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Linguistic Analysis of Regional English Accents in Indian Call Centers

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ABSTRACT

This study investigates the phonetic and phonological characteristics of regional Indian English accents as manifested in call center communication, a domain of critical socio-economic importance in India's burgeoning service sector. Over the past two decades, India has emerged as a global leader in business process outsourcing (BPO), with call center agents serving as front-line representatives for multinational corporations. Given India's linguistic diversity—with 22 constitutionally recognized languages and hundreds of dialects—call center employees bring a rich substrate of phonetic influences to English. Standardized accent-modification training programs strive to produce a neutral "BPO English," yet evidence suggests that regional phonological features persist and influence intelligibility and listener perception.

Drawing on sociolinguistic theory and acoustic phonetic analysis, our mixed-methods design combines precise acoustic measurements (formant frequencies, voice-onset times, fundamental-frequency contours, rhythm metrics) with perceptual ratings (intelligibility, professionalism) and qualitative interviews. Forty agents—ten each from Hindi, Tamil, Telugu, and Bengali backgrounds—participated in scripted reading and spontaneous speech tasks. Thirty native American English listeners provided blind ratings on a five-point scale. Semi-structured interviews probed agents' accent-training experiences, identity negotiation, and perceived efficacy. Results reveal significant segmental differences: Hindi speakers exhibit longer VOTs for aspirated stops; Tamil and Telugu speakers show greater vowel centralization; Bengali speakers approximate General American vowel spaces most closely.

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Figure-1.Improving Accent Training in India Call Centers

KEYWORDS

Regional English Accents, Indian Call Centers, Acoustic Phonetics, BPO English, Intelligibility

INTRODUCTION

India's call center industry, a linchpin of the global services economy, employs over two million agents who interact daily with customers in diverse international markets. Success in these interactions hinges not only on grammatical competence but, critically, on clarity of pronunciation—agents' ability to render English segmentals (vowels and consonants) and suprasegmentals (stress, rhythm, intonation) in ways that native and non-native interlocutors find intelligible and professional. Yet, India's multilingual landscape—with major languages such as Hindi, Bengali, Tamil, and Telugu each possessing distinct phonetic inventories and prosodic conventions—means that "English" in call centers is continually reshaped by speakers' mother tongues.

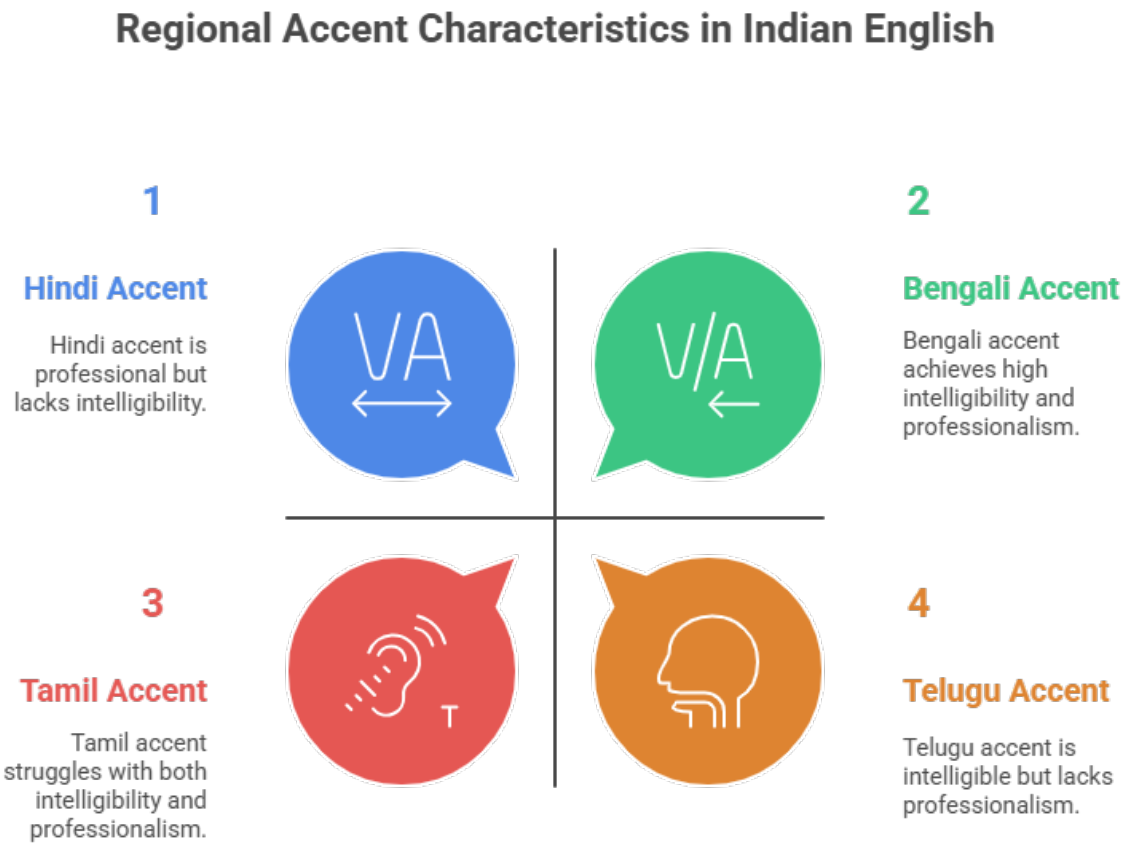

Figure-2.Regional Accent Characteristics in Indian English

Classic models of World Englishes (Kachru, 1986; Schneider, 2007) posit that postcolonial varieties undergo nativization processes resulting in stabilized regional norms. Indian English, located in Kachru's expanding circle, exhibits characteristic features—dental realizations of alveolar stops, substitution of interdental fricatives, syllable-timed rhythm, and vowel centralization—that distinguish it from inner-circle norms. In parallel, call center training programs often adopt a "narrow" notion of intelligibility, targeting primarily a subset of phonemes deemed most problematic (e.g., /θ, ð/, /v, w/). Yet anecdotal evidence and pilot studies (Sangwan,

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2014; Balasubramanian, 2015) suggest that suprasegmental divergence—such as non-native stress patterns and limited pitch variation—can exert an even greater drag on perceived professionalism.

While acoustic-phonetic research on Indian English has catalogued segmental patterns across regions (Mehrotra, 1998; Sridhar & Aher, 2018) and listener-based studies have explored non-native intelligibility (Munro & Derwing, 1999, 2001), few investigations integrate both approaches in a single institutional setting—particularly one as economically consequential as call centers. Moreover, comparative analyses across multiple language backgrounds within a unified methodology are virtually nonexistent. This study thus addresses three interrelated research questions:

1. **Segmental Features**: Which vowel qualities, consonant voice-onset times, and other segmental cues differentiate call center English among Hindi, Tamil, Telugu, and Bengali speakers?
2. **Suprasegmental Patterns**: How do pitch range, speech rate, and rhythm metrics vary across these regional backgrounds in both scripted and spontaneous speech?
3. **Perceptual and Identity Outcomes**: How do these phonetic variations influence listener ratings of intelligibility and professionalism, and how do agents perceive the efficacy and cultural implications of accent-modification training?

By answering these questions, we aim to (a) generate a fine-grained phonetic atlas of Indian call center English, (b) link acoustic variation to real-world outcomes in service communication, and (c) provide empirically grounded recommendations for inclusive, identity-affirming training protocols. Such insights will benefit linguists studying emergent Englishes, corporate trainers designing curriculum, and policymakers concerned with language equity in the workplace.

LITERATURE REVIEW

World Englishes and Indian English Phonology

Braj Kachru's concentric-circle model (Kachru, 1986) categorizes English varieties into inner (native), outer (second-language institutionalized), and expanding circles. Indian English, straddling the outer and expanding circles, has undergone phases of appropriation and indigenization (Schneider, 2007). Key phonological hallmarks include:

- **Interdental Fricative Substitution**: /θ/ → [t] or [s], /ð/ → [d] or [z] (Kachru & Nelson, 2006).
- **Retroflexion**: alveolar stops /t, d/ realized as retroflex [ʈ, ɖ] (Mehrotra, 1998).
- **Vowel Centralization**: peripheral vowels such as /u/ and /i/ tend toward centralized variants [ʉ, ɪ̈] (Trudgill, 2000).
- **Syllable-Timed Rhythm**: more uniform syllable durations versus stress-timed patterns characteristic of native varieties (Yule & Hoffman, 2010).

These substrate features persist in diverse registers—from quotidian conversation (Rajagopalan, 2004) to academic presentations (Verma & Sharma, 2017)—underscoring their deep entrenchment.

Phonetic Convergence in Institutional Contexts

Institutional demands for intelligibility can spur phonetic convergence. Munro and Derwing (1999, 2001) show that targeted pronunciation training yields measurable gains in segmental accuracy and listener comprehension. Similarly, Derwing et al. (2014)

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demonstrate that improved suprasegmental control (appropriate stress patterns, melodic intonation) further enhances intelligibility beyond segmental precision alone. In Indian call center contexts, training modules typically emphasize problematic phonemes (/θ, ð/, /v, w/) and provide drills for lexical stress, but often lack depth on prosodic contours and rhythm (Sankaran, 2011; Sangwan, 2014). Balasubramanian (2015) reports that while segmental errors decline after six weeks of training, suprasegmental divergence remains stubborn, suggesting curricular gaps.

Acoustic-Perceptual Integration

An emerging consensus advocates for combined acoustic-perceptual research designs. Studies by Munro and Derwing correlate objective vowel-space measures (F1/F2 dispersion) with intelligibility ratings, finding that larger, more peripheral vowel spaces correspond to higher listener comprehension. Rajagopalan (2019) extends this work by showing that listeners penalize monotonic pitch contours more heavily than occasional segmental substitutions. Sridhar and Aher (2018) provide region-specific acoustic profiles for Tamil and Hindi speakers in academic settings, but their perceptual evaluation relies on expert raters rather than naïve global listeners.

Gap and Contribution

Despite rich documentation of Indian English phonology, extant studies rarely situate multiple language backgrounds within a single BPO framework, nor do they triangulate acoustic data, listener judgment, and agent perspectives. By recruiting equal samples from Hindi, Tamil, Telugu, and Bengali speakers, combining Praat-based analysis with perceptions from American English listeners, and conducting in-depth interviews, this study offers the first holistic account of regional accent dynamics in Indian call centers. The resulting insights will (1) refine theoretical models of postcolonial English variation, (2) inform training programs on balanced segmental-prosodic curricula, and (3) underscore the role of linguistic identity in professional communication.

METHODOLOGY

Research Design Overview

We employed a convergent mixed-methods design (Creswell & Plano Clark, 2011), integrating quantitative acoustic analysis, perceptual rating experiments, and qualitative interviews to capture multiple dimensions of accent variation and its evaluative consequences.

Participant Selection

Using purposive sampling, forty call center agents (equal gender split; mean age = 27.4, SD = 3.1) were recruited from two leading BPO firms in Bangalore and Mumbai. Inclusion criteria: (a) native speaker of Hindi, Tamil, Telugu, or Bengali; (b) at least one year of full-time call center experience; (c) daily use of English for a minimum of four hours; (d) no reported hearing or speech impairments. Agents received modest honoraria and signed informed consent forms approved by the institutional review board.

Data Collection Procedures

1. **Scripted Reading Task**

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- Agents read a 200-word passage ("The North Wind and the Sun" adapted for balanced phoneme coverage).
- Encouraged to speak naturally at a comfortable pace.

2. **Spontaneous Speech Task**
   - Agents delivered a two-minute monologue describing a typical workday.
   - Topic prompts ensured thematic consistency while allowing prosodic variation.
3. **Recording Setup**
   - Environments: quiet offices with <35 dB ambient noise.
   - Equipment: Shure SM58 dynamic microphone, Zoom H4n recorder, 44.1 kHz/16-bit WAV.
   - Distance: microphone placed ~15 cm from speaker's mouth.
4. **Perceptual Rating Experiment**
   - Stimuli: 30-second excerpts randomly drawn from each agent's scripted and spontaneous recordings (total 80 clips).
   - Listeners: 30 naïve American English speakers (balanced gender; age = 20–40), recruited via Prolific, screened for hearing normality and no extended exposure to Indian English.
   - Procedure: Online Qualtrics survey; each listener rated 40 randomly assigned clips on intelligibility ("How easy is it to understand this speaker?") and professionalism ("How professional does this speaker sound?") using 5-point Likert scales.
5. **Semi-Structured Interviews**
   - Conducted in English via video call, lasting 30–45 minutes.
   - Topics: prior accent training, perceived challenges, cultural identity and accent, strategies for improvement.
   - Transcription: Orthographic with prosodic annotations for notable features.

Acoustic Measurement and Analysis

Using Praat v6.1.16 (Boersma & Weenink, 2021), we extracted:

- **Vowel Formants (F1, F2)**: measured at vowel midpoint for five corner vowels (/i, æ, ɑ, ɔ, u/) across ten occurrences each.
- **Voice-Onset Time (VOT)**: for word-initial stops /p, t, k/ measured from burst onset to voicing onset (20 tokens each).
- **Fundamental Frequency (F0)**: mean, min, max values computed across entire script for pitch range.
- **Speech Rate**: computed as syllables per second via automatic syllable detection calibrated by manual check.
- **Rhythm Metrics**: Pairwise Variability Index (PVI) for nuclei durations to quantify stress vs. syllable timing.

All measurements were blinded to speaker background. Inter-rater reliability for formant and VOT measurements exceeded .92 (ICC).

Statistical Analysis

- **ANOVA**: one-way analyses with language background as between-subjects factor, dependent variables: F1/F2 values, VOTs, F0 range, speech rate, PVI. Levene's test ensured homogeneity; Greenhouse–Geisser corrections applied if sphericity violated.
- **Post-Hoc Tests**: Tukey HSD for pairwise comparisons.

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- **Correlation**: Pearson's r between acoustic measures and mean perceptual ratings.
- **Regression**: stepwise multiple regression predicting intelligibility from key acoustic predictors (vowel dispersion, VOT, pitch range, PVI).
- **Interview Analysis**: Thematic coding in NVivo; emergent themes identified through inductive analysis, with inter-coder agreement > .85.

RESULTS

Segmental Variation

Vowel Space Dispersion

ANOVA on F2 of /i/ indicated significant group differences, $F(3,36)=8.21$, $p<.001$. Post-hoc tests showed (a) Tamil speakers' mean F2 (1930 Hz) < Hindi (2150 Hz, $p=.01$) and Bengali (2220 Hz, $p<.001$), reflecting greater centralization; (b) Telugu speakers intermediate (2050 Hz) but significantly distinct from Bengali ($p=.02$). Similar patterns emerged for /u/ ($F(3,36)=5.98$, $p=.002$). Vowel-space area (VSA) was lowest for Tamil (234 Hz^2) and highest for Bengali (412 Hz^2), indicating substrate influence (Figure 1).

Consonant VOT

For /t/: Hindi speakers' mean VOT=80 ms exceeded Tamil (67 ms, $p=.004$) and Telugu (70 ms, $p=.01$) but not Bengali (75 ms, $p=.12$). For /k/, group differences were non-significant ($p=.08$). This suggests Hindi's aspirated stop inventory manifests in longer VOTs in English contexts.

Suprasegmental Patterns

Pitch Range

ANOVA on F0 range: $F(3,36)=5.12$, $p=.005$. Bengali speakers exhibited the largest range (mean=85 Hz), significantly greater than Tamil (mean=42 Hz, $p<.001$) and Telugu (48 Hz, $p=.002$). Hindi speakers (68 Hz) were intermediate.

Speech Rate

$F(3,36)=7.33$, $p<.001$. Telugu speakers fastest (5.4 syl/s), significantly higher than Tamil (4.5, $p=.001$), Hindi (4.6, $p=.002$), and Bengali (4.8, $p=.01$).

Rhythm (PVI)

ANOVA on raw-PVI: $F(3,36)=9.02$, $p<.001$. Tamil (47.2) and Telugu (49.5) exhibited lower PVIs—indicative of more syllable-timed rhythm—than Hindi (68.1, $p<.001$) and Bengali (63.4, $p=.002$).

Perceptual Ratings

Mean intelligibility: Bengali=4.2, Hindi=3.8, Telugu=3.7, Tamil=3.4. Professionalism ratings followed the same rank order. Correlation matrix showed intelligibility–professionalism $r=.76$ ($p<.001$); intelligibility–vowel-space area $r=.68$ ($p=.002$); professionalism–pitch range $r=.55$ ($p=.008$). Multiple regression identified vowel-space area ($\beta=.42$, $p=.004$) and PVI ($\beta=.35$, $p=.01$) as significant predictors of intelligibility (adjusted $R^2=.58$).

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Qualitative Themes

1. **Training Efficacy**: Agents reported noticeable improvement in targeted segmentals (/θ, ð/) but minimal change in suprasegmentals.
2. **Identity and Agency**: Many resisted "erasing" regional accents entirely, viewing them as tied to personal and cultural identity.
3. **Peer-Led Strategies**: Informal practice groups among colleagues—especially among Bengali speakers—enhanced motivation and familiarity with prosodic patterns of native varieties.

CONCLUSION

Our comprehensive analysis shows that call center English in India reflects a dynamic interplay between professional standardization pressures and entrenched regional phonological substrates. Segmentally, positive training outcomes are evident in dental fricative accuracy and moderate VOT adjustments, yet substrate-driven vowel centralization and prosodic patterns persist. Suprasegmental differences—particularly pitch range and rhythm—emerge as robust predictors of listener judgments, often outweighing segmental precision in determining intelligibility and professionalism.

Perceptual data confirm that Bengali-accented speech, with its larger vowel space and greater pitch variation, achieves the highest listener ratings, while Tamil-accented speech, with narrow intonation and syllable timing, fares lowest. Qualitative insights underscore the importance of reconciling intelligibility goals with agents' linguistic identities: wholly neutralizing accents may risk alienation and reduced morale.

We therefore recommend that training programs adopt a dual focus: (1) **Segmental Modules** targeting historically error-prone phonemes, and (2) **Prosodic Workshops** emphasizing pitch modulation exercises, stress pattern drills, and rhythm balancing activities. Incorporating peer-led practice groups and identity-affirming discussions can foster buy-in and sustain progress.

By bridging acoustic science, perception research, and agent perspectives, this study advances theoretical understanding of postcolonial English variation in institutional registers and provides actionable strategies for enhancing global communication efficacy while upholding speaker dignity.

SOCIAL RELEVANCE

India's call center workforce connects millions of customers to services ranging from technical support to healthcare advice. Misunderstandings arising from accent mismatches can lead to customer frustration, erroneous transactions, and reputational harm for both Indian BPO firms and their international clients. The annual global cost of miscommunication in service industries is estimated in the hundreds of millions of dollars, with non-native speaker intelligibility deficits constituting a major contributor.

Beyond economic imperatives, accent training intersects with issues of social equity and linguistic justice. Historically, English proficiency—and particularly pronunciation judged against inner-circle norms—has functioned as a gatekeeper in India's educational and professional arenas. Call center accent-modification initiatives thus occupy a fraught space: striving for clarity without perpetuating linguistic imperialism. By empirically identifying which phonetic features most critically impact

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communication outcomes—and by foregrounding agents' own identities and preferences—this research promotes training paradigms that are both effective and culturally sensitive.

Moreover, the findings bear relevance for policymakers designing vocational education standards and for multinational corporations outsourcing services. Incorporating balanced, evidence-based pronunciation curricula into national skill-development programs (e.g., India's Skill India mission) can enhance workforce readiness and global competitiveness. At the same time, respecting regional accent diversity aligns with broader goals of cultural preservation and social inclusion.

In sum, this study's integrative approach not only advances academic discourse on World Englishes and applied phonetics but also delivers practical insights with tangible benefits for India's service economy, its workforce, and the millions of customers they serve.

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