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A Systems Framework of Bilingual Language Acquisition: How Development, Experience, and Contexts Interact to Shape Outcomes

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Abstract

Millions of children grow up learning multiple languages, yet their outcomes vary dramatically: Some have high proficiency across languages while others have more limited abilities in some languages. This review presents a systems framework for understanding diverse trajectories in bilingual language acquisition. Drawing on systems theories, we examine how multiple levels of influence interact, from individual factors, such as maturational processes that lay the foundation, to immediate language experiences with family and educational contexts that provide learning opportunities. These experiences unfold both dynamically over time and within broader societal contexts that determine language status and community support. The framework reveals how successful bilingual development depends on alignment across system levels: Children, equipped with powerful learning abilities, must meet rich and sustained language experiences, as well as supportive

social conditions. This approach illuminates systematic patterns in bilingual development and emphasizes coordinated, multilevel approaches for supporting bilingual development.

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INTRODUCTION

Millions of children grow up hearing multiple languages early in life: These can include societal languages, Indigenous heritage languages, and immigrant heritage languages. While every typically developing child becomes proficient in communicating in at least one language, bilingual language development varies significantly. Some children achieve high proficiency across two or more languages, while others develop more limited abilities. Indeed, language acquisition requires mastering multiple dimensions including phonetics and phonology, vocabulary, grammar, pragmatics, and both receptive and productive skills, each of which may be mastered to a varying degree.

This remarkable variation in bilingual outcomes emerges from complex interactions across multiple levels of influence. At the individual level, children bring different cognitive capacities and developmental trajectories to the task of learning multiple languages. Their immediate environment provides varying quantities and qualities of language exposure through family and educational settings. These experiences unfold over time within broader societal contexts that determine the status, support, and opportunities available for different languages. Understanding this variation requires examining how these multiple levels interact to shape development.

Here, we adopt a systems framework (illustrated in **Figure 1**) to explain the diversity of learning trajectories in bilingual children's language acquisition. Following Grosjean (2010), we define bilingualism inclusively as learning or using two or more languages in everyday life

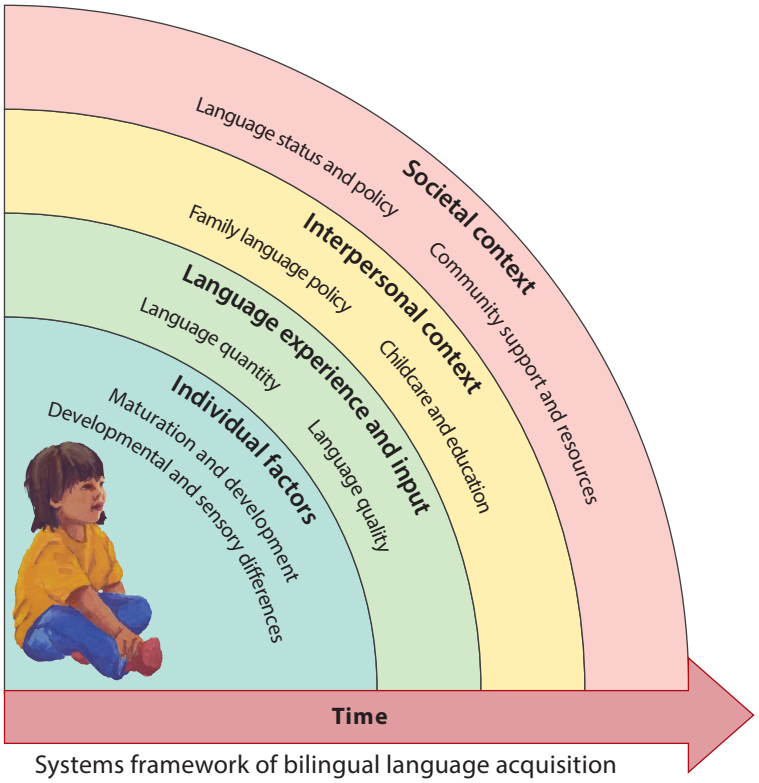

Figure 1

Systems framework of bilingual language acquisition. This conceptual model illustrates the dynamic, interconnected factors influencing bilingual language development across time through four nested systems: individual factors (e.g., maturation, sensory differences, language quantity), language experience and input (e.g., language quality and quantity), interpersonal context (e.g., family language policy, childcare/education settings), and societal context (e.g., language status, policy, community support, resources). The temporal dimension (time) emphasizes that these systems operate dynamically across development. Illustration created by Hilary Killam.

(for a discussion of how bilingualism is operationalized and measured in empirical studies, see the sidebar titled Who is Considered Bilingual). Building on ecological systems theory (Bronfenbrenner 1979, Bronfenbrenner & Ceci 1994) and its recent applications to language acquisition (Rowe & Weisleder 2020) and bilingualism (Titone & Tiv 2023), we examine how developmental factors, language experience, and broader contexts interact dynamically over time to shape bilingual outcomes. This framework reveals how successful bilingual development depends on alignment across system levels—from individual readiness, to sufficient and sustained high-quality exposure, to supportive family and educational environments, to positive societal conditions—while generating novel hypotheses about how these systems and their interaction shape language learning outcomes.

VARIATION IN BILINGUAL DEVELOPMENT

Before examining the factors that shape bilingual development, it is crucial to understand the characteristic patterns that emerge across children in diverse contexts and populations. Three key

WHO IS CONSIDERED BILINGUAL

Following Grosjean (2010), this review defines bilingualism inclusively as learning or using two or more languages in everyday life. However, researchers typically must operationalize bilingualism more precisely for empirical work. Research varies with respect to definitions of the threshold for bilingual classification in early childhood studies. Traditional approaches employ quantitative cutoffs, typically requiring 20–25% minimum exposure to each language (Rocha-Hidalgo & Barr 2023), with stricter criteria often yielding stronger monolingual–bilingual differences in outcomes. However, such cutoffs create artificial boundaries in what is inherently a continuous phenomenon, potentially excluding children with meaningful bilingual experiences who fall just below thresholds.

Recent approaches increasingly favor continuous measures of bilingual experience, either replacing categorical groupings entirely (Baum & Titone 2014, de Bruin 2019) or using them as complementary metrics (Kremin & Byers-Heinlein 2021). Research with adults has introduced sophisticated metrics such as language entropy to capture the social diversity of language-use patterns (Gullifer & Titone 2020), though some researchers question whether any single metric can adequately capture the multidimensional nature of bilingual experience (Marian & Hayakawa 2020). Future research will be needed to apply these approaches to childhood bilingualism.

patterns are particularly noteworthy and provide a framework for understanding the variation we observe in bilingual outcomes.

First, bilingual children's language abilities vary substantially across individuals. The notion of a balanced bilingual—a child who achieves equal and native-like proficiency in multiple languages—has historical appeal, but it does not reflect the reality of most children's bilingual experience (Grosjean 2010). This variation is evident in large-scale studies showing that even siblings in the same family can have markedly different language outcomes (De Houwer 2007). Some children become active bilinguals who regularly use both languages, while others become passive bilinguals who understand but rarely speak one of their languages (Montrul 2016). These differences reflect how children use their languages differently depending on their daily activities, conversation partners, and social settings.

Second, most bilingual children show asymmetries within their individual language profiles. This variation appears across all aspects of language—from pronunciation to vocabulary to grammar. For instance, children often develop distinct vocabulary knowledge across different contexts. A salient example of this is that children tend to learn words for household items in their home language and academic vocabulary in their school language (Bialystok et al. 2010). Children typically demonstrate different levels of proficiency across their languages, with a stronger (dominant) and weaker (nondominant) language (Yip & Matthews 2007). Importantly, understanding a child's total language knowledge requires considering their skills across all their languages rather than examining each language in isolation (Peña et al. 2018).

Third, children show variation in their language abilities and use over time. While some variation follows expected developmental patterns—such as the gradual progression from first words to complex sentences that occurs in all language learning—other changes stem from shifts in children's interpersonal and societal contexts. Bilingualism is thus highly dynamic, not static (de Bot 2008). Critical environmental transitions—such as starting day care, relocating, or changes in caregiving arrangements—can dramatically reshape children's language experiences and preferences.

These three patterns of variation—individual differences between children, asymmetries within each child's language profile, and dynamic changes across development—provide a framework for understanding how multiple factors shape bilingual outcomes, which we examine in the following sections.

INDIVIDUAL FACTORS IN BILINGUAL DEVELOPMENT

Individual-level factors create the foundation upon which bilingual development builds, shaping how children process and learn from their language experiences. These factors include basic maturational and developmental processes that support language acquisition, as well as individual differences in learning capacity. These individual characteristics alone do not determine bilingual outcomes because they interact dynamically with environmental influences. Indeed, a child's language learning capabilities must meet supportive contexts to result in successful bilingual development. Understanding these individual factors helps explain why children in similar language environments can show different patterns of acquisition and why the same child might develop their languages at different rates or to different levels of proficiency.

Maturational and Developmental Factors

Language acquisition emerges from fundamental maturational and developmental processes that support learning. While young bilinguals show considerable variation in their ultimate outcomes, research on both monolingual and bilingual infants reveals remarkably consistent developmental patterns in early language abilities (Werker & Byers-Heinlein 2008). Young infants, including newborns, can discriminate between different languages (Paillereau & Chládková 2024) and detect structural patterns in speech (Gervain et al. 2008). During their first year, infants refine their speech sound sensitivities, becoming more attuned to distinctions relevant in their linguistic environment (Werker 2018). These foundational abilities, as well as many others, support learning in both monolingual and bilingual contexts (for a review, see Rowe & Weisleder 2020). Research shows that, on average, monolingual and bilingual infants reach key language milestones, including their first word and their first multiword utterance, at approximately the same age (Muszyńska et al. 2025). This similar developmental progression suggests that the basic mechanisms supporting language acquisition are robust enough to handle input from multiple languages even from birth.

Building on these foundational abilities, individual differences in the timing of language exposure further shape acquisition patterns. Some children are simultaneous bilinguals, encountering multiple languages from birth, while others are sequential bilinguals, beginning with one language before acquiring additional languages through education or community contexts (De Houwer 2009, Paradis 2011). These patterns often reflect broader social circumstances: Simultaneous bilingualism is common in families with different parental languages or in multilingual societies, while sequential bilingualism often occurs in immigration contexts or educational programs.

The age at which children encounter their languages influences learning outcomes through multiple mechanisms. One key mechanism involves sensitive periods—developmental windows when the brain is optimally prepared for learning. While traditional language theories placed sensitive periods early, at puberty (Lenneberg 1967) or age 7 for grammar (Johnson & Newport 1989), recent work has refined our understanding of their timing and mechanisms (Werker & Hensch 2015, Hartshorne et al. 2018). Research consistently shows that earlier exposure typically yields greater proficiency, particularly in phonology and grammar (Flege et al. 2003), though there is no absolute cut-off age for language acquisition (Byers-Heinlein & Lew-Williams 2013).

However, age effects are complex to interpret because the context of language exposure changes systematically with age. In early development, children typically experience language in highly immersive, socially rich environments where learning occurs through natural interaction (Lew-Williams & Fernald 2010). Later, particularly after school entry, children increasingly encounter languages through more structured contexts with explicit instruction. Thus, apparent age effects may partially reflect these different learning contexts rather than solely maturational constraints.

The impact of timing extends beyond behavioral outcomes to fundamental aspects of brain organization and language processing. Neuroimaging studies reveal that age of second language exposure correlates with differences in brain structure and function, including changes in cortical thickness (Klein et al. 2014) and patterns of neural organization (Mayberry et al. 2011). These timing effects are particularly evident in how languages interact: While simultaneous bilinguals build two linguistic systems in parallel, sequential bilinguals must integrate new languages with established representations. This interaction manifests clearly in speech sound development, where later learners often process new sounds through existing phonetic categories, which can both facilitate initial learning and result in non-native pronunciation (Flege et al. 2003, Moore et al. 2025).

Language abilities remain dynamic throughout development, reflecting the interplay between cognitive maturation and ongoing language exposure. Eye-tracking studies reveal that word recognition abilities improve through two distinct pathways: accumulated language experience and cognitive development (Sander-Montant et al. 2024). As children's cognitive capacities expand—particularly in working memory, executive function, and analytical reasoning—they develop increasingly sophisticated strategies for language learning (Paradis 2011). The power of these maturing cognitive abilities becomes especially evident in cases of international adoption, where older children often demonstrate accelerated early vocabulary acquisition compared with younger adoptees. This advantage stems from their more developed memory systems and richer conceptual knowledge, which they can strategically apply to learning their new language (Snedeker et al. 2007).

Even among typically developing children, some individual differences exist in capacities for language acquisition and processing (Kidd et al. 2018). These variations arise from many sources, including cognitive abilities such as attention, prediction, and memory. Neuroimaging studies have suggested that brain differences present at or shortly after birth predict later language development (Chonchaiya et al. 2013). Early language abilities also build upon each other: Infants' ability to segment words from continuous speech predicts their later language skills (Bergmann & Cristia 2016). For bilingual infants, these cascading effects may be shared across languages, reflecting general language learning abilities, or operate independently within each language (Hurtado et al. 2014), potentially contributing to differences between stronger and weaker languages over time. However, in bilingual development, the impact of these individual differences in cognitive capacity is likely overshadowed by variations in language experience and specifically differences in the quality, quantity, and timing of exposure to each language, which we examine in more detail below.

Developmental and Sensory Differences

Understanding bilingual development in children with developmental and sensory differences highlights how individual characteristics interact with family choices, educational opportunities, and societal support to shape language outcomes. Importantly, research has consistently shown that bilingualism itself does not cause or exacerbate language disorders or delays (Paradis et al. 2011). While bilingualism research has traditionally focused on typical development, emerging evidence shows that children can successfully develop multiple languages across diverse developmental profiles when appropriate support systems are in place. Children with autism spectrum disorder, despite associated language delays, can become successful bilinguals when their language environments provide consistent, well-structured opportunities for learning and using both languages (Drysdale et al. 2015, Gonzalez-Barrero & Nadig 2018). Similar findings emerge for children with developmental language disorder (Nair et al. 2023) and Down syndrome (Kay-Raining Bird et al. 2005). Rather than developmental conditions preventing bilingual development, these studies suggest that success depends on alignment between children's individual learning needs

and the support available in their environment. This research opposes earlier assumptions that bilingualism might overwhelm children with developmental differences and instead shows how appropriate environmental supports can enable bilingual development across diverse profiles.

The case of deaf and hard-of-hearing children particularly illustrates these system-level interactions. While most languages are spoken, hundreds of sign languages exist worldwide, each with its own grammar and linguistic structure (Stokoe 1980). These languages can be acquired by both deaf and hearing individuals, including cochlear implant users, leading to diverse bilingual configurations: Some children learn multiple signed languages (unimodal bilinguals), while others acquire both signed and spoken languages (bimodal bilinguals; Emmorey et al. 2008). Sometimes, parents and professionals, hoping to promote spoken language development, may delay or restrict access to signed language. However, research shows that early exposure to sign language does not impede spoken language development (Davidson et al. 2014). Instead, children can successfully become bilingual in both signed and spoken languages when given the opportunity, and early sign language exposure supports overall language and cognitive development, even for children who later use spoken language as their primary means of communication (Mayberry et al. 2002). Success in these various pathways depends on early identification of hearing status, timely access to language models, family engagement, and educational support. Some deaf and hard-of-hearing children experience delayed access to language due to late diagnosis, restricted exposure, or waiting periods before cochlear implantation. These delays illustrate how barriers at any level of the system—medical, familial, or educational—can affect language development. Children show optimal outcomes when they receive early, consistent access to accessible and engaging language input in signed and/or spoken modalities, supported by coordinated efforts across family, medical, and educational contexts.

LANGUAGE EXPERIENCE AND INPUT

Development and experience are intimately linked in bilingual acquisition. While maturational factors constrain learning pathways, it is the child's immediate language environment that determines how these paths are traveled. This environment emerges from interactions across system levels—individual factors shape how children process input, family choices determine daily exposure patterns, and societal conditions influence which languages children encounter, as well as when and how they encounter them. Moreover, the specific properties of the languages being learned, and how similar or different they are from each other, create unique opportunities and challenges for bilingual development.

Two key dimensions characterize children's immediate language environment: the quantity and quality of their language input (for approaches to measuring and assessing bilingual children's language environments, see the sidebar titled Measuring and Assessing Bilingual Children's Language Environments). Quality encompasses not only the richness of input within each language but also how languages are combined or kept separate in children's daily experiences. When considering both quantity and quality of language exposure, it is crucial to recognize that not all types of exposure contribute equally to development. Some language experiences may appear to add to a child's quantity of exposure but may contribute less meaningfully to language learning due to their limited interactive quality. Children learn language primarily through direct social interaction rather than overheard speech (Weisleder & Fernald 2013; although, for a discussion of diverse cultural contexts, see Rowe & Weisleder 2020). Passive exposure through television or other media is thought to provide only minimal or moderate support for early language learning (Kuhl et al. 2003, Kuhl 2007), but interactive video chat can support language development by enabling meaningful social interaction with members of the child's kin network (Roseberry et al. 2014). This distinction has important implications for bilingual families, who sometimes

MEASURING AND ASSESSING BILINGUAL CHILDREN'S LANGUAGE ENVIRONMENTS

Researchers use various tools to understand bilingual children's complex language environments, including direct audio or video recordings and parent questionnaires (Orena et al. 2020, De Cat et al. 2023). Direct recordings can range from short structured play sessions to daylong recordings that capture children's natural environments (Cristia et al. 2021). Using a combination of manual coding and automated methods (Bain et al. 2023, Cristia et al. 2021), researchers can measure quantitative features (word counts), qualitative features (lexical diversity, syntactic complexity, turn-taking), and language mixing patterns, as well as the surrounding context. Yet, recordings have practical constraints: They raise privacy concerns, they depend heavily on parental commitment to implementation, and processing them remains labor-intensive even with partial automation. Additionally, recordings provide only snapshots of children's experiences, potentially missing important variation across development.

Parent-report questionnaires and interviews offer a more practical alternative. Language exposure questionnaires can capture relative exposure to each language (e.g., 30% English, 70% French) (Byers-Heinlein et al. 2020, De Cat et al. 2023), and they correlate well with home recording measures (Orena et al. 2020). However, they cannot assess children's absolute exposure to a language, and because language exposure often fluctuates across development, it is unclear whether to measure current or cumulative experience (Unsworth 2013). Other questionnaires focus on specific aspects of bilingual experience, such as language mixing (Byers-Heinlein 2013). However, parents cannot reliably report on many aspects of their own speech, such as grammatical complexity, vocabulary diversity, or other features of input quality, highlighting the complementary value of direct recordings.

overestimate how much children can learn from passive exposure to media or overheard speech in their heritage language (De Houwer 2015, Golinkoff et al. 2019, Byers-Heinlein et al. 2020).

The quality and quantity of language experience emerge from complex interactions between broader system levels. For instance, parents' choices about which languages to use with their child and whether to mix or separate them reflect both individual factors (such as language proficiency) and societal influences (such as community attitudes toward specific languages and bilingualism). The following sections examine how quantity, quality, language mixing patterns, and the properties of bilingual children's specific language pairs shape bilingual development, while considering how these immediate experiences are themselves shaped by broader contextual factors.

Effects of Language Quantity

For decades, researchers have demonstrated the key role of quantity of exposure in bilingual children's language outcomes (Unsworth 2016, De Houwer 2018). Put simply, the more children hear a particular language, the more learning opportunities they will have. This relationship between exposure and outcomes manifests across multiple aspects of language development, from early perception to productive language use.

Early effects of language exposure are evident in infants' speech perception during the first year of life. A large-scale collaborative study as part of the ManyBabies Consortium examined how bilingual infants from diverse language backgrounds respond to infant-directed speech compared with adult-directed speech in North American English (Byers-Heinlein et al. 2021). The study included 333 bilingual and 384 monolingual infants aged 6–9 and 12–15 months with varying levels of English exposure: from no familiarity (e.g., Spanish monolinguals and Arabic–French bilinguals), to partial familiarity (e.g., French–English bilinguals), to complete familiarity (English monolinguals). While all infants showed some preference for infant-directed speech

over adult-directed speech, the strength of this preference followed a gradient based on language familiarity: The more infants were exposed to English, the stronger their preference for infant-directed speech. These findings demonstrate how early language exposure shapes infants' listening preferences even before language production begins.

Studies of vocabulary development reveal the profound impact of exposure quantity on bilingual acquisition. Research consistently shows a strong relationship between children's vocabulary knowledge and real-time word recognition in each language and their proportional exposure to that language (Hurtado et al. 2014), especially child-directed input (Marchman et al. 2017). This pattern was first demonstrated in a classic study of Spanish–English bilingual children (Pearson et al. 1997) and explains why children tend to know more words in their dominant language than in their nondominant language (Byers-Heinlein et al. 2024). Importantly, initial differences in vocabulary size across a child's two languages can resolve over time. A recent large-scale study of Australian children found that bilinguals had smaller English receptive vocabulary sizes than monolinguals at age 5, but that these differences disappeared by age 10, suggesting that bilingual children's vocabulary in the societal language functionally catches up to that of monolinguals (Armstrong et al. 2025).

Effects of exposure quantity extend to grammatical development as well. Research shows that bilingual children's mastery of morphological and syntactic structures correlates with their exposure to each language (Thordardottir 2015). For instance, Spanish–English bilingual children's command of Spanish grammatical gender and verb morphology relates to their Spanish exposure (Gathercole 2002). Similarly, studies of heritage language speakers demonstrate that maintaining complex grammatical structures requires sustained language exposure throughout development (Montrul 2016).

Importantly, recent research has begun to elucidate the dynamic nature of language exposure and use across development. A large-scale study of more than 1,000 children aged 2–48 months across 12 countries found that children who heard more speech from adults produced more speech themselves, with no differences between monolinguals and bilinguals in the overall amount of speech they heard (Bergelson et al. 2023). These patterns of exposure often shift over time, with significant consequences for language abilities. When exposure to a language substantially decreases or ceases, as often occurs in cases of international adoption or migration, children can experience rapid attrition, especially in vocabulary. While some receptive abilities may persist longer, children may lose productive abilities in their first language within months of reduced exposure (Montrul 2016). This highlights how maintaining language abilities requires sustained exposure throughout development. The issue of maintaining sufficient exposure becomes especially relevant for children acquiring three or more languages, as exposure time must be divided among them, posing an increased challenge for families seeking to transmit multiple languages (De Houwer 2018).

Effects of Language Quality

The quality of language exposure, alongside quantity, plays a crucial role in bilingual development. Language quality is more difficult to characterize than language quantity, but broadly, it refers to features of language input that support children's learning. Rowe & Snow's (2020) comprehensive model of language equality identifies three key dimensions that evolve across development: interactive quality (e.g., engaging in peekaboo with younger infants or responding to questions from older children), linguistic quality (e.g., repetition of key words for younger children or introduction of sophisticated vocabulary for older ones), and conceptual quality (e.g., discussing concrete objects with infants or abstract topics with older children).

While most research on input quality has emerged from studies of monolingual infants, studies of bilingual populations reveal both commonalities and differences in how these quality dimensions manifest across linguistic contexts. At the interactive level, bilingual caregivers show sophisticated adaptations to their children's dual-language environment. For instance, bilingual parents often maintain distinct vocal patterns when speaking each language to their children (Danielson et al. 2014). Spanish–English bilingual 1-year-olds receive input more evenly distributed across infant-directed and adult registers compared with monolinguals (Ramírez-Esparza et al. 2017), although the reasons for and impact of this difference are unclear. At the linguistic and conceptual levels, bilingual caregivers must navigate additional complexities, such as deciding when to introduce vocabulary across languages and how to support concept learning through multiple linguistic systems, topics which are important for future research.

The question of input quality in bilingual contexts raises unique considerations, particularly regarding parental language proficiency. Bilingual children often receive input from caregivers with varying proficiencies across languages, which raises the question of whether native and/or highly proficient speakers provide higher-quality input that might better support language acquisition. Initial studies suggested a native speaker advantage, finding that native English speakers provided higher-quality child-directed speech in English compared with Spanish speakers with varying levels of English proficiency (Hoff et al. 2020) and that children with more input from native English speakers demonstrated stronger English skills (Place & Hoff 2016). However, recent research challenges these findings. Core et al. (2025) took an innovative approach by comparing two different measures of bilingual children's vocabulary: parent reports and standardized experimenter-administered tests. They found that Spanish-speaking mothers, particularly those with limited English proficiency, tended to underestimate their children's English vocabulary relative to standardized assessments, and they did so more than native English-speaking mothers. Importantly, no such differences emerged when measuring children's Spanish vocabulary. This suggests that parental language proficiency might affect vocabulary assessment methods more than actual input quality or children's language development. These measurement issues have important implications for understanding how parents make language choices: While very limited proficiency may genuinely constrain parents' ability to provide rich language input, parents with intermediate proficiency might unnecessarily avoid using certain languages with their children due to concerns about their abilities (King & Fogle 2013). Finding the right balance—supporting heritage language use while ensuring sufficient input quality—remains a key challenge for many bilingual families and an important area of ongoing research.

Language Mixing and Code-Switching in Children's Environments

From their earliest exposure to language, bilingual infants encounter language mixing—the alternation between languages within sentences or conversations—in their everyday environments, and this is an aspect of language quality that is unique to bilinguals. By definition, all bilingual children experience some degree of language alternation since they must transition between their languages across different contexts (Byers-Heinlein & Lew-Williams 2013). However, the frequency and nature of these transitions vary dramatically across bilingual environments. At one end of the spectrum are children who experience relatively strict language separation, perhaps using one language at home and another in educational settings. These children might encounter just one or two language switches per day. In contrast, children in highly bilingual communities often interact with speakers who frequently alternate between languages across and within conversations, leading to many more language switches. Recent research has begun to quantify these differences and to examine how parents' switching behavior might be modulated

by children's individual development. Using full-day home recordings, Kremin et al. (2022) found that French–English bilingual infants encountered language switches at markedly different rates depending on age: 10-month-olds heard approximately 7 switches per hour, while 18-month-olds experienced about 28 switches hourly. These rates were notably lower than those observed in a structured play session with Spanish–English bilinguals in the United States (Bail et al. 2015), though methodological differences make direct comparisons challenging.

The impact of language mixing on development has been examined across multiple timescales. In real-time processing experiments, toddlers are often slightly slower to understand mixed-language sentences compared with single-language sentences (Byers-Heinlein et al. 2017b), with particular difficulty when switches occur from their dominant to their nondominant language (Potter et al. 2019). However, the effects of mixing on learning are more complex. While French–English bilingual 3-year-olds showed poorer learning of novel words presented in mixed-language sentences (Byers-Heinlein et al. 2022), Spanish–English bilingual 4–5-year-olds showed either similar (Libersky et al. 2025) or enhanced learning from mixed-language input (Kaushanskaya et al. 2023). In naturalistic contexts such as shared book reading, language mixing appears either to have no impact on word learning (Brouillard et al. 2022) or may facilitate it (Read et al. 2021).

Research on longer-term vocabulary development shows similarly nuanced patterns. While some studies report that toddlers exposed to more language mixing have smaller vocabularies (Byers-Heinlein 2013), others find no association (Bail et al. 2015, Verhagen et al. 2022) or report inconsistent results (Place & Hoff 2016). These divergent findings likely reflect differences in how parents use language mixing. Both parent-report data (Byers-Heinlein 2013) and direct observations (Kremin et al. 2022) indicate that parents often mix languages strategically when teaching new words. Such pedagogical use of language mixing might support vocabulary development, while other forms of mixing could have different effects. Understanding these nuances is crucial for developing a complete picture of how language mixing shapes bilingual development.

How Language Properties Shape Bilingual Development

Beyond general aspects of input quality, the specific properties of the languages being learned create another important dimension of children's language experience. Languages share different degrees of overlap in their sounds, words, and grammatical structures, and these similarities and differences systematically affect how children process and acquire their languages.

Studies directly comparing different language pairs reveal how language similarity shapes acquisition. Floccia et al. (2018) examined vocabularies of children learning English alongside various other languages, finding that children learning similar language pairs (e.g., English–Dutch) developed larger vocabularies than those learning more distant language pairs (e.g., English–Hindi). Other studies have reported parallel findings (Gampe et al. 2021), suggesting that shared features between languages can facilitate learning. This facilitative effect of language similarity is particularly evident in vocabulary development. When children encounter cognates—words that sound similar across languages (e.g., English "plant," French "plante," Spanish "planta")—their vocabulary growth is accelerated (Mitchell et al. 2024). Even for noncognates, learning a word in one language can speed up learning of its translation equivalent (cross-language synonym) in another language (Tsui et al. 2022, Tan et al. 2024).

Language-specific properties also create distinct patterns of acquisition challenges. In grammatical development, the presence or absence of particular grammatical features in one language affects learning in the other (Yip & Matthews 2007). For instance, Mandarin–English bilingual children frequently omit articles in English (e.g., saying "I want apple" instead of "I want an

apple"), reflecting the lack of articles in Mandarin (Zdorenko & Paradis 2012). Spanish–English bilingual children may inappropriately apply Spanish gender patterns to English, producing errors such as "the chair, she is broken" (Meisel 2006), while French–English bilingual children sometimes follow French word order in English (e.g., "the house blue") (Nicoladis 2006).

These systematic effects of language similarity and language-specific properties help explain why bilingual children can show different developmental patterns depending on which languages they are acquiring. Understanding these patterns is crucial for supporting bilingual development effectively across diverse language pairs. While some acquisition challenges are fairly universal across all bilingual children, others are specific to particular language combinations, requiring targeted approaches for assessment and support (Genesee & Nicoladis 2007, Serratrice 2013).

INTERPERSONAL CONTEXTS

Family and educational settings, where children spend most of their time, form a crucial intermediate layer in the systems framework of bilingual development. These interpersonal contexts translate broader societal conditions into children's immediate language experiences while also shaping how individual factors manifest in day-to-day interactions. For example, family language choices reflect both societal attitudes toward specific languages and bilingualism as well as parents' and children's individual language abilities, while educational settings bridge between community language policies and children's learning needs.

The Family Context

The home environment fundamentally shapes children's bilingual development through family language policies—the complex system of interconnected language beliefs, language practices, and language management strategies that modify or influence language use within a household (King et al. 2008). Language beliefs include attitudes, ideologies, and concerns; language practices are exemplified by parents' moment-to-moment language choices in interactions with their children; and language management strategies include all activities and approaches aiming to promote bilingual development (Kircher et al. 2025, Quirk et al. 2024a). Family language policies create cascading effects that shape both children's immediate language environment and their longer-term opportunities for language learning while reflecting influences from multiple system levels. These include individual factors, such as family members' language abilities, as well as governments' official language policies and societal attitudes toward specific languages and toward bilingualism in general (Ballinger et al. 2022).

Parents' attitudes toward specific languages strongly influence whether they choose to speak these languages with their children (Kircher 2022). These attitudes also predict children's ultimate language outcomes, primarily through their impact on parents' daily language practices in the home (Ronderos et al. 2022). While there is less research regarding parental attitudes toward bilingualism, these have also been shown to influence home language practices (Surrain & Luk 2023). More research is needed, however, to understand the influence of other types of language beliefs on parents' home language practices.

Research examining actual language use patterns in bilingual families reveals considerable variation in how parents implement language strategies. For example, while the one-parent-one-language approach is widely discussed, in practice, a vast majority of families develop less rigid and more dynamic patterns of language use. In a study of nearly 2,000 Belgian families, De Houwer (2007) found that patterns where both parents spoke the same heritage language and only one parent additionally used the societal language (Dutch) were most strongly associated with children's continued heritage language use. Using a different approach, Sander-Montant et al. (2024)

investigated links between family patterns of language use and infants' exposure to their two languages in nearly 300 Montreal families, some of whom were transmitting French and English (two societal languages) and some of whom were transmitting one societal language and one heritage language. Mothers' language choices had an outsize impact, strongly predicting how much infants heard each language and having three times the impact compared with fathers' language choices—a gendered pattern likely reflecting uneven time spent with infants during early development. Importantly, one quarter of families showed changes in their patterns of language use prior to their child's third birthday, highlighting how family language policies can evolve over time even during early development.

Parents' language decisions reflect complex interactions between individual capabilities, family goals, and societal influences. A series of studies with more than 800 Montreal parents compared those transmitting French and English (both societal languages) with those transmitting heritage languages alongside one or both societal languages. These studies revealed important differences in language attitudes: Parents transmitting heritage languages deemed bilingualism more important for their children's social identities, but at the same time, they attributed less utilitarian value to their children's bilingualism (Kircher et al. 2022, 2025). Moreover, parents who were transmitting heritage languages reported more concerns about providing sufficient exposure to each of their children's languages and supporting children's ultimate attainment (Quirk et al. 2024a,b), and they expressed greater desire for resources to support their children's linguistic development (Ahooja et al. 2024). While language status likely plays a key role in these differences, other factors may contribute, including availability of speakers and resources in the heritage language, parents' own language proficiency and comfort using the language, and the presence of community networks and educational options that could support language use outside the home. These findings highlight the complex interplay of factors that shape family language practices and experiences.

The family language environment extends far beyond parent–child interactions (Okocha et al. 2024). Siblings play a particularly crucial role, often serving as agents of language shift toward the societal language. Research in immigrant contexts shows that school-aged siblings typically prefer the societal language in their interactions, increasing younger children's exposure to this language while reducing heritage language input (Bridges & Hoff 2014). This sibling effect can create different language environments for firstborn versus later-born children, contributing to documented birth order effects in heritage language proficiency. However, extended family members, particularly grandparents, can help counterbalance this shift by providing additional heritage language exposure (Macleod 2022).

Education and Childcare Contexts

Educational institutions directly shape bilingual children's language experiences while also mediating between family goals and societal conditions (García & Wei 2015). These settings vary widely in how they structure bilingual learning opportunities. Some programs deliberately support dual language development, such as French immersion in Canada or Spanish immersion in the United States (Genesee & Lindholm-Leary 2012). Others take more integrated approaches, like in Catalonia, where children naturally use both Spanish and Catalan throughout their educational experience (Hawkey 2014). However, many bilingual children, particularly those learning heritage languages, attend institutions where the majority language dominates. While some heritage language programs exist as supplements to regular schooling, these vary considerably in their availability and effectiveness (Lo Bianco 2020), leaving many children without formal educational opportunities in their heritage language. This can explain why parents raising

bilinguals with heritage languages express greater concerns about their children's educational outcomes than those raising bilinguals with two societal languages (Quirk et al. 2025).

The social dynamics of educational settings profoundly influence how children use and develop their languages. From infant day care onward, families must negotiate their language goals with caregivers who may have different perspectives on bilingual development (De Houwer & Bornstein 2016). Teachers play a crucial role not only through direct instruction but also through their attitudes toward bilingualism and their relationships with bilingual children (Howard et al. 2018). When teachers understand and support bilingual development, children are more likely to maintain active use of both languages. However, negative experiences with teachers who discourage heritage language use can lead children to retreat from using that language, even when they have opportunities to do so (Lindholm-Leary 2016).

Peer relationships add another layer of influence. From early childhood, children develop language-based social preferences that shape their daily interactions and language use patterns. While monolingual children typically gravitate toward others who share their language, bilingual children show more flexibility in their social choices (Byers-Heinlein et al. 2017a). These social dynamics create feedback loops: Bilingual children may choose to play with a mix of children who do or do not speak their different languages and, in doing so, shape their own opportunities for language practice and development.

The transition between home and day care or school contexts often marks a crucial turning point in bilingual development. When children enter education systems that primarily operate in the majority language, they encounter new patterns of language use that can differ markedly from those in their home environment (Bergroth & Palviainen 2020). This transition can be particularly challenging for children from heritage language backgrounds, who may suddenly find themselves in settings where their home language has little presence or value (Laursen 2013). Many children respond by shifting their language preferences toward the majority language, even in contexts where heritage language use would be possible (Curdt-Christiansen 2016). However, strong partnerships between families and educational institutions, along with clear policies supporting heritage language maintenance, can help children maintain active bilingualism through these transitions.

SOCIETAL CONTEXT

Children's bilingual development occurs within broader societal contexts that profoundly shape both the opportunities and challenges they encounter (Spolsky 2012, Titone & Tiv 2023). While individual and family factors play crucial roles in language acquisition, these operate within larger systems of social, political, and economic forces that can either support or constrain bilingual development (García & Kleifgen 2018, De Houwer 2020). Understanding these contextual factors is crucial for explaining the variation in bilingual outcomes that can be observed across different communities and societies.

Language Status and Policy

The status of languages within a society fundamentally shapes children's language learning opportunities and outcomes. Some children grow up in officially bilingual societies where multiple languages enjoy strong institutional support. In Canada, for example, both English and French hold official status, supported by constitutional protections and comprehensive educational infrastructure including widespread immersion programs (Ballinger et al. 2022). Similarly, in Catalonia, Spanish and Catalan coexist as official languages with mandated bilingual education from early childhood (Hawkey 2014). Children in these contexts typically have access

to high-quality educational resources in both languages and likely encounter more positive societal attitudes toward bilingualism than children in predominantly monolingual societies.

In contrast, many bilingual children acquire a heritage language alongside a societal language. These children tend to face significant challenges, as their heritage languages often do not have official status and typically receive limited institutional support. In the United States, for example, many states have politically formalized English as their official language, which signals a reduced status for other American languages such as Spanish, Mandarin, and Navajo. Even in areas that generally encourage bilingualism and have large immigrant or Indigenous populations, children's materials in heritage languages may be scarce in libraries and schools (Lambson 2002, Terhart 2023). Professional support services, including speech-language pathologists, often lack expertise in assessing and supporting heritage language development, leading to potential misdiagnosis or inadequate support (De Lamo White & Jin 2011). Moreover, the lower social status of heritage languages can affect children's motivation to use and maintain these languages. For instance, research in the United States has documented how heritage language speakers often shift toward English dominance during the school years, partly due to the social premium placed on English proficiency and the marginalization of other languages (Fillmore 1991). For the same reasons, many parents decide not to transmit certain heritage languages to their children in the first place (Kircher & Kutlu 2023).

Community Support and Resources

Government policies create frameworks that affect bilingual development through legislation such as Canada's Official Languages Act or the European Charter for Regional or Minority Languages (Ricento & Burnaby 1998). These policies shape multiple aspects of bilingual support—from funding for educational programs and public services to determining which languages are used and taught in schools (Tollefson & Pérez-Milans 2018).

Moreover, the societal context significantly shapes the pressures that parents face regarding language transmission. These pressures can be both positive and negative, influencing parents' language attitudes and family practices. On the positive side, parents often view heritage language maintenance as essential for cultural identity and intergenerational connections (Park & Sarkar 2007, Kircher et al. 2022). Some parents are also motivated by research suggesting cognitive advantages of bilingualism, such as enhanced executive function and delayed onset of dementia (Bialystok 2018), as well as by the belief that bilingual development fosters positive personality traits such as open-mindedness, compassion, and empathy (Kircher et al. 2025). However, parents also encounter negative pressures, including discrimination and linguistic xenophobia, when using heritage languages in public spaces (Surrain 2021, Kircher & Kutlu 2023). Many parents report anxiety about potential language delays or academic difficulties, despite research showing that bilingualism does not cause developmental delays (De Houwer 2015, Quirk et al. 2024a). These societal pressures directly influence parents' language attitudes and decisions about family language practices, highlighting how broader social contexts shape the immediate language environment children experience (Ballinger et al. 2022).

The vitality of language communities significantly influences children's bilingual development opportunities (Giles & Johnson 1987). Strong ethnolinguistic communities can provide children with rich opportunities for language use outside the home through social networks and cultural activities (Extra & Yağmur 2004), although the strength of these communities varies considerably (Bourhis & Sioufi 2017). Indigenous language communities, for instance, often grapple with the ongoing effects of historical assimilationist policies while working to revitalize their languages for future generations (Wilson & Kamanā 2011, McCarty 2013).

Language Revitalization Contexts

Language revitalization contexts create unique circumstances for children's bilingual development (Hinton et al. 2018). Unlike children learning established societal languages, children in revitalization contexts often have very limited exposure to their community's heritage language and may rarely encounter peers who speak it (Meek 2010) or adults who speak it in public (Olsen-Reeder 2022). Moreover, in some cases, intergenerational transmission was interrupted before the parents' generation grew up, leading to limited or no heritage language exposure in the home.

Research highlights how Indigenous communities in the Americas and Australasia, as well as in Europe (where they are commonly referred to as autochthonous communities), have developed innovative approaches to support children's language learning in revitalization contexts. For instance, for heritage languages whose intergenerational transmission was largely interrupted before the parents' generation, such as Gaelic on the Isle of Lewis, there are initiatives to foster children's language learning from grandparents and community elders, as well as programs where children learn the heritage language alongside their parents (O'Rourke & Pujolar 2013, Macleod 2022). In several contexts, such as in Canada as part of community-wide initiatives to revitalize Kahnawake's Kanien'kéha (Mohawk), language nests have been established—a form of immersive early-childhood education originally developed for the revitalization of Māori in New Zealand (Hinton et al. 2018, Gomashie 2019). In successful programs for older children, such as Hawaiian language immersion schools, children have become fluent speakers despite their parents' generation having limited proficiency in the language (Wilson & Kamanā 2011). However, research on revitalization efforts for languages such as Northern Athabaskan in the Yukon and North Frisian in Germany demonstrates that children struggle to develop proficiency when they have limited opportunities to use the language outside the classroom (Meek 2010, Terhart 2023). This poses a significant challenge to the long-term success of revitalization efforts.

Children's success in language learning in revitalization contexts depends on multiple interconnected factors. Their individual motivation often stems from family connections and cultural pride, but they need regular opportunities to use the language in meaningful ways with peers and across different settings (Norton 2013). Children are most likely to develop strong language skills when their families actively participate in revitalization efforts, creating opportunities for language use at home, and when their schools provide sustained, high-quality language instruction (Smith-Christmas 2016). Communities where children have successfully become speakers of revitalized languages typically provide them with strong cultural programs, opportunities to use the language both in and out of school, and clear messages about the language's value and importance (McCarty 2018).

Socioeconomic Factors

Socioeconomic status (SES)—typically measured through factors such as family income, parental education, and occupational status—operates across multiple system levels to shape bilingual development. While bilingualism itself does not determine SES, SES profoundly influences children's access to language learning opportunities and resources (Gathercole et al. 2016, Paradis & Jia 2017). These effects manifest differently across bilingual populations and contexts, with SES potentially having distinct impacts for children learning two societal languages versus those learning a heritage language.

At the immediate environment level, SES can sometimes affect the quantity or quality of language input that bilingual children receive. Higher-SES families typically have more flexibility to create enriching bilingual environments through activities such as cultural events, travel to heritage language communities, or hiring bilingual caregivers. In contrast, economic pressures

may limit lower-SES families' ability to provide such experiences, even when they strongly value bilingualism (Hammer et al. 2014). Access to high-quality bilingual education often depends on families' ability to afford private programs or live in neighborhoods with strong public immersion options (Howard et al. 2018, Schwartz & Palviainen 2016).

SES particularly impacts immigrant heritage language maintenance. Many bilingual children from immigrant or refugee backgrounds face compound challenges where economic constraints intersect with limited community support for their languages. These families may struggle to access heritage language programs, bilingual books, or educational technology that could support language development (Paradis 2011, Hammer et al. 2012, Fibla et al. 2022). The resulting disparities in language learning opportunities can have lasting effects on children's bilingual development.

CONCLUSION: INTEGRATING DEVELOPMENTAL, EXPERIENTIAL, AND CONTEXTUAL INFLUENCES

By synthesizing research across developmental psychology, linguistics, education, and sociology, this systems framework of bilingual development reveals several key insights about how children acquire multiple languages. Most fundamentally, it explains why similar language exposure patterns can yield dramatically different outcomes across contexts. When a child's individual language learning abilities meet rich language experiences and supportive social conditions that are sustained over time, strong bilingual proficiency typically emerges. However, misalignment across these levels—such as when societal pressures work against family language goals or when educational settings fail to support Indigenous and immigrant heritage languages—creates barriers to bilingual development.

The framework illuminates several critical gaps in our current understanding. First, while we know that factors across system levels interact, we have limited data on the specific mechanisms through which these interactions occur. For instance, how do community attitudes toward bilingualism influence parents' moment-to-moment language choices with their children? Second, our knowledge remains heavily skewed toward certain populations and contexts, and it is highly unlikely that interactions across levels operate in the same ways for every family in every setting. We urgently need research examining bilingual development in diverse linguistic contexts across Africa, Asia, South America, and Indigenous communities around the globe to understand how different sociocultural conditions shape language acquisition trajectories.

Recent methodological, technical, and theoretical advances are opening new avenues for understanding bilingual development. Technological innovation in naturalistic recording methods and automated data processing now allow researchers to capture and analyze children's daily language experiences with unprecedented granularity and scale. As artificial intelligence and computer vision capabilities continue to expand, automated annotation of large-scale naturalistic data is becoming increasingly sophisticated and accessible to more researchers. Meanwhile, theoretical perspectives that conceptualize bilingualism as an integrated system, exemplified by work on translanguaging, offer new frameworks for examining how children dynamically deploy their linguistic resources rather than maintaining rigid language boundaries.

The systems framework suggests three key priorities for supporting bilingual development in practice (see also Fibla et al. 2022). First, effective support requires coordinated interventions across multiple levels of the system. Supporting individual children, while necessary, is insufficient if broader barriers exist in their family, educational, or community contexts. Second, bilingual support must be tailored to each child's specific linguistic context. Strategies that effectively support children learning two societal languages (like French and English in Canada) may not meet

the needs of children learning Indigenous or immigrant heritage languages, which face different challenges in terms of resources, community support, and opportunities for use. Third, language support must evolve over time with development. While early exposure is valuable, children require sustained, age-appropriate support as their language needs change.

Looking ahead, bilingual development research and practice must address several emerging challenges. Global forces are reshaping patterns of language contact: Climate migration is creating new multilingual communities, and political conflicts are disrupting existing ones, affecting how languages are maintained across generations. The rise of digital technologies is fundamentally changing how children engage with multiple languages—from app-based learning to social media to video chat with relatives abroad. Meanwhile, educational systems worldwide are grappling with increasingly linguistically diverse student populations, requiring new pedagogical approaches and support systems. Addressing these challenges demands theoretical innovation to understand these new contexts for language learning, as well as practical advances in supporting and maintaining bilingual development under changing conditions.

Ultimately, this systems framework reveals how successful bilingual development emerges from aligned support across multiple levels of influence. When families' efforts to transmit languages are reinforced by strong community networks, when educational institutions provide robust language learning opportunities, and when policymakers ensure resources and institutional support, children are most likely to develop and maintain multiple languages. Understanding these interconnected influences allows us to design more effective interventions—ones that create virtuous cycles where strengthening support at one level catalyzes improvements at others. For the millions of children worldwide growing up with multiple languages, this coordinated, systems-level approach offers a promising path toward supporting their bilingual development.

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