

One Reader, Two Reading Profiles: Language-Dependent Dyslexia and Reading Behaviors in English-Spanish Readers

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Abstract

Reading processes differ across languages, yet dyslexia-related reading difficulty is often assessed without accounting for the ways bilingual individuals' reading challenges may vary across their languages. Prior work has examined cross-language differences at the group level, but there remain gaps in how dyslexia-related difficulties vary within the same bilingual individual. In this study, we conducted an online crowdsourced study with 62 English-Spanish bilingual adults using a standardized dyslexia screening questionnaire and questions about reading behaviors. Our results show that the likelihood of dyslexia was not consistently observed across languages within individuals: while some participants reported similar levels of difficulty across languages, others showed elevated difficulty in only one language. Participants with differing dyslexia profiles also reported switching between languages while reading and experiencing temporary confusion between them. These findings highlight the importance of considering language-specific reading experiences in dyslexia research and suggest opportunities for developing personalized reading support tools that account for language-dependent reading profiles in bilingual readers.

CCS Concepts

• **Human-centered computing** → **Human computer interaction (HCI)**.

Keywords

Readability, Dyslexia, Bilingual Individuals, Monolingual Dyslexia, Crowdsourcing

1 Introduction

Dyslexia is the most common language-based learning disability [13]. Globally, dyslexia is estimated to affect approximately 10-20% of the population [14, 18]. While some studies, e.g., [7], suggest that dyslexia can be identified regardless of the language spoken or the script used, others [8, 12] highlight language as a significant factor in dyslexia. Dyslexia is often associated with differences in brain structure and function and with differences in language-related processing [10]. More specifically, it is characterized by deficits in phonological processing that impair word decoding and contribute to reading difficulties [12].

Prior work suggests that the severity of dyslexia may vary across languages, as reading processes are shaped by language-specific linguistic characteristics [4, 5, 16]. Rozin et al. [11] showed that American children with English reading disabilities could successfully read English represented using Chinese characters, suggesting that characteristics of the writing system can influence how reading difficulties are expressed. The English writing system is highly inconsistent, with irregular spelling-sound correspondences that make learning grapheme-phoneme mappings more difficult, particularly for individuals with dyslexia [23]. This kind of irregularity is less common in more transparent orthographies, such as Italian, Spanish, or Finnish, where letter-sound correspondences are generally more consistent [15]. Also, work by Chang et al. [8] suggests that it is possible to be poor in reading of either Chinese or English or both, and that the cognitive correlates of such difficulties may differ by orthography [12].

Despite prior work showing that reading difficulty can vary across languages, less attention has been given to how these differences appear within the same bilingual individual. In particular, it remains unclear whether dyslexia-related difficulty remains consistent across languages or whether bilingual readers experience different levels of difficulty depending on the language. Understanding this distinction is important for both studying dyslexia in multilingual settings and designing reading support tools that account for language-specific reading experiences.

This study investigates how levels of dyslexia and reading behaviors may differ across languages in bilingual readers. The contributions of our paper are:

- We provide evidence that the likelihood of dyslexia is not always consistent across languages within the same bilingual individual.
- We present qualitative observations from bilingual readers describing cross-language reading experiences, including language switching and temporary confusion between languages, which help contextualize differences in reported reading difficulty.

Our results show that bilingual individuals with dyslexia exhibit distinct reading difficulty patterns in English and Spanish. To the best of our knowledge, we are the first study ever to identify and study this group of individuals. Prior work reported only a single case study of an English-Japanese bilingual individual who exhibited dyslexia in English but not in Japanese [22]. Participants in our

study also display reading behaviors that point towards new paths and technologies to support this unique population of readers. We hope our results influence future research to consider the unique behaviors and technology needs of bilingual neurodivergent readers. Thus, providing another path towards readability for all and personalization.

2 Method

Our Institutional Review Board (IRB) has reviewed and approved all study methods.

2.1 Participants

We recruited 62 participants through Prolific, an online paid crowdsourcing platform commonly used in remote readability studies. We limited eligibility using Prolific’s pre-built participant filters/screeners to recruit individuals with a prior medical diagnosis of dyslexia, aged 18 years or older, who reported being fluent in English and Spanish. All participants completed the study online and responded to the survey questions about their behaviors in both of their fluent languages: English and Spanish.

2.2 Study Procedure

We conducted a single online survey with three parts: 1) Questions related to their language background and reading habits, 2) Dyslexia screener, and 3) Questions about the survey. Participants first completed a background questionnaire that collected information about their language history, self-reported fluency, and reading habits in English and Spanish. Participants then completed a dyslexia screening questionnaire to estimate the level of dyslexia-related difficulty in each language. We calculated participants’ dyslexia scores using the Revised Adult Dyslexia Organization screening [2], following the same procedures as in related CHI readability research on readers’ level of dyslexia [9, 21]. Participants completed a dyslexia screening questionnaire presented in English see Figure 1. For each question, participants indicated whether the described difficulty applied to English, Spanish, both languages, or neither. This allowed us to estimate dyslexia-related difficulty separately for each language within the same individual.

We assessed fluency in English and Spanish using a 5-point Likert scale (1 = beginner, 5 = fluent). After data collection, we excluded participants who reported low fluency in either language, defined as a fluency rating of 3 or lower, based on their self-reported ratings in the survey.

2.3 Analysis Overview: Comparing Levels of Dyslexia per Individual

We estimated dyslexia-related difficulty using scores derived from the dyslexia screener (Figure 1). For each participant, we computed separate scores for English and Spanish following the guidelines in Cooper and Miles [2]. Total scores map to likelihood levels ranging from low (e.g., 1 in 60) to very high (e.g., 3 in 4), with a maximum score of 30. We used these levels to group participants based on their increased likelihood of dyslexia. Figure 2 shows how screener scores were grouped into these categories. Scores were divided into five ranges, from non-dyslexic (0-5) to higher likelihood levels (24-30), with each range associated with an estimated likelihood provided

Dyslexia Screener Questions	
Is your spelling poor?	
When writing down dates, do you often make mistakes?	
Do you find forms difficult and confusing?	
Do you find it difficult to take messages on the phone and pass them on correctly?	
Do you find it difficult to say the months of the year forwards in a fluent manner?	
When you were at school, did you find it hard to learn the multiplication or times tables?	
Do you take longer than you should to read a page of a book?	
When using the telephone, do you get the numbers mixed up when you dial?	
Do you mix up bus numbers like 35 and 53?	
Do you mix up dates and times and miss appointments?	
Do you find difficulty in telling left from right?	
Did you find it difficult to decide how to answer these questions?	

Figure 1: Dyslexia screening questions [2]

Screener Score	Dyslexia Likelihood	Category
0 - 5	1 in 60	Non - dyslexic
6 - 12	1 in 26	Low Probability
13 - 18	1 in 7	Medium Probability
19 - 24	1 in 3	High Probability
24 - 30	3 in 4	Very High Probability

Figure 2: Dyslexia score ranges and categories.

by the screener. The table is color-coded to indicate increasing likelihood levels to facilitate comparison of score ranges in analyses and visualizations.

After calculating dyslexia screener scores, we excluded participants with scores below 6 (Non-dyslexic) in both languages. We then compared scores within individuals, see Figure 3. This allowed us to examine whether bilingual participants showed similar or different dyslexia profiles across languages. We also identified cases in which dyslexia scores appeared higher in one language but not the other. Among participants fluent in both languages (fluency >= 3), screener scores showed cross-language differences, ranging from very high likelihood in English but low in Spanish (30 vs. 6) to the reverse pattern (0 vs. 17).

About 39% of participants showed similar dyslexia score levels in both languages (the same category based on Figure 2). However, 61% of participants showed different scores across languages, with elevated dyslexia likelihood appearing in only one language. For example, two participants showed English dyslexia scores of 0 and a Spanish dyslexia score of 17, while another participant showed the highest dyslexia likelihood in English (score = 30) and a low dyslexia likelihood in Spanish (score = 6). These examples illustrate that dyslexia-related difficulty was not uniform across languages within the same individual.

We also examined responses regarding self-reported reading experiences. About 83.3% of participants with differing dyslexia

Native Language	English Fluency	Spanish Fluency	English Dyslexia Score	Spanish Dyslexia Score
English	5	5	30	6
English	5	3	18	13
English	5	5	17	15
Both	5	5	15	12
English	5	5	12	12
English	5	3	12	13
English	5	5	11	10
Both	5	4	9	9
English	5	3	9	5
English	5	5	5	8
English	5	3	4	12
Both	5	5	3	8
Both	5	5	3	11
English	5	4	3	15
Spanish	5	4	2	9
Both	5	3	2	9
English	5	3	0	17
English	5	3	0	17

Figure 3: Distribution of dyslexic participants by language, fluency levels, and dyslexia screener scores in English and Spanish.

scores across languages (fluent in both languages) reported switching between languages while reading. For instance, a participant reported high comfort understanding texts in both languages (5 out of 5), but also reported frequently switching between languages while reading in English (His English dyslexia score is 30, while his Spanish score is 0).

2.4 Qualitative Results: Open-Ended Questions

To better understand participants’ reading experiences, we also conducted a qualitative analysis of open-ended participant responses using thematic analysis.

2.4.1 Do you experience confusion between languages while reading? As discussed in the study of Van et al. [17], bilingual readers experience cross-language interference during word recognition, because words from both languages become automatically activated and compete during processing. Participants’ responses align with this study, see Figure 4. About 55.5% of participants reported experiencing temporary confusion when switching between languages, including unintentionally swapping words or experiencing interruptions in reading flow (P4). Others described difficulty selecting the appropriate word or needing additional effort to interpret the meaning in one language. P18 in Figure 4 also highlighted interference caused by orthographically similar words across languages, which occasionally led to misreading or uncertainty during reading.

2.4.2 How reading habits changed over time? Participants described gradual changes in both languages. About 61.1% reported becoming more comfortable readers and moving from simpler texts to

Question / Participant	Do you experience confusion between languages while reading?
P1	yes.
P2	No I understand both languages perfectly
P4	Yes, sometimes I get confused with languages, especially when switching from English to Spanish or vice versa. Sometimes words and phrases can cross over and interrupt my flow, but with practice, this happens less often. It’s just part of being bilingual.
P8	Yes, I will swap words quite a lot.
P11	There will be words i wont understand and need to search up to know the meaning if. When speaking I will either not know what work to use or how to communicate just as well as in English.
P18	Some words like especially really confuse me because of how similar the Spanish equivalent is especial. When I read sometimes I’ll say it in Spanish and sometimes it will just feel wrong to read it a sentence. Words that I have more of a connection to like chupons from my early childhood never feel good in English. The f els incorrect and sterile.

Figure 4: Example of participant responses to the question on whether they experience confusion between languages.

Question / Participant	Describe how your reading habits in each language change over time
P4	My reading in English started from casual reading to more complex ones. In Spanish, it started with simpler books and grew into literature and news for fluency. Both have enriched my understanding and fluency.
P8	I used to read a lot more books in spanish; however, now I mostly read professional literature in English and social media / more junky literature in Spanish.
P13	I’ve always been a kind of poor reader.
P16	My reading habits evolved from struggling to comprehend texts in my non-native language to switching between languages
P17	My reading habits in English shifted from primarily consuming non-fiction and informational texts to exploring a wide range of literary genres and complex narratives.
P18	I’m dyslexic so reading is always difficult however it is a bit easier in Spanish since the language is phonetic. However my vocabulary is better in English so when reading dense texts English is easier for me.

Figure 5: Example of participant responses to the question on how reading habits changed over time.

more complex materials. About 16.6% reported using English more for academic or professional reading and Spanish more for leisure or informal reading, e.g., P8 in Figure 5. Others noted that their dominant reading language changed depending on daily use and exposure, see P4, P16, P17 in Figure 5. Overall, the responses show that bilingual reading habits change over time rather than remaining fixed.

2.4.3 How to improve study materials and surveys for bilingual readers. In response to the question of how they would improve the

survey, about 19% of participants suggested minor improvements, such as adding visual elements, making the survey more interactive, or including more opportunities for personalized and open-ended responses to capture deeper experiences. These responses are consistent with prior work showing that visual enhancements, such as highlighting, icons, and embedded graphics, can influence reading behavior and support readability by guiding reader attention to relevant information [3]. Our participants' qualitative feedback helps inform how future research can develop bilingual study materials to better understand their unique reading behaviors across languages.

2.4.4 How would you feel about the survey being written in Spanish compared to English? Because bilingual individuals may prefer working in their dominant language, we hypothesized that language choice could influence participants' comfort and response experience. We therefore asked participants how they would feel about completing the survey in Spanish instead of English. Most participants reported being comfortable with either language, although several noted that completing the survey in Spanish might take slightly longer or require more effort. We chose to conduct the survey in English, because most open-source readability study materials are in English [1, 19].

3 Discussion

3.1 Variation in the Likelihood of Dyslexia Across English and Spanish

Our results show that dyslexia-related difficulties were not consistently observed across languages in the same individual for English and Spanish. While a substantial portion of participants (39%) showed similar dyslexia score levels across languages, the majority (61%) showed differences between English and Spanish. These observations suggest that dyslexia-related difficulty may vary across languages for some bilingual readers. One possible explanation is that language-specific characteristics, such as differences in spelling-sound consistency and reading demands, may influence how reading difficulty is experienced across languages, as suggested by prior research on dyslexia and reading processes [5, 15, 23]. These observations align with prior work [8, 23] suggesting that dyslexia reading difficulties can vary across writing systems and linguistic contexts. English, which has fewer consistent spelling-sound correspondences than more transparent orthographies such as Spanish, may present additional challenges for some readers. Importantly, while prior work has documented differences in reading difficulty across languages and writing systems, our findings suggest that such variation may also appear within the same bilingual individual rather than only across language groups.

3.2 Participant's Everyday Reading Behaviors and Experiences

In the survey, participants reported their everyday reading experiences. From their responses, we observed that their reading behaviors are consistent with the finding that dyslexia-related difficulty was not always uniform across languages within the same individual. About 83.3% of participants who showed different dyslexia probabilities across languages reported switching between languages while reading. Open-ended responses further described

experiences such as temporary confusion between languages and interruptions in reading flow when switching between languages. These observations suggest that reading behavior may vary across languages for some bilingual readers. Together, our observations suggest that differences in dyslexia likelihood across languages may be reflected not only in screener scores but also in everyday reading behaviors reported by bilingual readers, answering calls for future research on studying dyslexia and reading behaviors across languages [9, 16, 20].

3.3 Implications for Future Reading Support Systems Across Populations

Our findings suggest opportunities to develop more personalized reading support tools for neurodivergent populations [6, 9]. Instead of assuming that reading difficulty remains constant across languages, future tools could adapt reading support based on the reader's language and individual profile [19]. For example, reading systems could adjust text presentation differently across languages, provide language-specific assistance, or support flexible switching between languages during reading. Such systems could also allow readers to use their dominant language to support reading and comprehension in their weaker language. For example, systems could show the same word or sentence in both languages side by side, helping readers use one language to understand the other. They could also highlight similar words or meanings across languages to support comprehension. More broadly, future systems could use readers' interaction patterns, such as when they switch languages, to provide adaptive, personalized support. For example, if a bilingual reader is reading an English text and pauses or switches to Spanish on certain words, the system can detect this pattern and automatically show the Spanish translation for those specific words or simplify them in English. Over time, the system can learn which types of words cause difficulty for that reader and proactively provide support only when needed.

4 Limitations

This study has several limitations. First, the study included a relatively small sample (18 participants with probability of dyslexia), limiting the generalizability of our findings. Future work with larger and more diverse participant groups is needed to confirm our observations.

Second, our analysis focused on bilingual readers of English and Spanish, two languages that share the Latin alphabet and relatively similar visual reading processes. It remains unclear whether these findings generalize to bilingual readers whose languages differ more substantially in writing systems. Prior work has reported a case of an English-Japanese bilingual individual who showed dyslexia in English but not in Japanese, suggesting that differences in orthographic structure and spelling-sound relationships may influence how reading difficulty appears across languages [22]. Future studies should examine bilingual readers across structurally distinct writing systems to better understand how dyslexia-related difficulty varies across alphabetic and logographic scripts, such as English-Chinese or Spanish-Chinese.

Finally, the study relied on self-reported fluency and online screening measures rather than clinical assessment. While this

enabled broader participation, future work should include medical diagnostic evaluations and controlled reading tasks to further validate these findings.

5 Conclusion and Future Work

We examined dyslexia-related difficulty in bilingual English-Spanish readers and showed that dyslexia likelihood was not always consistent across languages within the same individual. While some participants showed similar dyslexia difficulty across languages, others showed noticeable differences, suggesting that reading difficulty may vary by language within the same individual. In addition, participants reported reading behaviors such as switching between languages and experiencing cross-language confusion, suggesting that bilingual readers may experience and manage reading difficulty differently across languages. These findings highlight the importance of considering language-specific reading experiences when studying dyslexia and suggest that reading difficulty in bilingual contexts should be treated as language-dependent rather than uniform. More broadly, our work motivates the need for future research and reading technologies that support personalized and inclusive reading experiences for bilingual readers.

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References

- [1] Sofie Beier, Sam Berlow, Esat Boucaud, Zoya Bylinskii, Tianyuan Cai, Jenae Cohn, Kathy Crowley, Stephanie L Day, Tilman Dingler, Jonathan Dobres, et al. 2022. Readability research: An interdisciplinary approach. *Foundations and Trends® in Human-Computer Interaction* 16, 4 (2022), 214–324.
- [2] R Cooper and TR Miles. 2011. Revised Adult Dyslexia Organisation Screening. *Outsider Software Web site* (2011), 2–3.
- [3] Franziska Huth, Maurice Koch, Miriam Awad-Mohammed, Daniel Weiskopf, and Kuno Kurzahls. 2024. Eye tracking on text reading with visual enhancements. In *Proceedings of the 2024 Symposium on Eye Tracking Research and Applications*. 1–7.
- [4] Elizabeth Ijalba, Alicia Bustos, and Sayume Romero. 2020. Phonological-orthographic deficits in developmental dyslexia in three Spanish-English bilingual students. *American Journal of Speech-Language Pathology* 29, 3 (2020), 1133–1151.
- [5] Marie Lallier, Guillaume Thierry, Polly Barr, Manuel Carreiras, and Marie-Josephe Tainturier. 2018. Learning to read bilingually modulates the manifestations of dyslexia in adults. *Scientific Studies of Reading* 22, 4 (2018), 335–349.
- [6] Borano Llana, Alisa Baron, Kushas Khadka, Yusra Suhail, and Shaun Wallace. 2025. Typography and Pupilometry: Exploring the Speed, Comprehension, and Concentration Trade-Off in Reading. *Journal of Vision* 25, 9 (2025), 2470–2470.
- [7] Matthias Maunsell. 2020. Dyslexia in a global context: a cross-linguistic, cross-cultural perspective. *Latin American Journal of Content & Language Integrated Learning* 13, 1 (2020).
- [8] Catherine McBride-Chang, Hua Shu, Wai Chan, Terry Wong, Anita M-Y Wong, Yuping Zhang, Jinger Pan, and Paul Chan. 2013. Poor readers of Chinese and English: Overlap, stability, and longitudinal correlates. *Scientific Studies of Reading* 17, 1 (2013), 57–70.
- [9] Aleena Gertrudes Niklaus, Tianyuan Cai, Zoya Bylinskii, and Shaun Wallace. 2023. Digital reading rulers: Evaluating inclusively designed rulers for readers with dyslexia and without. In *Proceedings of the 2023 CHI Conference on Human Factors in Computing Systems*. 1–17.
- [10] Robin L Peterson and Bruce F Pennington. 2012. Developmental dyslexia. *The Lancet* 379, 9830 (2012), 1997–2007.
- [11] Paul Rozin, Susan Poritsky, and Raina Sotsky. 1971. American children with reading problems can easily learn to read English represented by Chinese characters. *Science* 171, 3977 (1971), 1264–1267.
- [12] Sally E Shaywitz. 1996. Dyslexia. *Scientific American* 275, 5 (1996), 98–104.
- [13] Sally E Shaywitz and Bennett A Shaywitz. 2007. The neurobiology of reading and dyslexia. *The ASHA Leader* 12, 12 (2007), 20–21.
- [14] Sally E Shaywitz, Jonathan E Shaywitz, and Bennett A Shaywitz. 2021. Dyslexia in the 21st century. *Current opinion in psychiatry* 34, 2 (2021), 80–86.
- [15] Ken Spencer. 2000. Is English a dyslexic language? *Dyslexia* 6, 2 (2000), 152–162.
- [16] Namrata Srivastava, Jennifer Healey, Rajiv Jain, Guanli Liu, Ying Ma, Borano Llana, Dragan Gasevic, Tilman Dingler, and Shaun Wallace. 2025. Priming at scale: An evaluation of using ai to generate primes for mobile readers. In *Proceedings of the Extended Abstracts of the CHI Conference on Human Factors in Computing Systems*. 1–10.
- [17] Walter JB Van Heuven, Herbert Schriefers, Ton Dijkstra, and Peter Hagoort. 2008. Language conflict in the bilingual brain. *Cerebral cortex* 18, 11 (2008), 2706–2716.
- [18] Richard K Wagner, Fotena A Zirps, Ashley A Edwards, Sarah G Wood, Rachel E Joyner, Betsy J Becker, Guangyun Liu, and Bethany Beal. 2020. The prevalence of dyslexia: A new approach to its estimation. *Journal of learning disabilities* 53, 5 (2020), 354–365.
- [19] Shaun Wallace, Zoya Bylinskii, Jonathan Dobres, Bernard Kerr, Sam Berlow, Rick Treitman, Nirmal Kumawat, Kathleen Arpin, Dave B. Miller, Jeff Huang, and Ben D. Sawyer. 2022. Towards Individuated Reading Experiences: Different Fonts Increase Reading Speed for Different Individuals. *ACM Trans. Comput.-Hum. Interact.* 29, 4, Article 38 (mar 2022), 56 pages. doi:10.1145/3502222
- [20] Shaun Wallace, Rick Treitman, Jeff Huang, Ben D Sawyer, and Zoya Bylinskii. 2020. Accelerating adult readers with typeface: A study of individual preferences and effectiveness. In *Extended abstracts of the 2020 CHI conference on human factors in computing systems*. 1–9.
- [21] Aleena Watson and Shaun Wallace. 2021. Improving reading outcomes using digital reading rulers for readers with & without dyslexia. *Journal of Vision* 21, 9 (2021), 2650–2650.
- [22] Taeko Nakayama Wydell and Brian Butterworth. 1999. A case study of an English-Japanese bilingual with monolingual dyslexia. *Cognition* 70, 3 (1999), 273–305.
- [23] Johannes C Ziegler, Conrad Perry, Anna Ma-Wyatt, Diana Ladner, and Gerd Schulte-Körne. 2003. Developmental dyslexia in different languages: Language-specific or universal? *Journal of experimental child psychology* 86, 3 (2003), 169–193.