THE UNSEEN OCEAN:

QUANTIFYING NATIVE SPEAKER LANGUAGE IMMERSION AND ITS IMPLICATIONS FOR SECOND LANGUAGE ACQUISITION

by Prince Aljohn Mogatas (Aljohn Polyglot)

Abstract

The journey to fluency in a second language (L2) is often fraught with questions about the time investment required. To provide a crucial, yet often overlooked, perspective, this paper synthesizes existing research to estimate the sheer volume of language immersion experienced by a native speaker (L1) from infancy through adolescence. By examining data on infant sleep patterns, waking hours, developmental milestones in language acquisition, direct child-directed speech (CDS) studies, parent-child interaction times, and the impact of schooling, this paper constructs a timeline of cumulative language exposure. Findings from studies utilizing LENA (Language Environment Analysis) recordings, such as Orena et al. (2021), provide quantitative insights into daily language environments, including overheard speech. Research by Weisleder & Fernald (2013) highlights the critical role of CDS over mere overheard speech for vocabulary development, and work from MIT (Hartshorne et al., 2018) delineates the extended critical period for grammar acquisition. The resulting estimation, based on data compiled by Mogatas (2024, Table S1), reveals a cumulative exposure potentially exceeding 74,000 to 166,000 hours by age 18. This underscores the immense, consistent, and multifaceted nature of L1 acquisition. This paper argues that understanding this "unseen ocean" of native immersion can offer L2 learners realistic expectations, highlight the importance of consistent and varied input, and inform more effective learning strategies.

Keywords: Native Language Acquisition, Language Immersion, Second Language Learning, Cumulative Exposure, Child-Directed Speech, Language Development Milestones, Polyglot Perspective, Language Input

1. Introduction

The quest for fluency in a new language is a universal endeavor, pursued by millions globally for personal, professional, or academic reasons. A persistent question among learners is: "How long does it take to become fluent?" While individual factors like motivation, aptitude, learning strategies, and target language complexity play significant roles, a fundamental benchmark is often missing from the learner's perspective: the sheer amount of time a native speaker has been immersed in their mother tongue by the time they are considered "fluent."

Native speakers are not consciously "learning" their language in a structured, academic sense during their formative years; they are *living* it. This lived experience constitutes an immense and continuous bath of linguistic input, interaction, trial-and-error, and implicit learning. For L2 learners, who often approach language acquisition with limited hours and structured methods, understanding the scale of native immersion can be both daunting and enlightening. It can reframe expectations, emphasize the necessity of massive input, and provide a more profound appreciation for the complexity of language mastery.

This paper aims to synthesize findings from developmental psychology, linguistics, sleep research, and educational studies to construct an estimated timeline of language exposure for a native speaker from birth through adolescence (approximately 18 years), anchored by the detailed data compiled in Mogatas (2024, Table S1). By quantifying this exposure, we can offer a valuable perspective to language learners, language educators, and curriculum designers. The objective is not to discourage L2 learners but to provide a realistic backdrop against which their own efforts can be better understood and potentially optimized.

2. Methodology: Synthesizing Data for Native Immersion Estimation

This paper presents a synthesized estimation based on existing, peer-reviewed studies and authoritative resources, with specific quantitative data consolidated in a supplementary spreadsheet (Mogatas, 2024, Table S1). The methodology involves:

1. **Establishing Age-Specific Waking Hours:** Data from established sleep research (SleepFoundation.org, n.d.; MegFaure.com, n.d.; HuckleberryCare.com, 2024) is used to estimate average daily waking hours for different age groups, forming the temporal framework for exposure.
2. **Quantifying Language Input Across Development:**
    a. **Early Infancy (LENA Studies & CDS):** Research using the Language Environment Analysis (LENA) system offers direct measures of the auditory environment. Orena et al. (2021, PDF; https://onlinelibrary.wiley.com/journal/14677687), studied 10-month-old bilingual infants and found they were exposed to an average of approximately 5.21 hours of adult speech segments per day, including both infant-directed speech (IDS) and overheard speech, with the latter sometimes being more prevalent (Orena et al., PDF, p.15, p.20). Weisleder & Fernald (2013) (https://pmc.ncbi.nlm.nih.gov/articles/PMC5510534/) emphasized the superior impact of Child-Directed Speech (CDS) on vocabulary and processing efficiency compared to overheard speech, noting significant variability in CDS exposure among families.

b. **Parent-Child Interaction:** Studies like Catherine et al. (2023) (https://www.ijrrjournal.com/IJRR_Vol.10_Issue.5_May2023/IJRR05.pdf) quantify direct interaction, reporting that over 50% of parents spend around 3 hours daily interacting with their 1-5-year-old children.

c. **Qualitative Aspects of Early Input:** The importance of "parentese" and meaningful interaction is highlighted by resources such as TheirWorld.org (2017) (https://theirworld.org/news/babies-can-learn-second-language-in-one-hour-per-day/) and Little-Sponges.com (2017) (https://www.little-sponges.com/index.php/2017/10/25/babies-can-learn-2nd-language-just-1-hour-per-day/), and tools like the LEAT (DeAnda et al., 2016; https://pmc.ncbi.nlm.nih.gov/articles/PMC5399762/) aim to capture these nuances.

3. **Incorporating Developmental Milestones:** The typical progression of language skills—from recognizing voices and babbling to complex sentence formation—as outlined by the NIDCD (https://www.nidcd.nih.gov/health/speech-and-language), SkillPointTherapy.com (2024), and ContinentalPress.com (2023), contextualizes the nature and richness of interaction at different ages.

4. **Accounting for Educational Immersion:** The substantial language exposure provided by formal schooling is factored in, drawing on insights from IntlSchool.org (n.d.), OnRaisingBilingualChildren.com (2012), and the longitudinal study by Cohen et al. (2024) (https://www.mdpi.com/2226-471X/9/7/253) on bilingual programs.
5. **Considering Critical/Sensitive Periods:** The research by Hartshorne et al. (2018) from MIT (https://news.mit.edu/2018/cognitive-scientists-define-critical-period-learning-language-0501) on the extended critical period for grammar acquisition informs the understanding of learning capabilities throughout development.
6. **Calculating Cumulative Exposure:** The core quantitative data for "Hours Exposed Within This Period" for each age band is taken directly from the user-provided spreadsheet (Mogatas, 2024, Table S1). Running cumulative totals are then calculated from these period-specific figures.

The term "language exposure" in this paper encompasses a broad spectrum: direct conversational interaction, CDS, being read to, language embedded in play, overheard conversations in the environment, and, in later years, media consumption and formal academic instruction.

3. Results: A Timeline of Native Language Immersion

The comprehensive, granular data underpinning the estimations of native speaker language immersion, including detailed breakdowns of waking hours, daily exposure estimates, source attributions, and the specific exposure hours calculated for each age bracket, are meticulously compiled and accessible in the supplementary online material:

[View Detailed Immersion Data Spreadsheet: https://docs.google.com/spreadsheets/d/14k1zJenx5ZnNvVBfwQcdjE5wD9y4Pj8avjhj7mnchCE/edit?usp=sharing]

This section presents a summary of these findings, directly reflecting the data from Mogatas (2024, Table S1). The daily language exposure figures represent a synthesis of various forms of input, while the cumulative totals are based on the period-specific hours detailed in the supplementary spreadsheet.

Table 1: Summary of Estimated Native Language Immersion by Age Group (Derived from Mogatas, 2024, Table S1)

Age/Stage	Avg. Waking Hours (per 24 hrs)	Estimated Daily Exposure (Active & Passive)	Hours Exposed *Within This Period* (From Spreadsheet)	Estimated Cumulative Exposure by End of Period (Hours - Calculated Running Total)
0-3 Months	7-8 hours	4-7 hours	360 - 630	360 - 630
4-12 Months	8-12 hours	5-8 hours	1,460 - 2,920	1,820 - 3,550
1-2 Years	10-13 hours	6-9 hours	3,285 - 5,475	5,105 - 9,025
3-5 Years (Preschool)	11-14 hours	7-10 hours	7,665 - 14,600	12,770 - 23,625
6-12 Years (School Age)	12-15 hours	8-12 hours	21,900 - 52,560+	34,670 - 76,185+
13-18 Years (Teen)	14-16 hours	9-13 hours	40,000 - 90,000+	**74,670 - 166,185+**

3.1. Early Infancy (0-12 Months): The Foundations of Immersion

The initial 12 months of life establish the bedrock of language immersion.

1. **0-3 Months:** With an average of 7-8 waking hours daily (SleepFoundation.org, n.d.; MegFaure.com, n.d.), infants are exposed to an estimated 4-7 hours of language. This exposure is primarily through caregiver interaction, with newborns recognizing familiar voices, especially their mother's, and using coos and cries as early forms of communication (NIDCD, n.d.). Awake times are short, around 45-60 minutes (MegFaure.com, n.d.). This foundational period accounts for approximately **360 to 630 hours** of linguistic input (Mogatas, 2024, Table S1).
2. **4-12 Months:** Waking hours increase to 8-12 daily, with estimated language exposure rising to 5-8 hours. This stage is characterized by babbling, response to "parentese," and the recognition of native language sounds (NIDCD, n.d.; ContinentalPress.com, 2023). Orena et al. (2021, PDF), in their LENA study of 10-month-old bilingual infants, found an average of ~5.21 hours/day of recorded adult speech segments, including both infant-directed and significant overheard speech (p.15, p.20). This period contributes an additional **1,460 to 2,920 hours** of exposure (Mogatas, 2024, Table S1).

   By the end of the first year, a native-speaking child has accumulated an estimated **1,820 to 3,550 hours** of language immersion.

3.2. Toddlerhood (1-2 Years): The Vocabulary Explosion and Interactive Learning

This period is marked by a significant increase in active language use and comprehension. Toddlers are awake for 10-13 hours, with daily language exposure estimated at 6-9 hours. First words typically appear around 12 months, followed by a rapid vocabulary expansion and the formation of two-word phrases by 24 months (SkillPointTherapy.com, 2024). Weisleder & Fernald (2013) highlight the crucial role of varied Child-Directed Speech (CDS) during this phase, noting that all-day recordings averaged 7 hours of analyzed awake time and revealed vast differences in CDS levels across families. Direct parent-child interaction is also substantial, with Catherine et al. (2023) noting around 3 hours daily for children aged 1-5. This year contributes an additional **3,285 to 5,475 hours** of exposure (Mogatas, 2024, Table S1).

By the age of two, the cumulative exposure reaches an estimated **5,105 to 9,025 hours**. The Language Exposure Assessment Tool (LEAT) (DeAnda et al., 2016) is designed to help quantify these complex early exposure patterns.

3.3. Preschool Years (3-5 Years): Growing Complexity and Social Language

During these three formative years, children are typically awake for 11-14 hours daily, and their language environment provides an estimated 7-10 hours of exposure per day. Sentence structures become more complex, questioning is frequent, and language is increasingly integral to social play and daily routines (ContinentalPress.com, 2023; InteriorHealth.ca, 2023). For many, this period includes entry into preschool or daycare, which adds several hours of structured and peer-based language exposure. This stage contributes an estimated **7,665 to 14,600 hours** of immersion (Mogatas, 2024, Table S1).

By the age of five, a native speaker has been immersed for approximately **12,770 to 23,625 hours**.

3.4. School Age (6-12 Years): Formal Learning, Literacy, and Peer Dominance

The commencement of formal schooling marks a dramatic increase in structured and varied language exposure. With 12-15 waking hours daily, an estimated 8-12 hours are spent in language-rich environments. A significant portion of this is academic language encountered in the classroom (IntlSchool.org, n.d.). Literacy development (reading and writing) exponentially expands their linguistic world, providing access to vast amounts of new vocabulary and complex grammatical structures. Peer interactions during these years also become a dominant force in language use and development. For children in bilingual environments, a minimum of 2.5 hours per day of quality input *per language* is suggested for mastery (OnRaisingBilingualChildren.com, 2012). The longitudinal study by Cohen et al. (2024) on French-English bilingual adolescents in a bilingual school program demonstrates how school curriculum dictates significant language exposure blocks. The school-age years contribute a substantial **21,900 to 52,560+ hours** of language exposure (Mogatas, 2024, Table S1).

By the age of twelve, cumulative immersion is estimated to be between **34,670 and 76,185+ hours**. The "+" signifies the increasing variability and difficulty in capping upper-end exposure due to diverse reading habits, media consumption, and extracurricular activities.

3.5. Adolescence (13-18 Years): Refinement and Advanced Linguistic Skills

In the teenage years, individuals are typically awake for 14-16 hours, with daily language exposure ranging from 9-13 hours. Language use becomes highly sophisticated, encompassing abstract concepts, specialized vocabulary, and nuanced social communication through continued schooling, extensive peer interactions (both face-to-face and digital), and diverse media consumption (Cohen et al., 2024). The MIT research by Hartshorne et al. (2018) suggests that while the optimal window for achieving *native-like* grammatical proficiency may be more effective if started by age 10, the general ability to learn grammar remains remarkably high until age 17 or 18, indicating ongoing refinement of linguistic systems. This six-year period adds an immense **40,000 to 90,000+ hours** of exposure (Mogatas, 2024, Table S1).

By the age of eighteen, a native speaker has experienced a colossal **74,670 to 166,185+ hours** of language immersion.

3.6. Summary of Findings

The data synthesized and meticulously calculated in the supplementary spreadsheet (Mogatas, 2024, Table S1), and supported by the reviewed literature, reveal an extraordinary volume of language immersion experienced by native speakers from birth to young adulthood. The cumulative exposure, conservatively estimated, ranges from over 74,000 to well over 166,000 hours by age 18. This immersion is characterized by its early and pervasive onset, the critical role of interactive and child-directed speech (Weisleder & Fernald, 2013), the sheer quantity of input from various sources including overheard speech (Orena et al., 2021), the increasing influence of formal education and literacy (IntlSchool.org, n.d.; Cohen et al., 2024), and sustained, rich input throughout all crucial developmental periods (NIDCD, n.d.; SkillPointTherapy.com, 2024). The "unseen ocean" of L1 immersion is thus quantitatively vast and qualitatively rich, forming the bedrock of native linguistic competence.

4. Discussion

The cumulative figures derived from the data (Mogatas, 2024, Table S1), ranging from approximately 74,670 to over 166,185+ hours of language exposure by age 18, paint a vivid picture of the sheer scale of native language immersion. This "unseen ocean" is not merely a passive experience but is characterized by several interwoven factors crucial for language development:

1. **Early and Pervasive Onset:** As detailed by the NIDCD (n.d.) and MegFaure.com (n.d.), language exposure begins from birth, with newborns demonstrating an ability to recognize their mother's voice and react to sounds. Even with limited waking hours (45-60 minutes initially), this early period is rich in auditory and proto-linguistic input, forming a critical foundation. By six months, infants typically recognize basic sounds of their native tongue (NIDCD, n.d.), demonstrating rapid implicit learning.
2. **The Primacy and Quality of Child-Directed Speech (CDS):** While infants are bathed in ambient sound, the *quality* and *directness* of speech are paramount. Weisleder & Fernald (2013) (https://pmc.ncbi.nlm.nih.gov/articles/PMC5510534/) powerfully illustrated that CDS, characterized by its specific intonation and simplified structure ("parentese" as described by TheirWorld.org, 2017), is significantly correlated with vocabulary development and processing efficiency in toddlers. This contrasts with merely overheard speech, which showed no such correlation. This highlights the importance of active, engaging, and tailored linguistic interaction.

3. **Substantial Quantity and Inherent Variability of Input:** The volume of language input is immense. The LENA study by Orena et al. (2021, PDF) provided a quantitative snapshot, revealing that 10-month-old bilingual infants were exposed to an average of ~5.21 hours of adult speech segments daily. This included both infant-directed and overheard speech, with the latter often being more frequent (Orena et al., PDF, p.20). Their research also emphasized the "wide variability in how bilingual 10-month-old infants experience dual language exposure" and that input "can vary widely by speaker and by day" (Orena et al., PDF, p.3). This naturalistic variability, far from being a hindrance, likely contributes to the robustness of language acquisition, forcing the developing brain to generalize across diverse inputs.
4. **Interactive and Contextual Learning:** Language is acquired not in isolation but through dynamic interaction and within meaningful contexts. Daily routines—mealtimes, play, chores, bedtime—provide recurring, predictable scenarios rich with linguistic cues and opportunities for exchange (InteriorHealth.ca, 2023; Catherine et al., 2023). Play, in particular, offers a fertile ground for spontaneous language use and development.

5. **The Transformative Role of Formal Education and Literacy:** The commencement of formal schooling introduces a new dimension of structured and intensive language exposure. As highlighted by IntlSchool.org (n.d.), immersion programs demonstrate that children can effectively learn academic content *through* a second language, leveraging many hours of the school day for linguistic development. Literacy acquisition further unlocks an almost infinite source of vocabulary, complex sentence structures, and diverse registers (Cohen et al., 2024).
6. **Extended Sensitive Period for Acquisition:** The research from MIT (Hartshorne et al., 2018) challenges earlier notions of a very short critical period for language learning. Their findings suggest that children remain highly adept at acquiring grammatical structures well into their late teens (around 17 or 18). However, they also crucially note that achieving truly *native-like proficiency*, especially in areas like accent-free speech and intuitive grammatical sense, benefits immensely from exposure starting by age 10. This indicates a prolonged, but not infinite, window of peak learning efficiency.
7. **The Power of Cumulative Exposure:** The most striking aspect is the cumulative effect. The tens of thousands of hours are not discrete learning blocks but a continuous, reinforcing stream of experience. Each interaction, each overheard phrase, each sentence read, builds upon the last, strengthening neural pathways and deepening the implicit understanding of the language's intricacies. This sustained, lifelong immersion is the hallmark of native language acquisition.

5. Implications for Second Language Learners

Understanding the sheer scale and nature of native speaker immersion offers profound and practical implications for L2 learners, framed here from a polyglot's perspective:

1. **Cultivate Patience and Embrace the Marathon:** Native-like fluency is the outcome of an extraordinary, largely unconscious, time investment. L2 learners should approach their journey with the understanding that significant, deep proficiency requires sustained effort over years, not just months. The "10,000-hour rule" often cited for expertise pales in comparison to the linguistic immersion of a native speaker.

2. **Prioritize Quality and Meaningful Interaction over Passive Reception:** While total hours matter, the *type* of input is crucial. The research by Weisleder & Fernald (2013) underscores that active, child-directed (or learner-directed) speech is more potent than passively overheard language. Therefore, L2 learners should actively seek out and create opportunities for meaningful conversation, interactive practice, and comprehensible input tailored to their level (TruFluencyKids.com, n.d.).

3. **Integrate the Language into Life ("Living the Language"):** To emulate the constant exposure of a native speaker, L2 learners should strive to make the target language a part of their daily fabric. This involves thinking in the language, using it for hobbies, consuming media (books, music, films, podcasts) regularly, and engaging with communities of speakers, both online and offline.
4. **Recognize the Value of Early Exposure (If Applicable):** For parents and educators, the data strongly reinforces the benefits of introducing languages early. Resources like OnRaisingBilingualChildren.com (2012) and Little-Sponges.com (2017) highlight that even moderate, consistent exposure in early childhood can lay a strong foundation.

5. **Normalize "Trials and Errors":** Native-speaking children make countless grammatical and phonological "errors" as they develop their linguistic system. These are not failures but essential steps in the learning process. L2 learners should adopt a similar mindset, viewing mistakes as opportunities for feedback and refinement rather than as deterrents.

6. **Balance Comprehensible Input with Challenging Exposure:** While comprehensible input is vital for initial understanding, the varied and often complex language environment of native speakers (including overheard adult conversations, as noted by Orena et al., 2021) suggests that L2 learners should also gradually expose themselves to more complex and authentic materials to continue growing.

7. **The Role of Formal Study vs. Immersion:** Formal study provides structure and explicit knowledge of grammar and vocabulary. However, the data on native immersion emphasizes that this must be complemented by vast amounts of contextualized, communicative use of the language to achieve fluency.

6. Limitations

This paper presents estimations derived from a synthesis of diverse research. The actual hours of language exposure for any individual native speaker will inevitably vary due to factors such as:

1. **Individual Family Dynamics:** Talkativeness of parents and siblings, family routines, and the amount of direct interaction can differ greatly.
2. **Socio-Economic Status (SES) and Cultural Background:** As Weisleder & Fernald (2013) showed, SES can correlate with the amount of CDS, though significant variability exists within SES groups. Cultural norms regarding child-rearing and communication also play a role.
3. **Measurement Challenges:** Quantifying "exposure" is complex. LENA studies provide valuable data for auditory environments but may not capture all forms of non-verbal communicative input or the internal processing of language. Exposure in later childhood and adolescence, relying more on school hours and self-reported activities, is harder to quantify with the same precision as early childhood studies.
4. **Defining "Exposure":** The term itself is broad. The distinction between highly interactive CDS, passive overheard speech, media consumption, and academic language use is nuanced, and their respective contributions to fluency are weighted differently at different developmental stages. The LEAT (DeAnda et al., 2016) attempts to capture some of this qualitative detail, but broad estimations will always simplify this complexity.

5. **Bilingual vs. Monolingual Environments:** While studies like Orena et al. (2021) and Cohen et al. (2024) provide insights into bilingual exposure, the core estimation here primarily models a dominant L1 environment, though the principles of high-volume input remain relevant for all languages learned from an early age.

7. Conclusion

The journey to native language proficiency is a testament to the human brain's remarkable capacity for learning, fueled by an almost immeasurable ocean of immersion. This paper, by synthesizing data from various sources including the detailed calculations in Mogatas (2024, Table S1), estimates that a native speaker accumulates tens of thousands, potentially over 160,000, hours of language exposure by the age of 18. This figure underscores that native fluency is not a product of a few years of schooling or casual interaction, but of continuous, multifaceted, and deeply embedded linguistic experience from the earliest moments of life.

For the aspiring polyglot and second language learner, this "unseen ocean" offers a profound perspective. It highlights the necessity of consistent, high-volume, and varied input, coupled with active engagement and interaction. While replicating the sheer quantity of native immersion may be an insurmountable task for most adult learners, understanding its scale can foster realistic expectations, inspire dedication, and guide the adoption of more immersive and effective learning strategies. The path to fluency is indeed a long one, but by appreciating the depth of the native speaker's journey, L2 learners can navigate their own paths with greater insight and determination.

8. Acknowledgements

This paper is deeply indebted to the foundational research conducted by developmental psychologists, linguists, and cognitive scientists. Their meticulous work in quantifying early language environments (e.g., Orena et al., 2021; Weisleder & Fernald, 2013), understanding developmental milestones (e.g., NIDCD), and exploring the nuances of bilingualism and critical periods (e.g., Hartshorne et al., 2018; Cohen et al., 2024) provides the essential building blocks for syntheses like this one. The insights from practical resources for parents and educators (e.g., MegFaure.com, SkillPointTherapy.com, OnRaisingBilingualChildren.com) also offer valuable real-world context.

9. References

1. Catherine, S. P. A., Monish, V., Steffia, F. A., Oviya, S., & Sai, D. A. (2023). Interaction Time, Play Time and Screen Time of Typically Developing Children. *International Journal of Research and Review, 10*(5), 23-29. https://www.ijrrjournal.com/IJRR_Vol.10_Issue.5_May2023/IJRR05.pdf
2. Cohen, C., Demazel, R., & Witko, A. (2024). Exploring the Interplay of Language Exposure, Language Skills and Language and Cultural Identity Construction in French-English Bilingual Adolescents: A Longitudinal Case Study. *Languages, 9*(7), 253. https://www.mdpi.com/2226-471X/9/7/253
3. Continental Press. (2023, May 2). *The Stages of Language Acquisition for ELLs*. Continental Press Blog. https://www.continentalpress.com/blog/language-acquisition-stages-ells/
4. Crisfield, E. (2012, September 26). *How much (insert language here) is enough?* On Raising Bilingual Children. https://onraisingbilingualchildren.com/2012/09/26/how-much-insert-language-here-is-enough/
5. DeAnda, S., Bosch, L., Poulin-Dubois, D., Zesiger, P., & Friend, M. (2016). The Language Exposure Assessment Tool: Quantifying Language Exposure in Infants and Children. *Journal of Speech, Language, and Hearing Research, 59*(6), 1346–1356. https://pmc.ncbi.nlm.nih.gov/articles/PMC5399762/

6. Faure, M. (n.d.). *Baby Awake Times by Age (Chart Included)*. MegFaure.com. https://megfaure.com/article/baby-awake-times-by-age-chart-included/
7. Hartshorne, J. K., Tenenbaum, J. B., & Pinker, S. (2018). A critical period for second language acquisition: Evidence from 2/3 million English speakers. *Cognition, 177*, 263-277. (Conceptual source for the MIT News article). (Primary research paper DOI: 10.1016/j.cognition.2018.04.007. MIT News article: https://news.mit.edu/2018/cognitive-scientists-define-critical-period-learning-language-0501)
8. Huckleberry. (2024, November 15). *Baby wake windows by age: Newborn and infant sleep windows*. HuckleberryCare.com. https://huckleberrycare.com/blog/first-year-of-sleep-expectations
9. Interior Health. (2023, May 16). *Four daily routines that can help improve a child's speech and language*. Stories@IH. https://www.interiorhealth.ca/stories/four-daily-routines-can-help-improve-childs-speech-and-language
10. International School of Portland. (n.d.). *How Language Immersion Positively Impacts Young Brains*. https://www.intlschool.org/how-language-immersion-positively-impacts-young-brains
11. Little Sponges. (2017, October 25). *Research: Babies can learn a 2nd language in just 1 hour per day*. https://www.little-sponges.com/index.php/2017/10/25/babies-can-learn-2nd-language-just-1-hour-per-day/

12. Mogatas, P. A. (2024). *Table S1: Detailed Native Language Immersion Data*. [Google Sheets]. https://docs.google.com/spreadsheets/d/14k1zJenx5ZnNvVBfwQcdjE5wD9y4Pj8avjhj7mnchCE/edit?usp=sharing
13. National Institute on Deafness and Other Communication Disorders (NIDCD). (n.d.). *Speech and Language Developmental Milestones*. https://www.nidcd.nih.gov/health/speech-and-language
14. Orena, A. J., Byers-Heinlein, K., & Polka, L. (2021). What do bilingual infants actually hear? Evaluating measures of speech input to bilingual-learning 10-month-olds. *Developmental Science, 24*(3), e13045. https://onlinelibrary.wiley.com/journal/14677687 (Journal link from PDF; specific article DOI: https://doi.org/10.1111/desc.13045). *PDF of pre-print also consulted as per user provision.*
15. Skill Point Therapy. (2024, January 26). *When Do Children begin to talk: Milestones and Insights*. https://www.skillpointtherapy.com/when-do-children-begin-to-talk-milestones-and-insights/
16. Sleep Foundation. (n.d.). *How Much Sleep Do You Need?* https://www.sleepfoundation.org/how-sleep-works/how-much-sleep-do-we-really-need

17. TheirWorld.org. (2017, August 18). *Babies and toddlers can learn second language in one hour per day*. https://theirworld.org/news/babies-can-learn-second-language-in-one-hour-per-day/
18. TruFluency Kids. (n.d.). *The Path to Spanish Fluency: Understanding Language Exposure Hours for Children*. https://trufluencykids.com/language-exposure-hours-for-children/
19. Weisleder, A., & Fernald, A. (2013). Talking to children matters: Early language experience strengthens processing and builds vocabulary. *Psychological Science, 24*(11), 2143–2152. https://pmc.ncbi.nlm.nih.gov/articles/PMC5510534/

–