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A Review: Accent Modification in Aerospace and Aviation

Bir Derleme: Uzay ve Havacılıkta Aksan Modifikasyonu

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Abstract Language serves as a critical tool for communication in the aerospace and aviation industries, where clarity and intelligibility are paramount for safety. This article explores the profound influence of language in these fields, emphasizing the necessity for high communication standards among professionals such as astronauts and pilots. The International Space Station mandates English. English is also the official language of commercial aviation because of the historical miscommunications that have led to catastrophic outcomes. The current article highlights the stringent English proficiency requirements set by the International Civil Aviation Organization (ICAO), necessitated by past accidents attributed to miscommunication. Furthermore, the role of accents in communication barriers which significantly impact the clarity of interactions, particularly in high-stakes environments, is presented. The aerospace industry has seen instances where miscommunications, often accentuated by linguistic differences, have compromised missions and safety. This article advocates for the integration of speech-language pathology into training programs to enhance intelligibility and mitigate communication-related accidents. It suggests that speech-language pathologists could offer crucial interventions in accent modification, potentially increasing safety by improving communication clarity across the aerospace and aviation industries.

Öz Dil, açıklık ve anlaşılırlığın güvenlik için çok önemli olduğu uzay ve havacılık endüstrilerinde iletişim için kritik bir araç olarak hizmet eder. Bu makale, astronotlar ve pilotlar gibi profesyoneller arasında yüksek iletişim standartlarının gerekliliğini vurgulayarak, dilin bu alanlardaki derin etkisini araştırmaktadır. Uluslararası Uzay İstasyonu'nda İngilizce zorunludur. İngilizce aynı zamanda, felaketle sonuçlanan tarihsel iletişimsizlikler nedeniyle ticari havacılığın da resmi dilidir. Bu makale, Uluslararası Sivil Havacılık Örgütü (ICAO) tarafından belirlenen ve geçmişte yaşanan kazaların iletişimsizliğe atfedilmesinden kaynaklanan katı İngilizce yeterlilik gerekliliklerini vurgulamaktadır. Ayrıca, özellikle yüksek riskli ortamlarda etkileşimlerin netliğini önemli ölçüde etkileyen iletişim engellerinde aksanın rolü sunulmaktadır. Havacılık ve uzay endüstrisi, genellikle dilsel farklılıklarla vurgulanan iletişimsizliklerin misyonları ve güvenliği tehlikeye attığı örneklere tanık olmuştur. Bu makale, anlaşılabilirliği artırmak ve iletişimle ilgili kazaları azaltmak için dil ve konuşma patolojisinin eğitim programlarına entegre edilmesini savunmaktadır. Dil ve konuşma terapistlerinin aksan modifikasyonu konusunda önemli müdahalelerde bulunabileceğini ve havacılık ve uzay endüstrilerinde iletişim netliğini artırarak güvenliği potansiyel olarak artırabileceğini öne sürmektedir.

Keywords Safety Risks · Miscommunication · Accent · Aerospace Communications · Speech-Language Pathology

Anahtar Kelimeler Güvenlik Riskleri · İletişimsizlik · Aksan · Havacılık ve Uzay İletişimi · Konuşma-Dil Patolojisi

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A Review: Accent Modification in Aerospace and Aviation

Language is the very thread that connects human beings. Without language, one would have no way to communicate wants, needs, request help, or express complex ideas and theories. Many extraordinary theories have led to human and scientific progression within the aerospace and aviation industries. These advancements are remarkable and have captured the world's attention and admiration for generations. Advancement in aerospace and aviation is growth for humankind and vice versa human progression and betterment is growth for the aerospace and aviation industries.

The aviation and aerospace industries require their professionals, such as astronauts and pilots, to speak with a high level of intelligibility. This is so they are understood by crew and support professionals over an intercom or via radiotelephony. Being understood during an emergency is of the utmost importance for astronauts, who must work together quickly and efficiently. For this reason, language protocols are required for those speaking via an intercom system. An example is an astronaut speaking during a spacewalk with those housed within the International Space Station (ISS). While the most common languages used in space are English, Chinese and Russian, English is the mandated official language used on the ISS. English is also the mandated language of commercial aviation.

Within aviation, the Federal Aviation Administration (FAA) closely follows the International Civil Aviation Organizations (ICAO) English Proficiency Descriptors (FAA, 2020 & ICAO, 2010). These requirements were created secondary to the repeated tragic loss of life over what was attributed to either air traffic controllers (ATCs) inability to understand the pilot's English or the pilot's failure to understand the English used by ATCs. Therefore, all pilots, regardless of their home culture, must be deemed English proficient in order to obtain the commercial pilot's license. Pilots must be ready to speak with other pilots in the airspace. For example, a pilot may need to urgently communicate and report an Unidentified Flying Object (UFO) in the immediate airspace. Ultimately, one airline captain's voice will speak on behalf of thousands of passengers throughout their career.

Within the aerospace industry, those participating in spaceflight must be fully intelligible when they speak. In fact, crew stationed on the ISS are no strangers to miscommunications and adhere to mandated spaceflight language protocols developed by the National Aeronautics and Space Administration (NASA). These language protocols have expanded since the 1975 Apollo-Soyuz Test Project where Russian and American astronauts struggled to adequately communicate, despite intensive language training (Ansdell, 2011). When communication is successful, incredible achievements are accomplished. A few notable examples of human aerospace advancements include: the first human space flight, the first communication satellite, and breaking the sound barrier. Clear and effective communication is the fundamental aspect in all of these great advancements for humankind.

While these sister fields thrive off of effective and clear communication, errors have been costly and of historical importance. Communication failure on the ISS may result in catastrophic safety errors. Furthermore, in an investigation regarding the issues affecting space crew performance on the ISS, it was noted that 17 miscommunications or misunderstandings had had a high impact on the overall ISS mission (Santy et al., 1993). Additionally, Kanas (1998) noted that the second major psychosocial issue that affected crew performance was language and dialect variations, where communication was hindered. Additionally, it was also reported that in a survey of 54 astronauts, all 54 felt it was important for every astronaut to be fluent in a common language and over half of those indicated language fluency was significantly important (Kelly &

Kanas, 1992). It was further noted, "Linguistic differences can lead to crew miscommunication, which especially may be problematic during crises and emergencies, where confusion exists and the need for prompt integrated crew response is paramount" (Kanas, 1998, p. 354). It is interesting to note that astronauts who were also highly trained pilots had rated communication as more important than others who were not pilots during space missions (Kanas, 1998). Thus, those who had already worked within the aviation industry were already exposed to the disastrous consequences when miscommunications occur.

Housed within language is the often-overlooked domain of intelligibility or the ability to be understood easily by a listener. One can have superb language skills, but they may see negative consequences presented by limits on relationships and work opportunities if they are unintelligible. It is difficult to communicate with someone who is hard to understand. Prospective pilots and astronauts may have accents that interfere with intelligibility. Accents consist of traits carried over from a native language to the learned foreign language. An accent is a "unique mode of pronunciation common to a particular nation, locality, or region" (Freysteinson et al., 2017, p. 300). When English is a second language, accented speech may challenge the communicative partner's understanding, which may negatively affect one's professional and personal careers. Carlson and McHenry (2006) found that accent directly affects employability. Speakers of a mainstream dialect or language may be viewed as competent speakers by the rest of the group members. Conversely, speakers whose speech patterns differ from that of the mainstream language may be negatively perceived by others. Speakers who present with similar speech characteristics as the listener are rated higher in socio-economic and social status, intelligence, and competence (Carlson & McHenry, 2006).

Miscommunication affects every industry. Catholic priests who move to English speaking nations struggle with being understood when giving a sermon to their parishioners (Gautier & Do, 2018). According to Freysteinson et al. (2017), "In 1999, the Institute of Medicine in the Paper To Err is Human recognized communication failure as a key contributing factor to the sentinel events that caused the death of almost 100,000 individuals annually" (p. 299). Moreover, Freysteinson et al. (2017) reported that ineffective communication occurring within the healthcare industry might happen when healthcare workers present with strong accents, either regional or foreign. In recent years, the medical industry has moved to electronic medical records systems, such as EPIC, where physician orders are placed within the computer system and read and released by the nurse. However, this would not work in the aerospace or aviation industries. One needs to stand ready to verbalize the current emergent situation.

The Federal Aviation Administration (FAA) in the United States has spent a considerable and solid effort into researching the principle causes of aviation accidents. These accidents cost the American Aerospace industry $1.64 to $4.64 billion annually (Sobieralski, 2013). How big is this modern-day problem? It is massive. A whopping 75% of aviation accidents result from human error (Kharoufah, Murray, Baxter, & Wild, 2018). Of those accidents, 60% stem from communication errors (Archer, 2015). The FAA concluded that pronunciation and accented speech affects Air Traffic Control's ability to understand more than radio quality (Prinzo et al., 2010). These causes of miscommunications between ATC and commercial pilots are the principal cause of costly incidents (Prinzo et al., 2010, Reports 1-6).

The Air Traffic Controller's (ATCs) use of English is just as crucial as pilots' English. ATCs are mandated by ICAO law to use English in all communications with pilots, regardless of native language or the native language of the airspace one is flying in. In a study funded by the FAA, Prinzo et al. reviewed an investigation by Tiewtrakul and Fletcher (2010) that examined fatal accidents that had occurred when Taiwanese ATC and native English-speaking pilots had trouble communicating. After a lengthy investigation and obtaining the audiotapes of communicative exchanges between ATCs and pilots, they found that "the controllers' accent influenced their English pronunciation to the point that the foreign pilots were at a disadvantage under-

standing clearances, as evidenced by differences in the number of readback errors, request for repeats, and failures to respond" (Prinzo et al., 2010, Report 6, p. 23). Another similar situation occurred in Brazil, where controller error likely caused an accident where the pilots experienced difficulty understanding the Brazilian air traffic controllers English (Prinzo et al., Report 2). The FAA investigated whether pilots and ATCs had trouble understanding one another due to low radiofrequency and inadequate intercom equipment. They reported, "Regardless of how frequently they experienced problems with word meanings, for them, accent, speech rate, and pronunciation adversely affected their ability to understand word meanings to a greater extent than radio technique and the quality of ATCs radio equipment" (Prinzo et al., 2010, Report 2, p. 31).

While it is evident that miscommunications and accents play a role in complicating missions for those involved in space missions and cause immediate deadly safety concerns in aviation, what can these sister industries do about safety concerns regarding clear communication? In a novel investigation by Pierson et al., (2024) accent modification was implemented with a group of Chinese pilot candidates who were facing dismissal from an American flight school due to English concerns, specifically difficulty being understood when speaking with ATC. Traditionally, speech-language pathologists work with patients and clients who experience neurodegenerative diseases, traumatic brain injuries, or pediatric disorders that affect one's ability to communicate effectively. The aim of speech-language pathology is to change speech patterns so that one is understandable every time they speak. Pierson et al., (2004) demonstrated the usefulness of the addition of speech-language pathology within the aviation industry. All participants in the investigation graduated, returned home to China, and currently fly large international commercial airplanes. This investigation's success may have been due in part to customization of each pilot candidate's program stemming from an in-depth phonetic analysis of each pilot candidate's unique speech patterns and transference of Mandarin Chinese characteristics when speaking in English.

There is no evidence to support that linguistic diversity within the aerospace industry is different than that seen within modern day aviation industry. When miscommunications occur, would the addition of a highly trained speech-language pathologist be useful to help prepare astronauts, engineers, and pilots to communicate in English as a non-native language effectively and quickly? Schmidt & Sullivan (2003) reported that professionals who partook in accent modification courses reported higher rates of self-confidence than those who did not. An increase in self-confidence may be worthwhile in situations where emotions and anxieties are heightened. Without the assistance of a speech-language pathologist, will an unintelligible accent improve? Per Ojakangas (2013), it is unlikely as a new way of speaking is comparable to learning how to write with the non-dominant hand. It will require someone who is trained to change speech patterns to assist a professional with learning a new way to speak with greater intelligibility.

The presence of miscommunications in the aviation industry is ever present and growing. In 2018, the FAA declared that accented speech was a primary cause of aviation accidents more so than radio quality or intercom equipment (Prinzo et al., 2010, Report 2). Designated Pilot Examiners measure pronunciation ability as part of the flight check to obtain a pilot's license. Miscommunications complicated by accents have historically been tied to aviation accidents and loss of life. Modern-day aviation has become and is an international industry. Accented aviation English remains a modern-day safety issue acknowledged by the FAA, ICAO, and those working within aviation and aerospace.

Discussion

The main contributions of this review indicate that the growing linguistic diversity seen in aviation is also present within the aerospace industry. Aerospace has always been a multi-national enterprise, where exceptional human beings, with various linguistic backgrounds, come together with the common goal of pur-

suing the exploration of space. Anytime individuals with diverse linguistic backgrounds come together, there will be communication breakdowns. Professionals struggle to understand one another. There is no room for miscommunications when a pilot is responsible for the lives of 300 passengers on the aircraft. There is no room for miscommunications within the ISS where the adherence to set protocols is paramount to survival. The field of speech-language pathology is focused on how to improve communication, whether that be through treatment implementation for those struggling with disease and disorders or via accent modification where a speech therapist assists an astronaut or pilot in being capable of clearly communicating through radiotelephony.

The speech-language pathologist can play a vital safety role in accent modification due to their education in understanding and analyzing articulation. Speech-language pathologists, through evidence-based practice, can increase aviation safety margins through intelligibility improvement.

It is time these scientific fields joined efforts to make air and space travel safter more everyone involved. A step forward for the speech-language pathologist is a step forward for everyone.

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