker (1992). She states that Grice's (1975) maxims present valuable concepts such as brevity and relevance. However, some other researchers such as Venuti (1998), criticizes the maxims of Grice and believes that they are appropriate merely in particular situations as technical.

Intercultural communication

According to Riley (2007), "culture" has been defined as a set of items including values, information, beliefs and skills that individuals need to communicate in the society with the others. He also points out that culture can be transmitted through culture. He claims that the connection between culture and language is at the point that culture is encoded.

Moreover, Naidoo (2011) states that interactions are rapidly increasing which cause further communication among individuals with various cultures throughout the world and in this case what is important is minimizing misunderstandings. She presumes that individuals with different languages, cultures, experiences and backgrounds try to compound all of them in order to facilitate meaning and understanding. She believes that a combination of them can raise the ability of cultures for influential communication. Additionally, Inoue (2007) proclaims that intercultural communication is eligible to block miscommunication and misunderstanding.

Furthermore, De Vito (2011), acknowledging culture as a crucial factor, claims that culture has a great impact on communication. He also believes that human beings are very susceptible to cultural differences. In this respect, Meyer (2006) asserts that it is a pivotal factor to receive the other cultures in intercultural communication.

Methodology

Materials

In the current study, a corpus of 31 authentic audio records and reports of incident cases and aviation mishaps from General Directorate of Air Traffic Management and also available at the website of Iran Civil Aviation Organization was selected. The reason that encouraged the researcher to select this data stemmed from their significance and authenticity in real context as a scientific subject related to safety and life. The selected data were as follows: 1) IRY 1214 (Eram 1214), 2) VIP flight, 3) IRA655 (Iran Air 655), 4) Fokker27 and Boeing 747, Mehrabad Airpoort, 5) IRC758 (Aseman 758), 6) KKK1185 (Atlasjet1185), 7) IRA1733 (Iran Air1733), 8) IRA3414 (Iran Air 3414), 9) IZG4016 (Zagros 4016), 10) IRC730 (Aseman730), 11) AFG703 (Ariana703), 12) KLM434, 13) Korean Cargo Flight, Mehrabad Airport, 14) Cessna plane and Fokker100 , 15) Handover- Takeover, Imam Khomeini Airport, 16) THY7CL (Turkish7 Charlie Lima), 17) IRA1733 (Iran Air 1733), 18) Sweeper car, Imam Khomeini Airport, 19) BAW153 (British Airways153), 20) miscommunication between aircraft maintenance engineers 21) miscommunication between aircraft maintenance engineers 22) IRA719 (Iran Air719), 23) DLH601 (Lufthansa601), 24) Qatar492, 25) IRC3700 and TBZ5206, Mehrabad Airport, 26) Technical car, Tabriz Airport, 27) IRM007 (Mahan007), 28) Mehrabid Radar & Pooria military flight, 29) IRA710 (Iran Air710), 30) TBZ5704, 31) IRM102 & Airbus 340 32) miscommunication between headset man and pushback driver, Imam Khomeini Airport.

Procedures

To address the first research question, i.e. to specify linguistic solutions to minimize misunderstanding among the Iranian aviators, a corpus of 31 authentic audio records and reports of incident cases and aviation mishaps was collected. By scrutinizing the communications, based on Grice's (1975) maxims, the reasons for miscommunication and misunderstanding

were analyzed and then the frequencies and percentages of violating the Grice's maxims were identified.

To address the second research question, i.e. to determine the other factors that need to be taken into consideration in aviation trainings, the collected data were analyzed based on Grice's maxims. Then, the frequencies and percentages of the other factors involved in the incidents (as a reason) were specified.

Data analysis

To address the first research question, based on Grice's (1975) maxims, a corpus of 31 authentic audio records and reports of incident cases were analyzed and the frequencies and percentages of violating Grice's maxims (as the reasons for misunderstandings) were presented in table 1.

Table 1

The Frequencies and Percentages of Violating Grice's Maxims

Violating Grice's maxims	Frequency out of 31 cases	Percentage
Maxim of quality	4	12.90%
Maxim of quantity	3	9.67%
Maxim of relevance	2	6.45%
Maxim of manner	6	19.35%

As it is depicted in Table 1, considering Grice's maxims model, violating maxim of manner with 19.35% had the highest frequency and the lowest frequency was related to violating maxim of relevance with 6.45%. According to Table 1, violating the maxim of quality is 12.90% and violating the maxim of quantity is 9.67%.

To address the second research question, 31 cases were analyzed. Table 2 demonstrates the frequencies and percentages of the other factors leading to misunderstanding.

Table 2
The Frequencies and Percentages of the Other Factors Leading to Misunderstanding

Reasons of misunderstanding	Frequency out of 31 cases	Percentage
Violating Grice's maxims	15	48.38%
Violating temporal maxims	6	19.35%
cultural maxims	5	16.12%
Others	5	16.12%

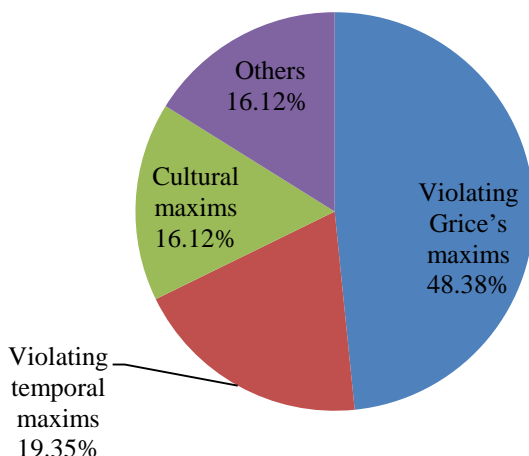


Figure 1. The pie graph of the other factors leading to misunderstanding

As Table 2 indicates, violating Grice's maxims with 48.38% had the highest percentage of reasons of misunderstanding. Furthermore, violating temporal maxims with 19.35% and cultural maxims with 16.12% were considered as the reasons for misunderstanding in Aviation context as well.

Discussion and Conclusion

As it was mentioned in the previous section, violating four Grice's maxims were determined as the reasons for misunderstanding among the aviators. In 19.35% cases, violating the maxim of manner led to misunderstanding among the aviators. For instance, in a case related to DLH601 (Lufthansa601), two contradictory instructions were given to the pilot at the same time (at own discretion vs. face east) as the following expression indicates:

ATC-DLH601: “push back and start up at own discretion, face east.” In this example, maxim of manner was violated by ATC since two different instructions were passed (firstly, push back at own discretion which means move either to east or west; secondly, face east which means move towards east).

In another example, the fuel leakage problem and conducted operation was reported in the aircraft maintenance logbook as “trouble shooting perform”; however, it was not clear that whether the problem was fixed or needs to be fixed. In this example, maxim of manner was violated.

Besides, in another instance, miscommunication took place between two aircraft maintenance engineers. The chief of aircraft maintenance unit asked his colleague to “put the panel on the aircraft tail”. Expressing the above sentence, he meant to install the panel on the tail, but his colleague just put it on the tail of the aircraft not installed. In the current example, it is crystal clear that the expressed sentence by the chief of aircraft maintenance unit was ambiguous for his colleague and thereupon, miscommunication happened due to violating maxim of manner.

In the other case, the headset man was told by the pilot to inform the pushback driver to move the plane to east (face east). Due to the accent of the foreign pilot, the headset man could not discern which direction the pilot requested. He passed the message wrongly to pushback driver and the plane was moved to the opposite direction. Later on, he proclaimed that he didn't recognized which direction the pilot said but he didn't ask for clarification. In this respect, maxim of quality has been violated in part of the headset man since he did not pass the message truly and therefore, miscommunication occurred.



Figure2. Imam Khomeini Airport

In addition, in the case of KKK1185, the pilot (P1) was instructed by the Air Traffic Controller (ATC) for a long pushback (moving backward) and facing to west; this message was passed to the pushback driver. The driver pushed the aircraft in a way that blocked the route of the second flight (P2) while taxiing, expected to use the conflicting taxiway known as K. The taxiing flight (P2) stopped and the push truck moved the plane (P1) forward to keep clear the route of that plane (Figure2).

In this case, it was not clear how far the driver had to move the plane (P1) backward and thus the maxim of quantity was violated providing insufficient information by ATC.

In one more report, while the runway in use (active runway) was 11 left (11L), in the middle of night the sweeping car was working on the runway and the departing aircraft was taxiing in order to take off from the beginning of the runway 11left which was farther to the control tower than the other side of the runway known as 29 right (29 R) (Figure2). In order to keep the active runway (11L) clear of the sweeping car, the ground controller instructed the sweeping car in Persian as follows:

"از باند 11 چپ یا همون 29 راست فاصله بگیر و بیاروی 11 راست یا همون 29 چپ"

Clear the runway 11 Left (11L) or 29 Right (29R) and move on runway 11R or 29 Left (29L).

Surprisingly, before commencing take off, the tower controller asked the pilot whether he sees any car on the active runway (11 L) and the pilot responded "yes". As the result, ATC cancelled take off clearance.

In this example, the maxim of quantity was violated by the ground controller as he passed much information than required making the driver perplexed. Moreover, according to the results, 6.45% of data were due to violating relevance maxims. For example, the pilot of Qatar492 flight asked the controller "what is RVR (runway visual range)?" expecting the number. However, the controller responded "Runway Visual Range" which indicated what the abbreviation stands for.

In the above example, miscommunication occurred due to violating maxim of relevance by the controller.

Furthermore, the findings of the study revealed that 19.35% of cases were due to violating the time (temporal maxim) as the following example indicates:

This case occurred between Mahan102 (IRM102) and Airbus340 (A340) at Imam Khomeini International Airport. Both airplanes were in parking position then Mahan102 requested authorization to push and start at 06:16 local time.

Mahan102- IKA Ground: "Mahan102 on stand 126request push and start."

IKA Ground- Mahan102: "Mahan102 push and start approved face east."

Although pushback instruction was given to Mahan102, it started pushback three minutes later. At the same time (i.e. at 06:19 local time) Iran Air plane received pushback clearance to be placed in another stand. Since Mahan102 started three minutes later, its movement was coincident with Iran Air movement. Therefore, both planes collided from the tail. Obviously, this accident showed the significance of time in aviation context. (It is worth noting that studying other contributing factors is beyond the goal of the current research).

Moreover, in another incident involving Fokker 27 (smaller aircraft) and Boeing 747 (larger and faster aircraft), both aircrafts were heading to Isfahan from Mehrabad airport in the same direction. In order to provide the required separation between two aircrafts, the air traffic controller instructed the first departing flight (Fokker27) temporarily to fly away from the specified route called R659(reroute), and then rejoined the route after 25 miles to ensure safety of both flights.

Soon after that, controlling the next flights was handed over to another air traffic controller. Ten minutes later, the second flight (Boeing 747) was cleared to takeoff by the new controller which subsequently within 5 minutes of its flying time both aircrafts were on the course to crash and a mid-air collision narrowly averted. Meantime, the first controller called the tower, and informed his colleague regarding the alteration of the route of the smaller aircraft (Fokker 27) which was too late and the serious incident had already happened. This example underscores the importance of time in aviation communication.

In sum, the results indicate that 16.12% of cases occurred due to cultural misunderstandings. For instance, in a case between Cessna and Fokker100, the minimum separation between two planes was infringed while approaching the same runway. Consequently, Cessna flight immediately veered off the runway after landing to allow the succeeding plane (Fokker100) to be able to land on the same runway just few seconds later. In this case, the assistant controller expressed that although he recognized the required separation between two planes was not applied, as a matter of courtesy, he did not warn his senior colleague to take remedial action so as to behave politely. Thus, the above example displays how culture can play an important role in Aviation.

Within the international environment of aviation, English language has been determined as a common language. Based on the data in the current study, ignoring and violating Grice's maxims caused misunderstanding or misinterpretation. The results of the study revealed that Grice's maxims need to be applied in aviation communication (both written and verbal) amongst those personnel working in aviation context including aircraft maintenance engineers, ground handlers, pushback drivers, pilots/

controllers, etc. Moreover, temporal and cultural factors were identified as the maxims that need to be taken into account in Aviation discourse. Therefore, based on the findings, it is of vital importance to take into account Gricean maxims in the trainings of the aviators both in English and national languages.

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