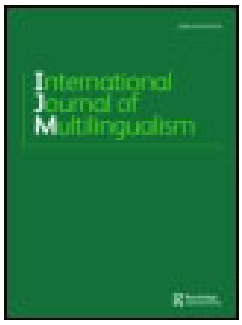

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Materialising semiotic repertoires: challenges in the interactional analysis of multilingual communication

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ABSTRACT

This article takes the inquiry into semiotic repertoires beyond their classifications and inventories to analyse their interactions with each other and the way they gain indexicality in situated communication. As previous theorisation suggests that semiotic repertoires are deployed by agentive individuals, this article draws from New Materialism to focus on how social agents, semiotic repertoires, and material ecologies work together in distributed practice for meaning making. Expanding sociolinguistic constructs for this purpose, the article defines the relevant units and objects of analysis, and illustrates the framing of activities in indexing the values, meanings, and relationships of semiotic repertoires. The role of these repertoires in the interaction of an international community of scientists is analysed through the research group meeting of a team of microbiologists. The article demonstrates that though the focal participant from Korea claims limited English grammatical proficiency in his personal repertoire, he draws strategically from the repertoires in the physical setting and those of his disciplinary community to communicate successfully.

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Semiotic repertoires; interactional sociolinguistics; frames; indexicality; new materialism; distributed practice

Scholars in applied and social linguistics have made useful advances in theorising the *semiotic repertoires* involved in multilingual interactions. In defining the differences between communal, personal, and spatial repertoires, they have deconstructed the monolithic notion of 'language' to address communicative diversity (see Kusters et al., 2017, for a review). In doing so, they have also departed from the logocentricism that was dominant in the field, which treated verbal resources as superior forms of communication. These scholars have now called for treating multimodal resources as equally significant in communication. Such developments are inspired by diverse theoretical orientations which situate communicative interactions in social and material contexts. These orientations have ushered a shift from the previously dominant structuralism and cognitivism that have influenced the foundations of modern linguistics. While early sociolinguistics and anthropological linguistics situated communication clearly in the social context (Gumperz, 1971; Hymes, 1968), other applied linguists have adopted socio-cognitive (Atkinson, 2011) and sociocultural (Lantolf, 2011) models to situate cognition

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also in the material environment, motivating a consideration of communication as an activity that involves objects and environmental affordances.

Along those trends, New Materialism has further materialised communication in motivating a consideration of objects and spaces as more agentive than treated before in the previously mentioned models (see Coole & Frost, 2010). It has particularly challenged the following two constructs, which have traditionally influenced linguistics from its structuralist and Chomskyan legacy:

- *Representationalism* (i.e. the human mind as the seat of thinking and communication, with language encoding knowledge that represents meaning and life);
- *Individualism* (i.e. individuals as the unit of analysis for initiating or explaining communication and activity).

Though recent models such as the sociocognitive and sociocultural treat cognition as mediated by social and material resources, they still treat the human mind as distinct and primary. These models also adopt a methodological individualism in treating human agents as each the repository of language competence, though humans might collaborate with other social actors and material affordances for communication and learning (see for a fuller discussion of these points, Canagarajah, 2018a, 2018b). However, New Materialism reverses the status of minds, languages, and individuals in communication by materialising them more completely and situating them in social networks and environmental ecologies.[1] Meanings and thinking are treated as always emergent from the distributed practice between people, social networks, and material ecologies. While *representationalism* posits meanings and knowledge as already coded in language and stored in people's mind, New Materialism treats them as always emerging from activity. It also acknowledges that cognition is embodied, and objects and space are equally agentive in shaping human thinking and communication. Similarly, while *individualism* treats the human agent as the locus of knowledge and competence, New Materialism treats meanings as emerging from *distributed practice*. This means that thinking and communication are generated through the contribution of all parties in social networks and material ecologies. Though speakers have a role in mediating these influences and positioning themselves strategically for ethical interactions, they have to treat themselves as 'hybrid agents' who must engage with others to negotiate their agency (Cooren & Bencherki, 2010, p. 53). To capture this shift, theoretical physicist Karen Barad (2007) proposes the notion of communication as *discursive practice*: 'A performative understanding of discursive practices challenges the representationalist belief in the power of words to represent preexisting things' (p. 132). She urges us to treat activity as the starting point for analysis, consider semiotic resources as shaped by material conditions, and analyse meanings as emerging in and through activity. Barad explains her preferred analytical method as follows: 'Performative approaches call into question the basic premises of representationalism and focus inquiry on the *practices* or performance of representing, as well as on the *productive effects* of those practices and the conditions for their efficacy' (emphasis in original; p. 28).

The recent treatment of *semiotic repertoires* in applied linguistics is informed by these theoretical shifts in treating communicative resources as embodied and situated. This notion gives equal importance to multimodal as to verbal resources. It particularly

acknowledges *spatial repertoires* (embedded in the material setting) as mediating and shaping communication that people bring to that environment (see Kusters et al., 2017). However, as the editorial introduction to this issue observes, these repertoires were treated as deployed by individual agents. To consider the meanings of semiotic repertoires as emerging from distributed activity, we have to consider how people, social networks, and material ecologies work together in meaning making practices. In fact, semiotic repertoires have to be situated in communicative activities to understand the way they gain variable and unequal indexicality. They don't hold meaning or values outside activity, or generated in people's minds. Scholars have to be wary of treating semiotic repertoires as coming readymade with meanings and stored in the minds of individuals to shape their communication. To give an example, scholars adopting a semantic model of gestures earlier treated each gesture as indexing predefined meanings (see McNeill, 2005). Such an approach would be similar to the representationalist orientation that Karen Barad has critiqued. Though the project of Kusters et al. (2017) and other scholars for 'extending our inventories of the semiotic resources that people use to communicate' (p. 11) is a necessary first step, we have to now focus on their interactional dynamics in communicative activity. It is time now to move beyond the classification of semiotic repertoires and situate them in material contexts of interactions to understand how they materialise meanings. This effort will also help in the objective of this special issue to take semiotic repertoires beyond the agency of individuals.

While the background to these theoretical shifts have been articulated elsewhere (see Canagarajah, 2018a, 2018b), in this paper I hope to make an analytical contribution. I aim to describe how interactional analysis might adopt units and objects of analysis that are suitable for addressing semiotic resources in discursive practice. I draw from the tradition of Interactional Sociolinguistics (IS, hereafter; Gumperz, 1971), but also expand its analytical constructs to address the materiality of semiotic repertoires. IS was formulated to explore how interlocutors negotiate meanings where shared norms should not be assumed. Its theoretical openness and methodological eclecticism makes IS suitable for my project. IS is elastic in accommodating new analytical considerations. It is remarkably eclectic in adopting insights from diverse sociolinguistic orientations, such as conversation analysis (CA), ethnographies of communication, and (critical) discourse analysis. While attending to the sequential evolution of talk, as in CA, IS also draws from broader ethnographic information to situate close analysis (see Canagarajah, 2020). I demonstrate below how some analytical constructs introduced earlier in IS can be expanded for our current purposes.

The term 'materialise' in the title of the article is used in two senses: i.e. treating semiotic repertoires as embodied and materially embedded; and treating their meanings and values as emergent in activity. I will demonstrate that while all objects in the material environment and spatiotemporal context are potentially indexical of many meanings, these *resources* become *repertoires* with specific meanings and values based on how they are materialised in situated communicative activities.

Defining the analytical constructs

Sociolinguists have proposed earlier that we treat 'speech event' as the unit of analysis in order to address language as socially situated. Bauman and Sherzer (1975) note:

> From the very first, the analysis of speech events has been central to the ethnography of speaking as empirical contexts within which speech activity is situated and acquires meaning. This focus on the event as the unit of analysis rests upon an ample conceptual base. (p. 109)

However, *speech event* places undue emphasis on spoken interactions, failing to bring into sufficient focus the multimodal nature of communication, where diverse media and modalities (such as computers and texts) now mediate speech. To address the multimodal nature of communication and treat meanings as embodied, I prefer to treat *activity* as the unit of analysis. Activity situates speech more fully in the social networks and material ecologies that involve communication, and draws attention to communicative strategies and practices more than repertoires. It helps us ask: How do meanings emerge in the activity that semiotic repertoires are part of?

Note that the traditional distinction linguists made between *text* and *context* collapses in this perspective to activity. Everything in the context is potentially communicative and, thus, can become semiotic repertoires. All material resources can entextualise meanings, depending on the nature of the activity. However, this analytical orientation makes the focus of inquiry overly broad and cumbersome. If everything is connected to everything else, where or how does one begin one's analysis? Here's where a second construct that sociolinguists traditionally adopted becomes useful: *frames*. Tannen and Wallat (1993) describe frame as 'a definition of what is going on in interaction, without which no utterance (or movement or gesture) could be interpreted' (pp. 59–60). Bauman and Sherzer (1975) similarly define frames as 'a metacommunicative device which signals the interpretive context within which a message is to be understood, a set of interpretive guidelines for discriminating between orders of message' (p. 106). However, what they observed in the 1970s about frames as being under studied is still true: 'There has been very little work published on frames thus far, although their relevance to the ethnography of speaking has been established in print' (p. 107). Therefore, I define frames in an inclusive way for this article. Frames can range from discoursal, cultural, institutional, national, geopolitical, and ideological tropes to relevant scales of space and time. Within discourse interactions specifically, frames might include the following: the communicative activity's task structure, participant frameworks, genre conventions, and language ideologies.

Though frames can help focus on the salient features of a communicative activity, they are not pre-given. They are interactively achieved. Goffman (1974) treats frames as ever-evolving schema that participants in interaction use in making sense of ongoing exchanges. In fact, frames and semiotic repertoires interact in dynamic ways to shape each other. While interlocutors might start the interaction with the frames into which they are habituated in relation to their ongoing practice, it is possible for the frame to be revised, based on the discourse strategies of the participants. A speaker can employ a code switch to index different identities or participant frameworks and seek a more advantageous framing, as Gumperz (1971) demonstrated from his study of metaphorical switches. Note also that diverse frames can be layered in influencing an interaction, along Blommaert's (2010) notion of 'layered simultaneity'. Which of the layered frames are relevant for the activity at hand on any one occasion depends on how they are cued by the participants through their choice of semiotic repertoires. Therefore, frames have to be empirically studied rather than assumed. Critical moments or trouble sources in an interaction can unveil for outside researchers and new participants the frames assumed by

other participants. Frames help both interlocutors and researcher narrow down their focus to the semiotic resources that matter for the activity in question. Frames thus provide valuable insights into what interlocutors perceive as structuring their talk. For these reasons, 'frame' might be a better term to address 'context', as it enables us to untangle the layered contexts participants dynamically negotiate in their interactions. Though it is difficult to disentangle such layered and interactional frames out of context, researchers can gain more clarity in situated interactions to consider which frames are indexed by the talk, whether explicitly or indirectly. Ethnographic research data often helps IS analysis by situating the interaction in the relevant contexts.

Frames can also help determine how semiotic *resources* become *repertoires*. Though all the symbolic and material resources in a setting could potentially be communicative, many resources are not salient for that activity. For resources to become repertoires requires sedimentation through repeated and ongoing activity. Framing helps in this matter. Based on how the activity is framed, certain resources become critical for that interaction. And as they get used frequently in specific interactions, these resources become part of the repertoire for that activity and for those interlocutors. Through such analytical orientation, we can also distinguish *between* repertoires. We can distinguish how 'some resources are permanent and enduring and others are temporary and dynamic' (Kusters et al., 2017, p. 5). We can also identify 'hierarchical constellations' within repertoires (Kusters et al., 2017, p. 8), mapping their relative importance for specific activities.

A particular construct that helps to bring into salience the semiotic resources that are functional in an activity are *rules of (ir)relevance*. Erickson (1975) adopted this construct from Goffman (1961) for his quantitative study of gatekeeping interactions in interethnic academic counselling sessions. Erickson defined them as 'decisions about which attributes of a person will be treated as important to the interaction' (1975, p. 49). In his studies, rules of (ir)relevance were found to be negotiated not solely based on the institutional frame of academic counselling, but also on ethnic identities and communication styles of the clients. Depending on the frame, rules of (ir)relevance can include utterances and nonverbal actions, in addition to physical attributes, and by extension, surrounding objects. Similarly, why interlocutors treat certain grammatical and discursive deviations as irrelevant (adopting the 'let it pass' principle – see Firth, 1996), and others as needing to be resolved, depends on their rules of (ir)relevance as framed by that communicative activity.

Frames also help us address broader issues of ethics and power in the way they shape the indexicality of semiotic repertoires in interactions. Based on the relevant task structure and participation framework for that activity, the interaction will call for different values, ethics, and language ideologies. For example, certain interactions I study in professional communication involve multiple people with different specialisations engaging in collaborative interactions for mutually invested and shared outcomes. These interactions call for ethical values such as collaboration, solidarity, and patience in negotiating diversity and achieving communicative success. However, in interactions where interlocutors are not invested deeply, or establish or exercise their own power, they will adopt a footing that is less inclusive and accommodating. Vickers (2020) illustrates this from an interaction in a southern US health clinic for migrants where the multilingual repertoires of an Anglo-American professional index condescension and exclusion. For example, the

professional uses Spanish expressions such as 'chica chica' and 'comida comida' in apparent accommodation to a Mexican diabetic patient who is undocumented, poor, and monolingual. However, coming from her status difference and her refusal to accommodate the patient's point of view in her diagnosis, her code switches index condescension. These examples suggest that semiotic repertoires are not of significance by themselves. It is in relation to how they are framed (including the values and relationships they invoke) that they gain their meaning. The notion of indexicality is important for this purpose. Semiotic repertoires may index unequal and variable meanings, based on how they are negotiated in the interaction. This orientation also drives home the importance of affect, ethics, and ideologies in the negotiation of repertoires – which is another objective of this special issue (see editorial introduction).

Before I move on to the analysis, we must observe that while the classification of semiotic repertoires has been undertaken well in IS, their *locus* needs more clarification. Gumperz defined verbal repertoire as 'the totality of linguistic forms regularly employed *within the community* in the course of socially significant interaction' (1971, p. 182; emphasis added). Though he expands repertoires beyond the labelled language, he locates them 'within the community'. Even if we qualify 'community' as expanding beyond and beneath the speech community, such as communities of practice of varying magnitudes and layered relationships, this locus doesn't explain all semiotic resources. Scholars like Blommaert and Backus (2013), Busch (2012), and Rymes (2010) have moved the focus to the repertoires of individual speakers. They treat these repertoires as evolving from people's life histories. For example, Blommaert and Backus (2013) define repertoire as 'individual, biographically organized complexes of resources' (p. 8). Detaching a speaker's repertoires from that of the community is well motivated. As we can expect, an individual's repertoire may not correspond to that of a community. One may not be proficient in all the resources that constitute a community's repertoire. Nor is proficiency limited to the norms of a single community. In the context of mobility, one's life trajectory might play a big role in what communicative activities have been relevant and what resources have mattered for accomplishing them. Similarly Rymes' (2010) definition focuses on 'how individuals use' communicative repertoires as they participate in 'multiple communities in which they participate' (p. 528). Räisänen (2018) demonstrates how a Finnish engineer's repertoire changes in keeping with his changing professional designation and transnational interactions over a period of 13 years. He first works as a factory intern in Germany, then as a project engineer and project manager in Finland, and later as an operations manager in China. His register changes from technical to business oriented, while he acquires additional proficiency in German and English, becoming more translingual. We must note that such personal repertoires are also embodied, indexing the places and experiences behind their formation.

An emerging consideration is the material environment as the locus of semiotic repertoires, labelled as 'spatial repertoires' (Canagarajah, 2018b; Pennycook & Otsuji, 2015). Going beyond the community and the person, this construct treats repertoires as embedded in the physical environment. An earlier formulation that leads to this construct is Goodwin's (2013) notion of 'substrate'. He suggests that interlocutors draw from resources that are embedded in a setting in order to accomplish relevant communicative activities. He defines substrate as:

> an immediately present semiotic landscape with quite diverse resources that has been given its current shape through the transformative sequences of action that culminate, at this moment, in the current action. […] the current substrate organizes coherence by gathering together a limited, but uniquely appropriate, collection of resources implicated in the organization of the specific actions now in progress. (p. 11)

That is, these are the semiotic resources used by previous interlocutors for that activity in that setting. They become sedimented to shape similar communicative activities associated with that place later. Other interlocutors may repurpose them for their own communication. Consider the typical layout of a classroom, with the configuration of a board, screen, podium, and chairs set up in particular relation to each other, and which instructors creatively use for their teaching purposes. Similarly, professionals in a particular setting might deploy and adopt certain terms specific for an activity in a given setting and sedimented by the history of work practices there. These resources are spatial in the sense that they are embedded in the physical contexts (or places) in which the communicative activity occurs.

In interactional analysis, therefore, researchers should be sensitive to how the repertoires of a community, participants, and those embedded in that setting work together in shaping communication for varying meanings and outcomes. I illustrate from an example Goodwin (2013) himself provided on how diverse repertoires work in his analysis of his father, Chil's, communication. After a medical episode, Chil was left only with three verbal resources: *yes*, *and*, *but*. These are the only three words that he shares with his English speaking speech community. In addition to these words, he also uses a few other nonverbal utterances such as 'dih duh' which are part of his personal repertoire. These sounds gain indexicality in particular spatial environments where his interlocutors collaborate for meanings with him. He also draws from available spatial resources in the interactional setting – i.e. such as objects and artefacts. Though these unconventional resources cannot guarantee intelligibility, they achieve indexicality and facilitate communication in the way the interactions are framed. In conversations with his family at home, his children adopt a suitable footing and demonstrate ethical values of patience and tolerance to collaborate in making meaning. Chil is also strategic. For certain interactions where his information is sought, he waits patiently for the other participants to build the substrate through their talk. He will then interject with his available verbal resources appropriately to make his contribution. In other cases, he will point to objects in the setting, such as grapes, to indicate what he wants to eat. Or he will shift his gaze to the persons whom he considers the recipient of new information, using his body as a spatial resource. We see in this example that material resources (human body, grapes) and also verbal resources (words spoken previously by others in that environment) can constitute the substrate or spatial repertoires to mediate Chil's three English words and other nonverbal sounds for indexicality. Thus community, personal, and spatial repertoires work together, facilitated by the distributed practice of the participants and their ethical dispositions of collaboration, for successful communication.

Background to the study

The data for this article derives from an ongoing qualitative research in the fields of Microbiology, Engineering, and Entomology in a midwestern US university, where I

am focusing on the interactions of international STEM (science, technology, engineering, mathematics) scholars as they engage in research work with a mix of native English speaking and multilingual professionals from diverse countries.[2] The research is motivated by the question: 'What role does grammatical competence in English play in the professional communication of international STEM scholars in American universities?'. Data collection has been proceeding since 2013 with different disciplinary groups. The video recording of research and teaching interactions is complemented by biographical interviews with focal international/multilingual scholars, discourse-based interviews on artefacts and transcripts, collection of drafts and publications, and ethnographic observations of workplace practices, including interactions in their *research group meetings* (RGM). The emerging findings have been reported elsewhere (see Canagarajah, 2018a, 2018b).

In this article, I perform an interactional analysis of excerpts from an extended interaction to illustrate the relationship between diverse semiotic repertoires. The interaction is that of a team of researchers in Microbiology as they do some troubleshooting from their experiments in their lab. This RGM interaction involves a South Korean postdoctoral researcher, whom I call Jihun. The others in the interaction are: Nick, Anglo-American, the Primary Investigator who runs the lab and the research project; Mohan, an Indian Associate Professor in Chemical Engineering; Jie, a Chinese postdoctoral researcher; Jane, an Anglo-American graduate student; and Rob, an Irish graduate student. The excerpts I analyse below mainly involve Jihun and Nick. I chose excerpts where certain trouble sources unveil the role of nonverbal resources in resolving potential communicative problems. Additionally, the excerpts involve Jihun's interactions, as he claimed limited grammatical competence in English. These excerpts help illustrate the role of distributed practice in facilitating successful communication when an individual's grammatical competence may not be sufficient. In the RGMs I recorded from this disciplinary group, the participants reviewed figures and images from their experiments projected on a monitor placed centrally in the room to interpret them closely and formulate their arguments. Notes from these conversations were recorded by Jihun in his notebook and helped him revise the publication drafts subsequently. In the interaction under consideration, the group is discussing whether their images make visible what they claim as their findings in an article submission. The journal's reviewers have challenged their claim. The participants discuss how to represent their findings more clearly and persuasively once they agree that the results are indeed evident. This group typically sits around a monitor, which displays images from the experiment.

Frames, resources, repertoires, and indexicality

Before I analyse the interaction, I situate it in ethnographic context, as typical of IS approaches. Based on the observations and interviews, I explain how the interaction is framed. We have to begin with the manner in which the RGM frames these interactions. Swales (2004) has introduced RGM as an important genre of scientific communication and a site of work and learning for scientists. Participants might troubleshoot experiments, develop their findings, plan articles for publications, discuss reviewer comments to revise their papers, assess ongoing needs for their labs and research resources, review grant applications, and share professional news on conferences and calls.

The physical setup of the meeting room is an integral part of the framing of the Microbiology RGM under consideration. It takes place in a small room equipped with a table that can accommodate five to six individuals, six chairs, and a computer connected to a wall-mount monitor and to a wireless keyboard (see Figure 1). Aside from these objects that are constitutive of the RGM, the room also contains a microwave and a refrigerator which are available to anyone in the department when the room is not in use. The participants of the meeting understand that the meeting starts 'officially' (Jihun's word) when the PI, Nick, arrives, and the door is closed. Objects such as the microwave become irrelevant, while others such as the monitor form the 'ecological huddle' – i.e. an emic organisation of human bodies and objects constituting a shared focus of attention (Goffman, 1963). The change in activity is evident in the marked increase in Jihun's verbal participation. While he leans backward and remains largely silent during the unofficial phase, he takes a leading role in the RGM proper. Typically, Nick and the person reporting on experiments sit next to the monitor across from each other, which Jihun explained as 'just everyone's preference'. This seating arrangement is not without implications for the unfolding of the meeting, as the participants frequently orient toward and use gesture relative to microscopic images presented on the monitor. The monitor, visuals, gestures, and body – and their physical configuration – serve as semiotic repertoires for RGM, enjoying equal importance as verbal resources.

Note the distinction between *resources* and *repertoires* in the above description. Though there are diverse material resources in the room (like the microwave and refrigerator), only a few become sedimented as useful for specific communicative activities. Through ongoing activity and relevant framing of the interaction, chosen resources materialise as repertoires. The microwave and refrigerator are part of a repertoire for another genre of communication – i.e. informal lunch room conversation. They haven't (yet) become part of the repertoire for RGMs. Note also that not all RGMs have the same spatial repertoires. Another RGM I am studying, featuring engineering scholars, includes different semiotic resources. The members sit around a chalk board. Though they have a projection screen, it is located on the wall behind the participants. They turn to it only occasionally when they focus on particular images or tasks. This arrangement reflects the framing of their communicative practice. The engineering group largely interacts by working mathematical problems on the chalk board. In one RGM I recorded, an

Figure 1. Physical configuration of the RGM.

Indian graduate student moved up to the chalk board, drew an elaborate figure for about 2 minutes, and then treated it as a substrate to latch his comments with a preponderance of deictics, in answer to a question by the PI. In another recording of a Chinese Math instructor's teaching, I found that he used a long and expansive chalk board in front of the class to construct a substrate. He used the whole length and breadth of the board to work out math problems in teacher-led instruction, spatially demonstrating the connection between concepts according to their visual placement on the board, treating the images and scripts he had written as his spatial repertoire (see Canagarajah, 2018a).

Before I bring out the language ideologies and ethical values framing the RGM interaction, I wish to provide some background information on the English proficiency of Jihun. This information will show the limitations of methodological individualism and demonstrate the importance of distributed practice and collaborative ethics. Jihun had done all his education, including his doctorate, in Korea. He had migrated to the United States about 7 years earlier for professional training, and has been working as a postdoctoral scholar successively in two universities. In interviews with Jihun, it became apparent that he had considerable difficulty in understanding conversational English and that he was anxious about his limitations. In his interview with me, he recounted an interaction in an academic conference where he experienced difficulty understanding and responding to questions after his presentation. He stated, 'It'll be better if I can understand spoken language better and I am more fluent'. He narrated that experience as follows:

Excerpt 1:

> **Jihun**: That's the most nervous time for me. The first talk in an international conference, I practiced a lot. Actually I made a script, then I know how to start from the beginning to the end. Then during the Q and A session someone was asking me something, but I didn't get it quite well. Actually I didn't answer quite well. But I think it was obvious for the audience. (INT.09/18/2016)

Though he had memorised the conference talk, he feels that he failed to communicate effectively during the question time. He fears that he came off as incompetent for the audience. It is important to note here that interactions such as this (i.e. conference presentations) are differently framed, and feature different spatial repertoires and ethics, compared to the RGM. Jihun doesn't have familiar spatial resources in the conference site (whose layout he didn't know till he arrived there). Also the audience constitutes an impersonal social network. Some members of the audience may come with different interactional values, framed around agonistic relations or competitive attitudes. We can understand, therefore, that the personal (non-normative) repertoires Jihun brought with him index deficiency for the audience in this context.

Jihun's self-acknowledged grammatical imperfections do not appear to compromise his ability to make meaningful contributions to the research group because of the different framing of RGMs. In other interviews with Jihun, I asked how he could explain the fact that, despite his claimed limited proficiency in English, he efficiently took the lead in RGMs where he had to report on emerging findings and negotiate conflicting interpretations. One might assume that very advanced English grammatical proficiency is needed to negotiate an interaction where participants from different countries and language groups use diverse varieties of English. In response, Jihun articulated the

language ideologies and ethical dispositions framing this interaction. I quote an interview exchange below:

Excerpt 2:

ASC: How do people from all these countries- able to work efficiently?

Jihun: They actually have some common things, like we have a goal. […] People keep looking for someone actually who can supplement or compensate our weak point. […] Because one person cannot do everything.

[…]

A: I wonder if there are any communication problems because you all talk differently? […]

J: I think it is sufficient what we need to do, what we have done. I am always hoping to be more fluent to get a better understanding of what to do what to say what to be spoken.

A: Do you have any problems understanding Jie? Because her accent is different?

J: Sometimes I had a problem during the conversation, but I know what she meant.

The following features of the RGM framing stand out. The task structure involves members engaged in a shared or common goal, i.e. the formulation of their research findings, which in turn is connected to other larger goals such as presenting them in successful publications, obtaining grants based on the success of their research, and thus ensuring the continuation of their lab and their careers. This influences a collaborative participation framework for this interaction. Jihun says that the relationship is based on complementing the strengths each person brings to the group. Jihun mentioned elsewhere that his expertise was in electromagnetic imaging, and that the group found his work indispensable for its research. In such a situation, the power relationships between the participants are relatively distributed and negotiated. For example, while Nick is the senior professor and Principal Investigator (PI) who also owns the lab, his status is qualified by the indispensability of Jihun's expertise for certain areas of research. In many instances I observed, Nick positioned Jihun as more knowledgeable about certain matters in research in his questions to him, and adopted a deferential footing.

Because of these work relationships, the participants' language ideologies and ethical values are also differently framed. In the above excerpt, Jihun says that their communication is based on 'sufficiency' rather than correctness or mastery. In other words, the group brings a functional orientation to language, treating the relevance to their work at hand as more important than normative grammatical correctness. Jihun goes on to say that in times of communicative difficulty or breakdown, they resort to guessing the meaning ('I know what she meant'). To understand this possibility, we have to consider how the group draws from all the communicative repertoires as relevant. Participants don't depend on words alone, but the embodied repertoires of their setting and community. Such an orientation is enabled by the ethical values motivated by this framing. Jihun says that their common professional goals motivate them to 'supplement or compensate our weak point'. The framing calls for values such as tolerance, patience, and collaboration. It is this framing of the RGM interactions, based on values of functionality, sufficiency, and solidarity, that can explain how Jihun's personal English verbal resources are sufficient for his purposes. (Note, however, that not all interactions of these

researchers are framed in this manner with supportive relationships. Those outside the RGM might feature other values. During my interviews with him, Jihun narrated other interactions where the PI imposed on him to meet publishing deadlines in an unreasonable manner or adopt his plans for publications. Also, in collaborative drafting of manuscripts for publication, other members corrected his linguistic infelicities, being much more discriminating.)

Interactional analysis

I now illustrate how we can situate semiotic repertoires in the framing of that activity to demonstrate the meanings and values they index. We will also see how the distributed practice of semiotic repertoires, social networks, and material ecologies are critical for such meaning making.

The chosen excerpt for illustration begins with Jihun explaining to his team the images he has obtained from his experiment. They are projected on the screen, and he moves his cursor across the screen to point others to the details:[3]

Excerpt 3:

6 *Jihun: this is the- so this is situated from one to seventeen
7 {using the cursor to point at the screen}
8 so one is actually same for the- {each gel
9 {moves open hand toward the screen}
10 {to make like something like (x) control.
11 {moves open hand toward the screen to point}
12 so one is cell extract and then done membrane protein
13 membrane and then (.) flow through and washing (step)
14 and then this dilution=
15 *Nick: =aha
16 *Jihun: and concentration (2) and then this concentrated one was (.) re- (1)
17 ((moves both hands in circling motion))
18 reincubated [with
19 *Nick: [is ten]
20 concentrated and nine is just dilution?
22 *Jihun: nine and ten >ten is actually concentrated one<, but the- it's not
23 {the (unintelligible)
24 ((showing a length with fingers))}
25 *Nick: [((polymerized))]

26 *Jihun: [yeah yes] so then, the whole thing was incubated again, then

27 then this is flow through, after

Note that many verbal resources Jihun uses in this interaction depend on the spatial repertoires for their indexicality. The frequent deictics ('this'), adverb ('then'), and numbers ('one … nine … ten') depend on the visuals on the screen and Jihun's synchronous activity of pointing with his gesture or the cursor for their meaning. Despite his frequent pauses and hesitations, and the low semantic value of his diction, his interlocutors don't register any failure of uptake.

In some instances, when he is lost for words, the spatial repertoires help his interlocutors to supply the words Jihun is looking for. In line 24, there is a pause as Jihun gestures when he looks for a word. Nick prompts 'polymerized'. Note that Nick should be attuned to all the spatial repertoires in the setting (i.e. visual, Jihun's cursor, and gestures) in addition to the preceding text to infer the needed word. Nick adopts a footing of collaboration and demonstrates values of patience and tolerance in drawing from all the ecological resources to help Jihun. While the movement and use of Jihun's body in the above instances might play a supplementary function to build indexicality for his verbal resources, there are other instances where they are more agentive in generating meaning. In line 16, Jihun gestures as he looks for a word. Perhaps the bodily movement provides a space for him to retrieve the word. It is possible that the word is also embodied with this gesture for him to recall the word. Some scholars have used the term 'thinking with your hands' to indicate how gestures facilitate thinking (Van Compernolle & Williams, 2011). This is an example of embodied repertoires whose locus is the body and not necessarily the mind.

Jihun does demonstrate another set of grammatical and lexical repertoires from his disciplinary community to facilitate his communication. These are technical terms from microbiology that demonstrate considerable complexity. Consider the following excerpt:

Excerpt 4:

30 *Jihun: and then, the washing (1) for washing and then this is

31 dilution and then this is concentrated so, this is histidine

32 body so, ((leaning back, turning face to PI)) histidine antibody

33 actually ((moves left hand away from his right hand once))

34 *Nick: [captured?]

35 *Jihun: [Right] so, (2.3)

36 *Nick: {This was histidine antibody?}

37 {points at the screen}

38 *Jihun: yeah both, yeah both histidine antibody somehow this one

39 is very {bad

40 {((waves hand in the direction of the screen, smiles))

41 dirty but they but they you see the band is actually there are

42 so many smaller band still [there like this

43 *Nick: [more of antibody?

44 *Jihun: right

Note that terms such as *washing*, *concentrated*, *dilution*, *histidine*, *antibody*, and *band* belong to the community repertoire. In my interviews with international STEM scholars, they mentioned that such community repertoires were not determined by their (personal) grammatical proficiency. They also didn't treat these words as 'English'. They mentioned that they use these disciplinary terms even in their own countries when they interacted with their fellow nationals in their first languages. They treated them as disciplinary repertoires accessible to everyone in their professional community.

While Nick continues to demonstrate alignment by doing turn completions for Jihun (see line 34 where he supplies 'captured'), in 43 he performs a more complex speech act. In the preceding lines, Jihun adopts a circumlocution to explain a finding by using vague words such as *bad* and *dirty* (and smiles in line 40 to perhaps indicate his embarrassment at his verbal inadequacy). Nick rephrases with 'more of antibody' in line 43 to capture Jihun's explanation (as a gist formulation or upshot), and indexes it through the community repertoire. Once again, Nick would have been aided by the spatial repertoires (visuals and gestures) to perform this rephrasing. In interacting in this manner, note that Nick is not being judgmental or condescending, as in 'foreigner talk' (Ferguson, 1975). His contributions are collaborative and matter of fact, designed to move the conversation forward, demonstrating the ethical values deriving from this framing.

In some instances, the interlocutors are able to locally renegotiate indexicality and adopt a resource as part of their substrate for ongoing conversation even if it violates the NES grammatical norms of the speech community repertoire. Consider the following instance:

Excerpt 5:

46 *Jihun: right and then there is two band still there

47 like maybe it's not quite clear as this one

48 *Nick: right

49 *Jihun: but it seems like there are two band

50 or {something like two=

51 {moves hand toward the screen

52 *Nick: = two sets of bands

53 *Jihun: right right two sets of band so it looks very similar to each other

54 *Nick: and so which band do you think we're going after?

55 *Jihun: ((puts hand on the cursor)) auum I think

56 *Nick: =so if you use your (.) aaa other antibody just's just

57 to the CeSa

58 *Jihun: yes

59 *Nick: which band might?

60 *Jihun: I usually get this two band not this smaller two band but this

61 top band and maybe this band

62 *Nick: so those could be the CeSa

Jihun refers to 'two band' in lines 46 and 49. Nick corrects him in line 52 ('two sets of band' – i.e. four bands) as this is not a mere grammatical deviation. It might index something different in the experiment, and have implications for how the findings are understood. Jihun demonstrates uptake of the correction in line 53. However, in line 60 he forgets the correction and reverts back to 'two band'. This time, Nick doesn't correct him, but adopts the 'let it pass' strategy, and demonstrates uptake by suggesting a possible interpretation for the question posed by Jihun. This phrase becomes shared in that spatial ecology as a resource for that activity, with an understood meaning. The atypical phrase gains indexicality and becomes a spatial repertoire relevant for that setting.

However, Nick can be insistent in correcting Jihun when a lexical or grammatical item that is critical for their project (belonging to the community repertoire) is misspoken. To adopt Erickson's term 'rules of (ir)relevance', these terms are significant for the discipline and interlocutors cannot adopt a 'let it pass' strategy. Consider the following use of the word 'scale':

Excerpt 6:

99 *Jihun: there are some- there are some more,

100 (.) this is (xx)° from the same grid, (0.5)

101 *Nick: >so your scale here is< pretty big right?

102 *Jihun: yes.

103 (2.6)

104 *Nick: so >it could< even be that these-

105 {these guys are your proteins right?

106 {points at screen with index finger

107 *Jihun: these thing?=

108 *Nick: =yeah.=

109 *Jihun: =ye:s?

110 *Nick: °(x)°

111 (3.5)

112 *Jihun: >actually i didnt< realize until (0.3)

113 uh: i- uh (0.5) (the) {I WAS using (.)

114 {lifts left hand

115 the >{em er ais< the microscope?

116 {turns right

117 (0.8) then

118 *Nick: (the) uh huh,

119 *Jihun: {the um (1.0)

120 {raises left hand to shoulder

121 *Nick: scale? [(yeah)?

122 *Jihun: >[the scale is actually different,=

Jihun first uses the term 'grid' in line 100. Nick corrects him and uses 'scale'. Though Jihun demonstrates uptake, he forgets it in line 116. As he hesitates, trying to recall the proper term, he signals through his posture that he is appealing to another member for help (i.e. he turns right in line 116 to look at Mohan). As he continues looking for the word, Nick supplies it in line 121. Though Nick was momentarily uncertain in line 118, Jihun's gesture in 120 helps him infer the word. What this example suggests is that the community repertoires (i.e. those belonging to microbiologists) are sometimes critical for the group's purposes and they are not dispensable. Though the grammatical and lexical features of Jihun's personal repertoire are successfully mediated by the spatial repertoires for intelligibility, at certain times the disciplinary community's verbal repertoires are more important. There are thus hierarchies within repertoires, giving more importance to community over personal or spatial repertoires in this activity.

Discussion

What I have demonstrated in this analysis is the way the framing of this interaction motivates multilingual STEM scholars to exercise collaborative ethical values and enact distributed practice to make meaning from diverse semiotic repertoires for successful communication. Though Jihun claims limited grammatical proficiency in English, he strategically employs a range of semiotic repertoires for his embodied communicative practice: i.e.

Community repertoires: the scientific terms he shares with his disciplinary community, in addition to nonverbal resources such as scientific texts, artefacts, and instruments;

Personal repertoires: the limited English grammatical items he brings, together with his habituated gestures and artefacts;

Spatial repertoires: the words and multimodal resources embedded in the setting, such as body positioning, mouse, screen, images, texts, seating arrangement, and other spatial features serving as the substrate that is currently available and has been developed through ongoing activity in that room.

We see thus how the personal, community, and spatial repertoires interact dynamically in the generation of meanings through distributed practice. Note also that these repertoires are not static or self-contained. They are changing and expanding as the community engages in its activities. For example, a community repertoire might become a spatial repertoire, and then become appropriated as one's personal repertoire. We see this happening when Nick offers 'scale' as the appropriate term when Jihun uses 'grid' in excerpt 6. This word appears to be part of the community repertoire for his field. It is not part of Jihun's personal repertoire, as he had difficulty producing it. Once it is deployed in the RGM, it becomes part of the substrate that Jihun can use for the activity. Though we see some difficulty in Jihun retrieving it the next time he needs it, requiring Nick's prompting, we can imagine how the word can become part of Jihun's personal repertoire over time as the group continues to use it. Through the corrections in the RGM, Jihun might be expanding his personal repertoires in the fashion of language socialisation.

Note also how certain semiotic resources that are part of the communicative ecology become sedimented and transformed into spatial repertoire. For example, verbal resources that are brought to the setting as part of the personal or community repertoire then become spatial repertoires. When they become sedimented through repeated use in an activity, these verbal resources become part of the substrate. Consider the phrase 'two set' in excerpt 5. Though it is grammatically idiosyncratic, it develops a situated indexicality in that setting. It then becomes embodied and embedded in the setting for participants to build on for their purposes in the future. However, the phrase might not become part of the community repertoire. Nor would it become personal repertoire for others. It might be used only by this RGM in this setting as participants might adopt the 'let it pass' strategy based on their rules of relevance.

My analysis demonstrates the critical role of ethical dispositions for interactions if diverse semiotic repertoires are to be valued and people draw from all of them to mediate their interactions. These repertoires will not be functional without a suitable language ideology or interactional ethics framing the communicative activity. Nick and the other interlocutors bring a solidarity ethic to engage in distributed practice in this interaction. They are willing to collaborate with the other participants in the RGM and draw from all the resources in the communicative ecology to make meaning. As we discussed earlier from Jihun's interview data (in excerpt 2), the members of the RGM adopt a different language ideology, as framed by the nature of their research activity. As a community of practice, where the participants are engaged in joint activity with mutual interests, they demonstrate dispositions and values that favour distributed practice.

To return to the theme of materialisation, we must recognise that not everything in the materiel environment is salient or functional for specific communicative activities. In the interaction analysed, the 'rules of (ir)relevance' of the group define which resources are important. They also explain which resources are 'sufficient' for Jihun for his professional activity (see his claim in excerpt 2), thus modifying the need for full and advanced proficiency in grammatical resources. The notion of sufficiency serves as a metapragmatic framing device to indicate to the participants which semiotic repertoires are functional for their activity. Note also the way in which the 'ecological huddle' frames the material resources that become salient for this group. The analytical constructs of IS thus help unveil the manner in which the framing of the activity makes certain semiotic resources

in the material environment gain salience and relative significance for the specific communicative activity.

Applied and sociolinguists need more empirical studies on how the framing differs in different interactions, with different semiotic repertoires gaining functionality. While all interactions involve all three repertoires, it is possible that certain resources are more salient in certain genres of communication, constituting 'hierarchical constellations'. The framing and footing of interactions will also explain the possibility of communicative failure, different valuation of material resources, and unequal statuses of translingual repertoires.

Notes

1. Other theoretical orientations such as Actor Network Theory (Latour, 2005), Deleuzian rhizomalysis (Deleuze & Guattari, 1987), and postmodern human geography (Massey, 2005) also contribute to developing a radically materialist orientation to communication as an activity.
2. This research was approved by the university's Institutional Review Board and consent was obtained from all participants. Their names are pseudonyms. Note also that traditional labels for languages, nations, and speaker identities (i.e. 'native speaker' etc.) are used in this article despite its critical transnational and translingual orientation. My position is that while languages and identities are not *ontological*, they are *ideological* and a social fact. I use the socially accepted labels to identify the participants.
3. In the interest of space and the focus of this paper on analysis, I keep the data representation simple. Though there is ongoing experimentation on new forms of transcription and visual representation, I adopt a simpler format in this article. See Appendix for transcription conventions.

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Appendix

Transcription conventions:
= Contiguous utterances (latching)
{ Gesture-speech co-occurrences
[Overlapping utterances
(.) Micro-pause (0.2 seconds or shorter)
(1.3) The number inside the parentheses represents the length of the pause.
> < Surrounds talk that is spoken faster
° ° Soft speech
$word$ Surrounds talk that is said in a smiley voice
: Elongation. Each : represents 0.2 seconds.
- Abrupt stop in articulation. Cut-off.
, Slight rise in pitch at the end of an utterance. Continuing intonation.
( ) Uncertain utterances. Surrounds the transcriber's best guess.
(xxx) Unintelligible syllables. The number of x's represents the number of unintelligible syllables.
(( )) Description of nonverbal conduct
[…] deleted from transcript