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EXPLORING THE LINGUISTIC FEATURES OF SHIP-SHORE COMMUNICATION: A CORPUS-BASED MULTIDIMENSIONAL ANALYSIS

Abstract

Investigations into maritime disasters involving human factors reveal that approximately one-third of accidents stem from communication failures, largely due to inadequate proficiency in maritime English (ME). As an important aspect of ME, ship-shore communication (SSC) is a contributory factor to the safety in the vessel traffic service (VTS) areas. While SSC instruction and learning have garnered growing attention from marine stakeholders worldwide, its specific linguistic features remain underexamined. Grounded in the multidimensional (MD) analysis framework proposed by Biber (1988), this study conducts a corpus-based comparative analysis of SSC and casual conversational English (CE) to identify how SSC varies from CE in terms of linguistic features and communicative functions. The results demonstrate that, compared to CE, SSC is characterized by greater information density, non-narrative concerns, and context independence. It tends to be less abstract and formal, less explicit in expressing viewpoints, and is produced under time constraints. Several pedagogical implications are proposed to enhance SSC instruction and improve effective communication in this high-stakes context.

Key words

ship-shore communication, vessel traffic service, multidimensional analysis, Maritime English, linguistic features, corpus linguistics.

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1. INTRODUCTION

As the shipping industry continues to expand, it is worth noting that the human factor remains the primary cause of maritime disasters (Astratinei, 2016), with communication identified as a significant contributory factor (Rashed & Kamal, 2010; Ziarati et al., 2009). Over 30% of accidents, whether at sea or in ports, which have the potential to cause catastrophic losses and damage at the financial, environmental, and human levels, can be attributed to communication problems, particularly a lack of proficiency in English (Trenkner & Cole, 2005).

In vessel traffic service (VTS) areas, communication-related factors contribute to up to 40% of collisions involving the human factor. Among these collisions, the majority can be attributed to radio communication failure, even in routine situations.

The International Maritime Organization (IMO) has long emphasized the importance of precise and unambiguous communication in the maritime domain, advocating for a standardized language to reduce the potential risks associated with misunderstandings that could harm individuals, vessels, or the environment (IMO, 2001). A high level of English proficiency not only improves navigation safety in the world's waters but also serves a social function by facilitating social interaction among multilingual crews on board vessels (Kahveci & Sampson, 2001).

Maritime English (ME), as a branch of English for specific purposes (ESP), can be broadly defined as the English language used by various stakeholders within the maritime industry for verbal or non-verbal communication, depending on its specific purpose (Bocanegra-Valle, 2010). One of its subregisters is English for marine communications, which occurs in three contexts: on board ships, between ships, and – importantly for this paper – between ships and shore services. This final context represents a highly specialized and narrowly focused aspect of ME (Bocanegra-Valle, 2013; Pritchard & Kalogjera, 1999).

Ship-shore communication (SSC) is a facet of external communication. It enables VTS operator (VTSO) to enhance life safety at sea by reducing accidents, to safeguard the marine environment by preventing pollution, and to improve navigation efficiency by overseeing ships within the VTS area (Costa et al., 2018; IALA, 2022; Jurkovič et al., 2019; Praetorius et al., 2015; Vries, 2015). VTSOs provide these services by communicating with ships, issuing clearances, responding to calls from vessels (Mansson et al., 2016), and coordinating traffic movements based on the VTSO's situational knowledge (IALA, 2022). Given SSC's pivotal role, the IMO and International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) have established a set of standardized protocols to enhance the safety and efficiency of maritime traffic. The present study conducts a comparative multidimensional (MD) analysis of SSC and casual conversational English (CE) to uncover the linguistic characteristics and communicative functions of SSC. This analysis aims to provide pedagogical insights for SSC instruction and learning, ultimately enhancing the clarity and effectiveness of marine communication.

2. LITERATURE REVIEW

2.1. Maritime English and ship-shore communication

ESP is vital for equipping learners with the necessary language skills for their specific fields, enhancing their communication abilities, and improving their overall employability in a globalized job market (Marín-Pérez & Aguado Jiménez, 2024; Soto-Almela, 2024). Maritime English has gained significant importance and widespread usage, given the challenges of today's global trade (Bocanegra-Valle, 2011; Hyland, 2022; Jurkovič, 2025). Given ME's key role in ensuring safety at sea, extensive research has focused on exploring it from different perspectives, including conversational structure (Strevens & Johnson, 1983; Strevens & Weeks, 1983); syntax, grammatical rules, and lexical/vocabulary items (Bocanegra-Valle, 2024; Johnson, 1994; Mironenko & Mironenko, 2023; Takagi & Saito, 2014); discursive features (e.g., message markers, message patterns, and move analysis) (Bocanegra-Valle, 2011; Franceschi, 2014; Johnson, 1994; Jurkovič, 2022); conversation features (Dževerdanović-Pejović, 2013; Pritchard & Kalogjera, 1999); pragmatic aspects (Boström, 2021; John et al., 2019; Johnson, 1994); information density (John et al., 2013); and other linguistic variables (e.g., word frequencies, lexical density, syntactical diversity, vocabulary growth, and structural idiosyncrasy) (John et al., 2017). Collectively, this body of research has deepened our insight into ME by providing detailed descriptions and analyses of its specific linguistic features.

A growing body of recent research has utilized authentic corpus data to examine ME communication styles and linguistic features (Boström, 2020, 2021; John et al., 2017, 2019; Jurkovič, 2022; Perea-Barberá & Parada Galindo, 2020). This corpus-based approach aims to provide in-depth insights into the usage of ME across various maritime domains, with investigations focusing on different contexts, including ship-ship/ship-shore communications, and onboard communication among crew members. Another noteworthy trend is the examination of how Standard Marine Communication Phrases (SMCP) are used in authentic contexts, particularly how actual communication deviates from standard communication protocols (Pritchard & Kalogjera, 1999). Franceschi (2014) investigated written and spoken ME at lexical and semantic levels and pointed out that spoken ME exhibits multifaceted language with a number of distinct features serving different purposes. It has been suggested that future studies on specialized discourse need to highlight the internal nature of the various domains under investigation to provide finer-grained descriptions of their organization.

Perea-Barberá and Parada Galindo (2020) analyzed a small corpus of routine ship-ship and ship-shore communication to examine the authentic use of SMCP. Their findings indicate that only 24% of conversations in the corpus adhered to the use of message markers, while 80% followed the recommendations provided in the SMCP, and 47% used SMCP as required. Using simulator data rather than authentic

communications, John et al. (2017, 2019) conducted a corpus-based study to identify quantitative linguistic differences between bridge team communication and other text corpora. Their research aimed to profile the speech patterns of non-native bridge teams and create a quantitative linguistic model for this discourse community. Boström (2020, 2021) compiled a corpus of authentic routine communication between ships and icebreakers (ship-ship communication) within the context of icebreaker operations. The findings highlight a clear gap between actual language use and prescribed communication protocols, revealing that closed-loop communication is not fully utilized. More recently, Jurkovič (2022) used a specialized spoken corpus to quantify compliance with standard communication protocols that are essential for navigational safety. The findings again showed that authentic routine ship-to-shore communication still deviates significantly from standard protocols.

However, existing research has several limitations. First, the analyzed data often originate from a single port, limiting the representativeness of the samples. Second, the research methods are predominantly qualitative case studies, with quantitative analysis playing a supplementary role. Third, few studies have focused on the specific linguistic features and communicative functions of SSC. To address these gaps and obtain a comprehensive linguistic profile of SSC, the MD analysis framework proposed by Biber (1988) can be effectively applied.

2.2. Multidimensional analysis framework

Biber's (1988) MD analysis framework[1] is a methodological framework designed to facilitate both quantitative and qualitative analyses of co-occurring linguistic features and their communicative functions in the text, revealing register variation and enabling comparisons across various parameters (Biber, 2004). This methodology provides a robust framework within the text-linguistic paradigm, based on the assumption that "strong co-occurrence patterns of linguistic features mark underlying functional dimensions" (Biber, 1988, p. 13). Accordingly, different registers are characterized by distinct distributions of linguistic features, which shape the linguistic landscape of texts (Biber & Conrad, 2009). These linguistic features tend to show systematic covariation, indicating that the presence of one feature frequently correlates with the absence of another (Biber, 1988, p. 79). Over the past three decades, the application of MD analysis across diverse corpora and communicative contexts has underscored the pivotal role of register in explaining language variation. Biber (1988) pioneered the MD analysis framework to systematically examine a broad spectrum of spoken and written English registers. Early studies on spoken registers explored patterns of variation in general conversation, including job interviews (White, 1994) and television talk shows or debates (Connor-Linton, 1989;

[1] The same framework was also utilized in my previous publication (Zhao, 2024), and therefore parts of its description necessarily overlap.

Scott, 1998). More recently, the MD analysis framework has been applied to specialized conversational varieties within ESP (e.g., Friginal, 2013; Zhao, 2024). However, while MD analysis has been applied to various ESP registers, its application to ship-shore communication within the domain of ESP remains largely unexplored.

2.3. Research questions

The current study seeks to address this research gap by conducting a multidimensional analysis of ship-shore communication, focusing on identifying how linguistic features vary by comparing the English used in this specific field to that in casual conversation. Specifically, it focuses on the distinctions between SSC and Santa Barbara (SB) corpora in terms of their linguistic features and communicative functions. The study builds on Biber's (1988, 2004) methodology, extending its application to the domain of ME as ESP, thereby expanding the existing scope of MD analyses and studies.

In light of the research gaps outlined above, this study addresses the following research questions:

1. How do the communicative functions of ship-shore communication differ from those of casual conversational English?

2. How do ship-shore communication and casual conversational English vary in terms of their linguistic features?

3. METHOD

3.1. Corpus compilation

The casual conversational English used in this study is represented by the Santa Barbara (SB) Corpus (Du Bois et al., 2000). It comprises a vast collection of recordings that capture naturally occurring spoken exchanges from various regions across the United States. It encompasses individuals from a wide range of backgrounds, including differences in age, gender, occupation, region, ethnicity, and social contexts. While the primary focus is on face-to-face conversations, the SB corpus also features recordings of other language usage scenarios encountered in everyday life, such as telephone conversations, classroom lectures, and tour-guide presentations. The SB corpus consists of 243,300 words, as illustrated in Table 2, providing a dataset for analysis and comparison.

The ship-shore communication corpus used in the current research is self-compiled. The recordings in the SSC corpus were obtained by convenience sampling. The radio feeds were sourced from Blanton's (2023) *Broadcastify.com*, which is a provider of live audio streams for aviation, marine, railway, and public safety. The researcher subscribed to the premium service, monitored the marine feeds during

off-peak and peak times, and downloaded 33 sample live recordings from representative marine channels as shown in Table 1. After downloading the recordings, non-SSC communications, such as information broadcasts and exchanges between the shipmaster (SM) and the ship's officers/crews at various ship's communication stations (fore, aft, bridge, engine room) were removed. The purpose of this removal was to ensure that the remaining communication in the corpus exclusively represented typical conversations in marine radio communication occurring between the ships and VTSOs. The primary context of the recorded conversations encompassed ships approaching major ports, the fairways of U.S. waterways, the lake region, and the harbors, occurring during both daytime and nighttime, under various weather conditions, including fair and adverse weather. The recorded SSC primarily focused on day-to-day operational scenarios, encompassing a range of routine activities, such as arrival at a port, berthing, anchoring, departure, towage operations, maneuvering, collision avoidance, telephone link calls, cargo operations, and bunkering operations. Typically, the participants in the exchanges are shipmasters speaking to ports or VTSOs. Cockatoo, an AI-powered audio-to-text converter, was utilized to transcribe the audio. The transcripts were manually checked and reviewed before further annotation.

Location	**Feed**	**Marine channels**	**Interactants**
Detroit	Detroit Area Marine	Channels 8, 10, 11, 12, 16, 21 and 22	
California	San Francisco Bay Marine	Channels 16 and 12	Pillar Point Harbor Traffic Coast Guard VTS San Francisco
Erie	Lake Erie Marine	Channels 8, 11, 12, 13 and 14	Seaway and Welland Canal VTS Operations
Florida	Port Canaveral Marine	Channels 12 and 16	Port operation involving mainly cruise ships, cargo ships, and fishing vessels
New York	Northern New Jersey and New York City Area Marine	Channels covering Hudson River, East River, New York Harbor, Newark Bay, Passaic and Hackensack Rivers, Raritan Bay and River, Atlantic Ocean and all other waters in the area.	US coast guard, Tug boats, Passenger ferries, Cruise ships, Freighters, Dinner cruise boats and recreational vessels.
Seattle	Kitsap Area Marine	Channels 16, 22 and 22A	Seattle VTS
New Orleans	Lower Mississippi Marine	Channels 16, 12 and 21A	New Orleans Harbor VTS

Table 1. Sources of authentic SSC in the SSC corpus

Table 2 shows the statistical description of the SSC and SB corpora.

Corpus	Texts	Tokens
SSC	33	69,099
SB	60	243,300

Table 2. The profile of the SSC and SB corpora

3.2. Multidimensional tagging and analysis

The analysis of the two corpora was performed using Nini's (2015) MAT software. The software began by identifying the grammatical category of each word and then applied annotation at both the morphological and syntactic levels. The tagger subsequently counted the frequency of features from the tagged texts. These frequencies were normalized per 100 tokens and used to calculate dimension scores for each text according to Biber's (1988) six functional dimensions (see Table 3). As shown in Table 3, Dimension 1 contrasts involved and affective discourse (e.g., verbs, pronouns) with informationally dense discourse (e.g., nouns, long words, attributive adjectives). Dimension 2 distinguishes narrative discourse (e.g., past-tense verbs, third-person pronouns) from non-narrative discourse. Dimension 3 separates context-independent discourse from context-dependent discourse (e.g., adverbs). Dimension 4 captures overt persuasion, marked by modal verbs that explicitly convey the author's viewpoint, with low scores indicating minimal persuasion. Dimension 5 contrasts abstract, technical, and formal discourse (e.g., passive clauses, conjunctions) with non-abstract discourse. Dimension 6 identifies informational discourse produced under time constraints. These dimensions provide a robust framework for analyzing linguistic features and their associated discourse functions across various registers (Biber, 1988).

MAT software produces three output files that provide information about individual input files and the entire corpus. The files contain the normalized frequency per 100 tokens for each linguistic feature, the *Z*-scores for these features, and the scores for each of Biber's (1988) six dimensions, as shown in Table 3. Furthermore, the MAT software produces two distinct sets of graphs that facilitate the identification of genres closest to the corpus in each dimension and the overall type with which the corpus aligns, according to Biber's (1988) register analysis.

Dimensions	**Linguistic features (2-3 greatest loading)**
D1 Involved vs. Informational discourse	Involved production: private verbs, that deletion, contractions (among others) Informational production: nouns, word length, attributive adjectives
D2 Narrative vs. Non-narrative concerns	Narrative concerns: past-tense verbs, third-person pronouns (among others) Non-narrative concerns: present-tense verbs, attributive adjectives
D3 Explicit vs. Situation-dependent reference	Explicit reference: WH relative clauses, pied-piping relative clauses nominalizations (among others) Situation-dependent reference: time adverbials, place adverbials, adverbs
D4 Overt expression of persuasion	predictive modals, necessity modals, possibility modals, (among others)

D5 Abstract vs. Non-abstract information	Abstract style: conjunctions, agentless passives, by-passives (among others) Non-abstract style: No features
D6 On-line informational elaboration	*That*-clauses, demonstrative pronouns (among others)

Table 3. The summary of dimensions and linguistic features on each dimension (Biber, 1988)

The output files, containing key statistical data, were exported from the MAT tagger and imported into SPSS 26.0 for further analysis. To address the research questions, a series of independent-samples *t*-tests was performed to determine the presence and nature of differences in the six functional dimensions between the SSC and SB corpora. The *Z*-scores of the linguistic features were also subsequently compared.

4. RESULTS

This section presents the descriptive statistics for the six dimensions, followed by comparative results for the SSC and SB corpora to address the specific research questions. Additionally, illustrative excerpts are provided for each dimension to clarify the findings.

4.1. RQ1: How do the communicative functions of ship-shore communication differ from those of casual conversational English?

As shown in Table 4, the two corpora exhibit significant differences across the six dimensions. Specifically, the lower scores of SSC in Dimensions 1, 2, 4, 5, and 6, along with a higher score in Dimension 3, reveal that SSC is more informationally dense, non-narrative, and context-independent than CE. It is also less explicit in expressing viewpoints, uses less abstract and formal language, and is produced under a greater time constraint than CE.

4.2. RQ2: How do ship-shore communication and casual conversational English vary in terms of their linguistic features?

As shown in Table 4, the SSC corpus exhibits lower mean scores than the SB corpus on five dimensions (D1, D2, D4, D5, and D6), whereas its mean score on D3 is higher. A detailed comparison of each dimension is presented below:

	SB corpus			SSC corpus		*t*	*df*	*p*
	Mean	SD		Mean	SD			
1	28.6055	8.08		0.8824	5.89	-17.321	91	0.000***
2	-1.1825	1.97		-2.9388	3.30	-3.216	91	0.002**
3	-1.6707	1.38		-0.3355	3.25	2.251	38.439	0.030*
4	-0.5593	2.42		-1.6555	2.50	-2.063	91	0.045*
5	-1.7015	0.88		-2.9618	0.79	-6.854	91	0.000***
6	0.6720	1.22		-2.0988	0.68	-14.119	90.975	0.000***

Note. *** $p<0.001$, ** $p<0.01$, * $p<0.05$

Table 4. The summary of the *t*-test results for the scores between the SSC and SB corpora along six dimensions

4.2.1. D1: Informational vs. involved production

Low D1 scores suggest a high level of informational density in the text (Biber, 1988). Table 4 demonstrates that there is a significant difference in D1 scores between the SSC and SB corpora (*M*=0.8824, *SD*=5.89 vs. *M*=28.6055, *SD*=8.08), with the SSC score being markedly lower. This indicates that the SSC is characterized by greater information density and more precise content compared to CE. Such low dimension scores correlate with specific linguistic features, including the frequent use of nouns, adjectives, and longer words (Biber, 1988).

Further analysis of the *Z*-scores reveals that SSC exhibits greater word length and a higher frequency of attributive adjectives and nouns than CE (see Table 5).

	Attributive adjectives	Nouns	Word length
SSC	-1.12	3.93	-0.48
SB	-1.31	-0.68	-1.85

Table 5. The comparison of attributive adjectives, nouns, and word length between two corpora in *Z*-scores

A greater frequency of attributive adjectives suggests a "careful integration of information in a text" (Biber, 1988, p. 104). The attributive adjectives in the SSC appear in various communication contexts, e.g., Briefing on position, movement and draft (Trenkner, 2005). In traffic information messages, for example, the directional information about ship movements is conveyed by adjectives, such as *upbound*, *downbound*, *inbound*, *outbound*, *eastbound*, *westbound*, *northbound,* and *southbound,* as illustrated in example 1.

Example 1 (ME-Seattle-0604)

VTSO: Starbound, this is Traffic, just be advised there's *southbound* container ship OOCL Asia. 21 knots, still be *inbound* at Sierra Gulf for Pier 30.

SM: Okay, good copy on OOCL Asia.

Nouns are the primary bearers of referential meaning in a text, and a high frequency of nouns thus indicates a great density of information (Biber, 1988, p. 104). The higher frequency of nouns may be partially attributable to a lower frequency of personal pronouns. As observed, personal pronouns are often replaced by call signs or omitted entirely, as shown in examples 2 and 3.

Example 2 (ME-Erie-1001)

SM: Seaway Newcastle, Seaway Newcastle, TAC-BG4, channel 11, over.
VTSO: TAC-BG4, Seaway Newcastle, over.
SM: Good afternoon, sir. *TAC-BG4* just left Cardinal Harbor. Our destination is La Prairie. We're pushing barges and milled cement in the ballast. Our ETA Newcastle will be 0030.

Example 3 (ME-California-1001)

SM: Coast Guard, this is *Daisy*. You were handed a message, over.
VTSO: *Daisy*, this is *Coast Guard*, *just want to reconfirm,* is this the sailing vessel *Daisy* that was reporting the whale earlier, over.
SM: No, that's not a whale. I'm not sure.

4.2.2. D2: Narrative vs. non-narrative concerns

Low D2 scores indicate that the text is non-narrative (Biber, 1988). Table 4 demonstrates that there is a significant difference in D2 scores between the SSC and SB corpora (*M*=-2.9388, *SD*=3.30 vs. *M*=-1.1825, *SD*=1.97), with the SSC score being lower. This suggests that SSC is more focused on non-narrative concerns than CE. Low scores on D2 correlate with a decreased frequency of third-person pronouns and past-tense verbs in the text (Biber, 1988). This finding aligns with Johnson's (1994) statement that a morphological feature is the substitution of a simple past form where a present participle would be expected (e.g., I've got two vessels *stood* by vs. I've got two vessels *standing* by).

	Third-person pronoun	Past-tense verbs
SSC	-1.06	-1.04
SB	0.34	0.11

Table 6. The comparison of third-person pronouns and past-tense verbs between two corpora in *Z*-scores

A further analysis of the *Z*-scores of two features demonstrates that the SSC corpus exhibits a lower frequency of third-person pronouns and past-tense verbs than the SB corpus (see Table 6). This can be attributed to the prioritization of clarity, brevity, and safety in SSC, which results in the use of ship call signs or the omission of pronouns instead of third-person pronouns. It is noteworthy that ships are sometimes referred to using feminine grammatical gender by seafarers (seafarers, including in-

service mariners, often refer to a vessel as *she*), as indicated in example 4. This distinctive linguistic feature of assigning feminine gender to ships remains prevalent in the English language as currently used at sea (Bocanegra-Valle, 2013).

Example 4 (ME-Erie-0601)

SM: Seaway Welland, Presco. What is your follow-up to Seville?
VTSO: Presco, Seaway Welland. You'll be meeting the Algo Titan in the pond. *She*'s loaded. *She*'s approaching Bridge 11 with time, and it's clear to call at mile 9 and again at Port Robinson for further inspection at that time, over.
SM: Copy that, thank you.

As observed, *received* is the only past-tense verb from the SMCP identified in the authentic SSC corpus, as shown in example 5.

Example 5 (ME-Detroit-0801)

SM: St. Jacques. Sarnia Traffic, Manitoulin.
VTSO: Manitoulin, St. Jacques, go ahead.
SM: Good morning, Sarnia Traffic, Manitoulin. We're secure here at Southwestern Sales West Windsor Dock. Expect to be here about six hours. On departure, we will be in ballast for Calcite, Michigan.
VTSO: Roger, *received* all.

4.2.3. D3: Explicit vs. situation-dependent reference

High scores on D3 indicate that the text does not depend on context for interpretation (Biber, 1988). Higher D3 scores are characterized by a greater frequency of WH relative clauses, pied-piping constructions, phrasal coordination, and nominalizations, and a lower frequency of place adverbials, time adverbials, and other adverbs (Biber, 1988). Table 4 demonstrates that there is a significant difference in D3 scores between the SSC and SB corpora (M=-0.3355, SD=3.25 vs. M=-1.6707, SD=1.38), with the SSC score being higher. This suggests that SSC is more context-independent than CE.

	Place adverbial	Time adverbial	Other adverbs
SSC	2.79	-0.15	-2.14
SB	-0.02	-0.39	-1.02

Table 7. The comparison of place adverbials, time adverbials, and other adverbs between two corpora in *Z*-scores

Place and time adverbials are used for locative and temporal references, often referring to places and times outside the text itself (Biber, 1988). A further examination of *Z*-scores reveals that the frequency of place and time adverbials in the SSC corpus is higher than in the SB corpus (see Table 7).

Ship-shore communication, typically conducted via VHF radio or other maritime communication systems, is highly task-oriented and occurs in a professional maritime environment. It involves interactions between ship crews and shore service operators to coordinate activities. This high-stakes context demands precise and explicit references to place and time to ensure clarity and prevent misunderstandings that could lead to operational errors or safety risks. In contrast, casual conversational English, such as informal chats among friends, is typically less constrained by operational needs. In these settings, place and time references are often vague or contextually implied (e.g., *meet me later* or *at the usual spot*) because interlocutors share common ground or rely on non-verbal cues. The lack of urgent, task-specific goals subsequently reduces the need for frequent or precise adverbials.

4.2.4. D4: Overt expression of persuasion

Low scores on D4 suggest an absence of overt persuasion, such as the explicit marking of the speaker's viewpoint or attempts to persuade the addressee (Biber, 1988, p. 111). Table 4 demonstrates that there is a significant difference in D4 scores between the SSC and SB corpora (*M*=-1.6555, *SD*=2.50 vs. *M*=-0.5593, *SD*=2.42), with the SSC score being lower. This suggests that the speaker's viewpoint in the SSC is less explicitly marked than in CE. Low scores on Dimension 4 are associated with the infrequent use of the modal verbs. Biber (1988) categorized modal verbs into distinct groups, which encompass predictive modals (e.g., *will*, *would*, *shall*); possibility modals (e.g., *can*, *may*, *might*), which indicate intention when used with a first person agent (e.g., I *will* go, I *may* do it); and necessity modals (e.g., *must*) that can mark the speaker's attempts to persuade the addressee that certain events are desirable or probable (e.g., you *should* go). These modals frequently function as indicators of the interactant's persuasion, reflecting their assessment of an event's likelihood or advisability (Biber, 1988).

	Necessity modals	Possibility modals	Predictive modals
SSC	-0.59	-0.3	0.34
SB	-0.47	0.31	0.88

Table 8. The comparison of modal verbs between two corpora in *Z*-scores

Table 8 shows that the *Z*-scores of modal verbs in the SSC corpus are lower than those of the SB corpus. As observed, common modals such as *must*, *can*, and *will* are often replaced by *be able to* and *be going to*, as indicated in example 6. The remaining modal verbs (e.g., *may*, *might*, *should*, and *could*) were rarely observed. This finding aligns with IMO's (2001) recommendations to avoid such conditionals, favoring the use of message markers instead. In fact, the necessity modal *must* is the only modal verb recommended by the SMCP (e.g., *You must rig another pilot ladder*) (IMO, 2001).

Example 6 (ME-California-0815)

VTSO: Sailing Vessels, hailing the Coast Guard. Do you have a visual on him? Over.
VTSO: Sailing Vessel, Coast Guard. If you'*re able to* render assistance, that would be great. If you could, just advise me. If you'*re not able to*, we're launching a small boat either way, over.
...
VTSO: Sailing Vessel, Coast Guard. Roger. Just to be clear, you *are or are not going to* render assistance to him over.
...
SM: We *weren't able to*...
VTSO: Captain, Coast Guard, roger.

4.2.5. D5: Abstract vs. non-abstract information

High scores on Dimension 5 indicate that the text conveys information using abstract, technical, and formal language (Biber, 1988). Low D5 scores are characterized by the infrequent use of conjunctions, by-passives, and agentless passives (Biber, 1988). Table 4 shows that there is a significant difference in D5 scores between the SSC and SB corpora (*M*=-2.9618, *SD*=0.79 vs. *M*=-1.7015, *SD*=0.88), with the SSC score being lower. This suggests that SSC is less abstract, technical, and formal than CE. A close examination of *Z*-scores reveals that the frequency of passive clauses and conjunctions in the SSC corpus is lower than that in the SB corpus (see Table 9).

	Agentless Passives	By-Passives	Conjunctions
SSC	-0.96	-0.61	-0.63
SB	-0.73	-0.51	-0.45

Table 9. The comparison of passives and conjunctions between two corpora in *Z*-scores

As observed, SSC often achieves cohesion by juxtaposing sentences rather than using explicit linking words, as indicated in example 7.

Example 7 (ME-New York-0601-1)

SM: Good afternoon, traffic. I'm checking in here. I'm southbound off Castle Point Hoboken with a loaded stone tow. We're going to be headed for Greenville Yard this afternoon. I have nine loaded stone boats made up in push gear. Overall length is 550, draft depth on the tug is 10. We'll be looking for a slow bell today.
VTSO: Captain, I currently have no reports. We'll be standing by channel 14.

Furthermore, a notable feature of SSC is the frequent omission of the verb *be* in standard phraseology (e.g., *gale/storm/typhoon expected in...at...; wide berth requested; berth changed to...; berthing delayed/occupied; anchoring prohibited; pilot delayed; pilotage suspended/resumed*), as illustrated in example 8.

Example 8 (ME-Detroit-0820-4)

SM: Sector, this is 49412. *Nothing heard*. Out.
VTSO: 49412, Sector. Where are you conducting the power trial?
SM: Sector, 49412, right outside of the Sector here in the Detroit River.
VTSO: Roger, good copy.

4.2.6. D6: On-line informational elaboration

High D6 scores indicate that a text is informational in nature but produced "on-line" or under certain constraints. Low scores on Dimension 6 indicate that the text is not produced online or under significant time constraints (Biber, 1988). Table 4 shows that there is a significant difference in D6 scores between the SSC and SB corpora (*M*=-2.0988, *SD*=0.68 vs. *M*=0.6720, *SD*=1.22), with the SSC score being markedly lower. This suggests that the SSC exhibits fewer features of online production than CE.

	That-clauses as verb complements	That-clauses on object positions	That-clauses as adjectival complements	Demonstratives
SSC	-0.48	-0.61	-0.48	-1.08
SB	-0.24	-0.02	-0.13	0.91

Table 10. The comparison of that-clauses and demonstratives between two corpora in *Z*-scores

The infrequent use of demonstratives and *that*-clauses, such as complements to verbs (e.g., *He anticipates that*...), complements to adjectives (e.g., *They are certain that*...), and *that*-clauses on object positions (e.g., *The scenario that they are in*...), is indicative of low D6 scores (Biber, 1988). Table 10 indicates that the *Z*-scores of the *that*-clauses and demonstratives in the SSC corpus are lower than those in the SB corpus.

As observed, *that* in SSC is used almost exclusively to refer to something already mentioned in a preceding instruction, as exemplified by phrases such as *copy that*; *roger that*, as shown in examples 9 and 10.

Example 9 (ME-Detroit-0801-2)

SM: We have two crew members getting on and two crew members getting off today.
VTSO: Okay, roger *that*.

Example 10 (ME-New York-0601-1)

SM: I am at Centerline Logistics, looking to depart and go to IPC Bayonne east of Pier 3 with the empty oil barge, Stoddard C. Overall length will be 380, deepest draft on the tug is 9 foot.
VTSO: Copy *that*.

5. DISCUSSION

5.1. Discussion on Dimension 1

SSC exhibited greater information density, as evidenced by the significantly lower score on Dimension 1. The lower scores on D1 are primarily attributed to a higher frequency of attributive adjectives, nouns, and greater word length.

In terms of nouns, the increased frequency may be partially associated with the reduced use of first-person pronouns. The use of attributive adjectives is more frequent due to the nature of traffic information messages, which primarily convey location and positional details (e.g., *port/starboard, fore/aft*) and directional information (e.g., *upbound, downbound, inbound, outbound, eastbound, westbound, northbound* and *southbound*). The increased frequency of these words may also stem from the reduced use of first-person pronouns. With many ships being managed simultaneously by the same VTSOs, there is a need for specific call signs for each motor vessel (e.g., *Ever Given HZDF*, *FNCX957*, *Matsonia WTKE*, *Aquarius WDE9309*, *MSC Joanna*), rather than pronouns. Likewise, VTSOs are identified by means of identification or calling station names (e.g., *Houston Traffic*, *Gibraltar Control*, *Istanbul Coast*, *Montreal Centre*, *Hamburg Port*, etc.) to avoid confusion.

This high frequency of nouns is also reinforced by the SMCP, which provides standard phrases for specific circumstances. These phrases are primarily concerned with safety information, such as the status of equipment (e.g., *cargo gear*, *pumps*, *engines or other machinery*), the sea and weather conditions (e.g., w*ind speed*, *visibility, and wave height*), and vessel position (e.g., *latitude/longitude, distance/bearing from a landmark*). The following types of information are often shared: estimated time of arrival at a certain position, estimated time of departure from the berth/anchorage, queuing information, pilot and berth arrangements, anchorage, etc. (Takagi, 2017). All such safety-related information is expressed by nouns (Takagi, 2017). This is also consistent with Takagi and Saito (2014), who found that nouns are the most frequent word class (367) in SMCP, followed by verbs (187) and adjectives/adverbs (178).

Word length and type/token ratio similarly indicate a high density of information, but they also reflect precise lexical choices, resulting in an exact presentation of informational content (Biber, 1988). Longer words typically convey more specific, specialized meanings than shorter words (Chafe, 1985). The greater word length in SSC reflects a greater reliance on standard phrases and terminology with highly specific meanings compared to CE. The finding aligns with Trenkner (2005), who notes that the SMCP prefers Latinisms and internationalisms (e.g., *assistance* vs. *help*, *require* vs. *need*, *transmit* vs. *send*, *proceed* vs. *go*). The SMCP also avoids contracted forms (e.g., *cannot* vs. *can't*, *do not* vs. *don't*, *have not* vs. *haven't*, *I am* vs. *I'm*, *I will* vs. *I'll*, *it is* vs. *it's*, etc.) and applies a "block language," which omits or sparingly uses function words (e.g., *the*, *a/an*, *is/are*) if they are not critical for communication. For example, the SMCP prescribes *I have damage below waterline*

instead of *I have a damage below the waterline*. By eliminating unnecessary words, content words take precedence in the sentence. Since ellipsis is prevalent, the percentage of short function words (like auxiliaries) is low. This is partially consistent with Takagi and Saito (2014), who found that content words constitute up to 732 out of the total of 800 items in SMCP.

5.2. Discussion on Dimension 2

SSC is more focused on non-narrative concerns, as illustrated by the significantly lower D2 score. The lower scores on D2 are attributed to the decreased frequency of employing third-person pronouns and past-tense verbs in the text (Biber, 1988). This can be attributed to the fact that clarity, brevity, and safety are prioritized in SSC, leading to the use of ships' call signs or *Traffic* instead of third-person pronouns. A lower frequency of past-tense verbs is consistent with SSC's focus on the immediate information exchange on current actions and instruction in real-time communication. Additionally, it is consistent with Franceschi's (2014) argument that the bulk of verbal interactions in spoken maritime English relies on the "here and now" of the speech event, with the imperative and present tenses dominating over past tense forms. The limited use of verbs related to prior activities serves solely to provide background context for the communicative event.

The infrequent use of past-tense verbs in SSC can be attributed to the following factors. First, SSC is highly immediate, focusing on present conditions, actions, and intentions. Consequently, the primary focus of the conversation is the resolution of those present circumstances. Second, SSC aims to convey information about the present situation to coordinate immediate and future actions, as VTSOs and ship crews discuss present and upcoming events. As Franceschi (2014) notes, the limited number of verbs that refer to past actions is employed solely to establish a context for the communicative event. Third, SSC is not only present-centered but necessarily future-focused, as voyage parameters change dynamically due to factors such as weather and traffic. Maintaining this future orientation is essential for adjusting plans accordingly.

5.3. Discussion on Dimension 3

SSC is more context-independent than CE, as illustrated by the significantly higher D3 score. The higher scores on D3 are attributed to the infrequent use of place and time adverbials, as well as other adverbs (Biber, 1988).

First, the use of place adverbials in SSC is necessary because ship-shore interactions focus heavily on spatiotemporal parameters. Place adverbials, such as *abeam*, *astern*, *to port,* or *to starboard*, are found in standard phrases to eliminate ambiguity regarding a vessel's position or trajectory, especially when navigating in

confined waters. This aligns with Franceschi's (2014) observation that the use of archaic terminology (e.g., *aground*, *adrift*, *astern*) that succinctly conveys fundamental nautical concepts is also indicative of conventionality in spoken ME. Second, regarding time adverbials, this context demands precise time references to ensure clarity and avoid misunderstandings.

5.4. Discussion on Dimension 4

SSC expresses speakers' points of view less explicitly than CE, as illustrated by the significantly lower D4 score. The lower scores on D4 correlate with a limited use of modal verbs.

Safety-critical maritime operations require unambiguous directives to mitigate risk. In this context, necessity modals clearly delineate obligatory actions that crew members are legally and ethically bound to perform. Predictive modals hold significance based on their context. Misunderstanding is common, particularly in SSC, and it has led to accidents (IALA, 2022).

Possibility modals, such as *can,* describe either the possibility or the capability of doing something. The IMO (2001) warns that *can* and *may* can create ambiguity. Consequently, the SMCP specifies that one ought to employ *Do I have permission to use the shallow draft fairway at this time?* instead of *Can I use the shallow draft fairway at this time?* (Franceschi, 2014). This recommendation results from replacing the modal verb with the auxiliary *do* and employing an object ellipsis. Additionally, the SMCP recommends using "*Do you read?"* rather than *Can you read me?* (IMO, 2001). If the context requires expressing capability, it is often conveyed through a paraphrase for clarity, although the verb retains its meaning of "being able to" (Franceschi, 2014). Reflecting this emphasis on precision, the IALA (2022) guidelines recommend avoiding *may/might*, *should*, *could*, and *can*, as they can lead to confusion.

5.5. Discussion on Dimension 5

SSC exhibits less abstract and formal language, as illustrated by the significantly lower D5 score. The low scores on D5 indicate the infrequent use of conjunctions and passives. Conjunctions (e.g., *and*, *or*, *but*, *because*) can introduce ambiguity regarding sequencing, options, and exceptions. In the time-critical context of SSC, decisions and information must be conveyed with directness and clarity, leaving little room for nuanced conditional phrases. Excessive conjunctions create wordiness without contributing to meaningful new information. Therefore, a more "stripped-down" grammatical style promotes unambiguous comprehension.

Regarding the infrequent use of passive clauses, the finding is consistent with Franceschi (2014) who argues that there is a prevalent inclination toward

conciseness in spoken maritime English. This is illustrated by cases where "superfluous" elements, such as articles and auxiliary verbs, are omitted, e.g., *I have leak below waterline*. *How many compartments flooded?* (IMO, 2001, p. 27). The finding also aligns with that of Lia and Ryoo (2017), who assert that a "block language" is utilized in SMCP, frequently excluding function words, such as *the*, *a/an*, and *is/are*.

Several factors contribute to the infrequent application of passives. As stipulated by the IMO (2001), active forms should be used to ensure efficient and unambiguous communication, such as *INFORMATION. Ship BRAVO is overtaking you* instead of *INFORMATION. You are being overtaken by ship BRAVO* (IALA, 2022). Regarding by-passives, they can obscure agent responsibility – a dangerous ambiguity in an industry where safety relies on each crew member performing clear-cut duties. Consequently, the examples shown in the SMCP are typically in active forms initiated by *Motor Vessel* (*MV*)or *I*, e.g., *I have / MV ... has problems with cargo/ engine(s) / navigation / ...* (IMO, 2001, p. 32).

5.6. Discussion on Dimension 6

SSC displays fewer features typical of texts produced online, as illustrated by the significantly lower D6 score. The lower scores on D6 reflect the restricted use of demonstratives and *that*-clauses. This finding is consistent with Johnson's (1994) argument that clause relations in ME are usually simple and paratactic, with rare hypotactic examples.

The avoidance of these features stems from the different communicative contexts of SSC and CE. In casual English conversation, speakers commonly use *this* or *that* to refer to physically present items within a shared context. Such contexts make it easier to identify the objects or concepts without the need for precise language. In contrast, SSC often focuses on time-critical operational updates, where the accuracy of details is more crucial than descriptive context. Communication in the maritime domain is task-oriented and occurs through speech between two interlocutors at different locations (Boström, 2020, 2021). In this non-shared context, demonstratives can introduce ambiguity. The use of *that* in SSC is therefore largely restricted to anaphoric reference – referring to a preceding instruction (e.g., *copy that*, *roger that*).

Similarly, the limited use of *that*-clauses – a form of subordinate clause – can be attributed to their potential to introduce ambiguity and create complex, less understandable sentences. Given that SSC occurs in a technical and safety- and time-critical environment, VTSOs and ship crews naturally refrain from utilizing such grammatically complicated structures.

6. PEDAGOGICAL IMPLICATIONS

The findings of this study offer pedagogical insights into the instruction and practice of ME as a field of ESP. The compiled SSC corpus, in particular, is a valuable resource for key maritime English stakeholders, including ME instructors, curriculum developers, instructional material writers, seafarers, and VTSOs, helping them fulfill their respective roles.

6.1. Implications for ME instructors

Regarding SSC instruction, the compiled corpus is a valuable tool for data-driven learning, enabling students to understand real-world contexts, acquire vocabulary, and improve their communicative competence. Specifically, the authentic SSC corpus can serve as an excellent resource, providing learners with realistic insights into SSC. Instructors can utilize the recorded transcripts to design in-class activities and simulations, such as role-playing exercises that mirror real-life interactions. For example, students can be tasked with responding to authentic scenarios using standard phrases. They can then compare their responses against those in the corpus, evaluating their output based on standard communication protocols. This approach not only enhances listening comprehension of real-life communication but also helps ensure that student production aligns with prescribed standard protocols.

Additionally, given the significance of vocabulary in ME instruction, authentic excerpts help learners understand how standard phrases are used in authentic contexts. A corpus-based approach not only aids in vocabulary acquisition but also supports the development and validation of technical wordlists. For instance, the corpus can be used to assess the coverage of standard phrases in authentic usage and to develop new technical wordlists as needed. Such an approach also enables students to develop independent vocabulary expansion strategies, enhancing their listening comprehension and term acquisition. Authentic materials from the corpus, when carefully selected and adapted to learner proficiency, can significantly enhance vocabulary retention (Elkasović & Jelčić Čolakovac, 2023).

6.2. Implications for curriculum developers and instructional material writers

The findings also have important implications for curriculum developers and instructional material writers. While the IMO model course outlines the essential knowledge and skills required of learners, along with instructional guidelines, it often falls short in providing comprehensive learning content. Incorporating authentic corpus data and transcriptions into curriculum development and

instructional materials is crucial for enhancing the comprehensiveness, functional utility, and contextual relevance of maritime English education.

First, the IMO model course syllabus treats grammar as equally important, organizing it in a linear fashion throughout the modules. However, the findings show that specific linguistic features in SSC occur with significantly different frequencies than in CE. The findings can help establish a hierarchy of syntactical and grammatical challenges, allowing curriculum designers to prioritize the most relevant structures. Furthermore, while it specifies the required knowledge and skills learners are expected to master and provides guidelines for instructors' practice, its limited learning content would be significantly enriched by the inclusion of authentic data and transcripts.

Second, the core sections 1 and 2 in the IMO Model Course 3.17 are based on the communicative approach to language teaching and integrated skills development (Jurkovič, 2015). The data profile of linguistic feature patterns and their communicative functions can be utilized to establish a function-notional syllabus. Material writers should organize educational content around these communicative functions, effectively integrating essential lexical, grammatical, and discourse features identified in this research. The authentic conversations and excerpts from the SSC corpus serve as invaluable resources for this purpose.

Third, the IMO Model Course 3.17 specifies that learners must be able to effectively utilize and comprehend ME across various contexts. The authentic corpus, which includes data and exchanges from different operational phases and diverse maritime environments, provides real-world scenarios that can be integrated into drills and activities to enhance students' flexibility, adaptability, and situational awareness.

7. CONCLUSION

Grounded in the MD analysis framework proposed by Biber (1988), this corpus-based study conducted a comparative analysis of SSC and CE to identify how SSC varies from CE in terms of linguistic features and communicative functions. The findings indicate that SSC is more informationally dense, non-narrative, and context-independent. It tends to be less abstract and formal, less explicit in expressing viewpoints, and is often produced under time constraints compared to CE. The findings provide both pedagogical implications for the instruction and insights into adherence to international standards for communication protocols.

However, the study has several limitations. First, the corpus is limited in size and scope. Regarding scope, the data were retrieved mainly from the USA, an English-speaking country, resulting in inadequate representation of non-native speaker interactions. Additionally, the corpus only covers ship-shore communication, excluding ship-ship and onboard communication interactions. Second, while the MD analysis provides insights into linguistic variation, it does not

fully address pragmatic or cultural factors in multilingual ME contexts. Substantial expansion of the corpus is essential in future research to gain a more comprehensive understanding of ME as ESP, particularly in its role as a lingua franca employed in multilingual settings.

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