Research article / Научная статья

Nonverbal communication at the ecolinguistic grassroots

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Abstract

In the Lebenswelt of everyday communication, meaning emerges from the interplay of verbal and nonverbal semiosis. While textual discourse analysis offers valuable insights, the richness and complexity of human communication come to the fore when considering communication in its entirety, including nonverbal elements. This paper aims to move beyond theoretical analysis and support real-world organizing efforts, offering a more comprehensive understanding of the human-environment relationship and its implications for environmental justice. It argues for integrating nonverbal analysis into ecolinguistic praxis, particularly in engagement with communities and civil society, or the ecolinguistic 'grassroots.' However, there is a gap in existing ecolinguistic scholarship regarding frameworks for this integration. To address this, the paper presents a multilevel methodology based on eight hours of audio and video recordings, which capture different perspectives on mining operations and proposed developments. These include interviews, documentaries, and recordings from 'town hall' meetings from YouTube recordings uploaded between approximately 2007 and 2018. Analysis of facial expressions and gestures reveals distinct cognitive responses at different thematic levels of discourse (ecological, cultural, socioeconomic). This paper demonstrates how such findings have important implications for practitioners engaging with working-class communities impacted by environmental change. As nonverbal research increasingly focuses on human-computer interaction and artificial intelligence, this study advocates for nonverbal analysis as humanistic inquiry, emphasizing meaning-centered approaches that draw from the embodied nature of human interaction to foster empathic understanding and more effective organizing within communities.

Keywords: *ecolinguistics, discourse analysis, nonverbal communication, environmental communication, body language*

Эколингвистика невербальной коммуникации

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Аннотация

В повседневном общении смысл возникает в результате семиозиса вербального и невербального. Хотя текстовый анализ дискурса дает ценную информацию, богатство и сложность человеческого общения выходят на первый план, только если рассматривать коммуникацию во всей ее полноте, включая невербальные элементы. Цель данной работы – выйти за рамки теоретического анализа и привлечь внимание к практическим мерам, направленным на более полное понимание отношений между человеком и окружающей средой, а также их последствий для экологии. В ней приводятся аргументы в пользу интеграции невербального анализа в эколингвистическую практику, особенно при взаимодействии с населением и гражданским обществом. Однако в современной эколингвистике заметен пробел в отношении подходов к такой интеграции. Для решения этой проблемы в статье использована многоуровневая методология. Материалом послужили аудио- и видеозаписи (8 часов), загруженные на YouTube в период с 2007 по 2018 гг., в которых отражены различные точки зрения на горнодобывающие работы и предлагаемые проекты. Они включают интервью, документальные фильмы и встречи с общественностью. Анализ мимики и жестов позволил выявить различные когнитивные реакции на разных тематических уровнях дискурса (экологическом, культурном, социально-экономическом). В статье показано, как полученные результаты могут помочь специалистам-практикам, работающим с представителями рабочих поселков, подверженных влиянию экологических изменений. В то время как исследования невербальных реакций все больше фокусируются на взаимодействии человека с компьютером и на искусственном интеллекте, данная работа выступает за невербальный анализ как гуманистическое направление, опирающееся на смыслоориентированные подходы и естественную природу человеческого взаимодействия.

Ключевые слова: *эколингвистика, дискурсивный анализ, невербальная коммуникация, экологическая коммуникация, язык тела*

1. Introduction

Ecolinguistics explores the intricate relationships between language, culture, and the natural world, emerging from Haugen's (1972) foundational concept of the "ecology of language." The field critically examines how language shapes—and is shaped by—human interactions with the environment, with applications ranging from environmental discourse analysis to linguistic diversity and sustainability (Stibbe 2015). Halliday (2001) argued that linguistic patterns often reflect anthropocentric ideologies that contribute to environmental harm.

While much of ecolinguistics focuses on verbal language, this paper proposes the integration of nonverbal communication into ecolinguistic praxis, specifically in engagements with grassroots communities and civil society. Nonverbal

communication—encompassing gestures, facial expressions, posture, prosody, and other embodied forms of interaction—plays a crucial role in how humans connect with their surroundings. By incorporating nonverbal analysis into ecolinguistic frameworks, this study seeks to present a more holistic understanding of how meaning is constructed and expressed in ecological contexts, advancing empathic understanding and promoting more effective organizing for environmental justice.

Traditional ecolinguistic research, which has predominantly focused on verbal discourse, has largely overlooked the embodied dimensions of communication. This gap limits the field's ability to account for the full range of human semiotic practices in ecological contexts. This paper proposes that integrating nonverbal communication into ecolinguistics can offer new insights into how individuals perceive, interpret, and respond to their environments. The observed patterns in nonverbal behaviors from this study underscore the need for methodological frameworks that adopt multimodal approaches to ecological meaning making.

The relationship between nonverbal communication and ecological perception is bidirectional. On one hand, environmental factors shape the form and function of nonverbal behaviors. For example, the prevalence of eye contact and spatial distancing in communication is influenced by habitat density and visibility (Eibl-Eibesfeldt 1970). On the other hand, nonverbal behaviors influence how individuals perceive and relate to their environments.

At a time when nonverbal research is increasingly driven by human computer interaction and artificial intelligence, this paper advocates for nonverbal analysis as humanistic inquiry. Meaning centered approaches, which draw from the rich, embodied nature of human interaction, can advance empathic understanding and create more inclusive methodologies for engaging with communities and civil society. By incorporating nonverbal communication into ecolinguistics, this paper aims to move beyond theoretical analysis and support real-world organizing efforts, offering a more comprehensive understanding of the human-environment relationship and its implications for environmental justice.

The following research questions guide this study:

- How do nonverbal behaviors, such as facial expressions and gestures, vary in response to ecological, cultural, and socioeconomic themes during community engagements on environmental issues?

- In what ways can the integration of nonverbal communication into ecolinguistic methodologies enhance the empathic understanding and effectiveness of environmental justice organizing?

- What implications do nonverbal patterns have for practitioners engaging with working-class communities affected by environmental change, and how can these insights inform more inclusive and culturally sensitive organizing strategies?

2. Theoretical background: Nonverbal communication

Nonverbal communication is a fundamental aspect of human interaction, often complementing or even surpassing verbal language in its capacity to convey meaning. Research in sociolinguistics, anthropology, and cognitive science demonstrates that nonverbals are profoundly influenced by cultural and environmental factors (Argyle 1988, Kendon 2004). For example, gestures vary significantly across cultures, reflecting different ecological and social contexts (McNeill 1992). This idea is further supported by the work of Leonteva, Cienki, and Agafonova (2023), which explores the metaphoric gestures in simultaneous interpreting, highlighting how embodied gestures can convey complex meanings that transcend verbal language. Cienki (2024) also emphasizes the self-focused versus dialogic features of gesturing, shedding light on how gestures in communication influence interpersonal dynamics in ecological discussions.

Moreover, nonverbal practices play a key role in shaping human relationships with the natural world. Indigenous communities, for instance, utilize embodied practices such as dance, ritual gestures, and spatial orientation to communicate ecological knowledge and values (Ingold 2000). Similarly, urban environments influence the rhythm and dynamics of bodily movement, as demonstrated in studies of proxemics and territoriality (Hall 1966). Ponton (2023) discusses the role of language and embodied gestures in ecolinguistics, particularly in response to the felling of 'Hadrian's tree,' reflecting how embodied communication is not only a means of environmental expression but also a way to navigate ecological destruction.

Nonverbal communication is also central to environmental activism. Protest movements often rely on embodied practices—such as marches, silent vigils, and symbolic gestures—to communicate their messages. An ecolinguistic analysis of these practices can reveal how nonverbal behaviors contribute to framing environmental issues and mobilizing public support (Johnston 2014). The concept of the *gaze* as a tool of power and oppression, as developed by bell hooks (1992), can deepen our understanding of how nonverbal practices in activism reclaim visibility and challenge systems of domination. Nonverbal communication in environmental movements is not only a means of dissent but also a form of asserting solidarity, promoting collective action, and resisting dehumanization in the face of environmental injustice.

By examining how these embodied forms of communication manifest in grassroots communities, this paper aims to provide more nuanced and culturally sensitive methodologies for engaging with civil society, particularly working-class communities affected by environmental change.

3. Materials and methods

This study focuses on the analysis of nonverbal, multimodal communication, including gestures, facial expressions, and paralanguage, which often occur within

and between spoken words. The analysis is situated within a multilevel framework, emphasizing the cognitive underpinnings of communication. The premise underlying this approach is that communication largely consists of unconscious nonverbal elements (e.g., body language, facial expressions, eye movements) that are integral to meaning and interpretation (Massaro 1987). Gestures are essential not only to communication but also to cognitive processes (McNeill 1992, McNeill 2005). Consequently, this analysis aims to interpret meaning beyond explicitly spoken words while considering nonverbal and verbal elements as complementary.

The analysis draws on a multimodal corpus of audio and video recordings of interviews, documentaries, and "town hall" type meetings related to mining operations and proposed developments. The multilevel methodology examines nonverbal communication in the recordings across ecological, cultural, and socioeconomic dimensions. Observed trends in facial expressions and gestures reveal that different cognitive responses are exhibited at distinct thematic levels of discourse (ecological, cultural, socioeconomic).

These analyses aim to uncover how nonverbal communication embodies and transmits ecological knowledge and values, reflecting the perspectives and priorities of specific communities.

3.1. Multimodal corpus

Multimodal communication is understood as an integrated process drawing on textual, aural, linguistic, spatial, and visual modes (Murray 2013). From a corpus linguistics and discourse analysis perspective, multimodal analysis involves a broader range of media, such as audio, video, and images, and incorporates nonverbal behaviors and paralanguage. Specifically, a multimodal corpus is defined as an annotated collection of communication data, including channels such as speech, gaze, gestures, and body language, typically based on recorded human behavior. Annotation is a key feature of multimodal corpus research, though it poses challenges due to time demands and the lack of standardized annotation methods (Abuczki & Esfandiari Baiat 2013).

3.2. Data collection and corpus description

The data for this study consists of approximately eight hours of audio and video recordings related to mining and natural resource development. These recordings include interviews, documentaries, and 'town hall' style meetings, which were collected manually using search engines, with results sourced from YouTube videos uploaded between approximately 2007 and 2018. Videos were searched using keywords such as "mining debates", "natural resource projects", and "ecological debates". A date range was applied to acquire results over a recent 10-year time span. The main criteria for video selection were the presence of a variety of speakers with sufficient video frames that could be analyzed for nonverbals. Emphasis was

placed on obtaining segments with a mix of professional and civil society actors with a balance of pro and anti-mining perspectives. An attempt was also made to gather videos from various geographic locations. The videos cover locations in the US, UK, Canada, Australia, South Africa, New Zealand, Afghanistan, and Honduras. 25 videos were collected (13 of which are analyzed in the present paper); 12 of those analyzed are in English, and one is in Spanish. Transcripts were generated for each media item and saved as individual text files, with timestamps (e.g., 05:45) included to facilitate reference. The corpus comprises 25 files, each linked to the original media via a URL. The total runtime of the media is 7 hours and 46 minutes, with an average runtime of approximately 18 minutes per recording.

3.3. Segment selection

Rather than annotating the entire corpus, a combination of top-down and bottom-up approaches was employed to select segments for detailed analysis:

• **Top-Down Approach**: The media recordings were manually reviewed, with attention given to gestures, body language, and other nonverbal expressions. Timestamps corresponding to distinctive nonverbal behaviors were marked for further annotation.

• **Bottom-Up Approach**: Keywords and phrases related to analytical themes (i.e. ecology, culture, socioeconomic issues) were searched within the transcripts. Segments associated with these themes were then identified for further analysis and annotation.

3.4. Annotation and analysis

The selected segments were annotated using an adapted version of Jefferson's (2004) transcription scheme, as summarized in Table 1. Annotations included visual, auditory, and verbal elements to capture the multimodal nature of communication. Each annotated segment was accompanied by descriptive narratives that integrate nonverbal and verbal components, addressing the following interpretive questions:

• What does the nonverbal communication reveal about the emotional state of the speaker?

• How does the nonverbal communication complement or contrast with the verbal communication?

• Does the nonverbal communication provide insights into the speaker's thought processes?

For presentation in this paper, image frames from the video segments were included to support interpretation along with the location, language, and a hyperlink to the relevant segment in the source video. To enable readability, footnotes were added to describe notable gestures, as in the example below.

Example Annotation

You *pray* before you go to bed... and >you just ask God to protect (you and) your family, that's all you *can* do,< because (.)　　　　　[*man* has done the damage to the earth (.) and man][1] (.) [I don't see how <man can correct what's been done>][2]. [*God* can handle this (.) and he will. When the right time comes][3], he will do what needs to be done.

1. Right hand motions forward; palm up.
2. Right hand motions forward, fingers and thumbs curled inward; head shaking.
3. Hand waves outward, stops at thigh; gaze upwards to sky; nodding.

Figure 1. Example; USA (English)
Source: https://www.youtube.com/embed/UvKe2LYy5pk?start=1198&end=1220

Table 1. **Adaptation of Jefferson's (2004) Annotation Scheme**

Symbol	Description
(.)	Micropause (< 0.2 seconds)
. or ↓	Falling pitch or intonation
? or ↑	Rising pitch or intonation
,	Temporary rise or fall in intonation
!-	Abrupt halt or interruption in utterance
>text<	Rapidly delivered speech
<text>	Slowly delivered speech
°	Whispered or reduced volume speech ALL CAPS
	Shouted or increased volume speech underline
	Emphasized speech
:::	Prolongation of a sound
hhh	Audible exhalation
.hhh	Audible inhalation
(text)	Unclear or doubtful speech
[text]	Gesture accompanying speech

3.5. Analytical considerations

Multimodal corpora present unique challenges compared to textual corpora due to the integration of both verbal and nonverbal elements. While textual corpora allow for clear segmentation of topics at the sentence level, multimodal data often blend themes (e.g., cultural, socioeconomic, and ecological) within single phrases, complicating the segmentation process. Furthermore, spoken language in

multimodal corpora typically features shorter sentences, reduced lexical diversity, and higher contextualization than written language. These characteristics shift the analytical focus from lexical items to moments of "highest communicative dynamism"—instances where speech and nonverbal expressions combine to underscore meaning (McNeill 2005).

The spoken language in the multimodal corpus is more conversational, with keywords like *know*, *people*, *right*, *mining*, and *think* emerging as top terms, reflecting the contextual nature of communication. In this analysis, rather than focusing solely on lexical items, attention is given to segments where nonverbal cues, such as gestures and facial expressions, intensify or complement verbal content. These moments of heightened communicative dynamism are key to understanding how speech and nonverbal behaviors interact to convey meaning.

3.6. Data annotation and interpretation

From the eight hours of video data, 13 clips were selected for detailed annotation and analysis. These clips share a common theme of mining and natural resource development. The descriptive analysis includes annotated video transcripts with accompanying physical descriptions of nonverbal behaviors. The annotation scheme, as summarized in Table 1, captures features such as pauses, pitch, intonation, and gesture integration. Interpretive narratives contextualize these annotations within broader communicative acts. Analysis was done for each thematic level (ecological, cultural, and socioeconomic) with 4–6 examples for each.

Following the individual segment analyses, a comparative analysis was conducted across all segments to identify patterns and overarching themes.

4. Analysis

4.1. Ecological level

4.1.1. Examples and analysis

For the ecological level, excerpts were selected wherein speakers are explicitly discussing ecological issues. These excerpts were selected manually, from a qualitative survey of the data. Despite the nearly 8 hours of video on the topic of natural resource development, there are relatively few cases where the speech segments clearly fell into the ecological level.

Below there are four examples of ecological level communication. Three of these excerpts feature subject matter experts who employ technical and scientific concepts. The final example features a citizen protester. Example 1 below consists of an excerpt and accompanying gestures in Figure 1. In this segment, a researcher is discussing impacts of deep-sea mining.

Example 1

(the) [*direct* impact][1] will likely result in biodiversity loss that will be very difficult to [recover from,][2] but we *really* don't understand if any of the [*wider* impacts][3] as well, so outside the [area of][4] mining itself <how will this> [affect the ecosystem at large how will this feedback into the oceans][5] we think that the deep sea...

1. Hand downward in swift movement, fingers pointed outward.
2. Hands in cycling motion forward.
3. Hands expanding outwards.
4. Hand in wide circular movement with palm down.
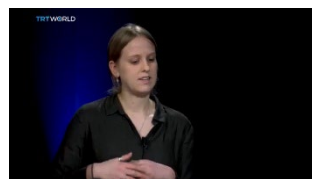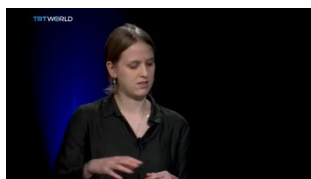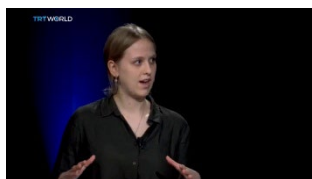5. Hands in cycling movement with palms inwards.

Figure 2. Example 1; UK (English)
Left: hands open palms down gesture with fingers extended to emphasize direct ecological impacts. Middle, *Right*: Hands loosened, palms inward/down in a cycling motion to reflect less certain long term ecological processes and feedback mechanisms.
Source: https://youtu.be/-UPjsuuyvD4?si=ltFHWbaV3LTNd2RI&t=624

Noticeable in Example 1 are the controlled hand gestures. The hands reflect the physical and ecological processes taking place. For instance, "direct impact" of mining is accompanied by a swift downward movement or arms and hands. The fingers and thumbs extended with palms facing downward are indicative of impact and gravity in a short time frame. When speaking of the "area of mining" the palm is similarly facing downward with a circular motion of the hand, indicating surety of the impacts in the mining area. By contrast, the cycling motions of the hands indicate a longer time frame of "feedback" and wider impacts. The palms shift to face inwards with more relaxed (non-extended) fingers and thumbs, suggesting less certainty about these long-term impacts. So, in this excerpt we see how the direction of palms and extension of fingers/thumbs reflect degrees of certainty and uncertainty.

Beyond hand gestures, other nonverbals are noticeable. For much of the segment the head is tilted to the side, which has been interpreted as a sign of interest, curiosity, and uncertainty (Lewis 2012: 94). There are moments where the eye gaze shifts upwards which, in European/North American cultures is commonly seen as a sign that someone is thinking (McCarthy et al. 2006). Finally, it should be noted that facial expressions in Example 1 are minimal and do not convey any apparent emotions.

Example 2 features a researcher talking about concerns associated with coal mining near a nature reserve.

Example 2
Where our [concern lies is with respect to dust because there's no analysis of the dust in terms of the toxic components in that dust][1] given the coal mining and the blasting and that sort of thing. Now, you can feel [this wind. <This wind>][2] is blowing across us [right into the game reserve][3], so [if] they mine here, this southeasterly wind will carry the dust and the fallout will be in the park, >in the wilderness area<.
1. Hand in front facing inwards palms open thumbs up.
2. Hands pointing left hand to left.
3. Hand (right) pointing to the right.

Figure 3. Example 2; South Africa (English)
Hand and arm points to left (*Left image*) and then to right (*Right image*)
to reflect the physical movement of dust
Source: https://www.youtube.com/embed/Sh0_Wf8F4RM?start=857&end=888)

Though difficult to see in the frame, when the man in Example 2 is speaking about "our concern," the palms are inward. The fingers and thumbs are extended and the hands motioning up and down with speech emphasis. This cluster of hand gestures suggests possession (palms inward to express *our* concern) as well as a confidence that this is serious (thumbs up) perhaps with a degree of uncertainty (palms inward). Also, as in the previous excerpt, the hands and arms are used to describe physical and ecological processes which, in this case, is the directional transfer of dust.

Compared with Example 1, there are several indicators in Example 2 suggesting the speaker's emotions are at play. In the first excerpt, hand movements are used to complement and reiterate the verbal communication. On the second, however, the nonverbals give more of an indication about what is not explicit verbally. For instance, the furrowed eyebrows indicate stress and concern, as do stress lines on the forehead. The swift, agitated up and down movement of hands also convey a sense of urgency. The speaker places stress on certain words (e.g. "dust", "wind") and changes the speed and cadence.

In Example 3, an engineer or industry representative is facing questioning on contamination of groundwater due to coal mining.

Example 3
People don't understand that <you have to> >maintain a well just like you do your car<.[1] A lot of people just [turn on the spigot,][2] and they think [it's going

to work for them][3] (.) when they have <things like iron hydroxide precipitate> (.) and other metals built up in [their wells (and) every time I go out on a well complaint, I tell people][4] you [need to have a friend at the local (.) volunteer fire department come out and flush your well (out)][5]....

1. Index finger and thumb together in precision.
2. Turning of index finger and thumb.
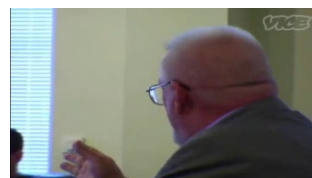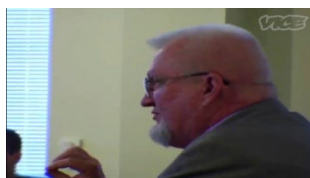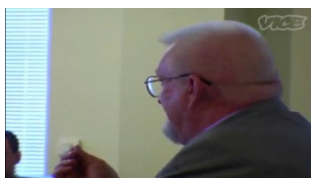3. Hand out palm up.
4. Hand out palm up.
5. Nodding.

Figure 4. Example 3; US (English)
Left and Middle: the index finger and thumb join to create a precision movement. *Right*: the open hand palm up gesture functions as a suppliant offer of an idea.
Source: https://www.youtube.com/embed/UvKe2LYy5pk?start=920&end=945

In the context of the segment, the speaker is on the defensive, since he is trying to convince listeners that the coal industry is not responsible for water quality issues. A noticeable gesture is the touching of the thumb and index finger, which is accompanied by a turning motion when describing well operation. Like in the previous examples, hand gestures complement and emphasize the verbal communication by mimicking physical processes. Touching the index finger and thumb together can be interpreted as precision, or a focus on technical details, while the turning motion emphasizes the mechanical nature of the process.

Similarly, the gesture that accompanies the phrase "you have to maintain a well," in which the palm is facing up, has the same interpretation. This suggests an offer of information to the listener, extending an idea to them. The body and facial gestures, such as nodding and brief pauses between phrases, suggest that this is an attempt to connect the audience with the practical aspects of well maintenance.

Example 4 features a protester, and it contrasts sharply with the previous three, as this excerpt is not at all technical.

Example 4
[We've got to build a whole new energy infrastructure for this country, and if we don't we're going to have (.) climate chaos and our kids are going to not thank us for that].[1]
1. Continuous shaking of HEAD.

Figure 5. Example 4; US (English)
The left hand gesture consists of hands raised upwards with wide arms signaling to the surrounding.
Source: https://youtu.be/vBhvFWRLiOs?si=6nCKIunurXSxJAsz&t=821

With the hands immobilized, gestures in Example 4 are confined largely to the head. In this segment, the speaker is expressing the need to build new energy infrastructure in the face of climate change. The words are accompanied by continuous shaking of the head. This head gesture might be interpreted as disapproval and condemnation. However, it can also be considered that this head shaking functions as a verbal intensifier with the negation carrying the meaning of "unbelievable" (McClave 2000: 861). Also noticeable in this clip is the slight head tilt (also seen in Example 1). The facial expression might be interpreted as serious and somber, but does not display a high degree of emotion.

4.1.2. Summary of ecological level

The four examples above feature speakers from different points of view with respect to the ecological issues at hand. Of the four speakers, two are researchers, one is a company representative, and another is a protester. In all cases, the level of emotion expressed through nonverbal communication is minimal. While the second speaker does appear to convey some agitation or urgency through facial expressions and paralanguage, the overall segment is more a rational argumentation than an emotional expression. The last speaker, despite the context of being arrested, comes across as somber and earnest, but not particularly emotional.

In the first three examples, gestures are predominantly iconic speech illustrators, meaning they display a close relationship with the content of the speech (Beattie 2016: 60); (Matsumoto & H. C. Hwang 2012: 76). For instance, the first speaker uses deliberate and measured hand movements that reflect biophysical processes (ecological impact, recovery) expressed in speech. Also in Example 2, hand gestures reflect physical processes of dust transfer. The third speaker uses nonverbal hand movements to reflect the process of inspecting a well, but also employs what could be described as rhetorical gestures to convince listeners.

4.2. Cultural level

4.2.1. Examples and analysis

The cultural level of communication often involves expressing aspects of one's identity, including national, subnational, ethnic, and religious affiliations. The

following examples illustrate how nonverbal cues and speech convey these cultural identities in different contexts, including resource development, indigenous rights, religion, and regional identity.

In this segment about extractive mining in Afghanistan, an Afghan archaeologist speaks about the loss of cultural identity due to prolonged wars. The phrase "our identity" signifies a strong connection to Afghan culture and the belief that cultural preservation is the key to reclaiming it. The speaker uses both speech and gestures to emphasize this message.

> Example 5
> ...with [all these wars (over) 30, 40 years][1], (.) what the Afghan has lost we lost [our identity][2]! and [I *believe*][3] to give (them) *back* that
> identity is only through [*culture*][4] ! because when it [*comes*][5] to culture, all Afghans are united.
> 1. Left hand forward palm up; lateral sweep of head and hand.
> 2. Right hand motion to side; index finger extended; eyebrows raised.
> 3. Right hand motion to side; index finger extended; head tilts to one side.
> 4. Right hand motion forward; index finger extended.
> 5. Right hand motion forward; index finger extended; intonation on "comes."

The hand gestures highlight the importance of the speaker's message, transitioning from a broad, open gesture to a pointed one to stress the significance of identity and culture. The use of metaphoric gestures, like the sweeping motion to represent the passage of time, contrasts with literal gestures that typically indicate object references. The pointing gesture emphasizes the central idea of culture and identity, which the speaker feels is at the core of Afghan unity.

Figure 6. Example 5; Afghanistan (English)
Source: https://www.youtube.com/embed/z6ewpjWYfYo?start=535&end=555

The next example discusses the proposed mining near sacred indigenous burial sites. The speaker's nonverbal communication underscores the emotional weight of this topic, reflecting both personal and collective cultural connections to the land.

> Example 6
> (It's) [my prehistoric ancestors][1] (.) that are right within this mining area and [I don't want (.) .hhh hhh you know][2] [any *mine*][3] near them, >I don't want any equipment near them.< We have <three known *burial* > (mound) groups that are there.
> 1. Nodding head on beat.

2. Shaking head.
3. Left lip tightened and raised; slight raising of shoulders.

The head movements serve to emphasize key points: the nod signifies agreement with the significance of the ancestors, while the shaking head expresses disapproval of the proposed mining. The facial expression during "any mine" conveys contempt, echoing Darwin's observations on expressions of antagonism. The combination of these movements with vocal stress enhances the emotional tone of the message.

Figure 7. Example 6; US (English)
Source: https://www.youtube.com/embed/1OFrfEa0Xck?start=33&end=45

In this example, the speaker reflects on the loss of sacred indigenous lands and the need to reclaim cultural dignity. The speaker's gestures—emphasized hand movements, clenched fists, and eye movements—reinforce the emotional and cultural significance of the message.

Example 7
<[They crushed out sacred site]>.[1] They never [listened to aboriginal people, <elders, female elders>][2] (.) you know they've been [*stomped* on].[3] So it's time for them to *stand* up and say [hey you're not doing this to me anymore].[4]
1. Right hand motion forward on beat; palm up; index finger and thumb touching.
2. Right hand motion forward on beat; palm up; fingers and thumb open; high blink rate.
3. Head swipe, left to right with emphasis.
4. Head motion with clenched fist.

The hand gestures punctuate key phrases, particularly the clenched fist, which conveys frustration and the resolve to fight back. The eye movements and facial expressions provide additional emotional depth, reflecting stress and determination. High blink rate and narrowed eyes indicate emotional tension, possibly linked to fear or frustration about the desecration of sacred lands.

Figure 8. Example 7; New Zealand (English)
Source: https://www.youtube.com/embed/awnLI4pRnUM?start=42&end=58

In this example, the speaker discusses the impact of mountaintop coal mining on the environment, expressing religious faith as a way to cope with the damage caused by human actions. The combination of gestures and gaze emphasizes the spiritual perspective on the issue.

Example 8

You *pray* before you go to bed... and >you just ask God to protect (you and) your family, that's all you *can* do, < because (.) [*man* has done the damage to the earth (.) and man][1] (.) [I don't see how <man can correct what's been done>][2]. [*God* can handle this (.) and he will. When the right time comes][3], he will do what needs to be done.

1. Right hand motions forward; palm up.
2. Right hand motions forward, fingers and thumbs curled inward; head shaking.
3. Hand waves outward, stops at thigh; gaze upwards to sky; nodding.

The contrast between the downward motions when discussing "man" and the upward motion when referencing "God" visually reinforces the distinction between human responsibility and divine intervention. The nodding and upward gaze serve as an affirmation of faith and trust in God's will.

Figure 9. Example 8; US (English)
Source: https://www.youtube.com/embed/UvKe2LYy5pk?start=1198&end=1220

The speaker in this example discusses their deep connection to the region, emphasizing that regional pride is integral to their personal identity. Nonverbal cues reinforce their personal and regional connections, showing an implicit ingroup/outgroup dynamic.

Example 9

If [they're for us][1], that's good. If they're [against us, get out][2] of the state.
1. Hand motion down towards ground, index finger extended.
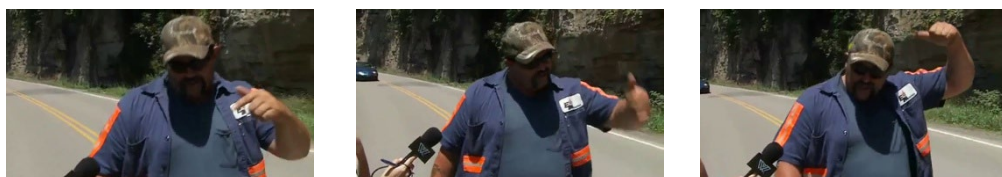2. Thumb up; hand motion back over left shoulder.

Figure 10. Example 9; US (English)
Source: https://youtu.be/vBhvFWRLiOs?si=vcPRnhRR8-fs1DfX&t=467

This example shows how ingroup/outgroup dynamics are embodied in gesture. The words "if they're for us..." is accompanied by a pointing downwards in front. When referring to those "against us," the speaker gestures with his thumb over the left shoulder. Using the thumb to point in this way is considered a sign of ridicule and disrespect (Lewis 2012: 140). Thumb displays in general are also associated with expressions of power and authority. Here, the thumb display might be seen as an embodiment of the confidence associated with ingroup association.

4.2.2. Summary of cultural level

At the cultural level, there is a noticeable increase in the animation of nonverbal communication. Hand movements appear more spontaneous and forceful than in the previous ecological level examples. Facial expressions and eye movements also become more apparent. Hand movements include markers of emphasis, such as pointing and onbeat motions. Clenched fists and thumb displays signal stronger, more emotive communication. Head movements are more pronounced compared to the ecological level, including negative shaking and affirmative nodding. Facial expressions also show increased blink rates, and in one case, the well-known indicator of contempt by raising one side of the lip.

The cultural level examples also exhibit a high degree of confidence and affirmation. Pointing, fist clenching, and nodding are signals that speakers believe in their message and affirm it. Similarly, the thumb display in the final example is a gesture of high confidence.

4.3.   Socioeconomic level

4.3.1. Examples and analysis

The socioeconomic level features four examples, where speakers refer to issues of justice, economics, and social institutions. These include a woman speaking about violence surrounding mining projects in Honduras; a woman addressing an audience regarding the need for economic opportunities in their community; a retired miner talking about the lack of institutional regulation toward the coal industry; and a woman stressing the importance of coal mining to her family's livelihood.

Example 10 below is a segment from an interview with a Lenca indigenous woman in Honduras.

> Example 10
> (Translated from Spanish-only gesture annotation) The worst impacts have been state violence. Why? Because we have comrades who have been killed following military harassment. [We've already lost one person].[1]
> 1.   Raised eyebrows; wide eyes; extenuated blinks.

Figure 11. Example 10; Honduras (Spanish)
Source: https://www.youtube.com/embed/gU7PBoywFE?start=10&end=21
(video no longer available)

In this example (10), the analysis is largely limited to facial expressions. As she discusses violence and harassment from mining and hydroelectric projects, the eyes and face are strong nonverbal indicators. Particularly in the final frames, the

eyebrows are pulled up and together, and the eyes are widened. The raised eyebrows are characteristic of what's often claimed as a universal facial expression denoting fear (Matsumoto & H. S. Hwang 2013: 28–30).

Example 11 is unique in that we are able to view body language of listeners as well as the speaker. In this clip, a woman is talking about economic hardships in the community in the context of a debate around proposed uranium mining.

Example 11
<*Five years* (we've been trying to keep our doors open,) *thinking* (.) any day now> those jobs were going to be here. >These are the only people that have come in and offered us jobs↑< If *any* (of the people here who are against it had come in and [said they had jobs to match it, we'd be behind that too. But right now this is all we've got) [1]. Everyone one of you who has stood up against this could have brought in jobs [for *us*].[2]
1. Raised and upward slanted eyebrows, stressed blink.
2. Hand points inwards toward chest; index finger extended.

Figure 12: Example 11; US (English)
Source: https://www.youtube.com/embed/Sh0_Wf8F4RM?start=390&end=420

Figure 13. Socioeconomic level, listener reactions

Here we observe an extended blink as well as upward slanted eyebrows. The eyes show concern, worry, and sadness. These expressions are mirrored among listeners. In 13 (bottom left), we see a woman with a similar worried and sad expression along with pursed lips. The emotional intensity is apparent, given that tearing eyes can be observed, both in the speaker and one of the audience members.

Audience members are shown with their hands clenched in front of their faces (Figure 12, top left and top right), another indicator of a negative or anxious attitude. On the bottom right of Figure 12, we see a man with an obvious expression of sadness, as well as a woman behind him with her hand placed on the sternum, a nonverbal expression of empathy.

In this segment, stress and intonation are used more emphatically than in any of the previous segments. For example, in the beginning of the segment, the stress on "five years" emphasizes the time duration of hardship. The intonation in the second sentence also conveys a sense of urgency and exasperation. Finally, the stress on the word "us," together with pointing toward the chest, indicates the personal feelings and emotions at play.

The next example (12) is an interview with a former coal miner on the topic of mountain top removal coal mining.

Example 12
[They're fighting][1] a losing battle I feel (.) myself I feel like they're just fighting a losing battle, because the <[politicians and the] big coal companies and things they're going to win hands down> because the judges and arbitrators are just going to go their way.<][3]
1. Both hands extend outward, palms up.
2. Both hands motion forward/downward, palms down.
3. Both hands extend outward, palms up, with emphasis.

Figure 14. Example 12; US (English)
Source: https://youtu.be/vBhvFWRLiOs?si=rRPDh2OZwAQFhIi5&t=1298

Example 12 exhibits the open hand palm up gesture at various points. At the beginning of the segment, the speaker displays an open hands gesture. This open palm gesture, commonly referred to as a "pleading" or "begging" gesture (Lewis 2012: 149), depicts a sense of helplessness and resignation. The words "fighting a losing battle" complement this sense. The palms-open gesture repeats several times on the stressed words, adding to the sense of futility the speaker is conveying. Briefly, the palm shifts downward to stress the word "politicians," indicating that the speaker is making a strong, assertive point. However, the palms quickly shift upwards for the remainder of the segment. Looking to the facial expressions, we can see eyebrows pinched at the center and sloping downwards. This "knit brow" can be interpreted as an expression of worry or concern (Hartley & Karinch 2017).

The final example is from the same piece on mountain top removal coal mining. The speaker is defending the coal miners and stressing the importance of the industry for her community and family.

Example 13

If you choose to live in West Virginia, [this is (.) this is the best paying job there is↑][1]. *Interviewer* : What happens if mountain top removal goes away, what happens to you and your family? WE GO HUNGRY![2]

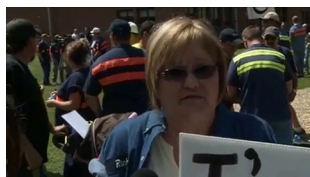1. Shoulders raise; nodding.
2. Eyebrows raise.

Figure 15. Example 13; US (English)
Source: https://youtu.be/vBhvFWRLiOs?si=0ryNRaZzeK-FAPR0&t=58

Like in the previous example, the facial expression is one of worry and concern. Coinciding with "this is the best paying job there is," is a subtle raising of the shoulders. Additionally, a strong emphasis on "WE GO HUNGRY," combined with the shoulders' dramatic rise and lowering, emphasizes the desperation felt in such moments. The facial expression also seems to convey exasperation and a heavy burden.

These four examples highlight how bodily gestures, facial expressions, and stress are key indicators of socioeconomic concerns within the context of these discussions. They emphasize both the economic struggles and personal stakes tied to industry and policy, as well as the emotional toll taken on the individuals and communities involved.

5. Discussion

5.1. Nonverbal communication and the unconscious

The notion that nonverbal communication is closely linked to the limbic system, which governs emotions and instinctive social responses. Sensory information is first processed by the thalamus, which directs it to different brain regions, including the amygdala for rapid emotional evaluation. Further interpretation occurs in the cortex, particularly in regions responsible for higher-order cognitive and social processing.

> Human cognition is mostly unconscious (about 98%) and is inseparable from emotion. Moreover, cognition is embodied, meaning that ideas, language, and even thought are mediated by the body (Lakoff 2010).
>
> Human needs, emotions, and intentions are processed by the limbic brain. Nonverbal communication, and particularly body language, is largely the expression of unconscious limbic processing (Navarro 2008, Lamendella 1977). Gestures are expressions of embodied cognition (Kinsbourne 2006).

> In contrast to nonverbal communication, human verbal language abilities are more consciously driven and concentrated in the frontal lobe, which is responsible for thinking, planning, and judgment.

In essence, cognition is mostly unconscious, inseparable from the body, and is expressed through embodied communication. This implies that nonverbal cues convey thoughts, feelings, and emotions in ways that speech alone cannot. Nonverbals are often not as inhibited and regulated as speech, which is managed by the cortical and frontal lobe areas of the brain. While this explanation is a simplification, it is grounded in the understanding that nonverbal communication is essential to comprehending the full communicative intent, encompassing emotions and reactions, as well as cognition and judgment.

While nonverbals can be deliberate and intentional, they often occur without our conscious awareness and are therefore explicable in terms of the limbic system. For instance, involuntary facial expressions originate in subcortical brain areas (Matsumoto & H. S. Hwang 2013). There is also evidence that head movements encode emotional intent (Livingstone & Palmer 2016). In fact, gestures, as opposed to sign language or emblems, are defined as being produced without conscious awareness (Beattie 2016).

5.2. Emotional expression

Another key point is that nonverbal communication is closely linked to the site of emotional processing, the limbic system. Sensory information is first processed by the amygdala, which is part of the limbic system, before further processing by the cortex. As LeDoux explains:

> Visual information is first processed by the thalamus, which passes rough, almost archetypal, information directly to the amygdala. This quick transmission allows the brain to start responding to possible danger (LeDoux 1994: 56).

In this way, emotions serve a crucial cognitive evolutionary function by enabling rapid information processing with minimal deliberation (Tooby & Cosmides 2008). In contrast to the classical Enlightenment ideal of rational thinking, emotions are inseparable from cognition (Lakoff 2010).

It should be noted that there is not universal agreement that nonverbal communication merely reflects internal emotions. With regard to facial expressions, Crivelli and Fridlund (2018) note that the behavioral ecology view of facial displays (BECV) sees these expressions as tools for social influence, contrasting with the basic emotions theory (BET), which holds that facial expressions reflect internal emotions. However, the behavioral ecology view offers an alternative explanation for what we perceive as emotions but remains compatible with the idea that facial expressions often occur without conscious awareness (Lakin 2006: 65).

5.3. Cognitive level interpretation of facial expressions

Psychological research has suggested that there are universal facial expressions (UEs), which correspond to the "six basic emotions" proposed by Paul Ekman and Friesen (1971) and P. Ekman (1972): happiness, surprise, disgust, sadness, anger, and fear. This early research also highlighted cross cultural variability in facial expressions, attributed to "display rules" that are learned in a cultural context. Recent research has challenged the universality hypothesis by finding distinct differences in how people from Western and Eastern cultures display and recognize the six basic emotions. Jack et al. (2012) also found cultural variability in the parts of the face used to express emotion, with East Asian models of emotion attributing greater intensity to the eyes. This supports the hypothesis that East Asian cultures learn to be more inhibited in expressing emotion, with the eyes (which are less under voluntary control than the mouth) becoming more prominent indicators of emotional expression (Mai et al. 2011).

Interpretation of facial expressions, therefore, is not always straightforward. While there may be some general, possibly universal characteristics, the expression and interpretation of emotion are also influenced by the culture of the speaker and observer. Paying particular attention to the eyes can help account for cultural variability.

In the examples presented, the facial expressions can be interpreted as indicating varying degrees of emotion depending on the level of analysis. For instance, in a professional context, a "neutral face" may indicate minimal emotion or an expression whose emotional meaning is context dependent. The speaker's engagement with nonbinary thinking also suggests that there is emotional modulation via the cortex, which enables exploration of multiple perspectives rather than a reflexive emotional response from the amygdala (Wood & Petriglieri 2005).

5.4. Cognitive level interpretation of gestures

In addition to facial expressions, the three levels of analysis (ecological, cultural, and socioeconomic) also exhibit differences in the gestures displayed. As mentioned, in ecological contexts, gestures tend to be iconic, reflecting literal spoken words, often at the interface of imagistic and linguistic representation (Özyürek 2010). As speakers begin to address cultural and socioeconomic topics, their gestures become more metaphorical. At these levels, emotional intensity increases.

Kinsbourne (2006) describes how gestures driven by emotion become less discrete, often occurring alongside postural shifts and facial expressions, which collectively emphasize and clarify the communicated meaning:

> When gestures are driven by emotion, they become less discrete, and may occur in concert with postural shifts and facial expressions that incidentally emphasize and clarify the meaning being communicated (Kinsbourne 2006: 208).

Thus, when a speaker is more emotional, their gestures often increase in amplitude, pace, or frequency. However, gestures alone do not convey emotion; they must be interpreted in conjunction with other nonverbal signals.

6. Conclusions

Nonverbals are not merely an important part of communication to consider alongside speech; they are inseparable from the message itself. This paper aimed to look at communication in a holistic sense, with verbal and nonverbal communication as part of an integrated flow. However, if there is a point at which we can distinguish nonverbals from verbal communication, it is with respect to their relation to cognition and emotions. As Beattie (2016) points out, with nonverbal communication, "meaning has not been controlled and self-edited by the speaker" (16). In other words, the nonverbal messages are reflective of mental processes and emotions, in ways that words alone are not.

The most notable conclusion is that different discursive levels corresponded to different types of nonverbal displays, as outlined in Table 2 below. These differences can be summarized as follows:

- Speakers at the ecological level generally show less facial expression. Gestures are predominantly iconic and depict physical/spatial processes. Compared to the other levels of analysis, intonation and stress are less pronounced.
- Speakers at the cultural level display more power and confidence gestures, including pointing (to add emphasis), thumb displays, and fist pumping. Gestures are more metaphoric than in the ecological level, depicting abstract concepts such as God, culture, identity, and fighting back. Contempt and agitation are displayed, at one point by the contempt expression (raised side of mouth) as well as the backwards thumb gesture on another occasion.

Table 2. **Summary of nonverbal communication observations**

Level	Gestures	Facial Expression	Paralanguage
Ecological	Iconic; depicting physical processes (directional pointing, hand motions)	Minimal emotional expression; some eyes looking up wards (thinking expression)	Minimal stress and intonation
Cultural	Metaphoric; depicting power, confidence, and assertion (palm down, pointing, fist pump, thumb displays)	Contempt displays; anger; agitation (sneer, higher blink rate, audible inhalation/exhalation)	Stress on key points; more variation in speed of speech
Socioeconomic	Hopelessness and innocence (palm open, shoulder shrug; hand on chest)	Sadness, concern, worry, fear (raised eyebrows, teary eyes, eyebrows pulled together)	Stress; intonation; more changes in pitch

- The socioeconomic level displays a high degree of emotion, often expressed in the eyes. Universal facial expressions of fear and sadness can be seen in the speakers and, in one case, among listeners. Gestures also indicate hopelessness and innocence, such as the palm open "pleading" gesture as well as the shoulder shrug.

It appears that emotions and unconscious attitudes vary when it comes to environmental issues. Specifically, when one's cultural identity or socioeconomic status are at stake, these attitudes intensify. When ecological issues are decontextualized from identities or livelihoods, the opposite seems to occur. Beattie (2016) discusses similar observations in terms of implicit and explicit attitudes towards environmental issues:

> The vast majority of people say that they really do care about environmental issues...yet... *sometimes* there is something about the form and nature of their hand movements...which might suggest otherwise. (19, original emphasis)

In other words, there is a discrepancy between what people consciously know they *should* care about, and how they unconsciously feel.

This discrepancy has great relevance when it comes to raising awareness about, and addressing, ecological issues. The implication is that mobilizing people to address ecological issues will depend on framing these issues in a way that speaks to their implicit, unconscious attitudes. From a cognitive science perspective, Lakoff (2010) makes this point and advances some implications for environmental communication, namely:

- The importance of discussing environmental issues in terms of moral values.
- The efficacy of stories and narratives as opposed to statistics and bland facts.
- The necessity to address everyday concerns and avoid technical jargon. (79–80)

The observations in this paper support these points. However, the point about "moral values" might be expanded to encompass cultural identity and worldviews. The examples in this paper show multiple ways in which culture emerges in environmental debates, and how issues become impassioned when this occurs. Also, the necessity to address "everyday issues" is underscored by the importance of framing issues in terms of economic livelihoods.

This study proposes an integrated methodology for analyzing nonverbal communication in environmental discourse. While many insights can be derived from textual discourse analysis, this research underscores the richness of human communication when verbal and nonverbal elements are analyzed together. Nonverbal communication, observed in interviews, documentaries, and town hall meetings, reveals important cognitive and emotional insights that textual analysis alone may miss. The observed patterns of facial expressions, gestures, and

paralanguage provide valuable data on the emotional and cognitive states of speakers, offering a more holistic understanding of their attitudes toward environmental change.

This approach is particularly useful in engaging with communities that are directly impacted by environmental issues, especially working-class communities whose livelihoods may depend on or be threatened by primary or extractive industries. By integrating nonverbal analysis into ecolinguistic praxis, this research highlights the potential for enhancing empathic understanding and supporting meaningful engagement between practitioners and civil society.

As the field of nonverbal communication increasingly intersects with human computer interaction and artificial intelligence, it is essential to remember that nonverbal communication is not merely a tool for technological application, but a profound element of humanistic inquiry. This study argues that by recognizing and valuing the embodied nature of human interaction, we can foster deeper understanding and empathy in addressing critical environmental and economic challenges.

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