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The Persistence of Safety Silence: How Flight Deck Microcultures Influence the Efficacy of Crew Resource Management

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Pilot-to-pilot communication has been a major subject of study both within the aviation industry and academia. Poor crew communication contributed to a series of airplane accidents in the 1970s leading to regulatory authorities requiring the implementation of a safety system known as Crew Resource Management (CRM); “a human factors approach for improving aviation safety by preventing or managing pilots' errors” (U.S. Government Accountability Office, 1997, p. 4).

In the early years of CRM, the National Transportation Safety Board (1994) published a safety study analyzing the cause of 36 accidents found that poor pilot communication the most frequently cited error, contributing to cause or causal factor in 90% of the errors. These findings led to the advancement and advocacy of CRM throughout the industry.

Flight deck communication can be broken down into four categories: safety voice (speaking up with safety concerns), safety listening (acknowledging safety voice with verbal acknowledgment or action), muted safety voice (speaking up in a hushed and hesitant way), and safety silence (remaining silent with safety-relevant information) (Bienefeld & Grote, 2012, Noort et al., 2019/2021).

Over the next few decades, the industry saw a proliferation of CRM training mandates for operators and individual pilots. All air carriers and charter certificate holders became required to train their pilots on CRM (e.g., Federal Aviation Regulations § 121.404, § 121.419, §121.420, and §135.330) and all individual pilots applying for an Airline Transport Pilot (ATP) license or a type rating were required to show proof they had undergone at least six hours of approved-course instruction on CRM, safety culture, professional development, and leadership (Federal Aviation Regulation § 61.155).

While all professional pilots are required to receive CRM training, there is no regulation stipulating specific topics or a syllabus outline. Therefore, a pilot from a Part 141 flight training academy may receive CRM training that looks quite different from a pilot at a Part 61 flight school. Similarly, each airline can curate and train CRM with a unique in-house training curriculum (albeit they must receive Federal Aviation Administration approval) (Federal Aviation Administration, 2018, FAR§ 121.405).

In hopes of providing a method of compliance, the Federal Aviation Administration published Advisory Circular 120-51E *Crew Resource Management Training* in 2004(a) which offers suggested training topics, curriculum, and observable behaviors for CRM best practices. The Advisory Circular lays a framework for a potential industry-wide standardized curriculum.

Despite mandated CRM training programs and 18 years of a suggested training framework, flight deck communication errors, such as safety silence, persist (Bienefeld & Grote, 2012; Noort et al, 2021; Rankin, 2007). We approach this problem in the current study by using industry pilot feedback to measure and

analyze muted safety voice, quantify the frequency of safety silence, and explore how the flight deck microculture impacts safety voice.

Power Distance and Safety Voice

Power distance is the measurement of the extent that society accepts the inequitable distribution of power (Hofstede, 2011). In a high-power distance flight deck, First Officers would be less likely to overtly challenge the power of the Captain. Conversely, in low power distance flight decks, First Officers would be more likely to speak up (safety voice) regarding safety-pertinent information (Edmondson, 1999; Noort et al., 2021). This phenomenon was measured through recent academic research (Noort et al., 2021) using 172 cockpit voice recorder transcripts to conduct analytic coding of more than 14,000 conversational turns from flight decks. The findings revealed that safety voice alone was insufficient in circumnavigating communication errors; safety listening was also required (Noort et al., 2021). Our research utilizes insight from industry pilots to question how institutional power (Captain vs. First Officer) influences safety voice and safety listening.

While there remains a hierarchy (and thus a permanence for institutional power), CRM requires First Officers to speak up and mandates that Captains listen (FAA, 2012; EUROCONTROL, 2022). In this regard, the system design either assumes it provides adequate countermeasures to power-induced silencing or it believes the flight deck to be an inclusive environment where safety voice is welcomed. There is a disconnect between the ethos of CRM and how it is operationalized within the flight deck. We argue that the next generation of aviation's human performance training must focus on system design flaws with recommendations for a human-centered redesign.

Psychological Safety and Safety Voice

Psychological safety is defined as, "a shared belief held by members of a team that the team is safe for interpersonal risk-taking" (Edmondson, 1999, p. 3). In the microculture of the flight deck, this means that pilots feel comfortable sharing ideas, admitting mistakes, and activating safety voice (Bienefeld & Grote, 2012; Edmondson, 2018). Psychological safety has been an influential concept in high-risk work environments, such as healthcare, as academic research found that psychologically safe teams were more open to speaking about mistakes made on the hospital floor (Edmondson, 2018; O'Donovan & McAuliffe, 2020).

Given that CRM was designed to reduce and mitigate human error (U.S. Government Accountability Office, 1997), psychological safety may inform a system design that could elicit safety voice to enhance aviation safety.

CRM does not specifically discuss psychological safety, but similar concepts are found in the Federal Aviation Administration's *Crew Resource Management Training* Advisory Circular (2004a). Concepts such as, "how to behave in ways that foster crew effectiveness" (p. 6), "interpersonal relationships"

(p. 8), and “showing sensitivity to other crewmembers’ personalities and styles” (p. 11), emphasize the importance of creating a collaborative and inclusive environment. These concepts align with the foundation of psychological safety. As with healthcare, the aviation industry is a high-risk, safety-orientated environment that would benefit from a focus on psychological safety as it pertains to safety voice in the flight deck. Our contribution with this study is to find systemic opportunities to enhance crew collaboration by utilizing direct feedback from industry pilots.

Self-Disclosure and Ethical Considerations

As a professional pilot, the first author has been trained and has more than 15 years of CRM experience. She has experienced the system as a First Officer and a Captain and is now committed to enhancing aviation safety through human-centered design for prosocial, inclusive behavior and interpersonal skills. An initial step in a system redesign is understanding the gaps. This research aims to accomplish that using mixed method research to gather rich insight directly from industry pilots.

Method

To explore our questions about the effectiveness of CRM, we conducted an industry-wide survey of professional pilots in December 2021. The survey was disseminated through social media and listservs of professional pilots, emphasizing that participation was voluntary. The research was approved by the Institutional Review Board at the University of Washington.

Design

The survey contained 34 questions, divided into 4 sections. In the first section we asked for basic information related to the occupation, such as flight experience in seat position (e.g., Captain or First Officer) and total flight time. We gathered data on which certificate the pilots were operating (e.g., FAA Part 121, 135, or 91), and whether they were trained or operated in the United States. The second section of the survey asked about pilots’ experience and familiarity with CRM training and implementation. The third section concerned questions of safety, asking about the company’s Safety Management System and the frequency and perceived usefulness of safety reporting. We explored the frequency of muted safety voice (in the form of hesitation) and safety silence. The final section contained questions about the microculture of the flight deck. We specifically focused on pilots’ perceived value in training interpersonal skills as a subset of CRM training and inquired about ways to enhance team dynamics through collaborative behaviorism.

The survey received a total of 822 responses from Captains and First Officers across the industry. In this paper, we focus broadly on responses to the following questions:

Q1 (N = 804): *Thinking about a time when you were a First Officer / Second-in-Command, how many instances in an average year have you hesitated about speaking up regarding safety because of something the Captain / Pilot-in-Command said or did in the flight deck?*

Q2 (N = 808): *Thinking about a time when you were a First Officer / Second-in-Command, how many instances in an average year did you feel silenced after bringing up a safety concern because of something the Captain / Pilot-in-Command said or did in the flight deck?*

Q3 (N = 718): *When flying with someone you haven't flown with before, what is one thing that they can do to create a trip culture where you feel included, valued, and comfortable to speak up?*

Participants

The survey participants were predominantly trained and/or are currently operating aircraft in the United States (85%, USA N=695 / Non-USA N=119). The majority (86%) either had previous experience operating as Captain in a crew environment or were currently operating as a Captain (Captain N=695, no Captain experience N=122). While gender and race are not explored specifically in this study, we acknowledge that 27.6% (N=217) of survey respondents self-identified as a woman and 64% self-identified as straight, white, and male (N=504). More than two thirds of survey respondents (68.4%) had more than 5000 flight hours (>5000 flight hours N=555, <5000 flight hours N=256).

Analysis

We analyzed responses to Q1 and Q2 through a quantitative approach to investigate trends of muted safety voice and safety silence. We reviewed the frequency with which pilots hesitated sharing safety-pertinent information or felt silenced after doing so. We then compared the responses across the pilot position variable - Captain versus First Officer. We supplemented these findings with a qualitative analysis of responses to Q3 using a grounded theory approach (Charmaz, 2006). Through an iterative process that included comparison within and across data sets and through theoretical sampling, we generated theory.

Findings

Through the grounded theory process, we categorized emergent themes around several ways in which First Officers felt undervalued, micromanaged, and uncomfortable, as well as various ways in which Captains exerted power in the flight deck. These themes collectively contributed to the experiences of First Officers' feeling discomfort in activating safety voice and oftentimes resulting in safety silence.

First Officers' Muted Safety Voice and Feeling Silenced

Our quantitative analysis of the responses to Q1 and Q2 are contained in Tables 1 and 2, respectively. From Table 1, we observed that a majority of current First Officers (66.4%, N = 79/119) and current Captains reflecting on their time as

First Officers (67.2%, N = 460/685) hesitated about speaking up regarding safety between 1-10 times a year. Similarly, from Table 2, we observed that a majority of current First Officers (51.2%, N = 62/119) and current Captains reflecting on their time as First Officers (52.1%, N = 358/685) felt silenced 1-10 times a year after bringing up a safety concern. Collectively, we observe broad trends of First Officers feeling uncomfortable in bringing up safety concerns or being silenced after doing so. Having observed this trend, we examine ways in which the flight deck microculture influenced their selection of safety silence or participation in muted safety voice through our qualitative analysis of Q3.

Table 1
Comparing Captains' and FOs' Responses to Q1

Q1. Thinking about a time when you were a First Officer / Second-in-Command, how many instances in an average year have you hesitated about speaking up regarding safety because of something the Captain / Pilot-in-Command said or did in the flight deck?						
	First Officers (N=119)		Captains (N=685)		Aggregated (N= 804)	
	N value	Percentage	N value	Percentage	N value	Percentage
0 instances: Never happened	27	22.7%	168	24.5%	195	24.2%
1 – 10 instances a year	79	66.4%	460	67.2%	539	67%
11 – 30 instances a year	12	10%	39	5.7%	51	6.3%
31 – 50 instances a year	1	0.8%	12	1.7%	13	1.6%
More than 50 instances a year	0	0%	6	0.9%	6	0.7%

Table 2
Comparing Captains' and FOs' Responses to Q2

Q2 (N=808): Thinking about a time when you were a First Officer / Second-in-Command, how many instances in an average year did you feel silenced after bringing up a safety concern because of something the Captain / Pilot-in-Command said or did in the flight deck?						
	First Officers (N=121)		Captains (N=687)		Aggregated N = (808)	
	N value	Percentage	N value	Percentage	N value	Percentage
0 instances: Never happened	52	43%	292	42.5%	344	42.7%
1 – 10 instances a year	62	51.2%	358	52.1%	420	52.2%
11 – 30 instances a year	4	3.3%	25	3.6%	29	3.6%
31 – 50 instances a year	1	0.8%	4	0.6%	5	0.6%
More than 50 instances a year	2	1.6%	8	1.2%	10	1.2%

First Officers Feeling Undervalued, Micromanaged, and Uncomfortable

First Officers reported on their experiences feeling undervalued, micromanaged, and uncomfortable by Captains in their roles on the flight deck. A primary way this manifested was Captains treating them like they were inept at their jobs by needing a lot of direction in order to do very basic things (e.g., micromanaging). Some illustrative comments from First Officers' responses to Q3 (N=718) highlight these findings:

Comment 1: *“Don't act like I have to be taught how to fly again, just because I am a FO.”*

Comment 2: *“Do not throw out commands in a military way during pre-flight.”*

Comment 3: *“Allow me to do my job. While the PIC is responsible and needs to oversee the safety of the operation, the FO must also be allowed and trusted to do his or her own job.”*

In these examples, First Officers talked about feeling disrespected by Captains due to the assumption that they were not trained professional or good at their job. Additionally, there is an element of infantilization in these remarks. First Officers can sometimes feel as if they do not have the agency to fully execute their roles.

Beyond being treated as amateurs at their jobs, some First Officers also spoke about how Captains made comments that they found personally intrusive or offensive. Some examples follow.

Comment 4: *“Don’t be a cocky jerk. Don’t make misogynistic jokes.”*

Comment 5: *“Don’t bring gender bias in the cockpit.”*

Comment 6: *“Stop berating woman and gays.”*

From these comments, we observed First Officers being made to feel uncomfortable on the flight deck by misogynistic and inappropriate comments from Captains. Such comments make it difficult for First Officers to focus fully on doing their jobs to the best of their abilities since they must expend cognitive energy processing (Salvatore & Shelton, 2007) or feel stigmatized by the comments (Pinel, 1999).

In our survey, we sought to compile a list of recommendations for creating a pro-safety voice culture where First Officers felt comfortable speaking up and sharing safety-pertinent data. Suggestions indicate that First Officers want to feel valued and appreciated, as seen in the following comments:

Comment 7: *“Asking for my opinion and listening to me makes me feel part of the crew, not a burden on the Captain. Involve me in the briefings - to cabin crew and in the flight deck”*

Comment 8: *“solicit input and listen to suggestions. Ask my opinion and include me on the team”*

First Officers indicated a desire to build rapport, or a sense of community, prior to conducting the trip:

Comment 9: *“establish easygoing rapport before the flight. Preflight conversation, such as the ‘cup of coffee’ chat and introductions. A friendly smile first thing makes all the difference.”*

Along similar lines but on a broader scale, First Officers were looking to find commonalities or shared vulnerabilities:

Comment 10: *“in the preflight briefing, admit own proneness to confirmation bias, feeling hurried, and blunder-error. Fundamentally: state that safety is the priority, not ego gratification”*

Comment 11: *“admit that you can make mistakes, and that there are no stupid questions.”*

These suggestions indicate First Officers believe that it is possible for Captains to create a trip culture where they are encouraged to speak up, rather than feeling undervalued or micromanaged.

These comments indicate that First Officers can sometimes feel left out of conversations, underutilized, and ignored. We find that some First Officers experience trip cultures laden with discomfort and uncertainty, where they feel underappreciated and unfairly treated. Thus, we envision an improvement to CRM training to incorporate our recommendations to improve such cultures. Crew Resource Management may have been built on the assumption that the flight deck is an inclusive environment, but our findings reveal that baseline CRM assumptions do not match reality.

Captains Exerting Power

CRM training is intended to instill the belief in Captains and First Officers that flying requires good team dynamics, where no one can “perform it effectively without help from the other team members” (EUROCONTROL, 2022). However, several First Officers spoke about their experiences with Captains exerting hierarchies of power by virtue of their designation or experience. Below are some examples of such situations.

Comment 12: *“Occasionally overbearing captains will do things that are the FO’s job because they are the PIC and think they are better than the FO.”*

Comment 13: *“Don’t act like a jerk. This is obviously not a thing that captains think is important.”*

In these examples, we saw First Officers being made to feel inferior on the flight deck, which negatively impacts their abilities to do their jobs effectively and can lead to muted safety voice or safety silence. A series of accidents where unprofessional behavior and poor leadership were contributing factors (e.g., Northwest Airliner Flight 3701, Continental Connection Flight 3407, Corporate Airlines BAE Systems BAE-J3201 in Missouri) led the Federal Aviation Administration to publish an Advisory Circular defining leadership and necessitating airline Captains be trained on how to be leaders (FAA AC 121-41, 2020). The Advisory Circular explains that leadership is a “proactive process” where Captains must operate in a professional manner in accordance with standard operating procedures (Federal Aviation Administration, 2020, p. 5).

In our survey, 93% of Captains and First Officers agreed that Captains are responsible for setting the tone on the flight deck and establishing the norms of a trip culture. First Officers are expected to adopt and adhere to said culture. With the onus on Captains to set the tone (Casner & Schooler, 2015; FAA, n.d.a), First Officers drew on their experiences to provide some suggestions on how Captains

could work towards creating a more collaborative flight deck with stronger crew dynamics:

Comment 14: *“Engage crew by asking their input/opinions before expressing his own. Collective pronouns (we, us) also help get everyone onboard!”*

Comment 15: *“Use words like ‘we’. Actively include me in the decisions.”*

Comment 16: *“Ask me to speak up, with assurance that it would be valued.”*

Comment 17: *“Put it on the table in the briefing that you are open to feedback and communication. Emphasis on cockpit operations as a team. Be approachable.”*

Comment 18: *“On first brief of the trip, include some phraseology that says, ‘I’m not perfect, nor do I expect you to be either, so please if you see something, say something; we can always talk about it after we land.’”*

These suggestions speak toward a call for establishing a culture of humility, empathy, and inclusivity on the flight deck. While this may be the ultimate goal of Crew Resource Management, there is a disconnect in how it is operationalized.

The Inclusive Captain Culture

We also received comments from Captains about their own efforts in creating an equitable trip culture. Some illustrative examples are shown below.

Comment 19: *“I tell them to feel free and speak up, I’m no better, and I make mistakes too. The only reason I am Captain is because I’m senior, not better.”*

Comment 20: *“It is my job to include my SICs and ensure they understand that their active participation and input is both appreciated and expected at all times.”*

Comment 21: *“Start off by fostering open communication. Not bring about who’s right but what’s right.”*

Comment 22: *“Put yourself on the same level as your FO/SIC. When you both can act as adults toward each other without creating a weird power dynamic, everyone will be more relaxed and open to the other. Be humble.”*

Comment 23: *“I always start with ‘We are a crew. Neither of us is infallible so feel free to question anything that you aren’t sure about or that you aren’t comfortable with. I’ll do the same.’”*

In these examples, we see effective strategies adopted by Captains in creating a more welcoming and equitable trip culture. In this light, First Officers may be more comfortable voicing their safety concerns if any arise.

Discussion

First Officers’ Barriers to Speaking Up

Based on Crew Resource Management training, First Officers are expected to speak up when they notice potential safety concerns (EUROCONTROL, 2022).

From a Captain's perspective, safety silence from the First Officer would be seen as a violation of CRM. This assumption makes it the responsibility of the First Officer to deal with whatever barriers prevent them from speaking up. The design of the system (CRM) assumes that the flight deck is a psychologically safe environment where First Officers are valued for speaking up and where Captains actively listen (safety listening). However, our findings indicate that this is not the reality for all First Officers. Captains heavily influence the flight deck microculture, which, in turn, impacts the likelihood that First Officers feel empowered to share safety concerns.

We observe that several First Officers feel undervalued and micromanaged in the flight deck. They mention being treated as if they need to be “taught how to fly again” (see comment 1) and/or are bossed around disrespectfully, “[not] allowed and trusted to do his or her own job” (see comment 3). Such flight deck microcultures create environments of discomfort for First Officers, where they do not feel valued as team members. This phenomenon results in their self-silencing as a manifestation of low psychological safety (Edmondson, 2018). Our quantitative analysis indicated that 75.8% (N=609) of pilots participate in muted safety voice every year because of a negative tone established by the Captain. More alarmingly, 57.3% (N=461) of pilots feel silenced after bringing up a safety concern.

While this is not at all a novel finding in the field, as Bienfield and Grote (2012) found that First Officers were the least likely to speak up behind Captains and flight attendants, we believe that it is a significant finding because it continues to be an unresolved problem. Our findings across a large number of pilots currently active in the industry further heighten the need to rectify this situation.

Our surveyed First Officers believe that the Captain has an important role to play in establishing a psychologically safe culture where everyone feels valued as a team member. To this end, we recommend that Captains take more active roles in establishing an inclusive and safe work environment. Some steps to do so could be to use collective ‘we’ pronouns during preflight briefings and conduct postflight debriefs to foster open communication by establishing that their input is valued, and dispelling attitudes of their own infallibility or perfection. In these ways, and others, Captains can take more initiative in establishing a flight deck microculture where First Officers feel psychologically safe to speak up about safety concerns.

Implications for CRM training

Our findings have implications for the current standards of Crew Resource Management training, as we observe a gap between the intended goals of CRM training and its practical phenomenology as experienced by industry pilots. While the intended goal of CRM training is to empower First Officers to “not assume that other people have noticed a problem” and “speak out and not make the problem worse by keeping it to yourself” (EUROCONTROL, 2022), there is a disconnect

between this and how such situations actually transpire in the flight deck. In reality, we find current CRM training insufficient as a tool to generate psychological safety in the flight deck. This lack of training results in First Officers reporting feeling unable to speak up due to a culture where they are made to feel inferior, underappreciated, undervalued, uncomfortable, micromanaged and psychologically unsafe.

Crew resource management was a system designed to improve aviation safety by preventing and managing errors, but the system was designed on the assumption that the flight deck was a psychologically safe environment where safety voice was welcomed, and safety listening was the norm. Our findings reveal these assumptions are not reality. Therefore, it is the system itself that must receive the spotlight. The disconnect between the ethos of CRM and its phenomenology, as explored through industry pilot feedback, highlights an imminent need to update training methods.

Further research on ways to train pilots on psychological safety as a subset of Crew Resource Management training may enhance the efficacy of the system itself.

Conclusion

This study lays the groundwork for exploring social norms and microcultures within flight decks and how these subcultures moderate the efficacy of existing safety systems, such as CRM. The recent FAA requirement for air carriers to conduct leadership training (§ 121.429) augments our findings of a system in need of redesign. However, further research should focus both on a standardized CRM training curriculum (social psychology and behavioral science research to promote collaborative behaviorism and interpersonal skills) and a pedagogical approach that elicits continuous learning. It is through this two-pronged approach that we believe that our human-centered data will enhance aviation safety.

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