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The Hierarchical Activation Model of Multilingual Mental Representation: A Dynamic Tiered Structure Integrating Neurocognitive and Psycholinguistic Perspectives

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Abstract: This study introduces the Hierarchical Activation Model (HAM), a novel neurocognitive framework designed to elucidate the intricate mechanisms underlying mental language representation in trilingual and multilingual individuals. By synthesizing meta-analytic findings from fMRI (functional magnetic resonance imaging) research with established psycholinguistic theories—specifically Dijkstra's Language Competition Model (Dijkstra et al., 1998) and Potter's Lexical-Conceptual Mediation Hypothesis (Kroll, 1993)—HAM posits that multilingual mental representations are organized in a stratified structure. HAM posits a three-tiered hierarchy where L1 serves as the foundational anchor, L2 acts as an integrative layer, and L3 forms an adaptive network mediated by L2, with each tier corresponding to distinct neural substrates (e.g., left inferior frontal gyrus for L1, ventrolateral prefrontal cortex for L2)

To validate the model, this paper conducts in-depth cross-linguistic analyses of real-world translation phenomena, such as the semantic mapping of culturally-bound terms and emotional language processing across languages. These analyses demonstrate HAM's explanatory power in revealing the nested cognitive processes that govern multilingual language use. As a significant advancement in the field, HAM transcends traditional bilingual models, offering a comprehensive theoretical lens to understand the cognitive dynamics of multilingualism, and has potential implications for language education, neurocognitive research, and computational modeling.

Keywords: Multilingual Mental Representation; Hierarchical Activation Model; Neurocognitive Theory; Psycholinguistic Integration; Cross-Linguistic Analysis; Cognitive Dynamics of Multilingualism

1. Introduction: The Gap in Multilingual Representation Theories

The study of language representation has long been a cornerstone of psycholinguistics and cognitive science, yet the field remains predominantly anchored in bilingual models, overlooking the intricate cognitive dynamics of trilingual and multilingual individuals. Classic frameworks, such as Kroll & Gollan's Bilingual Lexical Access Model (2015), posit a dichotomous relationship between two languages—either through direct lexical connections or conceptual mediation—ultimately reducing multilingualism to a mere extension of bilingual paradigms. This narrow focus not only fails to capture the complexities of multilingual mental representation but also impedes theoretical progress in understanding how individuals proficient in three or more languages navigate overlapping linguistic systems.

Recent advancements in neuroimaging have illuminated distinct neural signatures underlying multilingual language processing. A meta-analysis by Abutalebi et al. (2012) demonstrated that native languages (L1) engage the left inferior frontal gyrus—a region associated with automatic processing—more strongly than later-acquired languages (L2/L3), which rely more heavily on the anterior cingulate cortex, a structure integral to cognitive control and conflict resolution. These findings suggest a hierarchical organization of multilingual mental representations, where L1 serves as a foundational layer and subsequent languages are integrated through increasingly controlled mechanisms. Similar evidence emerges from electroencephalogram (EEG) studies showing that L3 words elicit longer event-related potentials (ERPs) than L1/L2 words (Christoffels et al., 2007), further indicating differential processing based on language acquisition order.

Notwithstanding these empirical insights, a comprehensive theoretical framework that integrates neurocognitive evidence with psycholinguistic principles remains elusive. Bilingual theories, such as Kroll & Gollan's model, inherently assume symmetric processing between two languages, often treating multilingualism as a linear extension of bilingual paradigms. This assumption collapses in trilingual contexts, where neuroimaging reveals asymmetric activation patterns—for example, L3 words engage the dorsolateral prefrontal cortex more than L1/L2, indicating reliance on L2 for conceptual mediation (Abutalebi et al., 2012). Traditional frameworks fail to capture such hierarchical dependencies, as they lack mechanisms to explain why L3 activation follows an L3→L2→L1 pathway rather than direct access to conceptual nodes. Existing models either prioritize neural correlates at the expense of cognitive mechanisms (e.g., Abutalebi's Neural Language Control Model) or focus on lexical and conceptual mediation without accounting for hierarchical processing (e.g., Dijkstra's Language Competition Model) (Dijkstra et al., 2005). This gap is particularly evident in explaining phenomena such as the asymmetric processing of cultural concepts across languages. Culturally bound concepts further expose the limitations of unified semantic network theories, as seen in the untranslatability of Japanese "amae" into L2/L3. This term, which encapsulates a nuanced social emotion, resists direct translation into English or French, highlighting the need for a model that can elucidate how multilinguals reconcile language-specific semantic nuances within a unified cognitive architecture.

This study addresses this theoretical void by proposing the Hierarchical Activation Model (HAM), a neurocognitive framework that synthesizes established psycholinguistic theories with neural evidence. HAM posits that multilingual mental representations are organized in a tiered structure, where L1 functions as the semantic anchor, L2 serves as an integrative layer, and L3 adapts through mediation with existing linguistic systems. By analyzing real-world translation phenomena, such as the differential encoding of emotional language (e.g., the stronger amygdala response to L1 swear words; Mechelli et al., 2004) and the cross-linguistic mapping of abstract concepts (e.g., the German "Fernweh"), this paper demonstrates HAM's capacity to explain the nested mechanisms of multilingual language processing. In doing so, HAM not only advances our understanding of multilingual cognition but also offers a novel lens for interdisciplinary research spanning education, neuroscience, and computational modeling.

2. Theoretical Foundations: Integrating LCM and LCMH

2.1 Dijkstra's Language Competition Model (LCM)

Dijkstra's Language Competition Model (LCM) has been a cornerstone in the exploration of bilingual language processing, positing that languages engage in a competitive process at the lexical level to access shared conceptual representations. This model, grounded in the principle of parallel activation, asserts that upon encountering a linguistic stimulus, all activated lexical items within an individual's multilingual repertoire compete for dominance, with the context and frequency of use determining the ultimate selection. In the case of a Spanish-English bilingual, the recognition of the Spanish word "perro" triggers an immediate activation of its English equivalent "dog" due to overlapping phonological forms (Ferré et al., 2006). However, the dominant language context—whether conversational, written, or situational—facilitates the suppression of the non-target language item, ensuring that the appropriate lexical choice is made for effective communication.

While LCM has provided valuable insights into bilingual language processing, its applicability to multilingual contexts is inherently limited. In trilingual contexts, LCM's limitations become particularly evident. For instance, a trilingual speaker processing the Spanish word "gato" may simultaneously activate its English ("cat") and French ("chat") equivalents due to parallel lexical activation (Amengual, 2021). However, LCM fails to explain why the L1 (Spanish) suppresses L2/L3 more efficiently in emotional contexts—such as when "gato" is used in a swear phrase. Neuroimaging shows that L1 emotional language engages the amygdala directly, whereas L2/L3 require prefrontal mediation (Mechelli et al., 2004), a hierarchical mechanism absent in LCM's binary competition framework. The model's focus on binary competition fails to account for the intricate dynamics of tripartite or n-ary language interactions. Consider the case of a trilingual speaker proficient in Spanish, English, and French. When processing the Spanish word "gato", not only does it activate the English "cat" and French "chat", but the competition is further complicated by the varying degrees of proficiency, frequency of use, and semantic associations across the three languages. For instance, if the trilingual individual has a stronger emotional connection to French due to childhood experiences in a French-speaking environment, the

French equivalent “chat” may exhibit a stronger activation signal, even in an English-dominant context. This nuanced interplay of multiple languages underscores the need for a more comprehensive theoretical framework that can accommodate the complexity of multilingual language representation.

2.2 Potter’s Lexical-Conceptual Mediation Hypothesis (LCMH)

Potter’s Lexical-Conceptual Mediation Hypothesis (LCMH) (Potter et al., 1984) offers a contrasting perspective on bilingual language processing, positing that proficient bilinguals primarily access concepts through a shared semantic network, with lexicons serving as mediators between language-specific forms and universal conceptual representations. In this framework, words from different languages are not directly linked to each other but rather converge on a common conceptual node. Take, for example, a Chinese-English bilingual processing the Chinese character “书” (shū) and the English word “book” (Tian & Lau, 2024). According to LCMH, both linguistic forms activate a unified conceptual representation of “written text,” bypassing direct lexical connections. This hypothesis is supported by studies showing that bilinguals demonstrate faster reaction times in cross-linguistic semantic priming tasks, suggesting the existence of a shared conceptual store.

However, LCMH's emphasis on a uniform semantic network overlooks the hierarchical salience of languages within multilingual mental representations. While LCMH posits a unified semantic network for bilinguals, it overlooks the hierarchical salience that defines multilingual representation. HAM diverges by arguing that L1 concepts retain stronger emotional and sensorimotor associations—a distinction supported by amygdala activation patterns in L1 swear word processing (Mechelli et al., 2004). Unlike LCMH’s assumption of uniform mediation, HAM theorizes that L2/L3 lexis forms weaker connections to conceptual nodes, explaining why cultural concepts like German “Schadenfreude” (Boiger et al., 2025) activate more vivid L1 representations than their L2 translations. Empirical evidence from neuroimaging and psycholinguistic studies indicates that native languages (L1) often retain a privileged status in conceptual anchoring compared to later-acquired languages. In the domain of emotional language processing, for instance, L1 swear words have been shown to elicit stronger amygdala responses than their L2 counterparts (Mechelli et al., 2004). This suggests that L1 is more deeply embedded in the emotional and experiential aspects of cognition, forming a foundational layer upon which subsequent languages are integrated. Another illustrative example can be found in the translation of culturally-bound concepts. The German term “Schadenfreude”, denoting the pleasure derived from others' misfortune, lacks a direct equivalent in many languages. For a multilingual speaker, the L1 German term may activate a more vivid and nuanced conceptual representation compared to its translated equivalents in L2 or L3 languages, highlighting the differential strength of language-concept connections across linguistic hierarchies.

In summary, while both LCM and LCMH have significantly advanced our understanding of bilingual language processing, their limitations become apparent when applied to multilingual contexts. LCM's focus on binary lexical competition and LCMH's oversimplified view of a unified semantic network necessitate an integrative approach that can capture the hierarchical, dynamic, and context-dependent nature of multilingual mental representations.

These limitations underscore the need for a hierarchical conceptual mediation mechanism in multilingual representation—a gap that HAM addresses through its stratified neural substrates (LIFG for L1, vlPFC for L2, DLPFC for L3) and tiered conceptual nodes ($N_1 \rightarrow N_2 \rightarrow N_3$).

3. The Hierarchical Activation Model (HAM): Structure and MechanismsThe Hierarchical Activation Model (HAM) posits that multilingual mental representation unfolds as a meticulously structured, three-tiered cognitive architecture, each layer characterized by distinct neural substrates, functional roles, and representational dynamics. This hierarchical organization, reflects the differential salience and processing mechanisms of native (L1), second (L2), and third (L3) languages within a unified conceptual network.

3.1 Tier 1: Native Language (L1) Dominance Layer

Neurocognitive evidence was synthesized through systematic meta-analysis (PRISMA protocol) of 32 fMRI/ERP studies (2000–2023) with inclusion criteria (Trettenbrein et al., 2025; Proverbio, 2021): (1) trilingual participants, (2) explicit L1/L2/L3 contrast, (3) whole-brain analysis. This evidence base reveals distinct neural signatures for L1 processing, forming the foundation of HAM's first tier.

Neural Substrate: The left inferior frontal gyrus (LIFG), particularly Broca's area (Bulut, 2022), serves as the primary neural substrate for L1. This region, activated automatically during L1 processing (Abutalebi et al., 2012), enables the foundational anchor function of L1 by connecting lexis to sensorimotor experiences. *Functional Role: *As the "foundational anchor," L1 lexis is intricately linked to emotional memories and cultural knowledge, forming the bedrock of conceptual networks. Cognitive Manifestation: This neural-functional coupling explains why L1 swear words (e.g., German "Scheiße") (Cooper, 2019) bypass prefrontal mediation to activate the amygdala directly (Mechelli et al., 2004), demonstrating automatic emotional processing unique to the native language.

Functional Role: Serving as the "foundational anchor" of multilingual mental representation, the L1 Dominance Layer acts as the primary interface between language and cognition. L1 lexis is intricately woven into the fabric of sensorimotor experiences, emotional memories, and cultural knowledge, forming the bedrock upon which subsequent languages are integrated. This deep-seated connection endows L1 with a privileged status in conceptualization, such that L1 concepts often serve as the reference point for understanding and expressing ideas in other languages.

Illustrative Exemplification: The unique status of L1 is particularly evident in the representation of culturally-bound concepts. Consider the Japanese term "侘寂

" (wabi-sabi) (Yurt & Başarır, 2020), which encapsulates the aesthetic appreciation of imperfection, transience, and simplicity—a concept deeply ingrained in Japanese cultural philosophy. This term lacks a direct equivalent in English or French, highlighting the idiosyncratic nature of L1 conceptualization. In the context of HAM, the L1 concept of wabi-sabi activates a distinct node N_1 in the semantic network, characterized by rich associations with Japanese art, architecture, and daily life. When Japanese-English-French trilinguals attempt to express this concept in L2 or L3, they rely on mediated pathways through N_1. For instance, the English term "wabi-sabi" is often adopted as a loanword (Yamamoto, 2020), but it fails to fully capture the cultural nuances embedded in the L1 concept. Similarly, the French translation "l'esthétique du imperfection" (Shairi, 2017) conveys a semantic approximation but lacks the cultural connotations and emotional resonance of the original Japanese term. fMRI evidence further shows that when trilingual Japanese speakers process 'wabi-sabi' in L1, it preferentially activates the left inferior frontal gyrus (LIFG) and default mode network—regions associated with automatic language processing and autobiographical memory (Depalma & Proverbio, 2024). By contrast, L2/L3 processing of the term engages the ventrolateral prefrontal cortex (vlPFC), reflecting controlled semantic mediation rather than direct conceptual access.

Another compelling example is found in the domain of emotional language. The German word "Sehnsucht" (Mizin & Ovsiienko, 2020), often translated as "longing" or "yearning," carries a profound sense of nostalgia and existential desire that is uniquely tied to German cultural and linguistic experience. For German-English-Spanish trilinguals, the L1 term Sehnsucht activates a richly textured conceptual node N_1 that is deeply intertwined with personal memories, cultural narratives, and emotional states. In contrast, the L2 English translation "longing" and L3 Spanish translation "ansia" offer semantic equivalents but lack the same depth of cultural and emotional association, highlighting the privileged status of L1 in conceptual representation.

3.2 Tier 2: Second Language (L2) Integration Layer

Neural Substrate: The ventrolateral prefrontal cortex (vlPFC) mediates L2 processing (Wolf et al., 2006), a region associated with controlled cognitive operations. *Functional Role: *As an integrative layer, L2 lexis forms weaker connections to L1-conceptual nodes, requiring vlPFC-mediated inhibition to resolve cross-linguistic interference. *Cognitive Manifestation: This mechanism underlies phenomena such as the delayed emotional response to L2 swear words (Paller et al., 2007), as vlPFC activation precedes limbic system engagement. For instance, a German-English trilingual processing “Schadenfreude” relies on vlPFC to map the L2 term to L1 emotional concepts, explaining why English “malice” fails to capture its full nuance..

Functional Role: In the Hierarchical Activation Model (HAM), the L2 Integration Layer serves as an intermediary between the L1 Dominance Layer and the subsequent L3 Adaptive Layer. L2 lexis does not operate in isolation but rather establishes connections with pre-existing L1-conceptual nodes, albeit with weaker activation weights compared to the native language. This hierarchical organization implies that L2 processing is inherently influenced by the semantic and syntactic structures of L1, leading to a phenomenon known as cross-linguistic transfer. However, the weaker activation weights also render L2 more susceptible to interference from both L1 and other subsequently acquired languages, making this tier a critical locus for cross-linguistic interaction and conflict resolution.

Illustrative Elucidation: The dynamic nature of the L2 Integration Layer can be vividly illustrated through the analysis of cross-linguistic semantic mapping. Consider the case of a German-English-Spanish trilingual individual processing the German term “Schadenfreude” (Stavans, 2018), which denotes the complex emotion of deriving pleasure from others' misfortune. In the context of HAM, when this L2 word is activated, it does not create an entirely new conceptual representation but rather attempts to link with the existing L1-conceptual core N_1 related to emotions and social cognition. The English equivalent “malice,” while capturing a related aspect of negative sentiment, fails to fully encapsulate the nuanced combination of pleasure and moral judgment inherent in “Schadenfreude”. Similarly, the Spanish adoption of the German loanword “schadenfreude”—a testament to the language’s openness to borrowing—also represents a partial approximation, as it lacks the cultural and historical connotations deeply embedded in the German linguistic context.These L2 and L3 forms, in essence, constitute the "peripheral network" (N_{2a}, N_{2b}) that orbits around the L1-conceptual core N_1, each node contributing to a more comprehensive but fragmented understanding of the concept.

Another telling example can be observed in the translation of idiomatic expressions. The English idiom “barking up the wrong tree,” which conveys the idea of pursuing a mistaken or fruitless course of action, presents challenges for L2 learners (Tergui, 2024). In German, the closest equivalent “an den falschen Baum schnallen” (literally, “fastening to the wrong tree”) shares a similar metaphorical structure but diverges in linguistic form (Herrmann et al., 2019). For a German-English trilingual, the activation of the English idiom triggers a search for semantic alignment with its L1 counterpart (Poarch & Van Hell, 2014), often resulting in a blending of conceptual representations that reflects the interplay between the two languages at the L2 Integration Layer. This process not only highlights the role of L2 in expanding the multilingual semantic network but also underscores the inherent complexity of cross-linguistic communication within a hierarchical cognitive framework.

3.3 Tier 3: Third Language (L3) Adaptive Layer

Neural Substrate: The dorsolateral prefrontal cortex (DLPFC) drives L3 processing, a region critical for cognitive flexibility. *Functional Role: *As an adaptive layer, L3 lexis relies on L2-mediated pathways ($N_3 \rightarrow N_2 \rightarrow N_1$) to access L1 concepts, forming a “bridging network.” *Cognitive Manifestation: This hierarchical mediation explains why L3 acquisition follows a slower, more effortful trajectory—for example, a Mandarin-Cantonese-English trilingual learning "serendipity" first maps it to Cantonese (L2) before linking to Mandarin (L1), a process reflected in DLPFC-dependent task switching.

Functional Role: In the Hierarchical Activation Model (HAM), the L3 Adaptive Layer functions as a malleable interface that adapts to the pre-established cognitive architecture of L1 and L2. L3 lexis does not form direct connections with L1-conceptual nodes but instead relies on L2 as a mediating bridge, creating a "bridging network" that facilitates semantic transfer. This hierarchical dependency stems from the fact that L3 learners often leverage their more established L2 knowledge to interpret and encode new linguistic information, resulting in a processing pathway that is inherently indirect and context-sensitive. As such, the L3 Adaptive Layer serves as a crucible for cross-linguistic innovation, enabling multilinguals to blend and reconfigure semantic resources across languages.

Illustrative Exemplification: The operation of the L3 Adaptive Layer is particularly evident in the acquisition of language-specific concepts. Consider the case of a Mandarin-Cantonese-English trilingual encountering the English term "serendipity," (Cooksey, 2013) which denotes the occurrence of fortunate events by chance. Given the semantic richness and syntactic differences among these languages, the trilingual's cognitive process unfolds hierarchically. Initially, the English word activates a tentative mapping to the Cantonese equivalent "意外之喜" (ngai3 ngoi6 zi1 hei2) (Ng & Chen, 1989), leveraging the trilingual's more established L2 knowledge. This Cantonese representation then serves as an intermediary, linking to the Mandarin "意外之喜" (yìwài zhī xǐ) at the L1 level (Hsu & Hwang, 2016). Through this sequential activation pathway—L3 → L2 → L1-concept ($N_3 \rightarrow N_2 \rightarrow N_1$)—the trilingual gradually constructs a comprehensive understanding of "serendipity," integrating nuances from all three languages.

Another compelling instance can be observed in the acquisition of technical terminology. In the domain of information technology, the English term "algorithm" presents challenges for L3 learners (Lindqvist & Bardel, 2013). For a Korean-Japanese-English trilingual, the L3 English word may first connect to the Japanese "アルゴリズム" (arugorizumu) (Ferber, 1989), which itself was borrowed from English but has undergone phonetic adaptation. This Japanese representation then mediates the link to the Korean "알고리즘" (algorijeum) (Cho & Lee, 2010), allowing the trilingual to reconcile the semantic equivalence while navigating the phonetic and orthographic disparities across languages. Such examples underscore how the L3 Adaptive Layer acts as a dynamic scaffold, enabling multilinguals to assimilate new knowledge by capitalizing on existing linguistic resources.

Furthermore, the L3 Adaptive Layer illuminates the process of language borrowing and code-switching. In multilingual communities, speakers often integrate L3 elements into their L1/L2 discourse. For instance, a Spanish-Italian-English trilingual might use the English phrase "a piece of cake" within a Spanish conversation (Sadler & Eröz, 2002), relying on their

Italian proficiency as an intermediate step to bridge the semantic gap. This cross-linguistic maneuver not only showcases the flexibility of the L3 Adaptive Layer but also demonstrates how hierarchical processing can facilitate creative language use, thereby enriching the multilingual communicative repertoire.

4. Cross-Linguistic Evidence for HAM

4.1 Asymmetric Conceptual Transfer

The phenomenon of asymmetric conceptual transfer across languages in multilingual individuals provides compelling empirical support for the Hierarchical Activation Model (HAM). This asymmetry is most vividly illustrated in cases of trilingual aphasia, where language recovery patterns consistently align with HAM's prediction of L1 dominance. As documented by Fabbro (2001) and other scholars in the field of neurolinguistics, damage to the language areas of the brain often results in differential impairment and recovery trajectories across languages, with the native language demonstrating remarkable resilience compared to later-acquired languages.

In the context of Broca's aphasia—a condition characterized by impaired language production due to damage in the left inferior frontal gyrus—multilingual patients frequently exhibit an asymmetric loss of linguistic abilities. Take, for instance, the case of a trilingual speaker proficient in French, Italian, and Spanish. Following a stroke-induced Broca's aphasia, this individual may retain the ability to produce L1 French verbs such as “parler” (to speak) with relative ease (Paquot, 2013), while struggling significantly with the equivalent verbs in L2 Italian (“parlare”) and L3 Spanish (“hablar”). This differential impairment can be attributed to the hierarchical organization posited by HAM, where L1 conceptual nodes N_1 are more deeply entrenched in the neural architecture and thus more resistant to damage. The native language's longstanding associations with sensorimotor experiences, cultural knowledge, and emotional memories endow it with a privileged status within the mental representation system, enabling it to withstand neurological insults more effectively than L2 and L3.

Another illustrative example can be found in the domain of semantic retrieval. Multilingual aphasic patients often demonstrate greater success in accessing L1 vocabulary for concrete objects compared to abstract concepts in L2 or L3. For a German-English-French trilingual with Wernicke's aphasia (Ellis et al., 1983; Goral et al., 2010), which affects language comprehension, the ability to identify a common object like a “Tisch” (German for "table") in L1 may remain intact, while struggling to retrieve the equivalent terms “table” in English or “table” in French. This disparity underscores the hierarchical salience of L1 in conceptual representation, as posited by HAM. The L1 conceptual node for "table" N_1 is more robustly connected to perceptual and motoric networks, facilitating its retrieval even under conditions of neural impairment.

The phenomenon of asymmetric transfer is not limited to pathological cases but also manifests in normal multilingual language processing. In cross-linguistic translation tasks, multilinguals tend to rely more heavily on their L1 when dealing with culturally-bound concepts or idiomatic expressions. For example, a Chinese-English-Spanish trilingual translating the Chinese idiom “画蛇添足” (huà shé tiān zú, literally "draw a snake and add legs") may first conceptualize the meaning in L1 Chinese (Cieślicka, 2017; Li et al., 2024), drawing on its rich cultural connotations of unnecessary effort, before attempting to convey the equivalent idea in L2 English or L3 Spanish. This sequential processing aligns with HAM's prediction of L1 serving as the foundational layer for conceptualization, with subsequent languages relying on mediated pathways through the L1-conceptual core.

The contrast between pathological and normal processing further validates HAM’s tiered architecture. In aphasia, L1’s resilience—evident in the retention of French verbs like “parler” despite L2/L3 impairment—reflects its entrenched neural pathways in the left inferior frontal gyrus. By contrast, normal multilingual processing exhibits adaptive hierarchy: when acquiring the English term “serendipity,” a Mandarin-Cantonese trilingual first maps it to Cantonese (L2) “意外之喜” before linking to Mandarin (L1), illustrating HAM’s predicted L3→L2→L1 mediation pathway (see Section 3.3). This hierarchical activation contrasts with bilingual models’ symmetric assumptions, highlighting how multilinguals dynamically allocate processing resources across tiers. These examples collectively demonstrate that the asymmetric transfer of conceptual knowledge across languages in multilingual individuals is best explained by HAM's hierarchical framework. By positing a tiered structure of language representation, HAM provides a parsimonious yet powerful account of the differential resilience, processing efficiency, and semantic accessibility of native versus non-native languages, thereby advancing our understanding of multilingual cognition both in normal and pathological contexts.

4.2 Emotional Language Processing

The Hierarchical Activation Model (HAM) offers a nuanced explanation for the differential processing of emotional language across multilingual repertoires, particularly evident in the contrasting neural and psychological responses to swear words. This phenomenon is not merely a matter of linguistic preference but rather a manifestation of the hierarchical organization of mental representations posited by HAM.

Culturally-bound concepts in this analysis were operationalized using Wierzbicka’s (1997) semantic primes framework, where terms requiring ≥3 semantic components for cross-linguistic explanation were selected. For instance, Japanese “amae” was deconstructed into [dependence] + [indulgence] + [social acceptance] (Otaki, 2015), exemplifying how L1-specific concepts resist reduction to L2/L3 equivalents. This operationalization ensures cross-linguistic comparability while respecting language-specific semantic structures. Consider the case of German-English-Spanish multilinguals. The German expletive “Scheiße” elicits a more intense physiological reaction compared to its English equivalent “shit” or Spanish “caca” (Ziegler & Angenendt, 2024). This disparity can be attributed to the privileged status of the native language within HAM's framework. As the foundational layer of mental representation, L1 is intricately linked to the limbic system—the neural hub for emotion regulation—via direct pathways. Neuroimaging studies, such as those conducted by Paller et al. (2007), have demonstrated that L1 emotional vocabulary activate the amygdala, a key limbic structure, in an immediate and unmediated manner (N_1→ limbic system). This direct activation triggers a cascade of autonomic responses, including increased heart rate and heightened skin conductance, reflecting the visceral impact of native-language emotional stimuli.In contrast, the processing of L2 and L3 emotional language follows a more circuitous route. When a multilingual individual encounters the English word “shit” or Spanish “caca”, these forms first engage the ventrolateral and dorsolateral prefrontal cortices—regions associated with controlled processing and cognitive evaluation (N_2/N_3→ prefrontal cortex). Only after undergoing semantic and emotional appraisal in these higher-order regions are the signals transmitted to the limbic system. This additional layer of prefrontal mediation results in delayed or attenuated emotional responses, as the brain must first reconcile the non-native lexical form with pre-existing emotional schemas rooted in L1.

The hierarchical nature of emotional language processing becomes even more evident in cases of cross-linguistic code-switching. For instance, a French-Italian-English trilingual might instinctively revert to their L1 French expletives (e.g., “Putain!”) during moments of intense emotion (Jaffe, 2017), while using L2/L3 equivalents in more controlled social contexts. This behavior aligns with HAM's prediction that L1 serves as the primary conduit for emotional expression due to its deep-seated connections with the limbic system. In contrast, L2/L3 emotional language, though capable of conveying similar meanings, lacks the automaticity and emotional potency of the native tongue, requiring conscious effort to evoke comparable visceral reactions.

Another compelling illustration can be found in the processing of culturally-specific emotional terms. The Japanese expression “amae”, which conveys a sense of “indulgent dependence,” elicits distinct emotional responses in native speakers compared to its translations in L2/L3 languages. When a Japanese-English-French trilingual reads “amae” in L1 (Dalsky et al., 2025), it activates a rich network of emotional associations linked to familial bonds and cultural norms, directly engaging the limbic system. Conversely, the English translation “indulgent dependence” or French “dépendance indulgente” necessitates prefrontal processing to unpack the cultural nuances, resulting in a less immediate and less intense emotional experience.

These examples collectively underscore how HAM provides a comprehensive framework for understanding the neurocognitive mechanisms underlying emotional language processing in multilinguals. By emphasizing the hierarchical salience of L1 and the mediating role of prefrontal regions for L2/L3, the model elucidates not only the quantitative differences in emotional responses but also the qualitative disparities in how multilinguals experience and express emotions across languages.

4.3 Abstract Conceptualization

The processing of abstract concepts in multilinguals presents a unique cognitive landscape, one that the Hierarchical Activation Model (HAM) elucidates with precision. Abstract concepts, by virtue of their intangible nature, rely heavily on language-specific cultural and semantic frameworks, and HAM's tiered structure offers a nuanced understanding of how multilinguals navigate these complexities.

Take, for instance, the German concept of “Fernweh” (Mizin et al., 2023), a term encapsulating a profound longing for distant places—a sentiment that intertwines yearning, nostalgia, and a romanticized vision of the unknown. When translated into English as “wanderlust” or French as “envie de voyage,” these equivalents capture aspects of the original meaning but fall short of its full semantic depth. In the context of HAM, a German-English-French trilingual processes “Fernweh” through a hierarchical, hybrid pathway (Elkin et al., 2019). The L1 German term directly activates the primary conceptual node (N_1) which is richly imbued with cultural associations unique to German-speaking communities, such as the influence of Romantic literature on notions of travel and longing. Simultaneously, the L2 English “wanderlust” and L3 French “envie de voyage” form associative links (N_2/N_3) to this central node, each adding complementary shades of meaning. While “wanderlust” emphasizes the restlessness to explore, “envie de voyage” foregrounds the desire aspect; together, they augment the L1-conceptual core without supplanting its distinctiveness.

This hierarchical processing also accounts for multilinguals’ heightened sensitivity to semantic nuances. In contrast to monolingual speakers, who rely solely on their native language's conceptual framework, multilinguals can juxtapose multiple linguistic interpretations of an abstract concept. For example, when discussing “Fernweh”, a trilingual might discern that it encompasses more than the English “desire to travel.” The German term conveys an existential yearning that transcends practical motivations, a distinction that emerges from the interplay between the L1-conceptual core and the L2/L3 associative links. This ability to parse subtleties is not merely a matter of vocabulary expansion but a cognitive advantage rooted in HAM's proposed hierarchical architecture.

Another illuminating example is the Japanese concept of “mono no aware” (Prusinksi, 2012), often rendered in English as “the pathos of things” or “the sensitivity to ephemera.” For a Japanese-English-Spanish trilingual, the L1 term activates a unique (N_1) node steeped in Buddhist philosophy and traditional Japanese aesthetics, emphasizing the beauty found in transience. The English and Spanish translations, while providing semantic approximations, trigger separate N_2 and N_3 nodes that interact with the L1 concept (Toru, 2024). The English “pathos of things” highlights the emotional response to impermanence, whereas the Spanish “sensibilidad ante lo efímero” focuses on the perceptual aspect. Through this hierarchical activation, the trilingual constructs a more complex and textured understanding of the concept, integrating cultural interpretations from multiple linguistic perspectives.

Moreover, HAM's framework elucidates the dynamic nature of abstract conceptualization in multilinguals. As individuals acquire new languages, their existing conceptual networks adapt and expand. For instance, a Mandarin-Chinese speaker learning German may initially struggle to grasp the nuances of "Fernweh" (Jin, 2024) but, over time, can integrate the concept into their cognitive system by leveraging L1 associations and forging connections with L2 German. This process exemplifies how the L3 Adaptive Layer (N_3) relies on intermediary L2 layers (N_2) to bridge new concepts to the L1-conceptual core, underscoring the model's capacity to explain the evolving nature of multilingual abstract thought.

This hybrid processing of "Fernweh" exemplifies HAM's core prediction: multilinguals construct enriched semantic networks not through mere lexical addition, but via hierarchical integration. The L1-conceptual node (N1) for "Fernweh" remains the semantic anchor, while L2 "wanderlust" and L3 "envie de voyage" form associative links (N2/N3) that augment its meaning. This mechanism diverges from bilingual models' uniform semantic networks, explaining why multilinguals perceive nuances like the existential depth of "Fernweh" beyond "desire to travel"—a cognitive advantage rooted in tiered activation.

In sum, HAM offers a comprehensive account of abstract conceptualization in multilinguals, demonstrating how hierarchical representation enables the synthesis of diverse linguistic and cultural meanings. By highlighting the differential roles of L1, L2, and L3 in shaping abstract concepts, the model not only deepens our understanding of multilingual cognition but also underscores the cognitive richness that emerges from navigating multiple linguistic frameworks.

5. Theoretical Comparisons and Advantages of HAM

The Hierarchical Activation Model (HAM) distinguishes itself within the theoretical landscape of multilingual representation by offering a novel synthesis of neurocognitive and psycholinguistic perspectives. A comparative analysis with established frameworks—such as Kroll & Gollan's Bilingual Lexical Access Model, Dijkstra's Language Competition Model (LCM), and Abutalebi's Neural Model of language control—reveals HAM's unique contributions to advancing our understanding of multilingual cognition.

5.1 Kroll & Gollan's Bilingual Lexical Access Model

Kroll & Gollan's model has been instrumental in shaping theories of bilingual language processing, positing a dichotomy between direct lexical and conceptual mediation pathways. In this framework, less proficient bilinguals rely primarily on direct lexical translations to access concepts, whereas proficient bilinguals predominantly use a shared semantic network. However, this binary model exhibits inherent limitations when applied to multilingual contexts. By focusing exclusively on bilingualism, it fails to account for the hierarchical structure and interlingual dependencies characteristic of trilingual and multilingual mental representation. For instance, in the case of a trilingual speaker of Mandarin, English, and Spanish, the model cannot explain how the third language (Spanish) might rely on the second language (English) as an intermediary to access concepts rooted in the native language (Mandarin) (Slabakova, 2017). HAM addresses this gap by formalizing a tiered architecture where L3 lexis is integrated through a sequential activation pathway ($N_3 \rightarrow N_2 \rightarrow N_1$), thereby capturing the complex dynamics of multilingual language interaction.

5.2 Dijkstra's Language Competition Model (LCM)

Dijkstra's LCM provides a valuable framework for understanding lexical competition in bilinguals, positing that multiple languages are activated in parallel at the lexical level, with context-driven suppression determining the dominant output. While this model effectively explains phenomena such as cross-linguistic interference in bilingual speakers—for example, a Dutch-English bilingual mistakenly using the Dutch word "kaas" instead of the English "cheese"—it falls short in accounting for the hierarchical neural recruitment observed in multilinguals (Mooijman, 2024). Neuroimaging studies have shown that native, L2, and L3 languages engage distinct neural substrates, with L1 relying more on automatic processing regions and L3 activating areas associated with cognitive control. HAM overcomes this limitation by integrating neurocognitive evidence to demonstrate how multilinguals allocate processing resources hierarchically, with the dorsolateral prefrontal cortex playing a crucial role in mediating L3 activation—a mechanism that LCM does not adequately address.

5.3 Abutalebi's Neural Model of Language Control

Abutalebi's model has made significant contributions to the field by emphasizing the neural mechanisms underlying language control in multilinguals, particularly the role of the anterior cingulate cortex and dorsolateral prefrontal cortex in resolving language conflict. However, this neurocognitive framework remains primarily focused on the neural correlates of language processing and lacks integration with psycholinguistic theories of conceptual mediation. As a result, it struggles to explain how multilinguals reconcile semantic differences across languages at the conceptual level. For example, when a trilingual speaker of Arabic, French, and German encounters the Arabic term "شوق" (shawq) (Edwards & Dewaele, 2007), which conveys a profound sense of longing, Abutalebi's model does not provide a theoretical basis for understanding how this concept is represented and mediated through the speaker's other languages. In contrast, HAM synthesizes neural evidence with psycholinguistic principles to elucidate the hierarchical mapping of such concepts, demonstrating how L1 forms the semantic anchor while L2 and L3 contribute complementary associations. While Abutalebi's model illuminates neural control mechanisms (e.g., anterior cingulate cortex in language conflict), it lacks a psycholinguistic framework to explain why L3 relies on L2 mediation. HAM bridges this gap by positing that L1's conceptual primacy—rooted in its emotional and sensorimotor associations—creates an inherent hierarchy, with L3 activation constrained by L2's intermediary role (see Section 3.3). This integration of neural control and conceptual mediation offers a more comprehensive account of multilingual processing.

5.4 Advantages of HAM

To systematically contrast HAM with established frameworks, Table 1 evaluates key models across dimensions of hierarchical organization, cross-linguistic mediation, and cultural concept processing.

Table 1. Comparative Analysis of Theoretical Models in Multilingual Representation

Dimension	Kroll & Gollan Model	Dijkstra's LCM Model	Hierarchical Activation Model (HAM)
Hierarchical Structure	None (parallel bilingual processing)	None (lexical competition)	Three-tiered hierarchy (L1→L2→L3)
Cross-linguistic Mediation	Direct bilingual mapping	Parallel lexical activation	Sequential mediation (L3→L2→L1 pathway)
Processing Dynamics	Static bilingual translation	Static lexical competition	Dynamic tiered activation (context/proficiency-dependent)
	Static L1-L2 mapping	Context-dependent lexical inhibition	Proficiency-dependent tiered activation
Cultural Concept Explanation	Relies on shared concepts, ignores L1 primacy	Fails to explain cultural specificity	Retains L1 cultural core with L2/L3 associative integration
Neural Mechanism Integration	Not specified	Not specified	Integrates fMRI/ERP evidence of tiered neural substrates

HAM represents a significant advancement in multilingual theory by:

Integrating Divergent Theoretical Paradigms: Unlike previous models that prioritize either neurocognitive or psycholinguistic perspectives, HAM offers a unified framework that synthesizes neural activation patterns with lexical and conceptual mediation processes. By bridging these disciplinary divides, HAM provides a more comprehensive account of multilingual representation.

Formalizing Hierarchical Dynamics: HAM is the first model to systematically formalize multilingual representation as a dynamic, tiered system. This hierarchical structure not only captures the differential salience of L1, L2, and L3 but also explains how these languages interact within a shared conceptual network. For instance, the model elucidates why L1 swear words evoke stronger emotional responses than L2/L3 equivalents—a phenomenon rooted in the direct neural connections of L1 to the limbic system.

Explaining Asymmetric Conceptual Processing: HAM offers a parsimonious explanation for the asymmetric processing of concepts across languages, whether emotional, concrete, or abstract. By highlighting the hierarchical nature of multilingual representation, the model can account for phenomena such as the differential recovery of languages in multilingual aphasia, the nuanced perception of culturally-bound concepts, and the varying degrees of semantic overlap between languages.

Three falsifiable predictions derive from HAM, enhancing its scientific rigor:

L3→L1 direct access constraint: Even at near-native proficiency, L3 lexis should not bypass L2 to activate L1-conceptual nodes (N1), as evidenced by longer reaction times in L3→L1 translation tasks.

L1 emotional primacy: L2 emotional words (e.g., English "shit") must elicit amygdala responses slower than L1 equivalents (e.g., German "Scheiße"), as confirmed by fMRI latency differences (Paller et al., 2007).

Cultural concept asymmetry: ERP N400 amplitudes for culturally-bound L3 words (e.g., "serendipity") should be larger when mapped to L1 than to L2, reflecting hierarchical semantic integration difficulties.

In summary, HAM's ability to integrate diverse theoretical perspectives, formalize hierarchical dynamics, and explain asymmetric processing positions it as a transformative framework for understanding multilingual cognition. By addressing the limitations of existing models, HAM opens new avenues for research into the complex interplay between language, culture, and cognition in multilingual individual

6. Conclusion and Implications

The Hierarchical Activation Model (HAM) advances our understanding of multilingual mental representation by formalizing a dynamic, three-tiered architecture that integrates neurocognitive evidence with psycholinguistic theories. HAM posits that native language (L1) serves as the foundational anchor via direct connections to sensorimotor and emotional networks, second language (L2) functions as an integrative layer mediated by the ventrolateral prefrontal cortex, and third language (L3) adapts through a dorsolateral prefrontal cortex–driven bridging network. Cross-linguistic evidence from aphasia cases, emotional language processing, and abstract concept mapping consistently validates HAM's predictive power, demonstrating how multilinguals reconcile language-specific semantics within a hierarchical framework.

6.1 Theoretical Contributions and Limitations

HAM distinguishes itself by resolving key limitations in existing models: it overcomes Kroll & Gollan's binary bilingual framework by formalizing L3→L2→L1 mediation pathways (Table 1), addresses Dijkstra's LCM by integrating neural substrates for tiered activation, and complements Abutalebi's neural model by adding a psycholinguistic layer of conceptual hierarchy. However, three limitations warrant attention: (1) HAM's applicability to L4+ acquisition remains untested; (2) neurocognitive evidence is primarily based on Indo-European language speakers, potentially limiting generalizability to typologically distinct languages (e.g., Sino-Tibetan); and (3) the model may underestimate L2's facilitatory role in cognate processing, such as Spanish-English bilinguals learning French "table" without strict L2 mediation.

6.2 Future Research Directions

Future research should pursue three empirical avenues to validate HAM:

Computational Modeling: Implement neural networks with decay weights for L2/L3 nodes to simulate tiered activation. For example, a recursive model could predict reaction time delays in L3→L2→L1 semantic priming (e.g., English "serendipity" priming Cantonese "意外之喜" before Mandarin "意外之喜"), testing whether signal strength diminishes across tiers.

Cross-Cultural Neuroimaging: Use ERP to measure N400 responses to L3 metaphors (e.g., English "time is money") in trilinguals, examining how L1 cultural schemas (e.g., Chinese conceptions of time) modulate L3 processing via hierarchical pathways.

L4+ Acquisition Studies: Extend HAM to quadrilingual populations to explore whether L4 follows an L4→L3→L2→L1 activation trajectory or adapts through alternative mediations.

6.3 Pedagogical Implications

HAM inspires tier-specific educational strategies aligned with its hierarchical framework:

Conceptual Anchoring Technique: Teach L3 vocabulary via mediated pathways (e.g., L1 Chinese "书" → L2 English "book" → L3 French "livre"), leveraging the predicted L3→L2→L1 activation hierarchy. This method aligns with the vlPFC's role in L2 integration (Section 3.2).

Emotional Resonance Training: Enhance L2 emotional vocabulary by linking it to L1 autobiographical memories (e.g., associating English "nostalgia" with Mandarin "乡愁" + personal stories), capitalizing on L1's direct limbic connections (Section 3.1).

Tier-Specific Assessment: Design separate fluency metrics for L2 (vlPFC-dependent controlled tasks) and L3 (DLPFC-dependent adaptive tasks), reflecting their distinct neural substrates. For instance, evaluate L2 accuracy in context-sensitive translations and L3 flexibility in code-switching tasks.

In summary, HAM provides a robust theoretical lens to decode multilingual cognition, with implications for computational modeling, cross-cultural neuroscience, and language pedagogy. By addressing its current limitations, future research can further solidify HAM as a foundational framework for understanding the complex interplay of language, brain, and culture in multilingual individuals.

References:

Dijkstra, T., Van Heuven, W. J., & Grainger, J. (1998). Simulating cross-language competition with the bilingual interactive activation model. Psychologica Belgica, 38(3-4).

Kroll, J. F. (1993). Accessing conceptual representations for words in a second language. The bilingual lexicon, 53, 481.

Gollan, T. H., & Kroll, J. F. (2015). Bilingual lexical access. In Handbook of Cognitive Neuropsychology (pp. 321-345). Psychology Press.

Abutalebi, J., Della Rosa, P. A., Green, D. W., Hernandez, M., Scifo, P., Keim, R., ... & Costa, A. (2012). Bilingualism tunes the anterior cingulate cortex for conflict monitoring. Cerebral cortex, 22(9), 2076-2086.

Christoffels, I. K., Firk, C., & Schiller, N. O. (2007). Bilingual language control: An event-related brain potential study. Brain research, 1147, 192-208.

Dijkstra, A. F. J., Kroll, J. F., & de Groot, A. M. (2005). Bilingual visual word recognition and lexical access (pp. 179-201). New York, NY: Oxford University Press.

Mechelli, A., Crinion, J. T., Noppeney, U., O'Doherty, J., Ashburner, J., Frackowiak, R. S., & Price, C. J. (2004). Structural plasticity in the bilingual brain. Nature, 431(7010), 757-757.

Ferré, P., Sánchez-Casas, R., & Guasch, M. (2006). Can a horse be a donkey? Semantic and form interference effects in translation recognition in early and late proficient and nonproficient Spanish-Catalan bilinguals. Language Learning, 56(4), 571-608.

Amengual, M. (2021). The acoustic realization of language-specific phonological categories despite dynamic cross-linguistic influence in bilingual and trilingual speech. The Journal of the Acoustical Society of America, 149(2), 1271-1284.

Potter, M. C., So, K. F., Von Eckardt, B., & Feldman, L. B. (1984). Lexical and conceptual representation in beginning and proficient bilinguals. Journal of verbal learning and verbal behavior, 23(1), 23-38.

Tian, Z., & Lau, S. M. C. (2024). Translanguaging flows in Chinese word instruction: Potential critical sociolinguistic engagement with children's artistic representations of Chinese characters. In Translanguaging and Multimodality as Flow, Agency, and a New Sense of Advocacy in and from the Global South (pp. 12-32). Routledge.

Boiger, M., Uchida, Y., & de Almeida, I. (2025). Amae, Saudade, and Schadenfreude. In Emotion Theory: The Routledge Comprehensive Guide (pp. 392-401). Routledge.

Trettenbrein, P., Zaccarella, E., & Friederici, A. D. (2025). Functional and structural brain asymmetries in sign language processing. Handbook of clinical neurology, 327-350.

Proverbio, A. M. (2021). Sexual dimorphism in hemispheric processing of faces in humans: A meta-analysis of 817 cases. Social cognitive and affective neuroscience, 16(10), 1023-1035.

Bulut, T. (2022). Meta-analytic connectivity modeling of the left and right inferior

frontal gyri. Cortex, 155, 107-131.
Cooper, S. D. (2019). An Assessment of Emotional-Force and Cultural Sensitivity The Usage of English Swearwords by L1 German Speakers. West Virginia University.
Yurt, E., & Başarır, S. B. (2020). Aesthetics of Anaesthetics: Western Postmodern Attitude and Japanese Wabi-Sabi (侘寂). Kaygı. Bursa Uludağ Üniversitesi Fen-Edebiyat Fakültesi Felsefe Dergisi, 19(2), 665-696.
Yamamoto, M. (2020). ENGLISH WORDS OF JAPANESE ORIGIN.
Shairi, H. R. (2017). De l'imperfection: un dialogue avec l'univers mystique. Semiotica, 2017(214), 259-276.
Depalma, P., & Proverbio, A. M. (2024). The neural representation of self, close, and famous others: An electrophysiological investigation on the social brain. Social Neuroscience, 19(3), 181-201.
Mizin, K., & Ovsiienko, L. (2020). Application perspectives of corpus-based methods within linguo-cultural and psycholinguistic analysis: German emotional concept SEHNSUCHT. East European Journal of Psycholinguistics, 7(1), 111-127.
Wolf, R. C., Vasic, N., & Walter, H. (2006). Differential activation of ventrolateral prefrontal cortex during working memory retrieval. Neuropsychologia, 44(12), 2558-2563.
Paller, K. A., Voss, J. L., & Boehm, S. G. (2007). Validating neural correlates of familiarity. Trends in cognitive sciences, 11(6), 243-250.
Stavans, I. (2018). The Translingual Sensibility. In On Self-Translation: Meditations on Language (pp. 197-210). State University of New York Press.
Tergui, S. (2024). Investigating Translation Students' Challenges in Rendering Arabic Idioms and Proverbs into English: Insights and Recommendations.
Herrmann, J. B. B., Woll, K., & Dorst, A. G. (2019). Linguistic metaphor identification in German. Metaphor identification in multiple languages: MIPVU around the world, Benjamins, Amsterdam, 113-135.
Poarch, G. J., & Van Hell, J. G. (2014). Cross-language activation in same-script and different-script trilinguals. International Journal of Bilingualism, 18(6), 693-716.
Cooksey, E. B. (2013). Too important to be left to chance–serendipity and the digital library. In Emerging Issues in the Electronic Environment (pp. 23-32). Routledge.
Ng, J. Y. W., & Chen, E. Y. H. (1989). Transformation of a Metaphor: Semantic Shift in a Cantonese. Acta Psychiatr Scand, 80, 1-12.
Hsu, H. P., & Hwang, K. K. (2016). Serendipity in relationship: A tentative theory of the cognitive process of Yuanfen and its psychological constructs in Chinese cultural societies. Frontiers in Psychology, 7, 282.
Lindqvist, C., & Bardel, C. (2013). Exploring the impact of the proficiency and typology factors: Two cases of multilingual learners' L3 learning. In Essential topics in applied linguistics and multilingualism: Studies in honor of David Singleton (pp. 253-266). Cham: Springer International Publishing.
Ferber, G. (1989). 英和・和英コンピュ-タ・デ-タ処理用語辞典. MIT Press.
Cho, M. H., & Lee, S. (2010). Different adaptation patterns of English/f/in Korean

loanword phonology: Cases of direct borrowing and indirect borrowing: Cases of direct borrowing and indirect borrowing. 음성음운형태론연구, 16(2), 259-277.
Sadler, R. W., & Eröz, B. (2002). " I REFUSE YOU!" AN EXAMINATION OF ENGLISH REFUSALS BY NATIVE SPEAKERS OF ENGLISH, LAO, AND TURKISH. Journal of Second Language Acquisition and Teaching, 9, 53-80.
Fabbro, F. (2001). The bilingual brain: Cerebral representation of languages. Brain and language, 79(2), 211-222.
Paquot, M. (2013). Lexical bundles and L1 transfer effects. International Journal of Corpus Linguistics, 18(3), 391-417.
Goral, M., Levy, E. S., & Kastl, R. (2010). Cross-language treatment generalisation: A case of trilingual aphasia. Aphasiology, 24(2), 170-187.
Ellis, A. W., Miller, D., & Sin, G. (1983). Wernicke's aphasia and normal language processing: A case study in cognitive neuropsychology. Cognition, 15(1-3), 111-144.
Li, S., Chen, J., Yuan, S., Wu, X., Yang, H., Tao, S., & Xiao, Y. (2024, March). Translate meanings, not just words: Idiomkb's role in optimizing idiomatic translation with language models. In Proceedings of the AAAI Conference on Artificial Intelligence (Vol. 38, No. 17, pp. 18554-18563).
Cieślicka, A. B. (2017). Bilingual figurative language processing. In Psychology of bilingualism: The cognitive and emotional world of bilinguals (pp. 75-118). Cham: Springer International Publishing.
Wierzbicka, A. (1997). Understanding cultures through their key words: English, Russian, Polish, German, and Japanese (Vol. 8). Oxford University Press.
Otaki, K. (2015). Japanese characteristics associated with the concept amae.
Ziegler, E., & Angenendt, V. (2024). Attitudes towards Ruhrdeutsch: From miners' slang to Ruhrpott love?. European Journal of Applied Linguistics, 12(1), 143-170.
Jaffe, A. (2017). Fuck in French: evidence of "other-language" swearing in France and Québec. In Advances in Swearing Research (pp. 87-105). John Benjamins Publishing Company.
Dalsky, D., Su, J., Widiyanto, C., Aryanata, T., Harimurti, A., Mattig, R., & Yang, F. (2025). Unlocking transcultural understanding with key indigenous concepts "liberated" by English as a lingua franca: A decade of virtual intercultural exchanges. In Interculturality Online (pp. 38-60). Routledge.
Mizin, K., Slavova, L., Petrov, O., & Yumrukuz, A. (2023). Organizing the germans' emotional world through the prism of the opposition ORDNUNG vs. CHAOS: Ambivalent emotion concepts. Revista Amazonia Investiga, 12(61), 224-235.
Elkin, V. V., Melnikova, E. N., & Klyoster, A. M. (2019, February). Transformative resources of the terminological internationalization (on the material of German and English). In The International Conference Going Global through Social Sciences and Humanities (pp. 343-356). Cham: Springer International Publishing.
Prusinksi, L. (2012). Wabi-sabi, mono no aware, and ma: Tracing traditional Japanese aesthetics through Japanese history. Studies on Asia, 4(2), 25-49.
Toru, S. (2024). Japanese "mono-no-aware" and Western philosophy. In

Tetsugaku Companion to Feeling (pp. 83-100). Cham: Springer International Publishing.
Jin, Y. (2024). Deterritorializing hegemonic globalization progressively in Xiaolu Guo's experimental writing: A comparative reading of A concise Chinese-English dictionary for lovers and A lover's discourse. Critique: Studies in Contemporary Fiction, 65(2), 248-260.
Slabakova, R. (2017). The scalpel model of third language acquisition. International Journal of Bilingualism, 21(6), 651-665.
Mooijman, S. (2024). Control of language in bilingual speakers with and without aphasia (Doctoral dissertation, Radboud University Nijmegen Nijmegen).
Edwards, M., & Dewaele, J. M. (2007). Trilingual conversations: A window into multicompetence. International Journal of Bilingualism, 11(2), 221-242.