Manuscript received December 14, 2018; initial decision January 21, 2019; revised February 11, 2020; accepted February 12, 2020. Date of current version: March 19, 2020.

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This paper has supplementary downloadable material at http://ieeexplore.ieee.org provided by the translators. The files consist of a Chinese translation of the abstract by Z. Xi (XXX kB in size), a Spanish translation of the abstract by R. Anido (XXX kB in size), and appendixes by the author (XXX kB in size).

Research Article

The Use of Multimodal Resources by Technical Managers and Their Peers in Meetings Using English as the Business Lingua Franca

—TIINA RÄISÄNEN

***Abstract*—Background**: *Engineers increasingly work and advance their careers in international business settings. As technical managers, they need management and technical skills when working with different stakeholders with whom they may not share a common first language. Studies have revealed that informal oral communication skills are of prime importance for global engineers who face challenges in building shared meaning and formulating clear messages in meetings with non-native speakers of English. This article proposes that studying the use of multimodal resources (spoken*

language, gaze, gestures, and objects) in meetings can unpack how work tasks are accomplished in business through different communicative strategies. **Literature review**: *This paper focuses on engineers' and technical managers' needs and challenges in professional and intercultural communication where English is used as a business lingua franca (BELF) in multimodal meetings. While multimodal conversation and discourse analytic studies highlight the dynamic nature of meeting interaction, previous technical and professional communication and BELF research on multimodality is limited.* **Research questions**: *1. How do technical managers use multimodal resources to articulate their ideas in BELF meetings with their peers? 2. How does the use of multimodal resources contribute to the construction of shared meaning in explanatory, consensus-seeking, and solution-finding communication?* **Methodology**: *This study reports on two case studies and multimodal discourse analysis of video-recorded meetings among technical managers and their peers in four companies. The use of multimodal resources is analyzed in explanatory, consensus-seeking, and solution-finding communication.* **Results and conclusions:** *In BELF meetings, assemblages of spoken language, gestures, tools, whiteboard, and documents contribute to constructing shared meaning. This study has implications for global professional and engineering communication. Future research should further examine multimodality in BELF meetings.*

Index Terms*—Engineering communication, English as a business lingua franca, gaze, gesture, meeting, multimodal discourse analysis, object, technical manager.*

As a result of the globalization of business operations, engineers increasingly work and advance their careers towards management positions in international settings. In the

globalized workplaces of many large, small, and medium-sized enterprises, engineers as well as technical and professional communication (TPC) professionals need good oral communication skills when communicating with different stakeholders [1]–[3], with whom they may not share a common first language (L1). These communication situations are ever more diverse and multimodal. Coping with this diversity requires the ability to operate not only with language but also with embodied (gestures, gaze) and material (objects, artefacts) resources.

TPC scholarship has acknowledged the oral nature of much engineering communication and the importance of communication and collaboration skills for succeeding on the job [4], [5]. In particular, engineers need skills to construct effective messages that are clear, concise, and logical, thus making informal oral communication the most important skill [6]. Research has shown that in these increasingly intercultural workplace settings [7], [8] where a shared language is needed especially for oral communication, English is often chosen as the lingua franca [9], [10]. This fact presents global engineers with challenges of accommodating to the many different ways of speaking and using English to which they are exposed, presenting technical material clearly, and using appropriate nonverbal signals to minimize miscommunication [11].

Earlier research highlights the importance of nonverbal communication skills for global professionals [12], [8]. As Freeman [12, p. 161] declares, “effective conversation involves much more than words,” a situation for which many engineering professionals will not be prepared. Engineering students commonly assume that their accent or limited vocabulary cause understanding problems for their interlocutor, without acknowledging other conversational factors causing miscommunication, such as the lack of expected

nonverbal or paralinguistic interactional features. The ability to use multimodal resources should be recognized as a necessary part of global engineers' competence.

Technical managers require this kind of competence when working with subordinates and peers, and helping them understand their individual tasks and organizational goals. In settings where English is used as a business lingua franca (BELF), these tasks are particularly challenging because of participants' differing language proficiency and unfamiliar accents. The BELF concept refers to a shared resource among business practitioners who do not have a common L1. It manifests in different ways in interactions where the main goal is to get the job done (e.g., [13]–[15]). BELF [10] is different from the more general notion of English as a lingua franca (ELF) [16], [17] because BELF interactions occur in the international business domain, the participants are professionals, and the goal of their interactions is to complete the task in hand and create rapport.

In BELF interactions, practitioners use different linguistic strategies, such as repetition and paraphrasing, to ensure mutual understanding, prevent miscommunication, and formulate a clear message. A common denominator of BELF interactions is cooperativeness, seen, for example, in participants' orientation to providing feedback to move the conversation forward [18]. Some BELF studies have investigated multimodal resource use in interaction [19]. For instance, active listening and backchannelling cues in verbal and non-verbal form have been found helpful in oral communication [18], while in written texts, the use of visuality (design features and diagrams) has been found to aid comprehension [20].

Although some research has been carried out on multimodal resource use in BELF meetings, most studies, also on workplace meetings in general, have focused on the linguistic dimension (e.g., [21]–[23]). To date, no research has investigated the use of multimodal resources in technical BELF meetings. This paper addresses this gap with two research questions.

> **RQ1**. How do technical managers use multimodal resources to articulate their ideas in BELF meetings with their peers?
>
> **RQ2**. How does the use of multimodal resources contribute to the construction of shared meaning in explanatory, consensus-seeking, and solution-finding communication?

Here, following Barclay [24], the term "technical manager" (TM) refers to a person with training in a particular technological discipline (in this case, mechanical engineering) who has progressed to a managerial position within that discipline. To answer the research questions, this paper draws on longitudinal ethnographic data from two case studies with two TMs and uses multimodal discourse analysis [25]of video-recorded meetings collected in four companies. More specifically, the use of multimodal resources (i.e., spoken language, gaze, gestures, and objects) is investigated in explanatory, consensus-seeking, and solution-finding communication, because the two TMs identified challenges in these areas. This paper shows that multimodal resources aid communication between technical managers and their peers and contribute to constructing shared meaning. By focusing on technical BELF meetings, the study contributes to both TPC

and BELF scholarship and to the discussion of the multimodal and multilingual nature of work interactions.

The next section reviews relevant literature that combines TPC scholarship on engineering communication, sociolinguistic research on BELF, and multimodal conversation and discourse analytic meeting studies. Then the paper presents the research methodology and the themes emerging from the results. Following a discussion, the paper concludes with implications for practice and research, and suggestions for future research.

LITERATURE REVIEW

Engineering Communication in Global Settings The skills repertoires of many engineers in multinational companies extend beyond uniform national, cultural, contextual, and disciplinary settings [26]. Earlier research reveals that conversation and informal oral communication constitute the most important engineering communication skills and are an essential element in technical training and professional life [6]. For instance, Darling and Dannels' [6] survey of 123 mechanical engineers' communicative practices suggested that a large proportion of engineering work gets done and productivity is created and sustained in oral communication, with meetings and informal or interpersonal situations in small teams and groups being the most important types of oral communication events (41%; for similar results, see [27]).

However, the respondents most frequently identified managing these situations successfully as their most immediate area of need. Engineers require skills to listen, negotiate and articulate ideas in meaningful ways for different stakeholders: a technical

discourse audience, co-workers, salespeople, and buyers [6, p. 13]. Engineers therefore value the skills required to construct effective messages that are clear, concise, and logical.

Trevelyan's [27] ethnographic research in South Asian and Australian companies showed that engineers frequently work with others in the same organization and influence others' work by taking part in executing the work and helping recognize mistakes and misunderstandings to prevent delays and unnecessary costs. Earlier work has thus identified a need to further investigate the ways in which ideas are articulated in technical disciplines, numerical and visual systems are reframed as verbal arguments, and communication and interpersonal skills are manifested "at the microscopic level of individual interactions between people," including interpersonal verbal and non-verbal communication and the selection of appropriate communication strategies [27, p. 198].

During their careers, engineers often become managers. As TMs, they need management, leadership, technical, and interpersonal skills when working with their team members and possible subordinates [28], including helping them understand their individual tasks and broader organizational goals [29], both technically and professionally [30]. Especially managers who have transferred from the role of technical expert to a management position often experience challenges in working with other people [31], [32] while still continuing to perform their special responsibilities as technical experts [29], [32]. In such situations, not only do TMs need to be able to communicate effectively with subordinates [33], but they need to be able to do all of this in a BELF environment, which adds to the demands and the complexity.

Many engineering professionals in international companies interact with people with whom they do not share a common L1 [9] and opt to use ELF. As Melton [8, p. 147] points out, communicating in a lingua franca is different from communicating in one's L1, so professional communication programs should not automatically take "common American communication practices as universal". Based on earlier research, engineers have difficulties communicating with non-native speakers of English and presenting technical material clearly [34], and in joining a fast-paced conversation full of idiomatic expressions, varying accents, and unpredictable shifts in topic [12].

Freeman's example is telling of the importance of communication and nonverbal skills in lingua franca settings. One of his students looked at the floor while listening to others, and sat in silence for several seconds before responding, unaware that his own lack of backchannelling cues caused him to be excluded from the conversation. The student later learned that by using such cues, he could show his listeners that he was paying attention and thereby encourage them to wait a few seconds while he formulated his response. Practicing engineers, then, should learn to communicate effectively in intercultural encounters in the English language. However, engineering programs do not yet adequately address this need, nor do they seriously discuss what adaptation in spoken and written communication means in practice [7].

English as a Business Lingua Franca According to Kankaanranta and Louhiala-Salminen [16], the BELF concept [10] was developed to distinguish it from the more general notion of ELF [17] in three main ways: BELF interactions occur in the international business domain, the participants are professionals, and the goal of their interactions is to get the job done and create rapport. These goals can be achieved

because professionals belong to business communities of practice (CoPs): they are mutually engaged with each other, and they share a common purpose and goal, and a repertoire of resources for negotiating meaning [35, pp. 72–73], [36], [16]. With the CoP as an analytical tool, most BELF studies investigate language use and linguistic aspects as embedded in the social context.

Studies of practitioners' perspectives and their actual interactions show that the linguistic strategies used to ensure mutual understanding and successful interactions constitute a special lexis relating to business in general and professional expertise in particular. For professionals, linguistic correctness and native-speaker-like language use are not requirements, and simplified English is accepted [37]. Participants focus on being cooperative, accommodative, and supportive. They may negotiate linguistic norms in their interactions. Successful communication in BELF involves clear delivery, careful speech, supportive chairing, paraphrasing, checking, and creativity [37], [13], [14].

Studies of negotiations have revealed the importance of showing active listening through the use of verbal and non-verbal backchannelling cues (e.g., *yes*, *yeah*, *mmhm*, *okay*, nodding, and smiling) [18]. After all, feedback signals are one of the main ways in which cooperation is pursued in dialogue and a prerequisite for achieving shared understanding [38, p. 118].

Few BELF studies have investigated multimodal resource use. There have been investigations of miscommunication moments in a university setting (e.g., [39]). Another study looked at mediation practices in a meeting in an engineering company, where the interlocutors combined different multimodal resources in their explanations of technical

processes [19]. In general, there have been calls for more contextual approaches to understand business communication in all its complexity [22].

Multimodality This section reviews relevant literature on multimodality, including social semiotic, spatial, and embodied approaches.

As Melton [8, p. 147] points out in the context of TPC, communicative competence must recognize what Hall (1976, cited in [8]) calls "the total communication framework," including "words, actions, postures, gestures, tones of voice, facial expressions, the way [a person] handles time, space, and materials, and the way he works […]". The total communication framework addressed in sociolinguistics draws from Hymes' [40] communicative competence and Gumperz's verbal repertoire containing "all the accepted ways of formulating messages" [41, pp. 137–138].

Work on individuals' communicative repertoires [42], [43] has investigated what communicative resources individuals draw on in social situations and activities. As shown in a study of languages, gestures, and body behavior in multilingual service interactions, communicative resources are multimodal and include linguistic, embodied (gesture, gaze), and material (objects and space) resources. In communication people "make meaning through repertoires of signs which integrate verbal and non-verbal action" [44, p. 255]. Language is thus a part of a broader semiotic or multimodal repertoire [19].

The resources available to people affect their possibilities in interactions. For example, engineers can draw on artefacts and objects available in the meeting room to articulate their ideas to others ([19]; see also [45]). This study aligns with spatial approaches to

interaction that draw on new materialism, post-humanism, and actor-network theory to investigate the active and changing ways in which space, materiality, and the environment, manifested as multimodal resources, are used by participants in interaction [46], [47]. The body is also seen as central in language production, perception, and social interpretation, and thus in communicative strategies (see [48, p. 175]).

These spatial and embodied orientations view language knowledge, agency, and cognition as distributed among participants, rather than residing in individuals' heads and minds as internalized systems and possibilities [48], [47]. Successful professional communication is viewed not as the result of perfect mastery of linguistic structures, such as grammar, but rather as the outcome of an appropriate combination of various multimodal resources in local interaction [46]. These combinations constitute *assemblages* [49] out of which meanings emerge. Hence multimodal resources work together to achieve meaning rather than certain resources (such as linguistic) working alone.

Although some resources may already be part of an individual's repertoire, others are assembled *in situ* and in collaboration with others [46]. This approach is similar to Kress and van Leuween's [50] social semiotic approach to texts, which draws on Halliday's [51] systemic-functional linguistics, where various multimodal signs are seen to contribute to meaning-making. In mediated approaches, following Scollon [52] and Scollon and Scollon [53], every action is viewed as mediated by various multimodal means that extend beyond the immediate context, namely to social, cultural, and historical layers (e.g., [25] and [54]). The layers then interact in complex ways in a nexus

of actions. Multimodal approaches can be applied to various types of communicative practices. This study focuses on multimodal resources in technical meetings.

Multimodal Resources in Meetings This section reviews the literature on the multimodal approaches applied in meeting research, including studies on gesture, gaze, and material use. Although some studies have investigated multimodal resource use in meetings, Asmuß [55] points to a text bias in meeting research. Mondada [23] argues that research on multilingual meetings has neglected the multimodal dimension, including gaze, facial expressions, gestures, and body posture, with the exception of a few conversation analytic studies (see [23] for a review).

Gesture studies (e.g., [56], [57]) are often applied in the study of multimodality in social interaction. For example, McNeill [56] distinguishes gestures based on their occurrence with speech, their established meaning, and their linguistic features. Together with speech, gestures can function as deictic—for instance, pointing to objects that are visible in the environment. Conversation analytic work in a telecommunications control center has shown how pointing gestures often co-occur with deictic expressions such as *this* and *these* [58]. They can be used to help understand a referent (e.g., tool, document) that is omitted [19]. Iconic gestures, on the other hand, demonstrate meaning—for example, by elaborating the shape or size of an object, depicting pictorial content, and mimicking what is communicated verbally [25, p. 29]. The following example illustrates how both spoken language and gestures (in *italics*) communicate meaning (adapted from [19]). See Appendix A in the supplementary materials for a key to the transcription.

Extract 1

43	Tero	so we make a ↑pressure
		((both hands in the air, twisting move))
44		<not going> through (0.8)
		((left hand sliding back and forth))
45		pressure (.) both sides.
		((both hands in the air, twisting move twice, gazes at J))

In the example, Tero, an engineering professional, gestures "pressure" with a twisting move, "not going through" with his left hand sliding back and forth, and "both sides" with both hands in the air, making a twisting move twice.

According to earlier research, actions performed with the body serve important interactional functions, such as conversational alignment [52, p. 92], turn-taking, and displaying speakership (see, e.g., [59] on pointing gestures). Even without our being aware of it, our bodies communicate meaning [53, p. 51, 58]. For instance, gaze can have various functions in interactions, affecting turn-taking and directing the recipient's attention [60]. Mondada's [61] study of a multilingual meeting among scientists demonstrates how gaze direction and body position are central in signaling participation. Moreover, in a technology-mediated environment, the verbal, body, and technological artefacts are coordinated in opening a business meeting [62].

Studies also show how material resources, particularly objects, shape interactions. For instance, in study-counselling meetings [45] and in a telecommunications control center [58], objects and artefacts contributed to conveying the intended meaning and making sense of other people's actions. Objects can function as interactional participants in the production of action, social meaning, and subjectivity [63], and as social actors mediating knowledge [64]. Some studies have analyzed white boards and notes used in meetings (see also [65]). Yates and Orlikowski's [66] study of advertising agencies, consulting firms, and high-tech companies suggests that PowerPoint presentations, as one type of material resource, both enable and constrain human action.

To summarize, meeting researchers have drawn on different disciplines and research traditions to understand participants' meaning-making with multimodal resources, focusing on one particular resource, such as an object or embodiment, or on a combination of resources.

METHODOLOGY

This section explains the study. First, I introduce the two cases and the data collected. Then I give an overview of the types of communication purposes studied and the analytical tools.

Two Case Studies Since engineering communication, multimodal resources in meetings, and BELF have all been studied recently but separately, I chose to conduct multi-sited ethnographic [67] case study research [68] of two TMs (pseudonyms Oskari and Tero, both male with Finnish as their L1) working in global business environments, and collect different types of BELF meeting data from the TMs' employer companies (N = 4)

between 2008 and 2018. Most earlier multimodal studies have concentrated on a single company or setting [45], [61], [65]; this study uses data from different settings to give breadth to the interpretations and enhance validity. These TMs were selected for the study because they participated in a longitudinal study of trajectories of socialization into global working life that began in 2003 when the TMs, as engineering students, had internships in Germany as part of their mechanical engineering studies at a Finnish university.

Both participants have moved up the career ladder from project management with technical responsibility to operational management with profit responsibility, where they continue to perform technical specialty responsibilities [29], [32] (see Appendix B in the supplementary data). Oskari, as a project manager (PM) in an engineering company, managed projects in China, following project workers' tasks, instructing the engineers, and solving technical problems. He mostly used Finnish and English when writing in Finland, and in China, where he spent about a third of the year, he used English with the Chinese workers. Several years later, as an operations manager (OM) in a Finnish company providing services and solutions to customers, Oskari lived in China and had more than 100 subordinates (most L1 Chinese). In his work, Oskari supervised the department managers (DM) in their team work.

Tero's job as a global business developer (GBD) and research and development (R&D) manager in a small engineering works in Finland included business development in the Asian markets, particularly in China, where the company had a subsidiary specializing in product manufacturing. As a key contact person to the subsidiary, Tero instructed Chinese staff via email and messenger chat, and in technical meetings. As the chief

executive officer (CEO) in a startup company, Tero held a technical expert role regarding the core product, a digital training stick. During product development, Tero interacted in English with subcontractors, discussing technical solutions in the stick via email, chat and Skype. Both TMs participated in various types of meetings with their peers and subordinates, the topics of which ranged from subsidiary issues (invoicing, logistics) to technical specifications and recruitment.

Data Collected Similar to earlier TPC and BELF research on practitioners' views, this study used interviews to identify the challenges faced by TMs in BELF meetings. To study multimodal resource use, meetings were video-recorded. The data collected in 2008–2018 was recorded by the Author (A) and the participants themselves (P) with an audio- or video-recording device (video camera or mobile phone) in Finland and China (see Appendix C in the supplementary data).

The interviews were conducted face-to-face at the participants' workplace or home, or via Skype or phone. Most of Oskari's meetings as PM were recorded in the negotiation room in China, where he worked during his trips there. The room had a large table, chairs, a whiteboard, and a screen that Oskari often used in meetings with local workers to display Excel files with core project details in them (see Fig. 1). Some meetings were also recorded in the kitchen and the factory (see Appendix D in the supplementary data).

Oskari's meetings in the OM position were recorded in the shared negotiation room and in his own office (Fig. 2), which had a desk with a computer, a table, two sofas, a whiteboard and a screen.

Tero's meetings in 2009 were recorded in a shared office and in a corridor at the workplace in Finland during the visit of two Chinese subsidiary colleagues and a supplier (see Fig. 3). In the office, Tero had a computer and a large table shared with a Finnish engineer. In the corridor, the company's product was on display.

Tero's meetings as CEO were held via Skype between Tero and a mechanical designer in India. Tero recorded them with his mobile phone (see Appendix E in the supplementary data).

These meetings were selected for recording in line with nondisclosure agreements made with the participants and employers. The data are not openly accessible. All names are pseudonyms, and references to confidential issues have been removed. The examples in this paper have been checked by the participants and modified in response to their requests to ensure anonymity. The study did not require approval from a research ethics committee.

Aligning with qualitative research methodology, the study uses an inductive analytical framework including three types of activities: reducing the data, creating thematic categories, and drawing conclusions based on categories [69]. All of the data have been roughly transcribed and thematically grouped into types of meetings, participants, topics, and the multimodal resources used in the meetings.

Communication Purposes in Meetings In the interviews, the TMs refer to three main types of communication purposes in which they identified challenges: explanatory, consensus-seeking, and solution-finding. Particularly as technical experts, they often explained product properties, functions, or manufacturing processes. They described to

the researcher the difficulty of knowing whether one's message had gotten across to Chinese engineers. To ensure that they were understood and to present technical material clearly, they would use repetition, gestures, and pictures in explanations (see also [11]). For example, a visible product can be examined and referred to with language and gestures, but explaining machining and production requires more resources. Challenges arise in explanations if the product is not visible. In various meetings, a document projected in printed or digital form is the center of attention and examined and pointed to. The document aids meaning-making and finding consensus and common ground. Oskari drew and wrote on the whiteboard especially when seeking consensus in meetings.

Solution-finding was part of the TMs' everyday tasks, and one of the challenges they faced. As an OM, Oskari often discussed emerging problems and challenges with DMs and Team Leaders (TLs). In the internal meetings with the DMs, Oskari followed his management strategy and encouraged the DMs to express their own opinions rather than giving his opinion first, and to show initiative instead of relying on him as the boss.

Multimodal Discourse Analysis I reviewed the entire recorded meeting data (a total 41 meetings, approximately 20 hours) to identify the communication purposes. Then I analyzed multimodal resources used in the data. The present multimodal discourse analysis draws on spatial (assemblage) and mediated approaches, particularly Norris's [25] framework of communicative modes, including spoken language, gestures, gaze, body position, proxemics and objects, multimodal conversation analysis, gesture studies, and the literature on embodiment and materiality.

The analysis draws on the notion of contextualization cues [70], which participants use to infer the meaning of messages. For instance, a coparticipant's gesture may function as a contextualization cue in the inference process. The unit of analysis is mid-level action [25]. Although meetings are higher-level actions, explanations constitute lower-level actions, which are smaller interactional meaning units formed by different modes [71] or assemblages. Some actions operate on an even lower level. For instance, in the mode of gesture, a gesture unit is also regarded as a lower-level action [71]. The mid-level actions described in this paper constitute actions in which multimodal resources are assembled in explanations of the product (Extracts 2 and 5) and production process (Extract 3), consensus-seeking communication (Extract 3), and solution-finding communication (Extract 4). These extracts are presented in the Results section.

The multimodal data and analytical framework are illustrated in Fig. 4, where Oskari explains to Kevin (an engineer, L1 Chinese) the properties and location of a metal sheet that will be installed in a factory.

The multimodal transcription, applying Jefferson's [72], Goodwin's [73] and Mondada's [23] conventions (see Appendix A in the supplementary data), is designed to support the arguments, providing the reader as clear a presentation of data as possible to illustrate the assemblages of multimodal resources used for communication purposes. Some modes were omitted from the transcript to enhance the clarity of presentation. Gestures have been marked with italics and placed below the corresponding speech or pause in the same temporal position. Gaze direction is marked with text, and gaze shift with an arrow. The transcript in Fig. 4 begins with topicalization of the issue. Oskari does this with *this sheet you know* with his hands lifted above his head. The analytical focus is on the multimodal

assemblage: spoken language (*it's blowing from the up*), gaze, and an iconic hand gesture (right hand lifted and moving forward) to illustrate the sheet location, which is not visible in the immediate environment. Finally, the analysis describes the effect of the assemblage on listener feedback (e.g., [18], [38]).

RESULTS

This section reports the results of the qualitative analysis of the TMs' use of multimodal resources to articulate their ideas in technical BELF meetings with their peers, and the ways in which multimodal resources contribute to constructing shared meaning in explanatory, consensus-seeking and solution-finding communication. The analysis also identifies the feedback elicited from the multimodal resource use.

Explanatory Communication First, I will continue from Fig. 4, in which Oskari explains the technical details of the metal sheet (Extract 2).

Extract 2

387 Oskari and then there is just the:

((*right hand down*))

388 ((*sliding right hand forward*))

389 ((*lowers right hand, slides it forward*))

390 aa: cover sheet there with a:

((*tapping x3 in the air with forefingers*))

391 or sheet with a lot of holes

((*tapping x4 in the air*))

392 Kevin aa aa yes

((*gazes at Oskari, nods*))

Oskari first gestures the cover sheet and then verbalizes it (lines 388–390). Similarly, the semantic properties of the sheet are shown with gestures, first tapping in the air three times and then, after a verbal description, four times. Clearly, the semantic tapping gesture conveys meaning and contributes to the interlocutor's gradual understanding of the message (see also [60, p. 281]), as Kevin's positive response shows (line 392). Gestures also depict knowledge that is not verbalized, such as the sheet location (line 383 in Fig. 4). Speech and gestures are also assembled [57] in depicting qualities, locations and movement. The resource assemblage illustrates Oskari's task of ensuring that local engineers know about the products.

Explanatory and Consensus-Seeking Communication This section extends the discussion to include consensus-seeking with explanatory communication. In Extract 3A, Tero, James (engineer, L1 Chinese), and Ville (engineer, L1 Finnish) are standing in the corridor around the product that the Chinese engineers are supposed to start manufacturing. They discuss machining and the product qualities by assembling speech, iconic and deictic gestures, and object use. First, Tero evaluates the machining (line 275), which he demonstrates with a small sliding movement with the forefinger of his right hand. Then the participants discuss a special machining technique (pressing).

Extract 3A: 180209_4

275 Tero this is much more tricky to machine than the [hook]

((slides right hand forefinger on the part))

276 Ville [much] more much

more

277 James @yeah@ heh

((gazes at Tero, nods))

((Tero smiles, gazes at Ville, right hand forefinger on part))

278 (2.8)

279 Tero and (0.5) also the threads are not making by machining

((pen on part, gazes at part))

280 it's making (0.7) eihän tätä tehä koneistamalla tätä kierrettä

((this thread is not made by machining right))

((gazes →Ville, pen on part))

((James nods, gazes at part))

281 sehän tehään sillä manglaamalla

((it's made by (mangling)))

((*gazes at Ville, pen touching part, James & Ville gaze at part*

282 (1.0)

283 Ville joo se kierteeseen kierre tehään manglaamalla [joo (tuolta)]

((yes to the thread; thread is made by mangling (([yeah (from

there)]))

((gazes at part→Tero))

((James glances Ville))

284 Tero [niin↑ niin]

((yeah yeah))

285 (2.0)

((Ville's right hand slides on top of part, Tero's pen on part))

286 Tero °joo°

((yeah))

287 and this aa: threads (0.4)

((gazes at part→James, pen on part))

((James gazes at part →Tero))

288 you do[n't make it]

((James gazes at Tero → part, nods))

289 Ville [made by pre]ssing

290 (0.2)

((Ville's right hand makes circle, gazes at James))

((Tero's pen on part, gazes at James))

291 Tero yeah pressing not machining

((*gazes at James →part →James*))

((*James gazes at part*))

292 James o:k

((*gazes at part, nods))*

Ville echoes Tero's evaluation (line 276). Then Tero starts verbally explaining how the threads are not made (line 279). He turns his gaze to Ville, from whom he requests confirmation in Finnish (lines 280–281). Here, Tero is claiming a novice role in a socialization process, treating Ville as the information provider (see also [74]), as a mechanical engineer who is the expert in threading. In his explanation, Ville assembles Finnish and a sliding hand movement above the part (line 285). Ville's hand gesture helps to acknowledge James, who does not speak Finnish.

Tero's feedback indicates the receipt of a preferred response. After a pause, Tero's gaze shifts to James to whom he explains how not to make the thread in English (lines 287–

288), again acknowledging James' participation. Then Ville overlaps with an iconic sliding hand gesture (line 290) to confirm that the thread is made by pressing (line 289). The situation continues with Tero asking James if he knows the process by which these kinds of threads are made (see Extract 3B in Appendix F in the supplementary data).

Tero's confirmation checks with James about the production of the threads indicate Tero's doubts about James' understanding. Tero assembles the deictic *this* with a gesture, pointing his pen to the relevant machine part (line 293). James asks for clarification (line 295). Ville collaborates by providing the term *thread*, which James then repeats.

While Tero illustrates pressing with an iconic gesture (right hand moving down), James slides his hands (line 301). Ville accepts this explanation (in the omitted lines); however, he produces a different, cyclic gesture [75] in opposite directions with his closed fists. After James's *yes*, Ville continues saying *two rolls*, now with his forefingers making the same cyclic gesture (line 309). Although James seems to be starting to say something related to this response (line 310), Ville's overlapping rolling hand gestures indicate that James' different gesture is treated as an insufficient indicator of understanding. Nor does James' *yes* (line 308) show his understanding. In line 312 James repeats *two* but says *parts*, with his hands coming together. Ville then repeats his earlier message (line 313). Then, James repeats the same sliding gesture for the third time and says *like this* (line 316). Although the participants' positive linguistic feedback suggests their reaching of sufficient understanding, their contradictory gestures indicate a different kind of feedback, and therefore a different understanding of pressing.

Explanatory and Solution-Finding Communication As an example of solution-finding and explanatory communication, in Extract 4A, a printed project log is at the center of attention, mediating core business information and functioning both as a resource in solution finding and as an affordance to the subsequent action of writing on a whiteboard for the purpose of summarizing [76]. While the printed document is fixed and non-modifiable, the writing action and whiteboard allow for more dynamic meaning-making.

Oskari, Chris (DM, L1 Chinese), John (TL, L1 Chinese), and Mike (DM, L1 Chinese) are solving an urgent problem—estimating the amount of overtime required from employees to compensate for a labor shortage on a customer site. Before the discussion in Extract 4A occurs, the participants, having heard the problem, have concluded that other customer projects need to lend workers to the site in need. This conclusion forces the participants, led by Chris, to investigate the current status of different projects. He brings a printed Excel file of his teams' project log to the office and moves towards the sofa to invite others to inspect the document.

Extract 4A: 271016_12

12 Chris okay so is this thing that erm

((walks towards sofa with pen in hand, gazes at document))

LINES OMITTED

16 Oskari it will happen?

((gazes at document))

17 Chris yeah it will happen very soon yeah

((others gaze at document and walk toward it))

LINES OMITTED *((participants sit around the document))*

21 Chris we add there one hundred

22 Oskari ahaa

LINES OMITTED

30 Chris this we can borrow this (Ewan) I think we

can borrow from Ningbo guy

((writes on document's margin))

31 John (Ewan)

((Oskari's left finger moves right→left on document, gazes at doc))

32 Chris it's temporary work

((points pen to spot where Oskari started underlining, gazes at doc))

33 Oskari okay

In line 12, Chris initiates the activity of inspecting the project log by verbalizing a move and walking towards the table, looking at the document. The others gather round the table and Chris begins to explain his projects' status using the document, speech, and embodiment. In line 16, Oskari seeks Chris's confirmation of the realization of a project with a declarative statement. Uttered with rising intonation, the statement functions as a question targeted to Chris, although Oskari meanwhile is gazing at the document instead of at Chris. Chris confirms that the specific project will happen (line 17). The deictic reference *this,* a verbal explanation, and pointing gestures to specific document sections are assembled for this purpose.

During Chris's explanations, Oskari's embodiment shows his reading of the document: by moving his left forefinger along the page from left to right he highlights a specific section (line 31, Figure 11). Chris's reply (line 32) indicates that he treats this as a question or a check (see [45] for similar object use). Oskari's embodiment can also be interpreted as reserving a turn [59]. The assemblage of document and Chris's explanation contributes to Oskari's subsequent actions. He stands up and writes *capacity* and *3800* on the whiteboard. Interestingly, although Chris says *three eight,* Oskari writes 3800, because earlier Chris had said how they add one hundred (line 21). While Oskari is writing, the others discuss in Chinese the number of people needed. Then Oskari asks how much overtime they should schedule (see Extract 4B in Appendix G in the supplementary data).

Oskari returns from the whiteboard, leans toward the document and asks about the exact amount of overtime (line 69), despite probably having heard the amount earlier. Others respond (lines 70–85). Oskari then returns to the whiteboard, writes the letter "h" after

"3800," and slowly says *okay*. Then he produces a confirmation check (line 89) which, as executed through language, has been identified as typical of BELF meetings (see also [19]). Here, the check emerges in the multimodal assemblage: the writing activity, the whiteboard use, and speech (a question). Oskari's body position indicates his awareness of this function: he does not say the number that he is writing, with his gaze on the whiteboard, and thus assumes that the others are looking at the whiteboard. After John and Chris provide positive feedback, Chris repeats the amount of capacity. Finally, Oskari asks for Chris's confirmation of the capacity, which Chris gives. When exact mutual understanding is required, multimodal resources are crucial in monitoring understanding.

Another example of explanatory and solution-finding communication comes from a Skype meeting between Tero and an Indian mechanical designer (Arjun, L1 English). Initially, Tero had sent Arjun an email explaining the functions of the exercise stick they are going to start producing and his aim of finding a supplier to develop the end cap for the stick. At the beginning of the meeting, Arjun admits that they had not completely understood the basic functions of the stick. In response, Tero grabs the stick, makes it visible on the computer screen, and explains and describes its basic functions.

After the participants have established mutual understanding of the functions, Arjun asks exactly what Tero is looking for. After Tero has explained his need, the participants start discussing possible materials for the end cap. Tero first disapproves of one material type because of its hardness, and further explains the end cap requirements. In Extract 5A, Tero assembles language, touch, and feeling in his explanation.

Extract 5A: 121016

158 Tero because it need to be aa little bit softer

((gazes at wall))

((left hand fingers rub stick's end cap ---------- X))

159 kind of mixed between the plastic and rubber

((gazes at wall))

((left hand fingers rub end cap----------X))

160 Arjun [okay fine]

161 Tero [bec-] because you you you can understand when this is against the wall

((gazes at screen))

((puts stick with end cap facing floor))

162 and I don't want it slippery

((moves stick to different sides x5))

Tero describes the material requirements by means of language and embodiment to showcase "feeling the softness" (line 158). Tero justifies his choice with a multimodal demonstration of the possibility of a stick without a proper end cap falling if placed

against the wall. In addition to his use of the adjective *slippery* (line 162), Tero's body-object-language explanation contributes to Arjun's acceptance and his suggestion of polyurethane as the material, expressed in question form (line 164, see Extract 5B in Appendix H in the supplementary data).

Arjun's suggestion both shows his expertise on suitable materials and acknowledges Tero's CEO position with technical responsibility. Tero seems to display some uncertainty regarding technical expertise here, shown by his response (line 166). His nervous laughter reveals his hesitation, developing expertise, and ignorance of the suitability of the material. He also twiddles his fingers to demonstrate the need to "feel" the material (line 166), adding the requirements (*elastic* and *sticky*). Accompanying the adjective *sticky* with a slight grin demonstrates a person's reaction when touching something sticky. Again, Arjun signals understanding (line 170) and seeks confirmation for his interpretation of Tero's explanations (line 171). Tero confirms Arjun's check as correct and says he is open to advice about the materials.

To summarize, in technical explanations of product qualities and processes, spoken language, iconic gestures and use, and simulations of or references to products were assembled to formulate messages, and they contributed to constructing shared meaning, as shown in the peers' feedback. Consensus-seeking and solution-finding communication showed more complexity in assemblages related to the type of feedback received. When the response was delayed or controversial, the subsequent and joint use of multimodal resources was crucial to reaching mutual understanding, especially in multi-party meetings. Multimodal assemblages contributed to creating shared meaning and they

fostered feedback, as illustrated in the peers' positive responses, confirmations, and explanations that showed understanding.

CONCLUSIONS, IMPLICATIONS, LIMITATIONS AND SUGGESTIONS FOR FURTHER RESEARCH

Conclusions This study set out to discover how technical managers use multimodal resources to articulate their ideas in BELF meetings with their peers and how the use of multimodal resources contributes to the construction of shared meaning in explanatory, consensus-seeking, and solution-finding communication. The paper drew on the multi-sited ethnographic case studies of two TMs' work practices and, using multimodal discourse analysis, analyzed interviews and video-recorded BELF meetings.

The findings indicate that multimodal resources and the resulting assemblages were used to articulate ideas, they contributed to constructing shared meaning and fostered understanding in ways that would have been impossible using spoken language alone [12] to accomplish the three communication purposes. This fact became clear in the elicited feedback. In their management tasks, the TMs relied on various multimodal resources. When crucial resources (the product in question, or the availability of the whole office space, for example) were missing or when mutual understanding was not achieved, more multimodal resources were needed.

As in meetings in other contexts [45], [58], objects—here products and documents—are central in engineering communication because they mediate core business knowledge. Whether the core object discussed is present or not affects multimodal resource use and subsequently the construction of shared meaning. In explanations without the object

present, speech and gestures are needed more, but with the object available, one can achieve better or sometimes faster understanding. In problem-solving, whiteboards, as flexible spatial resources, can accommodate the ongoing activity, allowing for writing and calculations. Skype meetings, in which individuals operate in a restricted space, offer more limited opportunity for resource use and so are more demanding than face-to-face meetings. These findings agree with earlier claims that nonverbal signals, appropriate feedback and adaptation are important for professionals' success in global work interactions [8], [6], [12].

Implications for Practice This study has implications for practitioners, educators, and academic programs. BELF meetings should be viewed as providing opportunities for expertise development in multimodal resource use in collaboration with speakers of different L1s and with experienced others in a real business setting with concrete aims, goals, and purposes. Engineering communication educators should therefore provide opportunities for students to practice different communication scenarios in their courses, preferably with authentic problems and worker roles in both face-to-face and computer-mediated environments.

This study also has implications for technical managers who, after moving from technical expert positions to managing people, continue to perform technical specialty responsibilities [29], [31], [32]. The findings suggest an extension to the notion of engineers' communicative competence to include articulating ideas with multimodal assemblages to communicate effectively with peers, especially in BELF environments.

Most importantly, present and future professionals should foster the total communication framework [6] for effective communication, with multimodal resources being used to overcome the challenges of presenting technical material clearly [11], [34] and of communicating effectively with people with different L1s. Practitioners should become even more "aware of conversational mechanics […] to explore specific personal, cultural, and professional influences that have shaped their assumptions about what constitutes effective conversation" [12, p. 162] and to consider micro conversational skills [12, p. 161] in global working life.

Implications for Research This study contributes to research on engineering communication in the global workplace, providing necessary insights into the microscopic level of interactions between people [27] and into the ways that ideas are conveyed in them [6]. The multimodal approach enabled a more comprehensive understanding of how meaning emerges out of assemblages in engineering communication where technical professionals need to achieve clarity, consistency and logic in presentation. Its use is recommended in the future.

This study also contributes to BELF research by showing what occurs beyond language and often "simplified English." The findings support earlier ideas on communicative strategies in BELF interactions, where repetition, reformulation, and checking for understanding are important (e.g., [14]). The findings illustrate the importance of the multimodal analysis of communicative strategies to fully understand how BELF interactions succeed. Multimodal resources are assembled in overcoming or preventing misunderstandings and ensuring mutual understanding. Their use depends on the level of the professionals' shared business knowledge and the length of their relationships (see

also [16]). When shared knowledge of the key business information is under construction, as in all of the examples studied here, albeit in different ways, other multimodal resources besides language are needed. In particular, embodied resources are used frequently when checking for understanding and providing more information.

Limitations The limitations of this study relate to its qualitative nature. First, findings from two technical managers' interactions cannot be generalized. However, the longitudinal ethnographic approach enabled me to delve more deeply into the participants' work, and to identify and analyze the types of interactions that they themselves found challenging. Second, as the examples included only male participants, showcasing interactions with female participants would bring more breadth to the findings. Finally, video images illustrating many of the interactions discussed in this paper would have needed to be heavily blurred to preserve participants' anonymity, most of them had to be omitted because they would not reproduce legibly in the paper.

Suggestions for Future Research This paper has shown how engineering communication and BELF research can move forward and more seriously account for the multimodal dimension of professional practices. Future research should further grapple with this complexity, including how knowledge is constructed and distributed in BELF settings and how multimodal resources are assembled for different purposes across space and time not only in global working life, but in other contexts too.

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