

# The ecology of Multilingualism: Integrating Theoretical Models to Understand Language Integration in Dynamic Contexts

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## Abstract

Multilingualism is no longer a marginal or exceptional condition; it is the lived linguistic reality of a growing portion of the global population. This article explores multilingualism through an ecological lens, emphasizing the dynamic, context-sensitive nature of language interaction. Drawing upon and synthesizing key theoretical models – including Dynamic Systems Theory, Multicompetence, Translanguaging Theory, and van Lier's ecological approach - this paper proposes a comprehensive framework for understanding how languages coexist, influence one another, and evolve within individual and societal systems. It argues that language interaction cannot be adequately explained through linear or static models; instead, multilingual development should be viewed as an emergent process shaped by cognitive, social, institutional, and technological ecologies. Through a theoretical synthesis, the article highlights how these models capture complementary dimensions of language interaction and proposes an integrated ecological framework that reflects the interconnectedness of linguistic systems in real-world contexts. By reframing multilingualism as an ecological system, the paper contributes a holistic and contemporary understanding of language development and offers implications for multilingual education, language policy, and future linguistic research.

**Key words:** *Multilingualism, Language Ecology, Dynamic Systems Theory, Translanguaging, Multicompetence, Language Interaction.*

## Introduction

In an era shaped by globalization, transnational mobility, and digital interconnectedness, multilingualism has emerged as a defining characteristic of both individual experience and societal structure. Across educational, professional, and technological domains, individuals increasingly navigate and negotiate between multiple linguistic systems. This shift necessitates a rethinking of traditional linguistic models that have treated languages as autonomous, bounded entities acquired in isolation. Instead, contemporary scholarship emphasizes the need for frameworks that capture the fluid, dynamic, and context-sensitive nature of language interaction (Ortega, 2023; Gkaintartzi & Tsokalidou, 2022). These perspectives foreground the complexity of multilingual development, the role of identity and ideology, and the influence of sociocultural context in shaping multilingual

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practices. Yet, despite this growing attention, few studies have attempted to integrate major theoretical frameworks into a single, unified ecological model that fully reflects the complexity of language interaction.

One promising approach is the **ecological perspective on multilingualism**, which conceptualizes language as embedded within

dynamic systems – cognitive, social, institutional, and environmental – that are continuously shaped by and shaping human interaction (van Lier, 2004). This view aligns with theoretical advancements in applied linguistics that emphasize non-linearity, emergence, and interactivity, including **Dynamic System Theory** (Larsen-Freeman & Cameron, 2008), **Multicompetence** (Cook, 1992), and **Translanguaging Theory** (Garcia & Li Wei, 2014). Together, these models offer a nuanced understanding of how languages coexist, interact, and evolve throughout a multilingual speaker's lifespan.

Despite their strengths, these models are often applied in isolation. This article argues for an **integrated theoretical approach** – a synthesized **ecology of multilingualism** – that draws on their complementarity to more fully account for the dynamic processes that govern language interaction. Specifically, it addresses the following research questions:

- How do languages interact within multilingual minds and communities?
- What forces shape this interaction across cognitive, social, and institutional dimensions?
- How can linguistic theory better reflect the complexity of multilingualism in real-world contexts?

By addressing these questions, this article proposes a historic theoretical framework that captures the interplay between individual agency, linguistic systems, and the broader ecologies in which language is used. The implications are significant not only for linguistic theory but also for multilingual education, curriculum design, and language policy – particularly in contexts where linguistic diversity is the norm rather than the exception.

## 2. Theoretical Models for Understanding Language Interaction

The study of multilingualism has long drawn from a wide range of theoretical traditions in an effort to explain how multiple languages are acquired, processed, and used within individuals and communities. While early models in second language acquisition (SLA) often relied on linear, stage-based paradigms, recent scholarship has challenged these frameworks by introducing more

dynamic, interactive, and context-sensitive approaches. This section synthesizes four major models that collectively underpin an ecological perspective on multilingualism: **Dynamic Systems Theory**, **Multicompetence**, **Translanguaging Theory**, and **Ecological Linguistics**. Each contributes unique insights into the fluid and adaptive nature of language interaction in multilingual contexts.

### 2.1 Dynamic Systems Theory (DST)

Dynamic System Theory (DST) conceptualizes language development as a non-linear, emergent process shaped by the ongoing interaction of multiple variables (Larsen-Freeman & Cameron, 2008). Rather than viewing multilingual competence as a fixed endpoint, DST frames it as a continuously evolving system influenced by input, interaction, motivation, exposure, sociocultural context.

In this framework, phenomena such as **cross-linguistic influence (CLI)**, **language dominance**, and **proficiency** are not static features but dynamic outcomes of co-adaptive processes. These dimensions shift over time, responding to changes in the learner's cognitive state, emotional environment, and communicative demands.

DST offers a critical foundation for ecological thinking, as both perspectives emphasize **adaptivity, variability, and self-organization**. By modeling multilingualism as a system that emerges through complex interactions, DST enables a more nuanced understanding of how linguistic resources develop and reorganize in response to environmental and internal pressures.

### 2.2 Multicompetence

The concept of **multicompetence**, introduced by Cook (1992), rejects the traditional native-speaker model and instead conceptualizes multilingual knowledge as a unified, dynamic system. Rather than viewing multilingual speakers as managing separate, autonomous grammars, this framework posits that their linguistic knowledge is **interconnected, co-activated, and mutually influential**. Such interaction leads to phenomena like **cross-linguistic transfer**, **innovation**, and the **creative recombination** of linguistic resources.

Multicompetence allows us to move beyond binary distinctions such as L1 versus L2 and focus

instead on the **holistic linguistic repertoires** that multilinguals draw from. It also brings to the forefront the **cognitive advantages** of multilingualism – such as enhanced cognitive flexibility, executive control, and metalinguistic awareness – reframing these traits as central to both linguistic theory and pedagogical innovation.

### 2.3 Translanguaging Theory

Emerging from bilingual education and critical sociolinguistics, **translanguaging theory** fundamentally challenges the notion that languages function as discrete cognitive or social entities. Instead, it proposes that multilingual individuals operate through a **single, integrated linguistic repertoire**, strategically drawing on diverse semiotic and linguistic resources depending on context, communicative intent, and audience (Garcia & Li Wei, 2014).

Translanguaging emphasizes **speaker agency, identity negotiation, and sociolinguistic equity**, especially for those who speak **minoritized, marginalized, non-standard language varieties**. It directly critiques monolingual norms in educational systems and advocates for pedagogies that recognize and legitimize **multilingual meaning-making** as both valid and empowering.

### 2.4 Ecological Linguistics

Grounded in van Lier's (2004) application of ecological theory to language education, **ecological linguistics** frames language development as taking place within a series of **interrelated systems** – ranging from the micro (e.g., classroom interactions), to the meso (e.g., family and institutional structures), to the macro (e.g., national policy and sociopolitical discourse). Central to this framework are the concepts of **affordances** - the opportunities for learning and interaction that the environment provides – and **constraints**, which may inhibit access or participation. Ecological linguistics emphasizes that language development is never purely cognitive; rather, it is **situated, relational, and deeply shaped by context, power, and ideology**. This perspective adds a crucial environmental and critical dimension to multilingual theory, making it indispensable to an ecological synthesis.

## 3. Synthesis: Toward an Ecological Model of Multilingualism

While each theoretical model discussed above offers a valuable lens for examining specific dimensions of multilingualism, their full potential emerges through synthesis. When integrated, these perspectives allow for a comprehensive nuanced understanding of how languages interact within and across individuals, communities, and institutional structures. This section presents a **unified ecological model** that draws on the contributions of **Dynamic Systems Theory** (Larsen-Freeman & Cameron, 2008), **Multicompetence** (Cook, 1992), **Translanguaging Theory** (Garcia & Li Wei, 2014), and **Ecological Linguistics** (van Lier, 2004) to conceptualize language interaction as a dynamic, contextually embedded, and relational process.

### 3.1 Multilingualism as a Dynamic Ecological System

Informed by DST, the ecological model views multilingualism as a **complex adaptive system** that evolves through interaction among multiple variables, including linguistic proficiency, frequency of use, emotional investment, motivation, and identity. These variables, are not static but dynamically interrelated and continuously reshaped by the learner's environment and lived experience.

Cross-linguistic influence (CLI) is therefore not a fixed or unidirectional phenomenon but an **emergent outcome** of system-level interactions. This perspective reframes multilingualism not as the sum of isolated language systems but as a **fluid, evolving process** – where small individual changes can trigger broader system-wide reorganization.

### 3.2 Integrated Linguistic Repertoires and Cognitive Interdependence

Building on the principles of **Multicompetence** and **Translanguaging Theory**, this model foregrounds a **non-separatist view** of language. Multilingual individuals do not operate as a collection of discrete monolinguals; rather, they draw on a **shared, integrated linguistic repertoire** formed through overlapping cognitive, emotional, and social experiences.

This conceptualization challenges traditional deficit-oriented views of CLI and instead interprets cross-linguistic interaction as a site of **creativity**,

### flexibility, and innovation.

Cognitively, the model highlights the ways in which multilingualism contributes to enhanced **executive functioning, metalinguistic awareness, and interdisciplinary cognitive flexibility**, extending our understanding of how multilinguals process and produce language across grammatical, lexical, discursive, and pragmatic domains.

### 3.3 Situated Language Use and Environmental Embeddedness

Drawing from **Ecological linguistics** (van Lier, 2004), the proposed model recognizes that multilingualism is not only an internal cognitive process but one that is **deeply embedded in sociocultural, institutional, and environmental contexts**. Language development is shaped by the learner's interaction with various layers of their environment, including across to **linguistic affordances**, exposure to dominant ideologies, and participation in meaningful communicative events.

This perspective demands a multi-scalar analysis of how **macro-level structures** – such as language policy and sociopolitical hierarchies – and **micro-level practices** – such as classroom discourse and peer interaction – jointly influence language acquisition and multilingual identity formation. It underscores that multilingualism cannot be divorced from its social and material conditions.

### 3.4 Agency, Ideology, and Equity in Language Interaction

The integration of **Translanguaging Theory** into the ecological framework also emphasizes the role of **agency, power, and ideology** in shaping language practices. As Pennycook (2010) and Garcia & Kley (2016) argue, multilinguals do not passively receive language norms but actively **navigate, negotiate, and sometimes resist** them. They move across linguistic boundaries in ways that challenge dominant language ideologies and disrupt traditional power relations embedded in monolingual schooling and institutional discourse. This dimension of the model highlights the need for **critical language awareness** in multilingual education and urges the adoption of pedagogies that **affirm the full communicative repertoire** of learners rather than enforcing reductive, monolingual norms. In doing so, it reframes multilingualism as a site of **equity, empowerment, and social justice**.

Taken together, these dimensions form a **holistic, multidimensional ecological model** of multilingualism – one that embraces complexity, centers sociocultural context, and affirms the value of integrated language practices. It is not merely a theoretical framework but a **call to action** for scholars, educators, and policymakers to adopt more **inclusive and ecologically responsive approaches** in linguistically diverse societies.

**Table 1. Layers and Components of the Ecological Model of Multilingualism**

Layer	Description	Key Concepts
<b>Cognitive Systems</b>	Internal, mental language systems that co-evolve dynamically	Multicompetence, Dynamic Systems Theory (DST)
<b>Social &amp; Identity Practices</b>	How language reflects and constructs identity and ideology	Translanguaging, Language Ideology, Agency
<b>Environmental Contexts</b>	External systems influencing	Classroom, Educational Policy,

	language use and development	Sociopolitical Structures
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#### 4. Implications for Research Education, and Policy

The proposed ecological model of multilingualism not only advances theoretical understanding but also carries significant implications for applied research, educational practice, and language policy. By framing multilingualism as a **dynamic, context-sensitive system**, this model invites a critical reevaluation of how we conceptualize language development, design research, and structure pedagogical and institutional responses to linguistic diversity.

##### 4.1 Implications for Research

The ecological perspective challenges researchers to move beyond reductionist approaches that isolate linguistic variables. It calls for **multi-dimensional, longitudinal, and context-rich investigations** that capture the complexity of language interaction in real-world settings. Rather than treating languages as bounded and discrete systems, future studies should explore the **fluid relationships** among languages within multilingual repertoires, the **temporal evolution** of cross-linguistic influence (CLI), and the **situated experiences** of multilingual speakers.

Methodologically, this shift favors **mixed-methods, ethnographic inquiry, and complexity-informed approaches** capable of tracking change, variation, and emergence over time. It also opens pathways for **interdisciplinary collaboration**, drawing from fields such as sociolinguistics, cognitive science, education, anthropology, and critical theory.

##### 4.2 Implications for Language Education

For language educators, this model underscores the importance of recognizing and affirming students' **multilingual repertoires** as legitimate and valuable. Instructional approaches should move beyond rigid, monolingual paradigms and toward practices that nurture **metalinguistic awareness, cross-linguistic transfer, and translanguaging**.

Teachers should be supported in adopting **asset-based pedagogies** that view CLI not as a deficit, but as **evidence of cognitive sophistication and linguistic resourcefulness**. Practical classroom strategies might include:

- **Cross-linguistic comparisons** to explore structural similarities and differences
- **Reflective journaling** on language use across contexts
- **Multilingual project-based learning** that validates diverse linguistic identities

These approaches contribute to move inclusive and equitable learning environments where all linguistic backgrounds are honored as assets, not obstacles.

##### 4.3 Implications for Teacher Training

To support the implementation of ecologically informed pedagogies, **teacher education programs must equip future educators with both theoretical insight and practical strategies** to engage with cross-linguistic influence (CLI) and multilingual realities in the classroom. This includes targeted training in:

- The **cognitive and social dynamics of multilingualism**
- **Inclusive assessment practices** that account for diverse linguistic repertoires
- **Sociolinguistic awareness and critical reflection** on language ideologies and equity

Educators should be empowered to recognize multilingual learners' communicative repertoires as assets, and to challenge deficit narratives that pathologize language transfer or variation. This preparation is crucial for cultivating **linguistically responsive and socially just classrooms**.

##### 4.4 Implications for Language Policy



At the institutional and national levels, this ecological framework supports an urgent call for **transformative language policies** that go beyond the symbolic inclusion of non-dominant languages. Policymakers should:

- Promote **curricula that integrate cross-linguistic knowledge and metalinguistic awareness**
- Ensure **assessment and teacher evaluation systems** reflect the realities of multilingualism
- Actively **protect and promote minority and heritage languages** as integral components of national linguistic ecosystems

When policy aligns with an ecological understanding of multilingualism, educational institutions become not just inclusive by design – but **actively generative spaces** where linguistic diversity is cultivated as a social and intellectual strength.

The theoretical synthesis presented here invites a deeper reconsideration of how we conceptualize language development, identity, and learning in increasingly multilingual societies. By adopting an ecological lens, we gain new insight into the **flexibility, interconnectedness, and contextual sensitivity** of multilingualism – offering fertile ground for innovative research, transformative pedagogies, and equity-oriented policy reform.

## 5. Conclusion

Multilingualism must be understood not as a fixed state but as a **living, evolving ecology** of language use, identity construction, and cognitive development. This article has proposed an integrated theoretical framework – drawing from **Dynamic Systems Theory, Multicompetence, Translanguaging Theory, and Ecological Linguistics** – to capture the complex, context-sensitive nature of multilingual interaction.

By synthesizing these models, the ecological perspective foregrounds the **interdependence of cognitive, social, and environmental dimensions** in shaping multilingual development. It underscores the importance of **fluid linguistic repertoires, learner agency, and situated language use** as foundational engage with their languages in real-world contexts.

The implications of this model are far-reaching. For researchers, it calls for **holistic, longitudinal methodologies** capable of capturing dynamic language processes. For educators, it affirms the need to foster **inclusive classrooms** that validate and build upon students' full linguistic repertoires. For policymakers, it offers a **compelling rationale** for designing systems that support multilingualism as both a pedagogical strength and a societal asset.

While this article provides a conceptual synthesis, it does not present empirical data. Future research should aim to **operationalize and validate** this model through **qualitative, longitudinal, or mixed-methods studies** across diverse multilingual contexts. In particular, interdisciplinary work – bringing cognitive science, sociolinguistics, education, and digital learning – will be vital in extending the theoretical insights outlined here.

Ultimately, reframing multilingualism through an ecological lens enables us to move beyond reductive models and toward a more nuanced, responsive approach – one that recognizes linguistic diversity as an essential, generative human resource. This vision offers a pathway for transforming how language is taught, studied, and valued in the 21<sup>st</sup> century.

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