



Phonological Transfer in Javanese - Indonesian Bilingual Speech: Optimality Theoretic Insights for Language Education

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Abstract

This study investigates phonological interference in a bilingual context, focusing on how Javanese phonology influences the pronunciation of Indonesian. Using Optimality Theory (OT) as its primary framework, the study examines patterns of interference, their underlying causes, and their broader social and educational implications. Fieldwork was conducted in Gampong Karang Anyar, Langsa, Aceh, involving six students from SDN 1 Karang Anyar who are Javanese-Indonesian bilingual speakers. Participants were selected through purposive sampling based on their linguistic backgrounds. Data were collected through interviews and audio recordings and were qualitatively analyzed within the framework of Optimality Theory (OT). The findings reveal systematic phoneme shifts: /d/ changes to /t/ (ahad → [a.hat]), /f/ changes to /p/ (foto → [po.to]), and /b/ changes to /p/ (sabtu → [sa.ptu]). These shifts reflect the dominance of Javanese phonological constraints. The study adopts a qualitative approach supported by relevant linguistic literature. The results indicate that phonological interference strongly influences communication and language acquisition, resulting in a combination of features from both languages. These findings have direct implications for language education, highlighting the need for pronunciation instruction that anticipates bilingual transfer, curriculum design that incorporates contrastive phonological analysis, and teacher training that enables educators to distinguish random errors from systematic interference. By linking OT with classroom practice, this study contributes to a deeper understanding of phonological transfer in bilingual speech and its relevance to language education in multilingual Indonesian contexts. Ultimately, the study provides empirical evidence for the operation of OT constraints in Javanese-Indonesian bilingual speech, shedding light on patterns of phonological transfer and offering insights for pronunciation pedagogy in multilingual educational settings.

Abstrak

Penelitian ini mengkaji interferensi fonologis dalam konteks bilingual, dengan fokus pada bagaimana fonologi bahasa Jawa memengaruhi pengucapan Bahasa Indonesia. Dengan menggunakan Optimality Theory (OT) sebagai kerangka utama, penelitian ini menganalisis pola interferensi, penyebabnya, serta implikasi sosial dan pendidikan yang lebih luas. Penelitian lapangan dilakukan di Gampong Karang Anyar, Langsa, Aceh, dengan melibatkan enam siswa SDN 1 Karang Anyar yang merupakan penutur bilingual bahasa Jawa Bahasa Indonesia. Partisipan dipilih menggunakan teknik purposive sampling berdasarkan latar belakang kebahasaan mereka. Data dikumpulkan melalui wawancara dan rekaman audio, kemudian dianalisis secara kualitatif menggunakan kerangka Optimality Theory (OT). Temuan menunjukkan adanya pergeseran fonem secara sistematis: /d/ berubah menjadi /t/ (ahad → [a.hat]), /f/ berubah menjadi /p/ (foto → [po.to]), dan /b/ berubah menjadi /p/ (sabtu → [sa.ptu]). Pergeseran ini mencerminkan dominasi kendala fonologis bahasa Jawa. Penelitian ini menggunakan pendekatan kualitatif yang didukung oleh kajian pustaka linguistik. Hasilnya menunjukkan bahwa interferensi fonologis berpengaruh kuat terhadap komunikasi dan pemerolehan bahasa, menghasilkan perpaduan ciri dari kedua bahasa. Temuan ini memiliki implikasi langsung bagi pendidikan bahasa, yaitu perlunya pengajaran pengucapan yang mengantisipasi transfer bilingual, desain kurikulum yang mengintegrasikan analisis fonologi kontrastif, serta pelatihan guru agar mampu membedakan kesalahan acak dari interferensi sistematis. Dengan menghubungkan teori OT dengan praktik pembelajaran di kelas, penelitian ini berkontribusi pada peningkatan kompetensi komunikatif pembelajar bilingual dan penyempurnaan pendekatan pengajaran bahasa di konteks multibahasa Indonesia. Pada akhirnya, penelitian ini memberikan bukti empiris tentang bagaimana kendala OT beroperasi dalam lingkungan bilingual, menawarkan wawasan mengenai interaksi sistem fonologis, sekaligus memperkaya bidang linguistik terapan dan pendidikan bahasa.



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Introduction

Indonesia, as a multilingual nation with more than 700 regional languages, faces unique linguistic complexities in the use of Bahasa Indonesia as its national and official language. Within formal communication contexts, the phenomenon of regional language interference with Bahasa Indonesia creates linguistic variation that reflects the diverse sociolinguistic realities of Indonesian society. This linguistic interference encompasses not only structural aspects of language but also the social, cultural, and identity dimensions inherent in language use within a multilingual setting. Formal communication in Bahasa Indonesia, as practiced in government institutions, educational settings, mass media, and the business sector, faces particular challenges within bilingual or multilingual communities. Speakers whose first language (L1) is a regional language and whose second

language (L2) is Bahasa Indonesia often display systematic patterns of interference. Bilingualism manifests in a community when its members can fluently speak two languages and employ them during social exchanges. From a sociolinguistic perspective, bilingualism is the practice of switching between two languages in conversations (Mackey 1962:12, Fishman 1975:73). These patterns can affect not only the effectiveness of formal communication but also the social perception of the speakers' linguistic competence. The phenomenon of regional language interference in the use of formal Bahasa Indonesia carries broad implications for language policy, educational practice, and social cohesion. On one hand, interference may be viewed as an obstacle to standardization and the effectiveness of formal communication. On the other hand, it can also be understood as a manifestation of local linguistic identity and creative expression, enriching the diversity of Bahasa Indonesia as a living and dynamic language.

The phenomenon of regional language interference in formal Bahasa Indonesia also has significant implications for language education, particularly in multilingual settings where students acquire Bahasa Indonesia as a second language while maintaining a regional language as their first language. Transfer from the first language may influence learners' pronunciation, vocabulary choice, and grammatical production, leading to systematic deviations from standard Indonesian norms (Odlin, 1989). In educational contexts, such interference should not merely be viewed as linguistic deficiency but rather as evidence of the interaction between linguistic systems in bilingual development (Cummins, 2000). Understanding patterns of phonological interference is therefore essential for designing effective pedagogical strategies, including pronunciation instruction, contrastive phonological analysis, and teacher training programs that enable educators to distinguish developmental language transfer from random performance errors. Furthermore, language education in multilingual societies should recognize learners' linguistic repertoires as valuable resources for learning rather than obstacles to linguistic competence (García & Wei, 2014). Consequently, investigating regional language interference contributes not only to theoretical discussions on bilingualism and phonology but also to the development of inclusive language teaching practices and policies in Indonesia's multilingual educational contexts.

Langsa's population is primarily composed of Acehnese, Malays, Javanese, Chinese, Gayo, Batak, Alas, and Karo ethnic groups. It ranks second among the most populous and developed cities in Aceh Province, after Banda Aceh. The main languages spoken are Malay, Acehnese, and Javanese, while Indonesian is the primary language and is widely used as a lingua franca, especially for communication with newcomers from outside Aceh. The presence of multiple languages heightens the likelihood of linguistic interference, which is often evident in public settings (Baghirova, 2021). This research examines how

contact with the Javanese language affects Indonesian in Langsa, focusing on interference patterns and consonant variation.

Meanwhile, language education plays a vital role in fostering inclusive and sustainable communities. Beyond serving as a tool for communication, language functions as a foundation for building mutual understanding and solidarity among diverse groups in society (Wang et al., 2021). Through effective language education, individuals can develop communication skills that enable them to participate actively in social, economic, and political spheres. Moreover, language education contributes significantly to the preservation and promotion of cultural diversity (Richards, 2022). By valuing and respecting linguistic diversity, communities establish a strong basis for upholding human rights, advancing inclusion, and reducing social inequality (Irshad et al., 2021). Students often face obstacles in language education, such as limited resources and inadequate support systems, which restrict their opportunities to access learning, understand linguistic structures, and develop mastery.

Related to the above phenomena, this research investigates phonological interference in bilingual settings related to language education, with particular attention to how the Javanese students' phonological system influences the pronunciation of Bahasa Indonesia. Employing Optimality Theory (OT) as its primary framework, the study examines interference patterns, explores their underlying causes, and considers their wider social and educational implications.

Language interference can manifest across different aspects of linguistic structure, including phonetic and phonological, morphosyntactic, and semantic elements. Such interference typically arises under particular social and linguistic conditions (Thomason & Kaufman, 2001). Mose (2021) notes that phonological systems may be altered through phonological processes. In his seminal work, Weinreich (1957) referred to phonetic and phonological interference as "phonic interference", describing the phenomenon in which speakers of a second language perceive and produce sounds that are influenced by the phonological system of their native language.

Optimality Theory (OT) was first introduced to the wider linguistic community at the 1991 Summer Institute of the Linguistic Society of America, where Alan Prince and Paul Smolensky served as instructors. The theory's first comprehensive presentation appeared in 1993. Generative phonology aimed to establish a distinct field within linguistics dedicated to the analysis of natural sound systems, with the key goal of clarifying the relationship between possible linguistic outputs, known as candidates, and the constraints that shape phonological processes (Prince, 1993). As Gussenhoven & Jacobs (1998) explain, OT is a branch of phonology that centers on a set of universal constraints organized hierarchically, with each language assigning its own rankings. The fundamental

principle of OT is that the surface forms of language reflect how competing constraints are resolved, leading to the selection of the optimal candidate (Kager, 1999). Additionally, systematic phonological mappings highlight the organized nature of these processes. Nevertheless, OT is recognized for its complex mechanisms, such as strict domination, in which multiple violations of lower-ranked constraints are tolerated if higher-ranked constraints are satisfied (Lamont, 2021). Optimality Theory (OT) has demonstrated its usefulness beyond phonology, extending to multiple fields within linguistics.

. The strict dominating features and the violation of the constraints

/input/	C1	C2
a.  candidate 'a'		**
b. candidate 'b'	*!	

Many researchers have explored interference and Optimality Theory. For example, Weda and Sakti (2018) studied how formal instruction affected students' acquisition of English short vowels in the English Literature Study Program at Universitas Negeri Makassar. They found that structured instruction greatly enhanced students' mastery of English short vowels. Conversely, Suhery et al. (2019) examined phonological processes using Optimality Theory, specifically investigating how Pilibhit Hindi Urdu speakers modified English loanwords by inserting vowels within consonant clusters. Their results showed that these speakers consistently broke up consonant clusters in all word positions of English loanwords. Suhery et al (2025) examined the forms of phonological interference that cause interference in the speech of the bilingual Singkil community in the Kuala Baru sub-district. Their result showed that Singkil phonology influences the development of Bahasa Indonesia. This is evident in how Singkil-Bahasa Indonesia speakers modify the final phoneme /d/ becomes /t/ from the word [mau.liḍ] becomes [mau.lit], and constrain ranks should be the leftmost constraint, which is the most powerful, and the rightmost, which is the least powerful ; *VOI-CODA >> MAX-IO >> IDENT-IO (VOI). And /b/becomes /p/ from the word [sə.bab] becomes [sə.bap] with the constraint ranks : *VOI-CODA >> VOP >> IDENT-IO. And finally, Suhery et al (2025) explored the complex phonological shifts within the Mewati language, focusing on the transformation of the alveolar lateral sound between two vowels into an alveolar tap/flap. And their findings revealed that Mewati speakers relinquished the identity of the alveolar lateral sound if it did not occur between two adjacent vowels. These linguistic constraints serve as crucial determinants in evaluating potential output candidates, aligning them with the ranking features of input candidates in the framework of OT.

Although previous studies have investigated bilingualism, language interference, and phonological transfer in Indonesian multilingual settings, limited attention has been

paid to the systematic analysis of Javanese-induced phonological interference in Indonesian speech through the framework of Optimality Theory, particularly among elementary-school bilingual speakers in multilingual communities. This gap motivates the present study, which seeks to explain the phonological mechanisms underlying sound substitutions and to explore their implications for language education.

The significance of this study lies in its contribution to the theoretical understanding of bilingualism in Indonesia and its practical relevance to advancing Optimality Theory, an area rarely explored by language scholars and researchers. Through the systematic analysis of interference patterns, this research provides insights that can support the dissemination and application of new phonological perspectives in the study of Indonesian languages, ultimately enriching the nation's linguistic heritage.

Method

The selected research method closely aligns with the study's aims and employs a descriptive qualitative framework. Specifically, a case study strategy complemented by descriptive quantification is adopted. Creswell (2014) defines qualitative research as a systematic exploration of social or human issues designed to generate an in-depth understanding of a particular phenomenon. This approach emphasizes the development of a rich and contextualized description of the subject under investigation by capturing participants' perspectives within their natural settings. Similarly, Ansell and Phillips (1994) argue that qualitative inquiry focuses on explanation, description, and interpretation rather than the establishment of absolute truths.

This study involved six students from SDN 1 Karang Anyar, Langsa, Aceh, who were identified as Javanese-Indonesian bilingual speakers. The participants were elementary school students aged between 10 and 12 years, originating from Javanese-speaking families and regularly using both Javanese and Indonesian in their daily interactions at home and in school. Their bilingual backgrounds made them suitable participants for investigating phonological interference in Indonesian speech. Participants were selected through purposive sampling based on several criteria: (1) they had Javanese as their first language (L1), (2) Indonesian functioned as their second language (L2) and the primary medium of instruction at school, and (3) they actively used both languages in everyday communication. These criteria were established to ensure that the participants exhibited bilingual characteristics relevant to the objectives of the study.

Data were collected through interviews and audio recordings conducted in naturalistic settings within the school environment. Each participant was asked to produce a set of Indonesian lexical items embedded in conversational and elicited speech tasks. Recordings were made using a TASCAM digital audio recorder to ensure high-quality acoustic data. The speech data were subsequently transcribed into the

International Phonetic Alphabet (IPA) for phonological analysis.

The analysis focused on three lexical items, namely, *ahad*, *sabtu*, and *foto*, because they consistently displayed phonological substitutions across all participants and represented different consonantal environments susceptible to interference. Specifically, *ahad* illustrates the substitution /d/ → /t/, *sabtu* demonstrates /b/ → /p/, and *foto* exemplifies /f/ → /p/. These words were selected as representative cases of systematic phonological transfer from Javanese to Indonesian and provided evidence for examining the operation of phonological constraints within the framework of Optimality Theory. Data analysis was conducted in several stages: (1) transcription of recorded speech into IPA symbols, (2) identification of phonological deviations from Standard Indonesian pronunciation, (3) classification of interference patterns, and (4) analysis of the observed phonological processes using Optimality Theory (OT) to determine the constraint rankings underlying the sound substitutions.

Results and Discussion

Upon analyzing the data, it was observed that certain instances reflect the phenomenon of the phonological transfer in bilingual speech, an optimality theoretic Account of Javanese Indonesian sound shifts. This process entails assessing the ranking properties of output candidates in relation to the input candidate, whether within a single language or across multiple languages, in order to determine the most appropriate candidate as the optimal form.

a. Obstruent Devoicing

Consideration of Optimality Theory in /a.had/

Table 1: Representation of OT constraints to find out an optimal candidate

/ahad/	ALIGN·OBST. ALIGN·STOP DEP-IO _{vow}	MAX – IO _{cons}	IDENT IO[Voice]
a. [ahad]	ALIGN-OBST *!		
b. [a.ha.dlə]	DEP-IO _{vow} *!		
c.  [a.hat] < V _{oi} >			*

From the table A, it can be described that:

- a. *ahad* : violates ALIGN-OBST (misalignment of obstruent). → Fatal violation (*!).
- b. *a.ha.dlə* : violates DEP-IO(vowel) (inserting an extra vowel not present in the input). → Fatal violation (*!).
- c. *a.hat* : violates IDENT-IO[Voice] (changes [d] → [t], losing voicing). → Non-fatal violation (*).

ALIGN-OBST and DEP-IO(vowel) are ranked high. That's why candidates (a) and (b) are eliminated immediately — their violations are fatal. IDENT-IO[Voice] is ranked lower. Candidate (c) survives even though it changes voicing because this violation is tolerated relative to higher-ranked constraints. And finally, c. [a.hat] wins because it satisfies the higher-ranked constraints, even though it violates the lower-ranked IDENT-IO[Voice].

Ranking Hierarchy:

ALIGN-OBST, DEP-IO >> MAX-IO(cons) >> IDENT-IO[Voice]

ALIGN-OBST is employed to capture the tendency of obstruents to conform to preferred phonological patterns in Javanese. The constraint is proposed because the data demonstrate systematic adaptation toward less marked consonantal structures.

b. Coda Neutralization

Consideration of Optimality Theory in /sab.tu/

Table 2: Representation of OT constraints to find out an optimal candidate

/sab.tu/	*VOI-CODA	VOP	IDENT.IO (V)
a. [sab.tu]	*!	*	
b.  [sap.tu]			*

In the above table, it is analysed that the candidate 'a' has fatal violation (*!) and violation (*) with the least rank of the similarity to the input candidate. It has the highest rank of the constraint and least member of the ranking features.

The candidate 'b' has only violation (*) and most of the ranking features similar to the input candidate. It has least member of the constraints to cover the ranking feature to the input candidate. So, based on the constraints and ranking features as it is evaluator that the candidate 'b' is the best candidate marked for the optimal candidate indicated by . There is a hierarchy of constraints with the most constraints are more powerful and right most powerful.

*VOI-CODA > VOP > IDENT-IO

*VOI-CODA : must be voiceless; if the coda in a syllable is voiced ,then fatal violation will be there.

VOP : voiced obstruents prohibition. It means that obstruents must be voiceless.

IDENT-IO (V) : Identical input-output voiced. It means the voicing among the speech segments of the input and output candidates must be similar.

c. Assimilation

Assimilation is the influence of a sound on a neighbouring sound so that the two become similar or the same (Crystal, 2008). It can be stated that the process of substituting a sound or making alterations to some properties of a sound under the effect of another sound which exists near it.

Consideration of Optimality Theory in /foto/

Table 3: Representation of OT constraints to find out an optimal candidate

/foto/	Labiodental	IDENT-IO(Place)	DEP-IO
a. [fo.to]	*!		
b.  [po.to]		*	

In the above table, it is analysed that the candidate 'a' has fatal violation (*!) and violation (*) with the least rank of the similarity to the input candidate. It has the highest rank of the constraint and least member of the ranking features.

Labiodental : High-ranked. Strongly penalizes [f] in onset position.
 IDENT-IO(Place) : Lower-ranked. Allows substitution of [f] → [p] when necessary.
 DEP-IO : No insertion occurs in either candidate.

It can be described that labiodental outranks IDENT-IO(Place), the candidate [fo.to] is eliminated despite being faithful. The system prefers [po.to], which avoids the marked fricative even though it changes the input feature.

So that, the candidate 'b' has only violation (*) and most of the ranking features similar to the input candidate. It has least member of the constraints to cover the ranking feature for the input candidate. So, based on the constraints and ranking features as it is evaluator that the candidate 'b' is the best candidate marked for the optimal candidate indicated by . There is a hierarchy of constraints with the most constraints being more powerful and right most powerful.

Labiodental >> MAX-IO >> DEP-IO

The substitution /f/ → /p/ suggests that the labiodental fricative [f] is disfavoured in the speakers' phonological system. Consequently, the markedness constraint *LABIODENTAL is introduced to penalize the occurrence of [f]. Because the speakers preserve the syllable structure without inserting segments, DEP-IO remains undominated by insertion-related constraints. The ranking *LABIODENTAL >> IDENT-IO(Place) explains why [po.to] emerges as the optimal output despite involving a change in place and manner of articulation.

The observed phonological substitutions demonstrate that bilingual speakers do not simply produce random pronunciation errors. Instead, their productions are systematically influenced by the phonological grammar of their first language. The preference for voiceless consonants and avoidance of labiodental fricatives suggest that Javanese phonological constraints remain active during Indonesian speech production.

The OT analysis reveals that the phonological substitutions produced by Javanese–Indonesian bilingual speakers are systematic and governed by specific constraint rankings rather than occurring randomly. The dominance of markedness constraints such as VOI-CODA, VOP, and *LABIODENTAL indicates that speakers tend to preserve phonological patterns associated with their first language. This finding highlights the persistence of first-language phonological representations in bilingual speech production and provides empirical evidence for phonological transfer in Indonesian multilingual settings. From a pedagogical perspective, understanding these transfer patterns can contribute to pronunciation teaching strategies, contrastive phonology instruction, and teacher awareness of bilingual language development.

These findings support previous studies on bilingual phonological transfer, which argue that bilingual speakers often rely on the constraint hierarchy of their first language when producing sounds in a second language. Thus, interference represents an interaction between two phonological systems rather than a deficiency in linguistic competence.

Conclusion

The analysis of phonological transfer in the speech of six Javanese–Indonesian bilingual students through the framework of Optimality Theory demonstrates that markedness constraints tend to outrank faithfulness constraints, shaping the repair strategies observed in the data. In the cases of obstruent devoicing (/ahad/ → [a.hat]), coda neutralization (/sab.tu/ → [sap.tu]), and consonant substitution (/foto/ → [po.to]), the optimal outputs emerge not from strict preservation of input features but from the prioritization of structural well-formedness. High-ranked constraints such as ALIGN-OBST, *VOI-CODA, and *LABIODENTAL eliminate faithful candidates, whereas lower-ranked faithfulness constraints such as IDENT-IO[Voice] and IDENT-IO(Place) are violated when necessary. These findings suggest that the phonological adaptations observed in the speech of the six participants are systematic and governed by constraint interaction rather than random variation.

From an educational perspective, the findings indicate that language teaching in bilingual contexts may benefit from incorporating contrastive phonological analysis to help learners recognize differences between the sound systems of Javanese and Indonesian. Such an approach has the potential to support pronunciation development and raise teachers' awareness of systematic transfer patterns in bilingual learners.

Nevertheless, the findings of this study should be interpreted within the scope of its limitations. The study involved only six participants from a single elementary school in Gampong Karang Anyar, Langsa, Aceh, and focused on three lexical items (ahad, sabtu, and foto) that exhibited recurrent phonological substitutions. Consequently, the results cannot be generalized to all Javanese–Indonesian bilingual speakers or to bilingual populations in other sociolinguistic contexts. Future studies are encouraged to include a larger number of participants, a broader lexical inventory, and multiple research sites to obtain a more comprehensive understanding of phonological transfer in bilingual Indonesian settings.

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