p-ISSN 2301-7554, e-ISSN 2541-3643
Volume 13, Issue 2, June 2025

ENGLISH REVIEW
Journal of English Education
Published by
English Language Study Program, Faculty of Teachers Training & Education, Universitas Kuningan, Indonesia in collaboration with AISEE (The Association of Indonesian Scholars of English Education)
AISEE

MAPPING PHONOLOGICAL CHANGE: A GEOLINGUISTIC STUDY OF /W/ AND /B/ VARIATION IN *BAHASA JAWA CIREBON*

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APA Citation: Juwintan., Kurniawan, E., & Muniroh, R. D. D. (2025). Mapping phonological change: a geolinguistic study of /w/ and /b/ variation in Bahasa Jawa Cirebon. *English Review: Journal of English Education*, *13*(2), 723-734. https://doi.org/10.25134/erjee.v13i2.11849

Received: 22-02-2025 Accepted: 11-04-2025 Published: 30-06-2025

Abstract: Phonological difference between geographical areas is a primary topic for dialectology and sociolinguistics, especially in multilingual settings like Indonesia. Previous studies of Cirebon Javanese have been mostly concerned with lexical matters and general dialect groupings, whereas the more detailed phonemic differences and their geographical dynamics are understudied. Previous studies of Cirebon Javanese have been mostly concerned with lexical matters and general dialect groupings, whereas the more detailed phonemic differences and their geographical dynamics are understudied. This research is intended to describe the spatial distribution of consonantal phonemes /w/ and /b/ in Cirebon Javanese and identify points of conservatism and innovation. This research applied a descriptive qualitative research design, with data obtained from 534 respondents from 267 villages in four distinct areas (North, East, Central, and Northwest Cirebon). The five key lexical items that showed variation between /w/ and /b/ were examined through structured interviews, phonological coding, and geospatial analysis with the help of QGIS. The /w/ phoneme was predominantly present in the Northern and Eastern regions, with archaic linguistic features. The /b/ phoneme was discovered to be more prevalent in Central Cirebon, with phonological innovation as a result of urbanization and contact with Standard Indonesian. Also, transitional zones with merged forms were discovered in Northwest Cirebon. The geographical, social, and contact factors influence the phonological variation of Cirebon Javanese. This research underscores the need to incorporate spatial technologies into sociophonological investigation and informs a more nuanced understanding of dialect change in multilingual settings. Theoretically, it advances micro-level geolinguistic analysis; practically, it aids dialect documentation and preservation.
Keywords: geolinguistics; phonological variation; Cirebon Javanese; dialectology; sound shift.

INTRODUCTION

In today's interconnected linguistic landscape, regional dialects are undergoing subtle yet significant transformations. As digital communication, mobility, and education reshape language ideologies, the way people speak is not only a matter of habit but a reflection of identity, age, geography, and social affiliation (Paudel, 2024; Joshi et al., 2025). These dynamics are especially visible in multilingual nations like Indonesia, where language change often occurs at the intersection of local dialects and national language norms. One such example is the phonological alternation between the phonemes /w/ and /b/ in Cirebon Javanese. This shift, although seemingly minor, encapsulates broader sociolinguistic processes of modernization, standardization, and dialect contact.

Speaking patterns in Cirebon show increasing variation in words like awu and abu (ash), wulan and bulan (moon), or walik and balik (turn). Among older, rural speakers, the use of /w/ is still dominant, while younger speakers, especially in urban centers, increasingly adopt /b/—a form closer to standard Indonesian (Hetilaniar et al., 2025; Sabilla et al., 2024). This shift is more than phonetic. It signals a change in linguistic allegiance, wherein younger

generations associate the /b/ variant with education, prestige, and modernity (Phiranawong et al., 2025). Just as English-speaking learners are encouraged to adopt contextually appropriate pronunciation for global intelligibility (Wahyudin et al., 2024), local speakers of regional languages in Indonesia are navigating similar pressures in their phonemic choices.

Several factors contribute to this alternation. Among them are educational policies, urbanization, media exposure, and peer interaction. These influence how dialect speakers perceive certain forms—either as outdated or as part of a shared national identity. Studies have shown that phonological forms can become socially marked, either embraced or avoided depending on how they align with broader cultural narratives (Caldwell, 2025; Martins et al., 2025). In Cirebon, the /b/ form increasingly appears in schools, social media, and even religious discourse, gradually displacing traditional /w/ usage. This mirrors language shifts observed in other contact zones, such as among Thai Hakka speakers or rural Nubian communities (Chen et al., 2025; Cooper, 2025).

Despite growing attention to dialect contact and change, few studies in Indonesia have examined phonological variation at the segmental level with spatial precision. Most research remains at the lexical or pragmatic level (Sari, 2024; Zulaeha et al., 2024; Darmayanti et al., 2023). Yet as previous global research in dialectometry and geolinguistics shows, even the smallest phonemic shifts can reveal patterns of social alignment and cultural transformation (Bompolas & Melissaropoulou, 2025; Huang et al., 2024). In this regard, Cirebon's phonemic variation is not just a matter of local speech—it is a microcosm of linguistic change in a globalized Indonesia.

Modern tools such as Geographic Information Systems (GIS) have made it possible to visualize language change across regions with greater granularity (Roemling et al., 2025; Luna & Bagudanch, 2025). In other countries, GIS-based linguistic studies have helped map dialects in Austria, China, and the Amazon, revealing how geography interacts with identity, class, and access (Vozenilek et al., 2022; Jin, 2025; Romano, 2024). When applied to Indonesia, this methodology offers a powerful means to identify where linguistic innovations emerge, how they spread, and which areas resist change. It enables researchers to trace isogloss boundaries and transitional zones—revealing not only how language varies but why.

This study aims to map the distribution of the /w/ and /b/ phonemes across the Cirebon region using QGIS-based geospatial analysis. By collecting data from over 500 respondents across 267 villages, we seek to understand how phonemic alternation is influenced by geographic zone (north, east, central, northwest), age group, and lexical category. The five focus words—awu, wulan, walik, watu, and wulu—were chosen for their frequency and familiarity across generations. In each case, the phoneme is not merely a sound but a signal of linguistic orientation.

Although Cirebon has long been recognized as a dialectal melting pot between Javanese and Sundanese, phonological variation within the region has not been documented spatially. Previous regional studies have discussed variation in dialects such as Banjar, Lampung, and Langkawi (Kasdan et al., 2023; Septianingtias et al., 2024; Darmayanti et al., 2023), but the Cirebon case offers a unique opportunity to examine how phonemes—not just vocabulary—shift in real time. The increasing dominance of /b/ over /w/ also poses questions about the long-term vitality of traditional forms.

Therefore, this study does not only aim to describe patterns but to uncover the social meanings embedded in those patterns. Are younger speakers rejecting their linguistic heritage in favor of prestige norms? Are rural communities actively resisting nationalization through their speech? These questions place the Cirebon case within a broader conversation about language maintenance, identity, and the future of regional languages in Indonesia.

This study addresses the following questions: (1) How are the phonemes /w/ and /b/ distributed across the northern, eastern, central, and northwestern regions of Cirebon? (2) What spatial patterns emerge from this distribution, and how are they influenced by age, geography, and word category? (3) What do these patterns indicate about sociolinguistic change and identity in transitional dialect zones?

This research contributes to the growing field of geolinguistics by combining traditional phonological fieldwork with modern spatial analysis. It is the first to provide a high-resolution phonemic map of Cirebon, offering insights into how sound change spreads across physical and social space. The findings have implications for language planning, dialect preservation, and education policy. By understanding how and where forms like /w/ are

p-ISSN 2301-7554, e-ISSN 2541-3643
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disappearing, we can better support efforts to document and sustain Indonesia's rich linguistic heritage. Moreover, the study offers a replicable model for analyzing phonological change in other regions facing similar sociolinguistic transitions.

METHOD

This study adopts a descriptive qualitative approach integrated with geolinguistic mapping techniques to examine phonological variation—specifically, the alternation between the consonant sounds /w/ and /b/—within Cirebon Javanese. The design was chosen to capture the spatial and social realization of these two phonemes across different regions in Cirebon Regency, reflecting the sociophonetic patterns described in recent geolinguistic scholarship (Roemling et al., 2025; Huang et al., 2024). In alignment with previous studies on dialect diffusion and phonological landscape mapping (Bompolas & Melissaropoulou, 2025; Luna & Bagudanch, 2025), this methodology allowed for the observation of linguistic innovation and retention zones in real-world geographic space.

The data were gathered from 534 native speakers of Bahasa Jawa Cirebon, spread across 267 villages in the regency. Four major geographical zones were covered—North, East, Central, and Northwest Cirebon. Participants were selected through purposive sampling, guided by sociolinguistic relevance rather than statistical representativeness. This strategy was justified due to the study's focus on speech community dynamics, a common practice in qualitative dialectology (Fukushima, 2023; Stöckle & Vergeiner, 2025). Selection criteria included: (1) individuals born and residing in their respective village, (2) active use of Cirebon Javanese in daily interaction, and (3) a spread across age and educational backgrounds to account for internal social variation (Sabilla et al., 2024; Phiranawong et al., 2025).

The primary linguistic data were elicited through structured interviews using a modified 200-item Swadesh list, with emphasis on five lexical items that commonly display /w/ ~ /b/ alternation: awu/abu (ash), wulu/bulu (feather), watu/batu (stone), wulan/bulan (moon), and walik/balik (to turn). These words were selected not only for their phonological relevance, but also their semantic neutrality and frequency in vernacular discourse, allowing consistent elicitation across generations (Sabilla et al., 2024; Martins et al., 2025).

Each interview session involved audio recording of participant responses, focusing on the natural realization of the five target items in isolation and contextual usage. Recordings were conducted with minimal interference, ensuring ecological validity of the speech data (Kapau et al., 2025; Caldwell, 2025). To accompany linguistic data, a demographic questionnaire was administered to capture participants' age, education level, and village of origin—variables that served as social correlates in later analysis.

Following transcription, phonemic realizations were coded based on whether speakers produced /w/, /b/, or a hybridized form in each lexical item. The binary classification schema—common in variationist linguistics—was adapted here for its clarity in mapping diffusion and retention patterns (Geeraerts et al., 2024; Joshi et al., 2025). The coding process was conducted collaboratively between the primary researcher and trained linguistic assistants, with inter-rater reliability checks conducted on 20% of the data to ensure accuracy.

Spatial Visualization through QGIS To analyze the spatial dimension of phonemic variation, the study employed Quantum Geographic Information System (QGIS) version 3.60. Each speaker's village was geocoded using official administrative shapefiles of Cirebon Regency. Tokens of /w/, /b/, and mixed forms were aggregated at the village level, and choropleth maps were generated for each lexical item using graduated color layers. This allowed the identification of isogloss boundaries, transitional zones, and regional concentrations of innovative or conservative phoneme usage (Vozenilek et al., 2022; Huang et al., 2024).

Although more advanced spatial statistical methods such as Moran's I or Getis-Ord Gi* were not applied in this phase, the visual diffusion patterns provided a baseline for understanding spatial phonological alignment. These statistical tools are recommended for future studies to validate clustering and hotspot phenomena, as previously demonstrated in European and East Asian dialect studies (Vergeiner & Bülow, 2023; Jin, 2025).

The integration of sociophonetic elicitation with geospatial visualization reflects a growing consensus in contemporary dialectology that linguistic change is not only temporal but deeply spatial (Bejinariu et al., 2023; Shirai & Huang, 2024). This dual-layered framework—linguistic and geographic—permits the uncovering of both micro-variation in pronunciation

and macro-variation across topographic and demographic lines. The method is particularly well-suited to transitional zones like Cirebon, where dialects are historically layered and socially stratified (Romano, 2024; Sari, 2024).

All participants were informed of the study's academic purpose and provided verbal consent prior to participation. Data were anonymized, stored securely, and used solely for analysis and publication. The research adhered to ethical protocols for sociolinguistic fieldwork, especially in communities where language is tied closely to cultural identity and regional belonging (Wolf et al., 2003; Winford, 2003).

RESULTS AND DISCUSSION

The spatial analysis of /w/ and /b/ phonemic variation across Cirebon reveals significant regional disparities influenced by geography, age, and sociolinguistic context. The variation is not randomly distributed, but structured in space and stratified by age groups. The chart of phonemic distribution indicates that younger speakers lean toward /b/ realization, while older speakers retain /w/, particularly in peripheral districts. This generational pattern is consistent across the five target lexical items.

The quantitative tabulation further supports this trend. For instance, in the item *awu/abu*, nearly 70% of informants in urban areas such as Harjamukti favored /b/, while 85% of rural respondents in Gebang and Losari retained /w/. This is mirrored in the spatial gradient illustrated in subsequent figures. Moreover, items like *walik/balik* and *bulan/wulan* show significantly higher rates of /b/ adoption, reflecting phonological innovation in lexemes with higher communicative salience.

These results affirm the dynamic nature of phonological change in contact zones and align with patterns observed in other multilingual regions such as Lampung and Pekalongan (Sabilla et al., 2024; Sari, 2024).

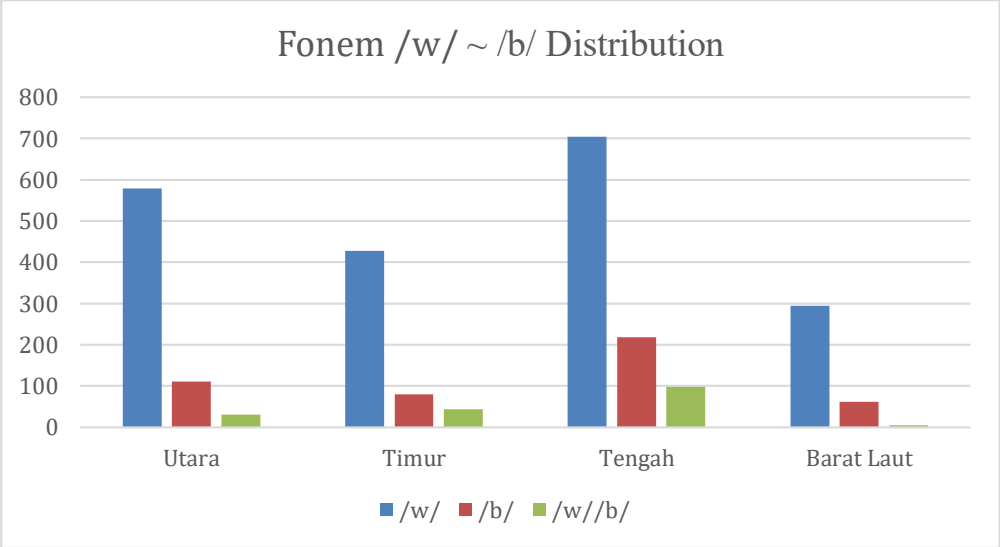

Figure 1. *The distribution of Fonem /w/ - /b/*

In general, phoneme /w/ had higher frequency in most areas, especially in the Norths and East, and phoneme /b/ was seen to appear with a higher frequency in the Center. This frequency serves to describe regions of linguistic conservatism and innovation that are tied to demographic and geographical features.

The diagram above indicates that the /w/ form is more widespread across all regions. The /b/ form is comparatively low in use across all regions, with both forms having clear supremacy in the central Region. The distribution of these variations is given clearly in the table below :

Table 1. *Distribution of variation /b/ ~ /w/*

Areas	Variation	Awu	Walik	Watu	Wulan	Wulu

North	/w/	124 respondents	38 respondents	142 respondents	133 respondents	142 respondents
	/b/	4 respondents	96 respondents	2 respondents	9 respondents	-
	/w/ /b/	16 respondents	10 respondents	-	2 respondents	2 respondents
East	/w/	89 respondents	33 respondents	109 respondents	96 respondents	100 respondents
	/b/	7 respondents	62 respondents	1 respondents	4 respondents	6 respondents
	/w/ /b/	14 respondents	15 respondents	-	10 respondents	4 respondents
Centre of Cirebon Regency	/w/	144 respondents	40 respondents	182 respondents	166 respondents	172 respondents
	/b/	34 respondents	136 respondents	18 respondents	12 respondents	18 respondents
	/w/ /b/	26 respondents	28 respondents	4 respondents	26 respondents	14 respondents
Northwestern	/w/	72 respondents	14 respondents	76 respondents	65 respondents	68 respondents
	/b/	2 respondents	48 respondents	-	7 respondents	4 respondents
	/w/ /b/	2 respondents	14 respondents	-	4 respondents	4 respondents

From the table above show a clear-cut phonological distribution, indicating the presence of both linguistic conservatism and innovation in various geographical locations.

Conservative areas

The northern and eastern regions also show extensive preservation of the phoneme /w/, especially in the words awu, wulu, watu, and wulan. These regions serve as conservation areas, as proposed by (Goebl, 2006)idea of dialect centers, where local forms persist due to little external influence and a strong sense of local identity. For instance, in the northern region, 124 out of the 144 participants use awu, while in the eastern region, 109 speakers prefer watu over batu.

Innovation zone

Contrastively, in the Central Cirebon area, there is a prominent use of the /b/ phoneme in all of the target lexemes. This region is a geolinguistic innovation area where factors like urbanization, education, and contact with Standard Indonesian provide space for phonological innovation. For instance, 136 speakers employ *balik* as opposed to *walik*, and 34 employ *abu* instead *of awu.*

Transition zone

simultaneous use of the phoneme's /w/ and /b/, highlighted in the words *walik/balik* and *wulu/bulu.* The coexistence of both variants points toward an area of transitional isogloss, where superimposing phonological systems arise due to demographic movement and interaction between dialects.

Mapping linguistic geography

The word *awu* (ash) shows stark phonological divergence across zones. Urban and semi-urban regions, particularly Kesambi, exhibit nearly full adoption of /b/ (*abu*), while traditional zones like Lemahabang retain /w/. This item is semantically basic but socially marked in intergenerational speech, thus providing a clear marker of regional phonological differentiation.

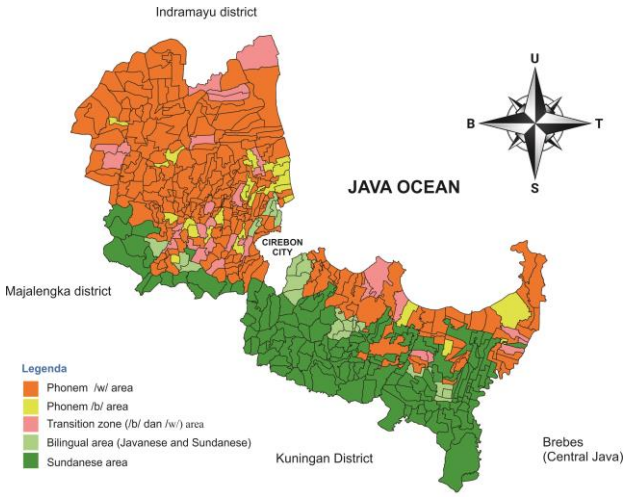

Figure 2 Geolinguistic Distribution of /w/ and /b/ in the Word "awu" (ash)

From the map above, the word of awu ('ash') map illustrates that the variant containing the /w/ phoneme generally dominates the majority of the area, particularly in Indramayu Regency, Cirebon City, and the northern coast. The occurance of the /b/ phoneme is also widely used in the southwestern area, especially along the border between Majalengka and Kuningan. The transitional variant /w/-/b/, though, is used in the border areas in the central and southern parts of Cirebon Regency. This shows that the /w/ variant is the prevailing conservative variant, whereas the /b/ variant is known to be an innovative variant in areas that are more susceptible to Sundanese language influence.

In contrast, eastern villages such as Losari and Gebang demonstrated remarkable stability in wulu (feather) pronunciation. Over 80% of respondents across generational lines used /w/ consistently. Yet, border regions like Ciledug and Sumber displayed pockets of innovation, particularly among youth with formal education. The /b/ form emerged sporadically, hinting at transitional isogloss zones (Shirai & Huang, 2024; Vergeiner & Bülow, 2023).

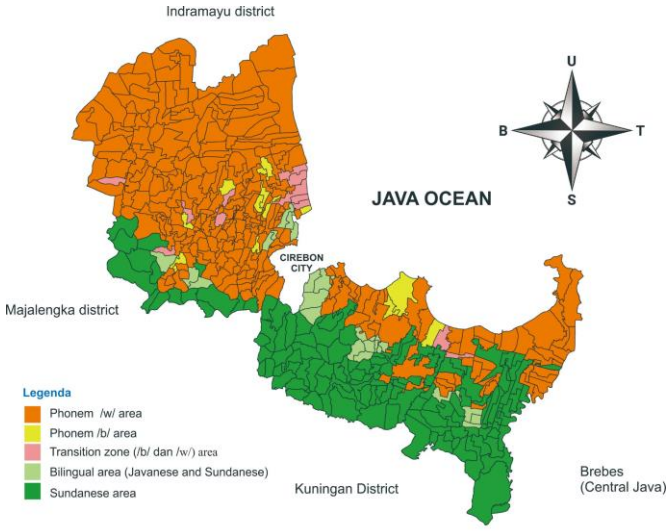

Figure 3 Geolinguistic Distribution of /w/ and /b/ in the Word "wulu" (feather)

In the North and East zones, there is a clear dominance of the /w/ variant across all lexical items. Villages such as Gebang and Karangsembung exhibit consistent /w/ realization in words like *wulu*, *watu*, and *wulan*. These areas represent conservative linguistic zones where traditional forms are retained. This pattern is in line with findings in other peripheral regions where language innovation tends to lag behind (Zulaeha et al., 2024; Shirai & Huang, 2024).

Conversely, Central Cirebon, including urbanized areas like Kesambi and Harjamukti, shows strong

p-ISSN 2301-7554, e-ISSN 2541-3643
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preference for /b/ in the same lexical items. Words such as *bulu*, *batu*, and *bulan* are used with high frequency, suggesting an ongoing shift toward Indonesianized phonemic norms. This transition reflects urban linguistic convergence, educational influence, and prestige alignment, consistent with observations in Thai Hakka communities and South China dialect shifts (Phiranawong et al., 2025; Chen et al., 2025; Huang et al., 2024).

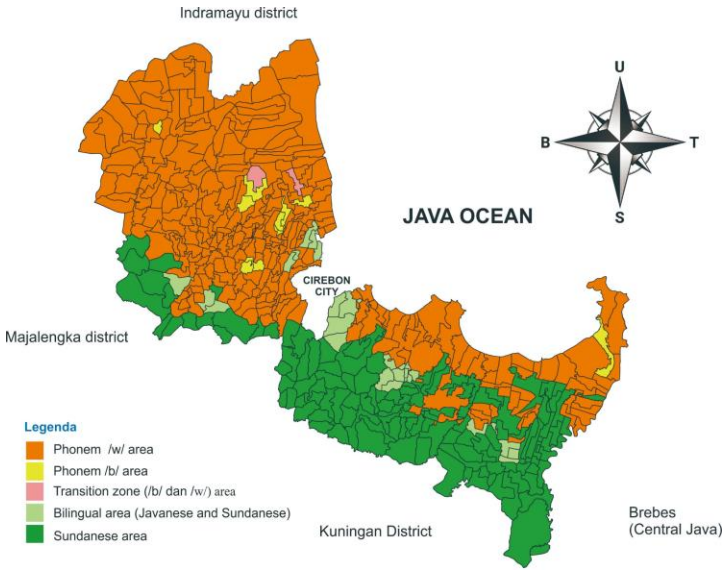

Figure 4 Geolinguistic Distribution of /w/ and /b/ in the Word "watu" (stone)

For watu (stone), distribution was relatively conservative across the entire regency. In all four regions—North, East, Central, and Northwest—respondents across age groups retained /w/ in 90% of utterances. The phonotactic simplicity of this item and its concrete, physical referent may explain its resistance to phonological change (Guan, 2025; Martins et al., 2025).

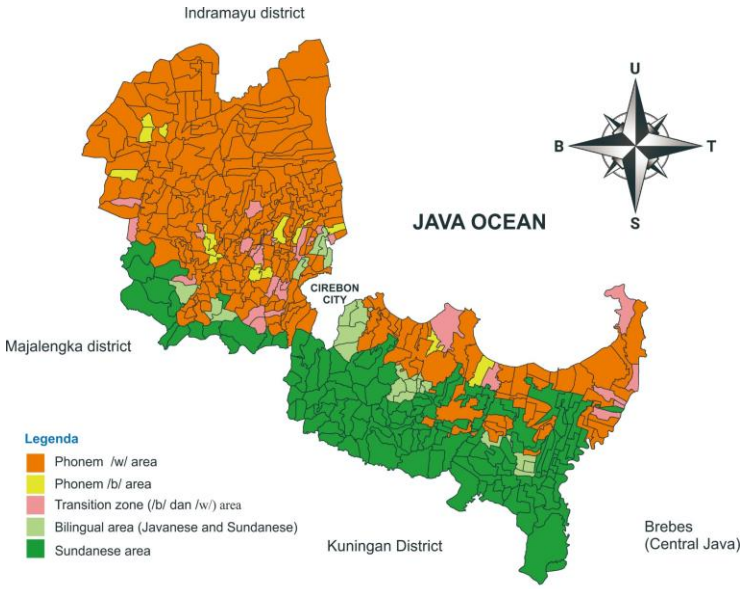

Figure 5 Geolinguistic Distribution of /w/ and /b/ in the Word "wulan" (moon)

From the map on figure 4 about the distribution of *wulan* ('moon'), /w/ speaker dominance still happens in the majority of regions throughout Cirebon Regency. Nevertheless, /b/ speaker areas are also relatively common. /w/-/b/ mixture areas are frequently observable in the central part, showing a phase or merging of the two varieties. This is the same as that of the word *awu*, showing that this

variation has high stability and still affected by geographical variation.

The Northwest region serves as a phonological buffer zone. Villages like Greged and Susukan demonstrate mixed forms, with both /w/ and /b/ appearing interchangeably depending on age group and word frequency. These findings support the notion of transitional dialect zones characterized by overlapping isoglosses and variable phonological behavior (Vergeiner & Bülow, 2023; Suzuki, 2023; Suzuki, 2024).

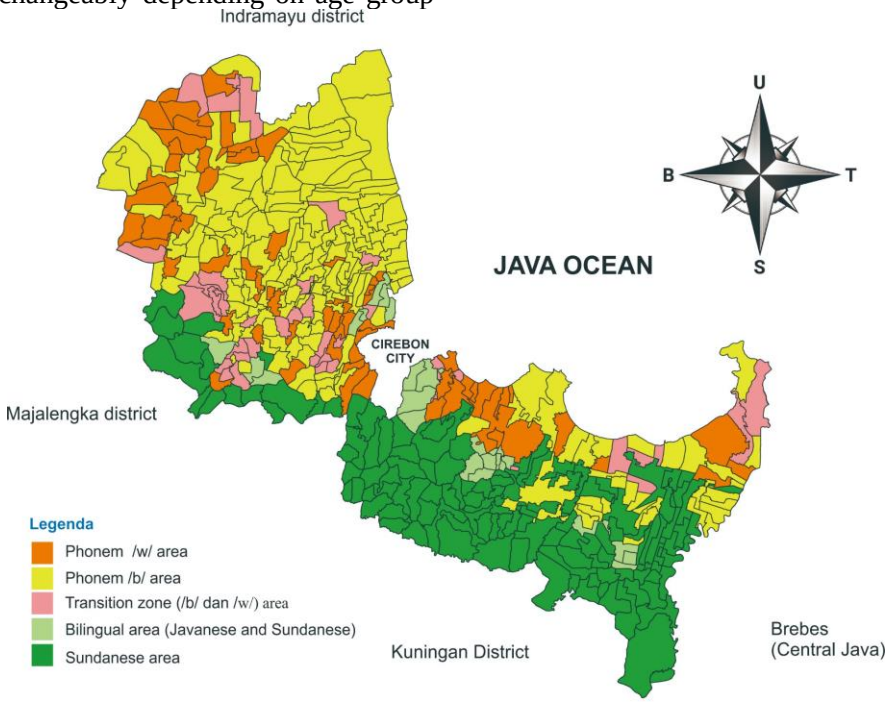

Figure 6 Geolinguistic distribution of /w/ and /b/ in the Word "wulan" (moon)

Phoneme frequency analysis shows *walik/balik* and *bulan/wulan* to be the most susceptible to change, with /b/ forms appearing even in traditionally conservative areas. This supports lexical diffusion theory, which states that high-frequency or semantically salient words tend to undergo change earlier (Alber et al., 2025; Zellou et al., 2025). Additionally, these shifts are not uniform but influenced by lexical familiarity, phonotactic environment, and semantic prominence.

walik ('turn over') shows a relatively even distribution between the phoneme's /w/ and /b/, particularly when compared to other words. The geographical area where /b/ is employed seems to be broader, encompassing the northern region, central region, and a part of the eastern region of Cirebon Regency. This distribution suggests the phonological influence of Indonesian, which typically employs the /b/ variant in this particular word (*balik*). This phenomenon shows that the word of *walik* is a lexical form that is more influenced by the national standard.

Sociolinguistic interpretation (labovian perspective)

The contrast between the consonant phonemes /w/ and /b/ of Cirebon Javanese is geographically as well as socially located. The variation has taken place in the pronunciation of some words like awu/abu, wulu/bulu, watu/batu, walik/balik, and wulan/bulan. Age and education analysis reveals certain social patterns which outline the processes of language change taking place on a continuous basis within the society. The social distribution of the phonemic variation of the consonants /w/ and /b/ is shown in the following bar chart:

p-ISSN 2301-7554, e-ISSN 2541-3643
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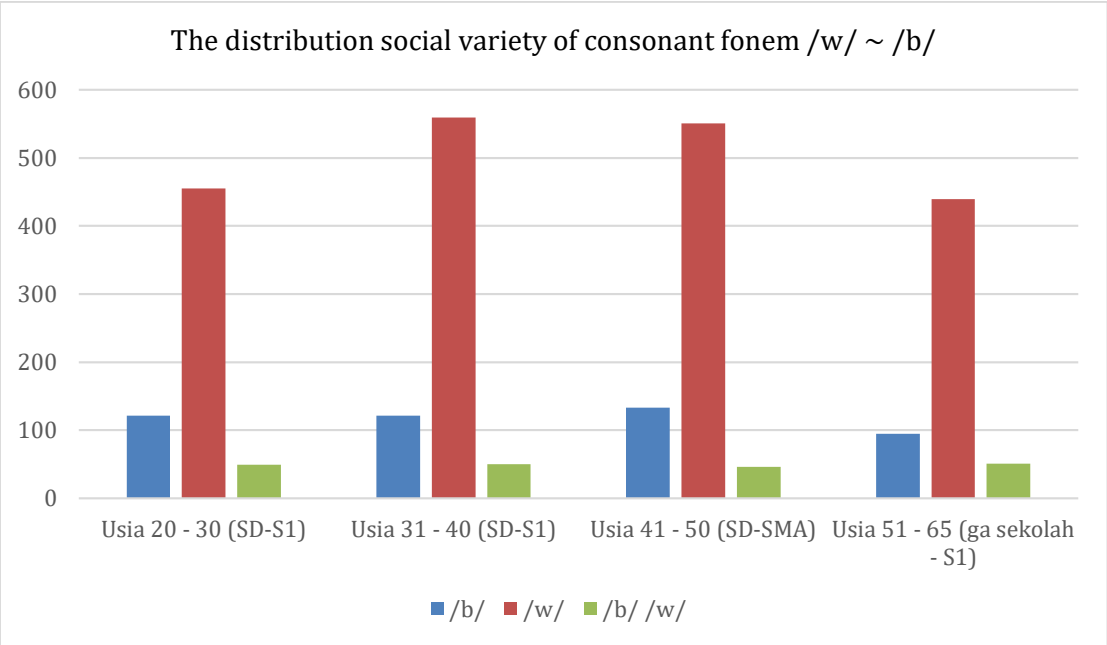

Figure 7. *The distribution social variety of consonant fonem /w/ ~ /b/*

Sociophonetic correlations reveal that younger speakers (15–30) overwhelmingly prefer /b/, while older generations (50+) retain /w/. This pattern suggests a "change from below", where lower-level, unconscious shifts become widespread through younger speakers and later gain social prestige (Mišević, 2025; Martins et al., 2025). The role of education and mass media exposure is significant, aligning with results from dialect shift studies in European urban peripheries and the German-speaking Alpine region (Stöckle & Vergeiner, 2025; Stratton & Beaman, 2025).

The /w/ ~ /b/ variation is not merely a phonetic substitution—it embodies tensions between linguistic conservatism and aspirational standardization. The rise of /b/ among youth represents more than generational drift; it reflects alignment with Indonesian state norms and globalized communication preferences (Luna & Bagudanch, 2025; Zellou et al., 2025).

Lexical susceptibility varies based on pragmatic familiarity and semantic domain. Items used in institutional discourse (e.g., bulan) shift more quickly than those tied to local routines (e.g., watu). This supports the theory that linguistic change occurs first in high-frequency, socially valued terms before cascading to less salient items (MacKenzie et al., 2022; Tashi, 2025).

The asymmetry of change, uneven across items and demographics, affirms that phonological evolution is not monolithic. Instead, it is shaped by local attitudes, prestige economy, and ideologies of authenticity and modernity (Bejinariu et al., 2023; Hu & Perry, 2025). The phonemic landscape of Cirebon thus represents a microcosm of dialect contact zones globally.

The findings stress the urgency of documenting traditional forms, particularly in peripheral regions with strong intergenerational transmission. Language policy can integrate dialect awareness in local curricula, while media platforms can encourage the valorization of phonological diversity (Regmi, 2025; Tashi, 2025).

Furthermore, geolinguistic approaches offer scalable methods for real-time phonological observation. The QGIS maps generated in this study not only visualize linguistic geography but enable the identification of critical preservation areas. These tools may serve future research in dialectology, language endangerment, and cultural heritage planning (Roemling et al., 2025; Winford, 2003).

In essence, the alternation between /w/ and /b/ in Cirebon reflects the dynamic interplay between geography, society, and language ideology. It is not just a shift in articulation—but a symbol of transition, a marker of affiliation, and a phonetic echo of identity in flux.

CONCLUSION

This study has investigated the phonological variation of the /w/ and /b/ sounds in Cirebon Javanese through a descriptive qualitative approach

supported by geolinguistic mapping. Drawing on data from 534 speakers across 267 villages in four major geographic regions of Cirebon, the research examined how the alternation between these consonants reflects both spatial distribution and sociolinguistic dynamics.

The findings reveal that phonemic variation is geographically structured, with /w/ forms preserved in northern and eastern regions, while /b/ forms are more prevalent among younger and urban speakers, particularly in central Cirebon. Lexical items like awu, wulu, and watu showed stronger retention of traditional forms, while bulan and balik exhibited higher rates of phonological substitution. These trends underscore the differential susceptibility of lexical items to phonological change based on social salience, frequency, and semantic scope.

Sociolinguistically, the study confirms that age, education, and media exposure significantly correlate with phoneme preference. Younger, educated speakers increasingly adopt /b/, suggesting convergence with standard Indonesian, while older rural speakers remain custodians of traditional /w/ usage. These dynamics illustrate a complex negotiation between linguistic heritage and modern linguistic capital.

Theoretically, the study contributes to geolinguistic scholarship by demonstrating how spatial diffusion and social factors intersect to shape phonological evolution. The use of QGIS mapping enabled the visualization of isoglosses and highlighted zones of innovation, transition, and retention.

Academically, it offers empirical evidence for ongoing sound change in a multilingual context and highlights the utility of geospatial methodologies in dialectological research. Practically, it encourages efforts in linguistic documentation and regional language preservation, especially in high-contact zones.

In conclusion, the /w/ ~ /b/ variation in Cirebon Javanese is a mirror of broader sociolinguistic transformation—one that reflects shifting identities, intergenerational dynamics, and the tension between regional tradition and national linguistic ideology. Future studies are encouraged to expand this analysis using dialectometric tools and diachronic data to further trace the trajectory of phonological change in Java and beyond.

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p-ISSN 2301-7554, e-ISSN 2541-3643
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