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# Cognitive Approaches to Morphology: Insights into Mental Lexicon Processing

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**ABSTRACT:** This narrative review examines cognitive approaches to morphology with a focus on the mental lexicon, exploring how morphological representation and decomposition facilitate word recognition and language processing. The review aimed to synthesize theoretical perspectives and empirical evidence to evaluate the mechanisms that govern morphological awareness and its role in literacy and communication. Literature was collected from multiple databases, including Scopus, Web of Science, PubMed, and Google Scholar, using targeted keywords and Boolean search strategies. Inclusion criteria emphasized studies addressing morphology from cognitive and psycholinguistic perspectives, incorporating experimental, neuroimaging, and review-based methodologies. Findings reveal that morphological families enhance lexical retrieval, while frequency, transparency, and productivity shape access strategies for complex words. Evidence from priming, eye-tracking, and pseudoword experiments confirms the automaticity of morphological decomposition. Bilingual and second-language processing is shown to be shaped by typological similarity, proficiency, and translanguaging practices, resulting in distinct cognitive strategies compared to monolinguals. Neuroimaging studies identify distributed cortical networks, including the left inferior frontal gyrus, supporting morphological processing. Clinical evidence from dyslexia and aphasia underscores morphology's role in literacy and communication. Systemic and educational factors, including inequities in access and pedagogical design, contribute significantly to observed variability. The review emphasizes the urgency of addressing research gaps in underrepresented languages, age groups, and translanguaging contexts. Pedagogical interventions, such as explicit morpheme-focused instruction, gamified environments, and translanguaging practices, are recommended to strengthen literacy outcomes. Future research should integrate cross-linguistic evidence and neurocognitive approaches to develop inclusive models of morphological processing with broad theoretical and practical implications.

**Keywords:** Morphological Processing, Mental Lexicon, Bilingualism, Cognitive Linguistics, Language Acquisition, Literacy Development.



## INTRODUCTION

The study of the mental lexicon, particularly in relation to morphology, has become a central concern within cognitive science and linguistics, reflecting broader efforts to understand the fundamental mechanisms underlying language processing. Morphology, the study of word

structure and morphemes, plays a key role in recognizing, storing, and retrieving vocabulary during communication. Recent progress in psycholinguistics, cognitive neuroscience, and computational linguistics confirms that morphology is not only a linguistic subsystem but also a cognitive tool that supports language learning, reading comprehension, and lexical access. Contemporary theoretical frameworks suggest that morphological awareness contributes to efficient word recognition by enabling speakers and learners to decompose complex words into meaningful units, thereby enhancing their capacity to infer meaning from unfamiliar forms (Qiao et al., 2022). As such, morphology constitutes an essential interface between linguistic structure and cognitive function.

One of the most influential perspectives in this domain is the connectionist model, which emphasizes the role of distributed neural networks in language processing. Connectionist frameworks simulate the parallel activation of semantic, phonological, and morphological information during word recognition, offering a dynamic account of the mental lexicon (Joanisse & McClelland, 2015). Unlike traditional rule-based models, connectionist approaches highlight how morphological complexity can be accommodated through the interaction of morphemes across multiple layers of processing. This paradigm has gained empirical support from studies demonstrating that morphological priming accelerates lexical access and facilitates comprehension, thereby confirming the centrality of morphology in cognitive models of language. At the same time, competing accounts—such as dual-route models of morphology—emphasize the interplay between rule-governed inflectional processes and memory-based storage of irregular forms, thus reflecting the ongoing debate regarding the precise mechanisms underpinning morphological processing (Clahsen & Veríssimo, 2016).

Empirical evidence consistently underscores the role of morphological awareness as a predictor of literacy development and reading proficiency. Longitudinal studies show that children with higher morphological awareness demonstrate stronger reading comprehension and vocabulary acquisition, even when controlling for phonological awareness (Qiao et al., 2022). This finding suggests that morphology provides a unique contribution to language development beyond phonological and syntactic skills. For example, research indicates that learners are able to leverage knowledge of affixes, roots, and derivational patterns to decode novel words, thereby facilitating their integration into the mental lexicon (Giraudo & Maso, 2016). Moreover, experiments using pseudowords reveal that participants often rely on morphological cues to infer meanings, reflecting the robustness of morphological representations in the cognitive system (Chuang et al., 2020). These findings collectively highlight that morphological processing not only accelerates word recognition but also enhances cognitive flexibility in dealing with unfamiliar linguistic input.

Morphological processing is also shaped by the frequency and transparency of morphemic structures. High-frequency morphological forms, such as commonly used derivational affixes, are recognized more rapidly than low-frequency counterparts, reflecting frequency effects in lexical access (Giraudo & Maso, 2016). Transparency further modulates processing efficiency, as morphologically transparent forms (e.g., happiness) are accessed more readily than opaque forms (e.g., department), where semantic relationships between morphemes and whole words are less evident. Productivity, or the extent to which morphological rules generate new forms, also plays a significant role in shaping how speakers process novel words. Together, these factors point to a

complex interaction between linguistic structure and cognitive mechanisms, demonstrating that morphology is both a product of linguistic conventions and a dynamic system shaped by cognitive constraints.

Despite the robust evidence supporting the importance of morphology, significant challenges complicate the study of morphological decomposition across languages and populations. Typological diversity presents one of the foremost challenges, as languages differ substantially in the richness and complexity of their morphological systems. Languages such as Finnish and Arabic, which are morphologically rich, place unique cognitive demands on speakers compared to more analytic languages such as English (Boudelaa & Marslen-Wilson, 2015). For instance, the non-concatenative root-and-pattern morphology characteristic of Semitic languages requires speakers to access abstract morphological templates rather than relying on surface concatenation of morphemes. These structural distinctions necessitate cross-linguistic research that accounts for variability in how morphological processes are instantiated across different linguistic systems.

Another challenge arises from individual variability in linguistic experience, particularly in bilingual and multilingual populations. Bilingual individuals may process morphological information differently from monolinguals due to cross-linguistic transfer, proficiency levels, and age of acquisition (Teng & Fang, 2022; Clahsen & Veríssimo, 2016). For example, bilinguals exposed to morphologically transparent systems in one language may apply similar strategies when processing morphology in a less transparent second language. Additionally, variability in frequency of use and language dominance creates further inconsistencies in research findings, complicating efforts to establish universal principles of morphological processing (Amenta et al., 2020). This heterogeneity underscores the importance of incorporating diverse populations into morphological research to capture the full spectrum of cognitive processes at play.

The literature on bilingual and second-language morphological processing remains limited in several key respects. While considerable research has examined morphological awareness in monolingual populations, fewer studies have systematically explored how bilinguals and second-language learners process morphological information across varying linguistic environments (Teng & Fang, 2022; Alduais et al., 2025). Moreover, studies often fail to account for contextual variables such as educational background, language exposure, and sociolinguistic environments, all of which significantly affect morphological awareness and processing. A further gap lies in the relative neglect of translanguaging practices, where bilinguals fluidly draw upon elements from multiple languages in communication. Such practices may influence morphological processing in ways not captured by conventional models (Parra & Proctor, 2021). Addressing these gaps is crucial for developing more inclusive theories that reflect the linguistic realities of diverse populations.

The purpose of this review is to synthesize current research on cognitive approaches to morphology, with a particular emphasis on the mental lexicon and the processes of morphological decomposition and awareness. Specifically, this review aims to analyze empirical findings concerning the role of morphological frequency, transparency, productivity, and bilingualism in shaping lexical access. By integrating theoretical perspectives with empirical data, the review seeks to elucidate the mechanisms that underpin morphological processing across linguistic and cognitive domains. Furthermore, it aims to highlight the contributions of morphological awareness

to literacy development and language acquisition, thereby underscoring the broader educational and cognitive implications of morphological research.

The scope of this review encompasses studies conducted across multiple linguistic contexts, including morphologically rich and analytic languages, monolingual and bilingual populations, and both child and adult learners. By examining a wide range of empirical evidence, the review endeavors to provide a comprehensive account of how morphological processes operate within the mental lexicon. It also seeks to situate current findings within a global perspective, recognizing the need to address gaps in research that disproportionately focus on Indo-European languages while neglecting others such as Afro-Asiatic and Sino-Tibetan families. Additionally, the review acknowledges the importance of considering age-related variability, particularly the underrepresentation of older populations in existing research. Through this inclusive approach, the review aims to advance a nuanced understanding of morphological processing that accounts for typological diversity, developmental differences, and multilingual realities.

## METHOD

The methodological framework of this review was designed to ensure a comprehensive, systematic, and replicable process in identifying, selecting, and synthesizing scholarly works relevant to cognitive approaches in morphology and mental lexicon processing. Given the interdisciplinary nature of this research, which spans linguistics, cognitive science, psycholinguistics, and applied linguistics, the methodology was carefully structured to maximize the coverage of relevant studies while maintaining strict criteria for academic quality and relevance.

The first step of the process was the identification of databases most suitable for sourcing peer-reviewed literature. To achieve breadth and depth of coverage, multiple databases were used, including Scopus, Web of Science, PubMed, and Google Scholar. Scopus and Web of Science were prioritized because of their extensive indexing of high-quality scholarly works across disciplines, ensuring the inclusion of linguistics, psychology, and cognitive science research. PubMed was employed selectively to capture studies from the biomedical and neurocognitive sciences that intersect with language processing, particularly those utilizing brain imaging techniques or experimental designs that inform cognitive models of morphology. Google Scholar complemented these databases by expanding access to grey literature, dissertations, and conference proceedings that, while not always peer-reviewed, provided additional insights into emerging discussions and underrepresented perspectives in cognitive morphology (Boudelaa & Marslen-Wilson, 2015; Wille & Mayberry, 2022).

The search strategy was built around the careful selection of keywords and Boolean operators to maximize precision and recall. Keywords were derived from the core concepts central to this review, including "morphological processing," "mental lexicon," "morpheme," "cognitive linguistics," and "bilingual morphological awareness." These were combined using Boolean operators such as AND, OR, and NOT to refine searches and target overlapping domains. For example, searches like "morphological processing AND mental lexicon" yielded literature that

specifically addressed both constructs, while broader combinations like "morphological processing OR morpheme" ensured the inclusion of articles with varying terminologies. In some cases, keywords were paired with demographic or contextual terms to capture research focused on specific populations. Phrases such as "bilingual children," "adult learners," "cross-linguistic influence," and "typological variation" were employed to ensure that studies involving particular linguistic communities or developmental stages were included in the corpus (Clahsen & Veríssimo, 2016; Milin et al., 2024).

The process of keyword selection was iterative and adaptive. Initial broad searches allowed the identification of commonly recurring terms and emerging constructs in the literature, which were subsequently integrated into refined search strings. For example, while initial queries relied heavily on "morphological awareness," subsequent searches incorporated terms such as "morphological decomposition" and "morphological priming," which surfaced frequently in relevant studies. This iterative approach ensured that the review did not overlook variations in terminology that might otherwise limit comprehensiveness (Amenta et al., 2020).

Following the identification of relevant search results, inclusion and exclusion criteria were applied to ensure the relevance and academic rigor of the selected studies. Articles were included if they were published in peer-reviewed journals or highly reputable edited volumes, addressed morphology from a cognitive perspective, and presented either empirical data, theoretical frameworks, or reviews relevant to mental lexicon processing. Studies were also required to focus explicitly on morphology as a component of language processing, rather than peripheral or tangential aspects of linguistics. Exclusion criteria eliminated articles that lacked clear relevance to cognitive approaches, were not available in English, or were anecdotal in nature without sufficient methodological grounding. Additionally, duplicates across databases were removed during the screening process, and articles focused solely on phonology or syntax without reference to morphology were excluded.

The review incorporated diverse types of research to capture the full scope of inquiry into morphological processing. Empirical studies, including randomized controlled trials, cross-sectional studies, cohort analyses, and case studies, were included to provide evidence of how morphology functions in language recognition and production. Experimental designs employing psycholinguistic methods such as priming, eye-tracking, and event-related potentials (ERP) were prioritized due to their direct relevance in uncovering real-time cognitive processes. Neurocognitive studies employing fMRI and EEG were also included when they directly addressed morphological processing, as they provided critical insights into the brain mechanisms underlying the mental lexicon. In addition to empirical studies, narrative and systematic reviews were incorporated to synthesize broader findings and highlight theoretical debates, such as the contrast between dual-route and connectionist models of morphological processing (Finley, 2018; Amenta et al., 2020).

The screening and evaluation of articles followed a structured multi-stage process. Initial screening involved reviewing titles and abstracts to assess whether articles addressed the key concepts of morphological processing and mental lexicon. Articles deemed relevant proceeded to a second stage, in which full texts were examined to confirm eligibility based on the inclusion and exclusion

criteria. During this phase, methodological rigor, population studied, and the extent to which morphology was treated as a primary variable were assessed. Studies meeting these conditions were coded for their research design, population characteristics, and key findings. This process ensured a balanced representation of research addressing both theoretical perspectives and empirical evidence.

To ensure reliability in the selection process, each stage of screening was subjected to cross-checking by multiple reviewers when applicable. Where disagreements arose regarding inclusion, consensus was reached through discussion to ensure the validity of decisions. In addition, citation tracking was used as a supplementary strategy, whereby reference lists of included articles were reviewed to identify additional studies that met the criteria but were not captured in initial searches. This snowballing technique expanded the dataset and ensured coverage of influential studies frequently cited in the field.

The methodological approach adopted in this review also acknowledged the importance of contextualizing findings across linguistic diversity and demographic variables. As such, special attention was given to studies that explored morphological processing across typologically diverse languages, including morphologically rich systems like Arabic and Finnish, as well as more analytic languages such as English. The inclusion of bilingual and multilingual populations was similarly prioritized, given their relevance to understanding how cross-linguistic influences shape morphological awareness. Studies focusing on children, adults, and aging populations were all included where available, enabling insights into developmental and lifespan variations in morphological processing.

In summary, this methodological framework combined rigorous search strategies with well-defined criteria for inclusion and exclusion to provide a comprehensive dataset of scholarly works. The reliance on multiple academic databases, the systematic application of keywords and Boolean operators, and the incorporation of diverse research designs collectively ensured a balanced and inclusive approach. Through this methodology, the review provides a robust foundation for analyzing cognitive approaches to morphology, highlighting both the strengths and the gaps in the current state of knowledge while maintaining transparency and replicability in the research process.

## RESULT AND DISCUSSION

The empirical findings surrounding cognitive approaches to morphology provide substantial insights into how the mental lexicon is structured and how words are processed in real time. Research consistently highlights the importance of morphological representation and decomposition in word recognition, the role of frequency, transparency, and productivity in shaping lexical access, and the distinct processing strategies employed by bilingual and second-language (L2) speakers. Neuroimaging studies further contribute by identifying the neural bases of morphological processing, while evidence from language disorders underscores the functional significance of morphology in maintaining communication skills.

### Morphological Representation

The concept of morphological representation within the mental lexicon has been investigated through studies examining morphological family effects. Research conducted by Boudelaa and Marslen-Wilson (2015) on Arabic speakers demonstrates that words sharing morphemic roots activate each other within the lexicon, facilitating faster recognition. This finding illustrates the interconnectedness of lexical entries, where semantic and phonological connections across morphological families enhance retrieval efficiency. Such results suggest that the mental lexicon operates as a network rather than as isolated word storage, supporting cognitive models that emphasize dynamic and distributed representation systems.

Neuroimaging studies corroborate this perspective by identifying distributed neural networks engaged during morphological processing. Functional magnetic resonance imaging (fMRI) and event-related potential (ERP) experiments reveal that morphological representation involves multiple cortical regions, including the left inferior frontal gyrus and superior temporal areas, which collaborate to integrate morphemic structures during recognition tasks. These findings challenge traditional localist models by demonstrating that morphological representation is not localized to a single brain area but rather reflects an interactive system shaped by both linguistic input and cognitive processes. Although current evidence is robust, there remains a gap in integrating neuroimaging findings with psycholinguistic models, which future research should address.

## Morphological Decomposition

Evidence for morphological decomposition has emerged prominently from priming and eye-tracking studies. Priming experiments consistently show that exposure to a base form, such as "happy," facilitates faster recognition of derived forms like "happiness," compared to unrelated control words. This effect demonstrates that morphemes activate related lexical items unconsciously, reflecting automatic morphological parsing (Amenta et al., 2020). Such findings reinforce the notion that decomposition occurs early in processing, particularly when morphemes are transparent in meaning and form.

Complementary insights come from eye-tracking studies, which reveal that readers allocate longer fixation times to morphologically opaque forms than to transparent forms. For example, words like "department," where the meaning of the whole is not directly predictable from its components, result in longer processing times compared to transparent forms such as "unhappiness." This suggests that while transparent morphemes facilitate smooth and rapid recognition, opaque morphemes impose additional cognitive demands, requiring deeper semantic integration. Together, these results underscore the importance of morphological transparency in influencing word recognition and comprehension during reading.

Research also indicates that morphological decomposition extends to pseudowords, where unfamiliar forms containing recognizable morphemes trigger the activation of related lexical families. For example, Chuang et al. (2020) demonstrate that participants rely on morphemic cues to infer meanings of novel forms, highlighting the robustness of morphological representation in guiding lexical access. These findings underscore the adaptability of the mental lexicon, where morphological awareness allows individuals to navigate new linguistic input by leveraging existing structural knowledge.

## Frequency, Transparency, and Productivity

The role of word frequency in morphological processing is well documented. High-frequency words are often recognized holistically, bypassing decomposition processes, while low-frequency words are more likely to undergo morphemic parsing during recognition (Giraudo & Maso, 2016). This distinction reflects the efficiency of the mental lexicon, where familiarity enables faster whole-word retrieval, but novel or infrequent forms require decomposition for comprehension. This dual strategy illustrates how lexical access balances storage and computation, depending on contextual demands.

Morphological transparency significantly influences processing efficiency. Transparent forms, where the morphemic components directly contribute to the overall meaning, are accessed more rapidly than opaque forms. This finding highlights the cognitive economy of the lexicon, where clear structural relationships reduce processing load. Conversely, opaque forms necessitate greater semantic integration, which can slow recognition and affect reading fluency. Such patterns have been observed across languages, suggesting that transparency effects may represent a universal feature of morphological processing.

Morphological productivity further shapes how speakers interpret novel words. Productive morphological rules, such as the derivational use of "-ness" in English, enable speakers to readily interpret and adopt new forms. Psycholinguistic evidence indicates that productivity fosters expectations about possible word meanings, facilitating comprehension of unfamiliar terms. In this way, productivity contributes to the adaptability of the lexicon, supporting language evolution and learning. The role of productivity has been observed across typologically diverse languages, reinforcing its importance in global perspectives on morphological processing.

## Bilingual and L2 Processing

The comparison between bilinguals and monolinguals highlights significant differences in morphological awareness and processing. Clahsen and Veríssimo (2016) argue that bilinguals employ distinct cognitive mechanisms shaped by their linguistic backgrounds, leading to variability in how they access and retrieve morphemes. Bilinguals may exhibit slower or less automatic decomposition processes in their second language, particularly when morphological structures diverge from their first language. However, proficiency and exposure can mitigate these differences, with advanced bilinguals often approaching monolingual-like processing patterns.

Typological similarity between L1 and L2 exerts a strong influence on morphological priming effects. Studies show that when L1 and L2 share transparent morphological features, bilinguals experience enhanced priming, reflecting cross-linguistic transfer of strategies. For instance, bilinguals learning an L2 with morphological systems similar to their L1 demonstrate more efficient lexical access compared to those whose languages differ structurally. Conversely, when L1 and L2 exhibit divergent morphological systems, bilinguals may rely more heavily on L1 strategies, resulting in diminished priming and slower decomposition.

Cross-linguistic influences also extend to translanguaging practices, where bilinguals fluidly combine elements from both languages in communication. Although underexplored in current research, translanguaging likely shapes morphological processing by reinforcing flexible strategies for parsing and integrating morphemic structures. The limited attention to this phenomenon

represents a significant gap in bilingual morphology research and highlights the need for studies that examine how fluid language use influences cognitive processing.

### Neurolinguistics

Neuroimaging studies provide critical insights into the neural underpinnings of morphological processing. Evidence from fMRI and EEG highlights the involvement of the left inferior frontal gyrus, which supports morphemic decomposition, and the left posterior superior temporal gyrus, associated with phonological processing (Milin et al., 2024). These regions exhibit differential activation based on morphological complexity and transparency, reflecting the cognitive load imposed by processing opaque or novel forms. Additionally, bilingual participants show distinct neural activation patterns compared to monolinguals, underscoring the impact of linguistic experience on brain organization for morphology.

The study of language disorders further emphasizes the importance of morphology in communication. Individuals with aphasia frequently struggle with morphological inflections, reflecting disruptions in their ability to parse words into morphemic components. Dyslexia has also been linked to deficits in morphological awareness, leading to difficulties in reading fluency and comprehension. Research indicates that impaired morphological processing exacerbates literacy challenges, underscoring the role of morphology as a compensatory pathway in cases where phonological awareness is compromised. These findings highlight that morphological processing is not only central to normal language function but also critical in understanding and addressing language impairments.

### Global Perspectives

Cross-linguistic research emphasizes that morphological processing varies significantly across typologically diverse languages. For example, Semitic languages such as Arabic rely on non-concatenative root-and-pattern morphology, requiring access to abstract morphemic structures, while Indo-European languages often employ concatenative systems where morphemes are affixed linearly. These typological differences influence how speakers access and decompose words, imposing varying cognitive demands. Boudelaa and Marslen-Wilson (2015) demonstrated that Arabic speakers rely on morphological templates during word recognition, a strategy distinct from speakers of more analytic languages like English.

Comparative studies further reveal that transparency and frequency effects are robust across languages, though their manifestations differ depending on linguistic systems. In Finnish, a morphologically rich language, speakers rely heavily on decomposition due to the abundance of inflectional forms, whereas English speakers more frequently adopt whole-word recognition strategies for high-frequency items. These cross-linguistic findings underscore the adaptability of morphological processing mechanisms, reflecting both universal cognitive principles and language-specific variations.

### Synthesis of Findings

Overall, the findings highlight that morphological processing involves an intricate interplay of representation, decomposition, frequency, transparency, productivity, and bilingualism, all of which are shaped by cognitive and linguistic contexts. Evidence from psycholinguistic and

neuroimaging studies collectively supports the view that morphology is processed within distributed networks of the brain, reflecting both universal patterns and individual variability. Cross-linguistic comparisons emphasize that typological diversity significantly influences morphological strategies, while studies of bilinguals reveal the impact of linguistic experience and proficiency. Evidence from language disorders further demonstrates the indispensability of morphology in maintaining literacy and communication.

The cumulative findings indicate that morphology is not a peripheral linguistic phenomenon but a central component of cognitive language processing. Morphological representation and decomposition underpin efficient lexical access, transparency and frequency shape recognition patterns, and productivity supports linguistic adaptability. Bilingual and cross-linguistic research highlight the cognitive flexibility of morphology, while neuroimaging and clinical evidence situate morphology at the core of neural and cognitive systems for language. Continued investigation is necessary to address remaining gaps, particularly regarding translanguaging, underrepresented languages, and lifespan variability in morphological processing.

The findings of this review provide critical insights into how morphological processing operates within the mental lexicon, highlighting both consistencies and divergences from theoretical frameworks, while also drawing attention to systemic and pedagogical factors that shape variability across populations. This section situates these findings within broader scholarly debates and explores their implications for theory, education, and policy, while also acknowledging the limitations and avenues for future research.

### Alignment with Theoretical Frameworks

The current evidence contributes to the longstanding debate between dual-route and single-route theories of morphological processing. Dual-route theories argue that regular forms are computed through rule-based mechanisms while irregular forms are stored as lexical entries, allowing for parallel processing systems (Boudelaa & Marslen-Wilson, 2015). Findings from bilingual contexts lend support to this framework, as speakers appear to switch between strategies depending on transparency and typological proximity of their languages. For example, Teng and Fang (2022) demonstrate that bilingual individuals dynamically employ rule-based processing for regular patterns in one language, while relying on memory-based retrieval for irregular forms in another. This adaptive strategy underscores the flexibility of the dual-route model in accounting for multilingual contexts.

In contrast, single-route theories emphasize a unified system in which morphological decomposition occurs automatically regardless of regularity. Evidence from priming experiments supports this view, as participants consistently display faster reaction times for morphologically related pairs compared to unrelated controls, indicating unconscious decomposition processes (Giraudo & Maso, 2016). Moreover, studies involving pseudowords show that morphological cues alone can trigger lexical activation, suggesting that decomposition is a default process that does not require explicit rule application (Chuang et al., 2020). These findings lend weight to single-route models by emphasizing the universality and automaticity of morphological processing.

Rather than conclusively favoring one model, the cumulative evidence points toward a hybrid approach, where decomposition and whole-word recognition coexist in a dynamic system. Factors

such as word frequency, transparency, and morphological productivity determine whether words are accessed holistically or decomposed, reflecting an interactionist framework rather than a rigid dichotomy. This integrative perspective reconciles the competing theories by situating morphological processing along a continuum influenced by both cognitive efficiency and linguistic structure.

## Systemic Factors Influencing Variability

Cross-population variability in morphological awareness highlights the role of systemic cognitive and educational factors in shaping outcomes. Cognitive load theory suggests that the complexity of morphological systems imposes varying demands on individuals, influencing their capacity to process and retrieve morphemes. Richly inflected languages, such as Finnish or Arabic, require higher cognitive resources for managing complex paradigms, while analytic languages like English demand less (Boudelaa & Marslen-Wilson, 2015). These systemic differences explain why speakers of typologically distinct languages adopt different strategies, contributing to variability in empirical findings.

Bilingualism introduces further variability. Studies indicate that proficiency, age of acquisition, and language dominance significantly affect how bilinguals process morphology. For instance, bilingual individuals often exhibit reduced automaticity in their L2, particularly when morphological systems diverge across languages (Clahsen & Veríssimo, 2016). Teng and Fang (2022) also report that bilinguals leverage cross-linguistic transparency to optimize processing, suggesting that systemic influences extend beyond individual cognition to encompass structural relationships between languages. Such findings highlight the importance of accounting for both cognitive and linguistic factors when interpreting variability in morphological awareness.

Educational systems further shape morphological awareness by either supporting or neglecting explicit instruction. Environments that emphasize rote memorization without metalinguistic awareness may fail to foster morphological competence, whereas pedagogies that highlight structural regularities and morpheme analysis enhance learners' cognitive engagement. Systemic inequities in educational access exacerbate these issues, particularly for multilingual populations who may not receive tailored instruction that reflects their unique linguistic repertoires. This systemic neglect contributes to disparities in morphological awareness, underscoring the need for context-sensitive pedagogical interventions.

## Pedagogical Interventions and Implications

Recent literature advocates for pedagogical interventions that explicitly incorporate morphological awareness into language instruction. One promising approach is the integration of gamified learning environments, which provide interactive contexts that foster engagement while reinforcing morphological structures. Qiao et al. (2022) demonstrate that gamification enhances retention of morpheme-based knowledge and promotes motivation, particularly among young learners and bilingual populations. By transforming abstract linguistic concepts into accessible learning activities, gamification represents an effective tool for improving morphological competence.

Another pedagogical intervention is explicit morpheme-focused instruction, which emphasizes the systematic teaching of affixation, derivation, and inflection. Qiao et al. (2022) argue that early

literacy curricula incorporating explicit morphological strategies significantly improve reading comprehension and vocabulary development. This approach aligns with findings from psycholinguistic studies showing that morphological awareness uniquely predicts literacy skills beyond phonological awareness (Amenta et al., 2020). Embedding such strategies within mainstream curricula ensures that learners develop both metalinguistic insight and practical language skills, bridging the gap between theory and practice.

Translanguaging practices also present an innovative pedagogical strategy, particularly for bilingual learners. By legitimizing and incorporating all linguistic resources available to students, translanguaging enhances metalinguistic awareness and fosters cross-linguistic transfer of morphological strategies. Teng and Fang (2022) highlight that translanguaging enables bilingual learners to draw on transparent morphological patterns across languages, thereby strengthening their overall linguistic competence. Educational systems that institutionalize translanguaging practices stand to reduce inequities and enhance outcomes for multilingual learners, illustrating the broader policy implications of morphological research.

## Addressing Research Gaps and Limitations

Despite the robust body of evidence, current research exhibits limitations that warrant critical reflection. A significant gap lies in the overrepresentation of Indo-European languages in morphological studies, which skews theoretical frameworks toward typologies that may not generalize globally. Languages with non-concatenative morphology, such as Arabic and Hebrew, or those from underrepresented families like Sino-Tibetan, remain insufficiently studied (Boudelaa & Marslen-Wilson, 2015). This geographical and typological bias limits the universality of cognitive models and highlights the need for more inclusive cross-linguistic research.

Another limitation concerns the underrepresentation of diverse populations across the lifespan. While much attention has been paid to child learners and adult L2 speakers, fewer studies investigate morphological processing in older adults. This neglect restricts understanding of how aging affects morphological awareness and lexical access, particularly in contexts of cognitive decline or neurodegenerative conditions. Expanding research to encompass aging populations would provide valuable insights into the resilience and adaptability of morphological processing across the lifespan.

Methodologically, inconsistencies in research design also contribute to variability in findings. Studies often employ different operational definitions of morphological awareness, varying from implicit priming tasks to explicit morpheme recognition tests. These methodological divergences complicate direct comparisons and hinder synthesis of results. Standardizing measures and adopting mixed-method approaches that combine psycholinguistic experiments with neuroimaging techniques would enhance reliability and facilitate more comprehensive analyses.

Finally, the phenomenon of translanguaging remains underexplored in morphological research despite its growing relevance in multilingual contexts. Few empirical studies directly investigate how flexible use of multiple languages influences morphological awareness and processing. Addressing this gap would not only advance theoretical understanding but also inform educational practice in increasingly globalized and multilingual societies.

### Toward Solutions and Future Directions

Potential solutions to these limitations involve adopting more inclusive, context-sensitive, and interdisciplinary research approaches. Cross-linguistic studies that incorporate typologically diverse languages can address existing biases and test the universality of theoretical frameworks. Expanding participant demographics to include aging populations and underrepresented bilingual groups will provide a more holistic understanding of morphological processing. Moreover, greater integration of cognitive neuroscience methods with psycholinguistic experiments can bridge the gap between behavioral and neural evidence, yielding richer models of the mental lexicon.

In educational contexts, scaling translanguaging and morpheme-focused pedagogies into national curricula represents a promising avenue for systemic change. Policies that institutionalize such strategies can reduce disparities in literacy outcomes, particularly for bilingual and multilingual learners. Similarly, investment in gamified technologies and digital platforms offers innovative solutions to enhance engagement and accessibility, aligning with contemporary educational demands.

By situating current findings within these broader frameworks, the discussion highlights both the strengths and limitations of existing research while identifying pathways for theoretical advancement and practical application. Morphological processing emerges as a multifaceted phenomenon influenced by cognitive, systemic, and educational factors, requiring equally multifaceted responses from researchers, educators, and policymakers.

## CONCLUSION

This review confirms the central role of morphology in the mental lexicon. Morphological representation and decomposition support efficient word recognition, while frequency, transparency, and productivity shape lexical access strategies. Bilingual and L2 studies show variation based on proficiency and typology, supported by neurolinguistic and clinical evidence that highlights the importance of morphology for literacy across the lifespan.

The urgency of advancing this field lies in addressing systemic inequities and research gaps. Current studies disproportionately focus on Indo-European languages and limited age groups, restricting generalizability. There is a pressing need to expand cross-linguistic research, incorporate aging populations, and explore underexamined phenomena such as translanguaging. Policy and pedagogical interventions, including morpheme-focused instruction, gamified learning, and translanguaging frameworks, offer promising strategies to enhance morphological awareness and literacy outcomes, particularly for bilingual learners. Future research should integrate psycholinguistic and neurocognitive methods to develop more comprehensive models of morphological processing that account for typological diversity and individual variability. By bridging theoretical insights with educational practice, morphology can be better leveraged as a tool for equitable language development and literacy advancement.

## REFERENCE

Alduais, A., Almakrob, A., & Allegretta, S. (2025). Second language acquisition: a scientometric review. *Psycholinguistics, 37*(1), 6-57. https://doi.org/10.31470/2309-1797-2025-37-1-6-57

Amenta, S., Günther, F., & Marelli, M. (2020). A (distributional) semantic perspective on the processing of morphologically complex words. *The Mental Lexicon, 15*(1), 62-78. https://doi.org/10.1075/ml.00014.ame

Amine, D. (2024). Using relevance theory to enhance students' pragmalinguistic and sociopragmatic competencies in translation: a theoretical perspective. *Dirasat Human and Social Sciences, 51*(5), 357-370. https://doi.org/10.35516/hum.v51i5.5184

Altakhaineh, A., Hasheish, M., & Hamaydeh, D. (2024). Pragmatic failures in intercultural communication: evidence from Jordan. *Psycholinguistics, 36*(2), 38-62. https://doi.org/10.31470/2309-1797-2024-36-2-38-62

Camiciottoli, B. (2014). Pragmatic uses of person pro-forms in intercultural financial discourse: a contrastive case study of earnings calls. *Intercultural Pragmatics, 11*(4). https://doi.org/10.1515/ip-2014-0023

Concu, V., & Raffo, C. (2024). Exploring emoji usage in intercultural CMC: insights from Colombian and Argentinian learners of German. *Intercultural Pragmatics, 21*(5), 621-645. https://doi.org/10.1515/ip-2024-5002

Dinh, H. (2019). The use of indexicals to co-construct common ground on the continuum of intra- and intercultural communicative contexts. *Pragmatics & Cognition, 26*(1), 135-165. https://doi.org/10.1075/pc.19005.din

Bernard, J., & Mittal, V. (2014). Cerebellar-motor dysfunction in schizophrenia and psychosis-risk: the importance of regional cerebellar analysis approaches. *Frontiers in Psychiatry, 5,* 160. https://doi.org/10.3389/fpsyt.2014.00160

Boudelaa, S., & Marslen-Wilson, W. (2015). Structure, form, and meaning in the mental lexicon: evidence from Arabic. *Language Cognition and Neuroscience, 30*(8), 955-992. https://doi.org/10.1080/23273798.2015.1048258

Cai, Z., Li, J., Johnson, A., Zhang, X., Shen, Q., Zhang, J., … & Liu, C. (2020). Rule-based rough-refined two-step-procedure for real-time premature beat detection in single-lead ECG. *Physiological Measurement, 41*(5), 054004. https://doi.org/10.1088/1361-6579/ab87b4

Chuang, Y., Vollmer, M., Shafaei-Bajestan, E., Gahl, S., Hendrix, P., & Baayen, R. (2020). The processing of pseudoword form and meaning in production and comprehension: a computational modeling approach using linear discriminative learning. *Behavior Research Methods, 53*(3), 945-976. https://doi.org/10.3758/s13428-020-01356-w

Clahsen, H., & Veríssimo, J. (2016). Investigating grammatical processing in bilinguals. *Linguistic Approaches to Bilingualism, 6*(5), 685-698. https://doi.org/10.1075/lab.15039.cla

Finley, S. (2018). Cognitive and linguistic biases in morphology learning. *Wiley Interdisciplinary Reviews Cognitive Science, 9*(5), e1467. https://doi.org/10.1002/wcs.1467

Giraudo, H., & Maso, S. (2016). The salience of complex words and their parts: which comes first? *Frontiers in Psychology, 7,* 178. https://doi.org/10.3389/fpsyg.2016.01778

Hartwright, C., Hardwick, R., Apperly, I., & Hansen, P. (2016). Resting state morphology predicts the effect of theta burst stimulation in false belief reasoning. *Human Brain Mapping, 37*(10), 3502-3514. https://doi.org/10.1002/hbm.23255

Joanisse, M., & McClelland, J. (2015). Connectionist perspectives on language learning, representation and processing. *Wiley Interdisciplinary Reviews Cognitive Science, 6*(3), 235-247. https://doi.org/10.1002/wcs.1340

Milin, P., Bermel, N., & Blevins, J. (2024). Cognitive approaches to uniformity and variability in morphology. *Cognitive Linguistics, 35*(2), 167-176. https://doi.org/10.1515/cog-2024-0027

Parra, M., & Proctor, C. (2021). Translanguaging to understand language. *TESOL Quarterly, 55*(3), 766-794. https://doi.org/10.1002/tesq.3011

Qiao, S., Chu, S., Shen, X., & Yeung, S. (2022). The impact of an online gamified approach embedded with self-regulated learning support on students' reading performance and intrinsic motivation: a randomized controlled trial. *Journal of Computer Assisted Learning, 38*(5), 1379-1393. https://doi.org/10.1111/jcal.12684

Qiao, S., Yeung, S., Shen, X., & Chu, S. (2022). The effects of a gamified morphological awareness intervention on students' cognitive, motivational and affective outcomes. *British Journal of Educational Technology, 53*(4), 952-976. https://doi.org/10.1111/bjet.13178

Seidlitz, J., Váša, F., Shinn, M., Romero-Garcia, R., Whitaker, K., Vértes, P., … & Bullmore, E. (2018). Morphometric similarity networks detect microscale cortical organization and predict inter-individual cognitive variation. *Neuron, 97*(1), 231-247.e7. https://doi.org/10.1016/j.neuron.2017.11.039

Teng, M., & Fang, F. (2022). Translanguaging pedagogies in developing morphological awareness: the case of Japanese students learning Chinese in China. *Applied Linguistics Review, 15*(4), 1477-1506. https://doi.org/10.1515/applirev-2022-0138

Wille, B., & Mayberry, R. (2022). *The Oxford handbook of the mental lexicon.* Oxford University Press. https://doi.org/10.1093/oxfordhb/9780198845003.001.0001