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Title of Project

Toward a Theory-based Account of the L2 Vocabulary
Processing and Learning Benefits of Reading While Listening

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TIRF Research Topic Investigated

Digital Technology in Language Education

Final Report

Motivation for the Research

Developing vocabulary knowledge is crucial to English teaching and learning at all stages and in all contexts. A rich body of research into both how modifying materials and delivery can impact processing and learning has revealed much regarding how English learners can benefit in learning new words. Recent work has especially focused on how the presentation of multiple simultaneous input modalities (i.e., reading/listening/watching) during learning can result in better learning outcomes. The rich linguistic environment of the digital language learning world, from the colorful gamification of language learning apps to the use of online platforms even in the physical language classroom, allows for an ideal location for testing predictions regarding multiple input modalities and their impact on learning. Students encounter several input modalities immediately upon opening any language learning app and most websites, many of which contain rich content immediately available to instructors who may differ widely on teaching methodology, instructional design, and assessment. How do these learning conditions impact both the process and outcome of learning?

Substantial research has focused on underlying mental representations of first language (L1) and second language (L2) words, how these representations do or do not interact, and the relationship between types of linguistic information and activation during language processing (see Jiang, 2000; Bordag et al., 2022). Remarkably few studies, however, have sought to connect particular instructional interventions designed to maximize new word learning with underlying psycholinguistic theoretical motivations for such interventions (see Tuzcu, 2023). Even fewer have made specific testable predictions regarding a mechanism for such benefits in the digital learning environment. My dissertation study was designed to address both these gaps.

Research Questions

RQ1a: Is the online processing trajectory of form acquisition (as measured by eye tracking) for novel L2 words when reading different under incidental conditions during reading while listening (RWL), compared with reading only (RO)?

RQ1b: To what extent is learning of novel word form and meaning different under incidental conditions during RWL, compared with RO?

RQ2a: To what extent does reading slightly ahead of the text in an RWL task contribute to learning of novel word form under incidental conditions, as evidenced by faster reading times?

RQ2b: To what extent does reading slightly ahead of the text in an RWL task contribute to learning of novel word form and meaning under incidental conditions, as evidenced by posttest outcomes?

RQ3: Accounting for individual differences in L2 proficiency, to what extent do individual differences in working memory influence vocabulary learning outcomes from RWL, compared with RO?

Research Methodology

One hundred nineteen advanced-level English learners read or read while listening to a modified 7,400-word short story, an English translation of *How Much Land Does A Man Need?* by Leo Tolstoy. The text was embedded with 25 target pseudoword items, with ten occurrences of each. Measures of real-time form learning were defined as faster reading times and fewer total visits to the new words across encounters (Godfroid, 2020), and three tests of explicit word knowledge were administered (form recognition, meaning recognition, meaning recall). The participants were told to focus on meaning during the reading task and provided with reading comprehension preview and post-reading questions to answer. The vocabulary learning tests were not announced, and most participants indicated that they were not expecting to be tested on their knowledge of the new words, even though most mentioned noticing them during the task.

New to this area of vocabulary research, learning outcome items were presented in randomized item modality (visual or auditory). Group-level comparisons were conducted, utilizing mixed-effects growth curve models to examine the trajectory of form familiarity during in first reading time and total reading time, while logistic mixed-effects models were used to compare total visits to the new words and learning outcomes. Additionally, several tests of English proficiency and phonological short-term memory were included in the models, both to account for and predict how they impacted both processing and learning. Additional within-RWL analysis focused on whether reading slightly ahead of the audio makes a positive impact on processing and learning.

Summary of Findings

The overall pattern for RWL indicated longer initial reading times for new words, fewer re-readings, and steadier and smoother decrease in reading time across encounters. Additionally, differences in learning outcomes were most clearly revealed through auditory test items, with RWL superior to RO across all three posttest outcome measures, and a group by item modality interaction. In other words, RWL indicated superior overall effects compared with RO across all items in form recognition and meaning recall, across all three posttests in auditory items, and better scores on visual than auditory items in RO (but equal across test item modality in RWL).

Crucially, even though the participants in the RO group re-read the words more times than the participants in the RWL group, participants in RO learned less information about the form and meaning of words overall, and especially in phonological forms. Within-RWL analyses revealed that reading ahead

of the audio was a positive predictor of total reading time, as well as the most difficult of the three outcome measures (meaning recall). This finding was confirmed even when individual differences both in proficiency and phonological short-term memory were accounted for. In other words, the extent to which the participants read ahead of the audio indicated how much time they spent looking at the new words, and the degree to which the underlying knowledge of deeper form-meaning connections was developed.

Implications

In sum, this study provided clear evidence that *process* and *product* are both positively impacted in learning new words under multimodal conditions for advanced English learners, along with an initial indication that a slight asynchrony between the eye and the ear (i.e., reading slightly ahead of the audio) may play a role in multimodal benefits in learning new words, even when English proficiency and memory skills are accounted for as covariate predictors. English proficiency or memory skills. The participants in the RWL group spent more initial time reading the new words, which can be attributed to the fact that the speed of the auditory reading (which the participants were instructed to follow along with) was substantially slower than participants' natural reading speed. The participants in the multimodal RWL group learned significantly more auditory/phonological information about the new words than the learners in the unimodal RO group. Crucially, these learning benefits at the phonological level (which are quite difficult for lower-level readers, as well, both in L1 and L2 English reading) came at *no cost* to orthographic learning, with the participants in the RWL group equally or more successful on visual items on outcomes than the participants in the RO group.

Given that the way learners read may be impacted by multimodality, these initial findings call for much more research, and bring many more questions. Do these differences in the way English learners read surface at early stages of English learning? Could it help develop L2 fluency, as others (e.g., Taguchi et al., 2016) have argued? What is the optimal *individual* rate of audio in RWL? This study provides some initial evidence that utilizing multiple input modalities in and out of the classroom can both change the *way* learners encounter new words and help them map sounds (phonology) to symbols (orthography). This is especially crucial in learning English, since its orthographic structure can be particularly challenging to learners (e.g., the "ough" sound in "tough" vs. "cough").

Since the participants were consistently reminded to read along with the audio, and the extent to which participants in the RWL group actually followed the instructions was monitored, these findings should be taken with caution when applied in the classroom. As with any technology, the use of multiple input modalities should be utilized thoughtfully and judiciously when designing learning materials. That being said, the proliferation of language learning apps, control over speed of audio in podcasts/audiobooks, and improved AI transcription of video and instructional materials such as TED talks make the possibilities for maximizing learning through multimodal activities very attractive for English language instruction.

Finally, these findings have direct implications for language policymakers, especially relative to funding decisions. Recent work in the so-called "reading wars" related to the Science of Reading, both for English-speaking children (e.g., Duke & Cartwright, 2021) and multilingual learners of English (Goldenberg, 2020), centers on the crucial importance of phonemic awareness, phonological skills in comprehending English, fluency, and vocabulary development as foundational cognitive factors in literacy development. The findings from this study take a cautious initial step, along with other similar studies (e.g., Tuzcu, 2023) in examining how multimodal conditions can be utilized among English learner populations to facilitate more efficient literacy development. There are a host of caveats to make and additional areas to examine in terms of the effects of multimodality on vocabulary learning and phonological development during reading, but this study provides initial evidence that language



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learning in general, and literacy specifically may be enhanced in important ways by relatively simple and accessible technology.

References

- Adelman, J. S., Brown, G. D. A., & Quesada, J. F. (2006). Contextual diversity, not word frequency, determines word-naming and lexical decision times. *Psychological Science, 17*, 814 – 823. <http://dx.doi.org/10.1111/j.1467-9280.2006.01787.x>
- Adesope, O., & Nesbit, J. (2012). Verbal redundancy in multimedia learning environments: A meta-analysis. *Journal of Educational Psychology, 104*(1), 250.
- Akbulut, Y. (2007). Effects of multimedia annotations on incidental vocabulary learning and reading comprehension of advanced learners of English as a foreign language. *Instructional Science, 35*(6), 499-517.
- Andringa, S., & Godfroid, A. (2020). Sampling bias and the problem of generalizability in applied linguistics. *Annual Review of Applied Linguistics, 40*, 134-142.
- Antúnez, M., Milligan, S., Hernández-Cabrera, J. A., Barber, H. A., & Schotter, E. R. (2022). Semantic parafoveal processing in natural reading: Insight from fixation-related potentials & eye movements. *Psychophysiology, 59*(4), e13986.
- Audacity Team (2023). Audacity(R): Free Audio Editor and Recorder [Computer application]. Version 3.0.0 retrieved June 6, 2022 from <https://audacityteam.org/>
- Baddeley, A. (1998). Recent developments in working memory. *Current opinion in neurobiology, 8*(2), 234-238.
- Balota, D., Yap, M., Cortese, M., Hutchison, K., Kessler, B., Loftis, B., Neely, J., Nelson, D., Simpson, G., & Treiman, R. (2007). The English Lexicon Project. *Behavior Research Methods, 39*(3), 445-459.
- Barcroft, J. (2009). Effects of synonym generation on incidental and intentional L2 vocabulary learning during reading. *TESOL Quarterly, 43*(1), 79-103.
- Barcroft, J. (2015). Can retrieval opportunities increase vocabulary learning during reading?. *Foreign Language Annals, 48*(2), 236-249.
- Bates, D., Mächler, M., Bolker, B., & Walker, S. (2015). Fitting linear mixed-effects models using lme4. *Journal of Statistical Software, 67*(1). <https://doi.org/10.18637/jss.v067.i01>
- Birch, S., & Rayner, K. (2010). Effects of syntactic prominence on eye movements during reading. *Memory & Cognition, 38*(6), 740-752.
- Bisson, M., van Heuven, W., Conklin, K., & Tunney, R. (2013). Incidental acquisition of foreign language vocabulary through brief multi-modal exposure. *PLoS One, 8*(4), e60912.
- Bisson, M., Van Heuven, W., Conklin, K., & Tunney, R. (2014). The role of repeated exposure to multimodal input in incidental acquisition of foreign language vocabulary. *Language Learning, 64*(4), 855-877.
- Bisson, M., Van Heuven, W., Conklin, K., & Tunney, R. (2015). The role of verbal and pictorial information in multimodal incidental acquisition of foreign language vocabulary. *Quarterly Journal of Experimental Psychology, 68*(7), 1306-1326.
- Bley-Vroman, R. (1988). The fundamental character of foreign language learning. In Rutherford, W. & Sharwood Smith, M. (Eds.), *Grammar and second language teaching* (pp. 19–30). Newbury House.

- Blum, I., Koskinen, P., Tennant, N., Parker, E., Straub, M., & Curry, C. (1995). Using audiotaped books to extend classroom literacy instruction into the homes of second-language learners. *Journal of Reading Behavior*, 27(4), 535-563.
- Bonilla, C., Golonka, E., Pandža, N., Linck, J., Michael, E., Clark, M., Lancaster, A., & Richardson, D. (2020). Leveraging Spanish knowledge and cognitive aptitude in Portuguese learning. In Molsing et al. (Eds.), *Linguistic Approaches to Portuguese as an Additional Language*, 191-230. John Benjamins.
- Bordag, D., Kirschenbaum, A., Tschirner, E., & Opitz, A. (2015). Incidental acquisition of new words during reading in L2: Inference of meaning and its integration in the L2 mental lexicon. *Bilingualism: Language and Cognition*, 18(3), 372-390.
- Bordag, D., Gor, K., & Opitz, A. (2022). Ontogenesis model of the L2 lexical representation. *Bilingualism: Language and Cognition*, 25(2), 185-201.
- Borro, I. (2021). *Enhanced incidental learning of formulaic sequences by Chinese learners of Italian* (Doctoral Dissertation, University of Portsmouth).
- Brennan, R. L. (Ed.). (2006). *Educational measurement* (4th ed.). American Council on Education.
- Brown, J.D. (1980). Relative merits of four methods for scoring cloze tests. *The Modern Language Journal*, 64(3), 311-317.
- Brown, D. (2021). Incidental vocabulary learning in a Japanese university L2-English language classroom over a semester. *TESOL Journal*, 12(4), e595.
- Brown, R., Waring, B., & Donkaewbua, S. (2008). Incidental vocabulary acquisition from reading, reading-while-listening, and listening to stories. *Reading in a Foreign Language* 20(2), 136-163.
- Bruton, A., García López, M., & Esquiliche Mesa, R. (2011). Incidental vocabulary learning: an impracticable term? *TESOL Quarterly*, 45(4) 759-768.
- Brysaert, M. (2022). Word Recognition II: Phonological Coding in Reading. In Snowling, M., Hulme, C., & Nation, K. (Eds.). *The Science of Reading: A Handbook*, 79-101.
- Brysaert, M., & New, B. (2009). Moving beyond Kučera and Francis: A critical evaluation of current word frequency norms and the introduction of a new and improved word frequency measure for American English. *Behavior Research Methods*, 41(4), 977-990.
- Brysaert, M., & Stevens, M. (2018). Power analysis and effect size in mixed effects models: a tutorial. *Journal of Cognition*, 1(1), 1-20. <https://doi.org/10.5334/joc.10>
- Brysaert, M., Warriner, A. B., & Kuperman, V. (2014). Concreteness ratings for 40 thousand generally known English word lemmas. *Behavior Research Methods*, 46, 904-911.
- Bunting, M., Cowan, N., & Scott Saults, J. (2006). How does running memory span work? *Quarterly Journal of Experimental Psychology*, 59(10), 1691-1700.
- Bürki, A. (2010). Lexis that rings a bell: on the influence of auditory support in vocabulary acquisition. *International Journal of Applied Linguistics*, 20(2), 206-231.
- Carbo, M. (1978). Teaching reading with talking books. *The Reading Teacher*, 32(3), 267-273.
- Carney, N. (2021). Diagnosing L2 listeners' difficulty comprehending known lexis. *TESOL Quarterly*, 55(2), 536-567.

- Carrol, G., & Conklin, K. (2020). Is all formulaic language created equal? Unpacking the processing advantage for different types of formulaic sequences. *Language and Speech*, 63(1), 95-122.
- Cepeda, N. J., Vul, E., Rohrer, D., Wixted, J. T., & Pashler, H. (2008). Spacing effects in learning: A temporal ridge of optimal retention. *Psychological Science*, 19(11), 1095-1102.
- Chang, A. C. S., & Millett, S. (2015). Improving reading rates and comprehension through audio-assisted extensive reading for beginner learners. *System*, 52, 91–102.
- Chaudron, C. (1985). Intake: on models and methods for discovering learners' processing of input. *Studies in Second Language Acquisition*, 7(1), 1-14.
- Chee, Q. W., Chow, K. J., Yap, M. J., & Goh, W. D. (2020). Consistency norms for 37,677 English words. *Behavior Research Methods*, 52(6), 2535-2555.
- Chen, Y. (2021). Comparing incidental vocabulary learning from reading-only and Reading-while-Listening. *System*, 97, 102442.
- Chen, X., Dong, Y., & Yu, X. (2018). On the predictive validity of various corpus-based frequency norms in L2 English lexical processing. *Behavior Research Methods*, 50, 1–25.
<http://dx.doi.org/10.3758/s13428-017-1001-8>
- Chen, C., & Truscott, J. (2010). The effects of repetition and L1 lexicalization on incidental vocabulary acquisition. *Applied Linguistics*, 31(5), 693-713.
- Chun, D. (2016). The role of technology in SLA research. *Language Learning & Technology*, 20(2), 98-115.
- Chung, H. (1995). Effects of elaborative modification on second language reading comprehension and incidental vocabulary learning. *University of Hawai'i Working Papers in ESL*, 14(1), 27-61.
- Cleeremans, A. (2011). The radical plasticity thesis: How the brain learns to be conscious. *Frontiers in Psychology*, 2. <https://doi.org/10.3389/fpsyg.2011.00086>
- Cobb, T. (2022). Compleat Web VP v2.6 [computer program]. Accessed May 18, 2022 at <https://www.lex tutor.ca/vp/comp/>
- Cohen, J. (1962). The statistical power of abnormal-social psychological research: a review. *The Journal of Abnormal and Social Psychology*, 65(3), 145.
- Coltheart, M. (2005). Modeling reading: the dual-route approach. In Snowling & Hulme (Eds.), *The Science of Reading: A Handbook*, 6-23. Blackwell.
- Conklin, K., Pellicer-Sánchez, A., & Carrol, G. (2018). *Eye-tracking: A guide for applied linguistics research*. Cambridge University Press.
- Conklin, K., Alotaibi, S., Pellicer-Sánchez, A., & Vilkaitė-Lozdienė, L. (2020). What eye-tracking tells us about reading-only and reading-while-listening in a first and second language. *Second Language Research*, 36(3), 257-276.
- Conklin, K., & Schmitt, N. (2012). The processing of formulaic language. *Annual Review of Applied Linguistics*, 32, 45-61.
- Conklin, K., & Alotaibi, S. (2023). Eye-tracking reading-while-listening: challenges and methodological considerations in vocabulary research. *Research Methods in Applied Linguistics*, 2(3), 100086.
<https://doi.org/10.1016/j.rmal.2023.100086>

- Cook, S., Pandža, N., Lancaster, A., & Gor, K. (2016). Fuzzy nonnative phonolexical representations lead to fuzzy form-to-meaning mappings. *Frontiers in Psychology, 7*, 1-17.
- Cop, U., Drieghe, D., & Duyck, W. (2015). Eye movement patterns in natural reading: A comparison of monolingual and bilingual reading of a novel. *PloS one, 10*(8), e0134008.
- Cunnings, I. (2012). An overview of mixed-effects statistical models for second language researchers. *Second Language Research, 28*(3), 369-382.
- Darcy, I. (2022). From fuzzy to fine-grained representations in the developing lexicon. *Bilingualism: Language and Cognition, 25*(2), 206-207.
- Darcy, I., & Thomas, T. (2019). When blue is a disyllabic word: Perceptual epenthesis in the mental lexicon of second language learners. *Bilingualism: Language and Cognition, 22*(5), 1141-1159.
- DeKeyser, R. M. (2000). The robustness of critical period effects in second language acquisition. *Studies in Second Language Acquisition, 22*(4), 499-533.
- DeKeyser, R.M. (2008). Implicit and explicit learning. In Long, M. & Doughty, C. (Eds.), *The Handbook of Second Language Acquisition* (pp. 312-348). Wiley.
- Dempster, F. N. (1987). Effects of variable encoding and spaced presentations on vocabulary learning. *Journal of Educational Psychology, 79*(2), 162.
- Dewaele, J. M. (2009). Individual differences in second language acquisition. In Ritchie, W., & Bhatia, T. (Eds.). *The New Handbook of Second Language Acquisition* (Brill), 623-646.
- Diao, Y., & Sweller, J. (2007). Redundancy in foreign language reading comprehension instruction: concurrent written and spoken presentations. *Learning and Instruction, 17*(1), 78-88.
- Dörnyei, Z. (2006). Individual differences in second language acquisition. *AILA review, 19*(1), 42-68.
- Doughty, C. (2008). Instructed SLA: constraints, compensation, and enhancement. In Long, M. & Doughty, C. (Eds.), *The handbook of second language acquisition* (pp. 256-310). Wiley.
- Doughty, C. J., & Mackey, A. (2021). Language aptitude: Multiple perspectives. *Annual Review of Applied Linguistics, 41*, 1-5. doi:10.1017/S0267190521000076
- Doughty, C., & Williams, J. (1998). Pedagogical choices in focus on form. In Doughty, C. & Williams, J. (Eds.). *Focus on form in classroom second language acquisition* (pp. 197-261). Cambridge University Press.
- Duke, N. K., & Cartwright, K. B. (2021). The science of reading progresses: Communicating advances beyond the simple view of reading. *Reading Research Quarterly, 56*, S25-S44.
- Durrant, P., & Schmitt, N. (2010). Adult learners' retention of collocations from exposure. *Second Language Research, 26*(2), 163-188.
- Elgort, I. (2011). Deliberate learning and vocabulary acquisition in a second language. *Language Learning, 61*(2), 367-413.
- Elgort, I. (2017). Incorrect inferences and contextual word learning in English as a second language. *Journal of the European Second Language Association, 1*(1), 1-11, DOI: <https://doi.org/10.22599/jesla.3>
- Elgort, I., & Warren, P. (2014). L2 vocabulary learning from reading: Explicit and tacit lexical knowledge and the role of learner and item variables. *Language Learning, 64*(2), 365-414.

- Elgort, I., Brysbaert, M., Stevens, M., & Van Assche, E. (2018a). Contextual word learning during reading in a second language: An eye-movement study. *Studies in Second Language Acquisition*, 40(2), 341-366.
- Elgort, I., Candry, S., Boutorwick, T. J., Eyckmans, J., & Brysbaert, M. (2018b). Contextual word learning with form-focused and meaning-focused elaboration. *Applied Linguistics*, 39(5), 646-667.
- Ellis, N. (1994). Implicit and explicit language learning—An overview. In N. Ellis (Ed.), *Implicit and explicit learning of languages* (pp. 1–31). Academic Press.
- Ellis, R. (2005). Measuring implicit and explicit knowledge of a second language: A psychometric study. *Studies in Second Language Acquisition*, 27(2), 141-172.
- Ellis, N. C. (2008). Usage-based and form-focused language acquisition: The associative learning of constructions, learned attention, and the limited L2 endstate. In *Handbook of cognitive linguistics and second language acquisition* (pp. 382-415). Routledge.
- File, K. A., & Adams, R. (2010). Should vocabulary instruction be integrated or isolated? *TESOL Quarterly*, 44(2), 222-249.
- Flege, J., & Bohn, O.S. (2021). The revised speech learning model (SLM-r). In Wayland, R. (Ed.), *Second language speech learning: Theoretical and empirical progress* (pp. 3-83). Cambridge University Press.
- Foster, J. L., Shipstead, Z., Harrison, T. L., Hicks, K. L., Redick, T. S., & Engle, R. W. (2015). Shortened complex span tasks can reliably measure working memory capacity. *Memory & Cognition*, 43(2), 226-236.
- Frost, R., Katz, L., & Bentin, S. (1987). Strategies for visual word recognition and orthographical depth: a multilingual comparison. *Journal of Experimental Psychology: Human Perception and Performance*, 13(1), 104-115.
- Gathercole, S. E., Pickering, S. J., Hall, M., & Peaker, S. M. (2001). Dissociable lexical and phonological influences on serial recognition and serial recall. *The Quarterly Journal of Experimental Psychology Section A*, 54(1), 1-30.
- Godfroid, A. (2020a). Sensitive measures of vocabulary knowledge and processing: expanding Nation's framework. In S. Webb (Ed.), *The Routledge handbook of vocabulary studies* (pp. 433-453). Taylor & Francis.
- Godfroid, A. (2020b). *Eye tracking in second language acquisition and bilingualism: a research synthesis and methodological guide*. Routledge.
- Godfroid, A., Boers, F., & Housen, A. (2013). An eye for words: gauging the role of attention in L2 vocabulary acquisition by means of eye-tracking. *Studies in Second Language Acquisition*, 35(3), 483-517.
- Godfroid, A., Ahn, J., Choi, I., Ballard, L., Cui, Y., Johnston, S., Lee, S, Sarkar, A., & Yoon, H.J. (2018). Incidental vocabulary learning in a natural reading context: An eye-tracking study. *Bilingualism: Language and Cognition*, 21(3), 563-584.
- Godfroid, A., & Hui, B. (2020). Five common pitfalls in eye-tracking research. *Second Language Research*, 36(3), 277–305. <https://doi.org/10.1177/0267658320921218>
- Goldenberg, C. (2020). Reading wars, reading science, and English learners. *Reading Research Quarterly*, 55, S131-S144.

- Goldman-Eisler, F. (1961). The significance of changes in the rate of articulation. *Language and Speech* 4, 171–74.
- Gor, K., & Cook, S. (2020). A mare in a pub? Nonnative facilitation in phonological priming. *Second Language Research*, 36(1), 123-140.
- Gor, K., Cook, S., Bordag, D., Chrabaszcz, A., & Opitz, A. (2021). Fuzzy lexical representations in adult second language speakers. *Frontiers in Psychology*, 12,1-19.
- Goswami, U., & Bryant, P. (1990). *Phonological skills and learning to read*. Lawrence Erlbaum.
- Grainger, J., & Ziegler, J. C. (2011). A dual-route approach to orthographic processing. *Frontiers in Psychology*, 2, 54.
- Granena, G., & Long, M. H. (2013). Age of onset, length of residence, language aptitude, and ultimate L2 attainment in three linguistic domains. *Second Language Research*, 29(3), 311-343.
- Griffiths, R. (1990). Speech rate and NNS comprehension: A preliminary study in time-benefit analysis. *Language Learning*, 40(3), 311-336.
- Hamrick, P., & Pandža, N. B. (2020). Contributions of semantic and contextual diversity to the word frequency effect in L2 lexical access. *Canadian Journal of Experimental Psychology/Revue canadienne de psychologie expérimentale*, 74(1), 25.
- Harm, M., & Seidenberg, M. (2004). Computing the meanings of words in reading: division of labor between visual and phonological processes. *Psychological Review*, 111(3), 662–720.
- Hastie, T. J., & Tibsharani, R. (1986). Generalized additive models (with discussion). *Statistical Science*, 1, 336-337.
- Hatami, S. (2017). The impact of learner-related variables on second language incidental vocabulary acquisition through listening. *Vocabulary Learning and Instruction*, 1, 1-20.
- Hazenbergh, S., & Hulstijn, J. (1996). Defining a minimal receptive second-language vocabulary for non-native university students: An empirical investigation. *Applied linguistics*, 17(2), 145-163.
- Horst, M., Cobb, T., & Meara, P. (1998). Beyond a clockwork orange: acquiring second language vocabulary through reading. *Reading in a Foreign Language*, 11(2), 207-223.
- Hui, B. (2021). *A construct validation study of implicit and time sensitive vocabulary measures*. Michigan State University (doctoral dissertation).
- Hui, B. (2024). Scaffolding comprehension with reading while listening and the role of reading speed and text complexity. *The Modern Language Journal*, Early View. doi: <https://doi.org/10.1111/modl.12905>
- Hui, B., & Godfroid, A. (in-principle acceptance). Audiobooks decomposed: Toward a psycholinguistic account of the benefits of reading-while-listening for verbal comprehension. *Language Learning*.
- Hui, B., & Godfroid, A. (2021). Testing the role of processing speed and automaticity in second language listening. *Applied Psycholinguistics*, 42(5), 1089-1115.
- Hulstijn, J. H. (2001). Intentional and incidental second-language vocabulary learning: A reappraisal of elaboration, rehearsal and automaticity. In P. Robinson (Ed.), *Cognition and Second Language Instruction* (pp. 258-286). Cambridge University Press.

- Hulstijn, J., Hollander, M., & Greidanus, T. (1996). Incidental vocabulary learning by advanced foreign students: the influence of marginal glosses, dictionary use, and reoccurrence of unknown words. *The Modern Language Journal*, 80(3), 327-339.
- Hulstijn, J. H., & Laufer, B. (2001). Some empirical evidence for the involvement load hypothesis in vocabulary acquisition. *Language Learning*, 51(3), 539-558.
- Jaeger, T. F. (2008). Categorical data analysis: Away from ANOVAs (transformation or not) and towards logit mixed models. *Journal of memory and language*, 59(4), 434-446.
- Jelani, N., & Boers, F. (2018). Examining incidental vocabulary acquisition from captioned video: Does test modality matter? *ITL-International Journal of Applied Linguistics*, 169(1), 169-190.
- Jeon, E. H., & Yamashita, J. (2014). L2 reading comprehension and its correlates: a meta-analysis. *Language Learning*, 64(1), 160–212. <https://doi.org/10.1111/lang.12034>
- Jiang, N. (2000). Lexical representation and development in a second language. *Applied Linguistics*, 21(1), 47-77.
- Jiang, N. (2021). Examining L1 influence in L2 word recognition: A case for case. *Journal of Second Language Studies*, 4(1), 1-18.
- Judd, C. M., Westfall, J., & Kenny, D. A. (2017). Experiments with more than one random factor: designs, analytic models, and statistical power. *Annual Review of Psychology*, 68(1), 601-625.
- Kalyuga, S., Chandler, P., & Sweller, J. (1998). Levels of expertise and instructional design. *Human Factors*, 40(1), 1-17.
- Kaushanskaya, M. (2012). Cognitive mechanisms of word learning in bilingual and monolingual adults: The role of phonological memory. *Bilingualism: Language and Cognition*, 15(3), 470-489.
- Kim, Y. (2006). Effects of input elaboration on vocabulary acquisition through reading by Korean learners of English as a foreign language. *TESOL Quarterly*, 40(2), 341-373.
- Kim, Y. (2011). The role of task-induced involvement and learner proficiency in L2 vocabulary acquisition. *Language Learning*, 61, 100-140.
- Kinchla, R. A. (1974). Detecting target elements in multielement arrays: a confusability model. *Perception and Psychophysics*, 15(1), 149-158.
- Kobayashi Hillman, K. (2020). Effects of different types of auditory input on incidental vocabulary learning by L2 Japanese speakers. Unpublished dissertation.
- Krashen, S. D. (1981). Bilingual education and second language acquisition theory. In *Schooling and language minority students: A theoretical framework*, California State Department of Education, p. 51-79.
- Kuder, G. F. & Richardson, M.W. (1937) The theory of the estimation of test reliability. *Psychometrika*, 2, 151-160. <https://doi.org/10.1007/BF02288391>
- Kuperman, V., Siegelman, N., Schroeder, S., Acartürk, C., Alexeeva, S., Amenta, S., Bertram, R., Bonandrini, R., Brysbaert, M., Chernova, D., Da Fonseca, S. M., Dirix, N., Duyck, W., Fella, A., Frost, R., Gattei, C. A., Kalaitzi, A., Lõo, K., Marelli, M., ... Usal, K. A. (2023). Text reading in English as a second language: evidence from the multilingual eye-movements corpus. *Studies in Second Language Acquisition*, 45(1), 3–37. <https://doi.org/10.1017/S0272263121000954>

- Laufer, B. (2001). Reading, word-focused activities and incidental vocabulary acquisition in a second language. *Prospect*, 16(3), 44-54.
- Laufer, B. (2003). Vocabulary acquisition in a second language: Do learners really acquire most vocabulary by reading? Some empirical evidence. *Canadian Modern Language Review*, 59(4), 567-587.
- Lawless, J. F. (1987). Negative binomial and mixed Poisson regression. *The Canadian Journal of Statistics/La Revue Canadienne de Statistique*, 15(3), 209-225.
- Lee, S. K., & Huang, H. T. (2008). Visual input enhancement and grammar learning: A meta-analytic review. *Studies in Second Language Acquisition*, 30(3), 307-331.
- Lemhöfer, K., & Broersma, M. (2012). Introducing LexTALE: a quick and valid test for advanced learners of English. *Behavioral Research Methods*, 44(2), 325-343.
- Leung, J., & Williams, J. The implicit learning of mappings between forms and contextually derived meanings. *Studies in Second Language Acquisition*, 33(1), 33-55.
- Lewandowski, L., & Kobus, D. (1993). The effects of redundancy in bimodal word processing. *Human Performance*, 6(3), 229-239.
- Li, M., Jiang, N., & Gor, K. (2017). L1 and L2 processing of compound words: Evidence from masked priming experiments in English. *Bilingualism: Language and Cognition*, 20(2), 384-402.
- Lim, H., & Godfroid, A. (2015). Automatization in second language sentence processing: A partial, conceptual replication of Hulstijn, Van Gelderen, and Schoonen's 2009 study. *Applied Psycholinguistics*, 36(5), 1247-1282.
- Linck, J., Hughes, M., Campbell, S., Silbert, N., Tare, M., Jackson, S., Smith, B., Bunting, M., & Doughty, C. (2013). Hi-LAB: a new measure of aptitude for high-level language proficiency. *Language Learning*, 63(3), 530-566.
- Llompарт, M., & Reinisch, E. (2019). Robustness of phonolexical representations relates to phonetic flexibility for difficult second language sound contrasts. *Bilingualism: Language and Cognition*, 22(5), 1085-1100.
- Loewen, S. (2014). The acquisition of vocabulary. In *Introduction to Instructed Second Language Acquisition* (pp. 107-126). Routledge.
- Loewen, S., & Hui, B. (2021). Small samples in instructed second language acquisition research. *The Modern Language Journal*, 105(1), 187-193.
- Long, M. H. (1980). Inside the "black box": Methodological issues in classroom research on language learning. *Language learning*, 30(1), 1-42.
- Long, M. H. (1981). Questions in foreigner talk discourse. *Language learning*, 31(1), 135-157.
- Long, M. H. (1990). The least a second language acquisition theory needs to explain. *TESOL Quarterly*, 24(4), 649-666.
- Long, M. M. (2017). Instructed second language acquisition (ISLA): Geopolitics, methodological issues, and some major research questions. *Instructed Second Language Acquisition*, 1(1), 7-44.
- Maie, R., & DeKeyser, R. M. (2020). Conflicting evidence of explicit and implicit knowledge from objective and subjective measures. *Studies in Second Language Acquisition*, 42(2), 359-382.

- Malone, J. (2018). Incidental vocabulary learning in SLA: Effects of frequency, aural enhancement, and working memory. *Studies in Second Language Acquisition*, 40(3), 651–675.
- Marian, V., Blumenfeld, H., & Kaushanskaya, M. (2007). The language experience and proficiency questionnaire (LEAP-Q): Assessing language profiles in bilinguals and multilinguals. *Journal of Speech, Language, and Hearing Research*, 50(4), 940-967.
- Martin, K., & Ellis, N.C. (2012). The roles of phonological short-term memory and working memory in L2 grammar and vocabulary learning. *Studies in Second Language Acquisition*, 34(3), 379-413.
- Mayer, R. E., Heiser, J., & Lonn, S. (2001). Cognitive constraints on multimedia learning: When presenting more material results in less understanding. *Journal of Educational Psychology*, 93(1), 187.
- Mayer, R. E., & Fiorella, L. (2014). 12 principles for reducing extraneous processing in multimedia learning: Coherence, signaling, redundancy, spatial contiguity, and temporal contiguity principles. In *The Cambridge handbook of multimedia learning* (Vol. 279). Cambridge University Press.
- Mayer, R. E., & Johnson, C. I. (2008). Revising the redundancy principle in multimedia learning. *Journal of Educational Psychology*, 100(2), 380.
- McKoon, G., Ratcliff, R., Ward, G., & Sproat, R. (1993). Syntactic prominence effects on discourse processes. *Journal of Memory and Language*, 32(5), 593-607.
- McQuillan, J. (2019). Where do we get our academic vocabulary? Comparing the efficiency of direct instruction and free voluntary reading. *The Reading Matrix: An International Online Journal*, 19(1), 129-138.
- McQuillan, J., & Krashen, S. D. (2008). Commentary: Can free reading take you all the way? A response to Cobb (2007). *Language Learning & Technology*, 12(1), 104-108.
- McZgee, V. E., & Carleton, W. T. (1970). Piecewise regression. *Journal of the American Statistical Association*, 65(331), 1109-1124.
- Mirman, D. (2014). Growth curve analysis: A hands-on tutorial on using multilevel regression to analyze time course data. In *Proceedings of the Annual Meeting of the Cognitive Science Society* (Vol. 36, No. 36).
- Mohamed, A. A. (2018). Exposure frequency in L2 reading: An eye-movement perspective of incidental vocabulary learning. *Studies in Second Language Acquisition*, 40(2), 269–293.
<https://doi.org/10.1017/S0272263117000092>
- Montali, J., & Lewandowski, L. (1996). Bimodal reading: benefits of a talking computer for average and less-skilled readers. *Journal of Learning Disabilities*, 29(3), 271-279.
- Montero Perez, M. (2020). Incidental vocabulary learning through viewing video: The role of vocabulary knowledge and working memory. *Studies in Second Language Acquisition*, 42(4), 749-773.
- Moravcsik, J. E., & Healy, A. F. (1998). Effect of syntactic role and syntactic prominence on letter detection. *Psychonomic Bulletin & Review*, 5(1), 96-100.
- Moreno, R., & Mayer, R. E. (2002). Learning science in virtual reality multimedia environments: Role of methods and media. *Journal of Educational Psychology*, 94(3), 598.
- Muñoz, C., Pujadas, G., & Pattemore, A. (2021). Audio-visual input for learning L2 vocabulary and grammatical constructions. *Second Language Research, Online First*.

- Nagy, W. E., Herman, P. A., & Anderson, R.C. (1985). Learning words from context. *Reading Research Quarterly*, 20(2), 233–53.
- Nation, I. S. P. (2001). *Learning Vocabulary in Another Language*. Cambridge University Press.
- Nation, I. (2006). How large a vocabulary is needed for reading and listening? *The Canadian Modern Language Review*, 63(1), 59-82.
- Nation, I.S.P. (2017). The BNC/COCA Level 6 word family lists (Version 1.0.0) [Data file]. Available from <http://www.victoria.ac.nz/lals/staff/paul-nation.aspx>
- Nation, P., & Meara, P. (2013). 3 | Vocabulary. In *An Introduction to Applied Linguistics* (pp. 44-62). Routledge.
- Nation, I. S. P., & Chung, M. (2009). Teaching and testing vocabulary. In M. H. Long & C. J. Doughty (Eds.), *Handbook of language teaching* (pp. 543-559). Wiley-Blackwell.
- Nicklin, C., & Vitta, J. P. (2021). Effect-driven sample sizes in second language instructed vocabulary acquisition research. *The Modern Language Journal*, 105(1), 218-236.
- Nguyen, C. D., & Boers, F. (2019). The effect of content retelling on vocabulary uptake from a TED talk. *TESOL Quarterly*, 53(1), 5-29.
- Paivio, A. (2013). Dual coding theory, word abstractness, and emotion: a critical review of Kousta et al. (2011). *Journal of Experimental Psychology: General*, 142(1), 282-287. doi: 10.1037/a0027004
- Paivio, A., & Csapo, K. (1973). Picture superiority in free recall: imagery or dual coding?. *Cognitive Psychology*, 5(2), 176–206. doi:10.1016/0010-0285(73)90032-7
- Paribakht, T. S., & Wesche, M. (1999). Reading and “incidental” L2 vocabulary acquisition: An introspective study of lexical inferencing. *Studies in Second Language Acquisition*, 21(2), 195-224.
- Pawlas, A. A., Ramig, L.O., & Countryman, S. (1996). Perceptual voice and speech characteristics in patients with idiopathic Parkinson’s disease. *NCVS Status Report 10*, 79-87. Available at <http://www.ncvs.org/ProgressReports/NCVS%20Status%20&%20Progress%20Report%20Vol.%2010,%20Nov%201996%20copy.pdf>
- Peirce, J., Gray, J. R., Simpson, S., MacAskill, M., Höchenberger, R., Sogo, H., Kastman, E., & Lindeløv, J. K. (2019). PsychoPy2: Experiments in behavior made easy. *Behavior Research Methods*, 51(1), 195-203.
- Pellicer-Sánchez, A. (2016). Incidental L2 vocabulary acquisition from and while reading. *Studies in Second Language Acquisition*, 38(1), 97-130.
- Pellicer-Sánchez, A., & Boers, F. (2018). Pedagogical approaches to the teaching and learning of formulaic language. In A. Siyanova-Chanturia & A. Pellicer- Sánchez (Eds.), *Understanding formulaic language: A second language acquisition perspective* (pp. 153–173). Routledge.
- Perfetti, C. (2007). Reading ability: Lexical quality to comprehension. *Scientific Studies of Reading*, 11(4), 357-383.
- Montero Pérez, M., Peters, E., & Desmet, P. (2015). Enhancing vocabulary learning through captioned video: An eye-tracking study. *The Modern Language Journal*, 99(2), 308-328.
- Ota, M., Hartsuiker, R. J., & Haywood, S. L. (2009). The KEY to the ROCK: Near-homophony in nonnative visual word recognition. *Cognition*, 111(2), 263-269.

- Ota, M., Hartsuiker, R. J., & Haywood, S. L. (2010). Is a FAN always FUN? Phonological and orthographic effects in bilingual visual word recognition. *Language and Speech, 53*(3), 383-403.
- Peters, E., & Webb, S. (2018). Incidental vocabulary acquisition through viewing L2 television and factors that affect learning. *Studies in Second Language Acquisition, 40*(3), 551-577.
- Pitts, M., White, H., & Krashen, S. (1989). Acquiring the second language vocabulary through reading: A replication of the Clockwork Orange study using second language acquirers. *Reading in a Foreign Language, 5*(2), 271-275.
- Plonsky, L., & Oswald, F. L. (2014). How big is “big”? Interpreting effect sizes in L2 research. *Language Learning, 64*(4), 878-912.
- Pollack, I., Johnson, I. B., & Knaff, P. R. (1959). Running memory span. *Journal of Experimental Psychology, 57*, 137–146.
- Pollatsek, A., Reichle, E., and Rayner, K. Tests of the EZ Reader model: Exploring the interface between cognition and eye-movement control. *Cognitive Psychology 52*(1), 1-56.
- Qian, D. D. (2002). Investigating the relationship between vocabulary knowledge and academic reading performance: An assessment perspective. *Language Learning, 52*(3), 513-536.
- Rayner, K. (1998). Eye movements in reading and information processing: 20 years of research. *Psychological Bulletin, 124*(3), 372.
- Rayner, K., Pollatsek, A., Ashby, J., & Clifton Jr., C. (2012). *Psychology of reading*. Psychology Press.
- Rayner, K., & Pollatsek, A. (2016). Eye movements in reading a tutorial review. *Attention and performance XII, 327-362*.
- Rebuschat, P., & Williams, J. N. (2012). Implicit and explicit knowledge in second language acquisition. *Applied Psycholinguistics, 33*(4), 829-856.
- Ren, J., & Wang, M. (2023). Sensitivity to word endings as probabilistic orthographic cues to lexical stress among English as second language learners. *Memory & Cognition, 51*, 1881-1897.
- Reichle, E. D., Rayner, K., & Pollatsek, A. (2003). The EZ Reader model of eye-movement control in reading: Comparisons to other models. *Behavioral and Brain Sciences, 26*(4), 445-476.
- Reichle, E. D., Warren, T., & McConnell, K. (2009). Using EZ Reader to model the effects of higher level language processing on eye movements during reading. *Psychonomic Bulletin & Review, 16*, 1-21.
- Reichle, E. D., Liversedge, S. P., Drieghe, D., Blythe, H. I., Joseph, H. S., White, S. J., & Rayner, K. (2013). Using EZ Reader to examine the concurrent development of eye-movement control and reading skill. *Developmental Review, 33*(2), 110-149.
- Robinson, P. (2002). Learning conditions, aptitude complexes, and SLA. In P. Robinson (Ed.), *Individual differences and instructed language learning* (pp. 113-133). John Benjamins.
- Robinson, P. (2008). Attention and memory during SLA. In C. J. Doughty & M. H. Long (Eds.), *The handbook of second language acquisition* (pp. 631–678). Blackwell.
- Robinson, P. (2012). Individual differences, aptitude complexes, SLA processes, and aptitude test development. In *New Perspectives on Individual Differences in Language Learning and Teaching* (pp. 57-75). Springer.

- Rodgers, M. P., & Webb, S. (2020). Incidental vocabulary learning through viewing television. *ITL-International Journal of Applied Linguistics*, 171(2), 191-220.
- Roehr, K (2012) Aptitude treatment interaction (ATI) research. In P. Robinson (Ed.) *The Routledge encyclopedia of second language acquisition* (pp. 31–35). Routledge.
- Rott, S. (1999). The effect of exposure frequency on intermediate language learners' incidental vocabulary acquisition through reading. *Studies in Second Language Acquisition*, 21(4), 589-619.
- Rott, S. (2007). The effect of frequency of input-enhancements on word learning and text comprehension. *Language Learning*, 57(2), 165-199.
- Sánchez Gutiérrez, C. H., Serrano, M. P., & García, P. R. (2019). The effects of word frequency and typographical enhancement on incidental vocabulary learning in reading. *Journal of Spanish Language Teaching*, 6(1), 14-31.
- Saragi, T. (1978). Vocabulary learning and reading. *System*, 6(2), 72-8.
- Schmidt, R. W. (1990). The role of consciousness in second language learning. *Applied Linguistics*, 11(2), 129-158.
- Schmidt, R. (1994). Deconstructing consciousness in search of useful definitions for applied linguistics. *Consciousness in Second Language Learning*, 11, 237-326.
- Schmidt, R. (2012). Attention, awareness, and individual differences in language learning. *Perspectives on Individual Characteristics and Foreign Language Education*, 6, 27.
- Schmitt, N. (2000). Key concepts in ELT. *ELT Journal*, 54(4), 400-401.
- Schmitt, N. (2010). *Researching vocabulary: A vocabulary research manual*. Springer.
- Schmitt, N., & Schmitt, D. (2012). A reassessment of frequency and vocabulary size in L2 vocabulary teaching. *Language Teaching*, 47(4), 484-503.
- Schotter, E. R., Angele, B., & Rayner, K. (2012). Parafoveal processing in reading. *Attention, Perception, & Psychophysics*, 74, 5-35.
- Segalowitz, N. (1997). Individual differences in second language acquisition. In A. de Groot & J. Kroll (Eds.), *Tutorials in bilingualism: Psycholinguistic perspectives* (pp. 85-112). Erlbaum.
- Segalowitz, N. (2008). Automaticity and second languages. In C. J. Doughty & M. H. Long (Eds.), *The handbook of second language acquisition* (pp. 382–406). Blackwell.
- Seol, H. (2020). *snowIRT: Item Response Theory for jamovi*. [jamovi module]. Retrieved from <https://github.com/hyunsooseol/snowIRT>.
- Serrano, R., & Pellicer-Sánchez, A. (2019). Young L2 learners' online processing of information in a graded reader during reading-only and reading-while-listening conditions: A study of eye-movements. *Applied Linguistics Review*, 13(1), 49-70.
- Skehan, P. (1991). Individual differences in second language learning. *Studies in Second Language Acquisition*, 13(2), 275-298.
- Spit, S., Andringa, S., Rispens, J., & Aboh, E. O. (2021). Do kindergarteners develop awareness of the statistical regularities they acquire? *Language Learning*, 71(2), 573–611. <https://doi.org/10.1111/lang.12445>

- SR Research. (2010). EyeLink 1000 User Manual (version 1.5.0). Available at <http://srresearch.jp/support/EyeLink%201000%20User%20Manual%201.5.0.pdf> (accessed 1 June 2022).
- Stæhr, L. S. (2008). Vocabulary size and the skills of listening, reading and writing. *Language Learning Journal*, 36(2), 139-152.
- Stanovich, K. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly*, 21(4), 360-407.
- Stekhoven, D. J., & Bühlmann, P. (2012). MissForest—non-parametric missing value imputation for mixed-type data. *Bioinformatics*, 28(1), 112-118.
- Stekić, K., Ilić, O., Ković, V., & Savić, A. M. (2023). ERP Indicators of Phonological Awareness development in children: A systematic review. *Brain Sciences*, 13(2), 290.
- Strauss, A., & Corbin, J. M. (1997). *Grounded theory in practice*. Sage.
- Suk, N. (2017). The effects of extensive reading on reading comprehension, reading rate, and vocabulary acquisition. *Reading Research Quarterly*, 52(1), 73-89.
- Suzuki, Y. (2015). Using new measures of implicit L2 knowledge to study the interface of explicit and implicit knowledge (Doctoral dissertation, University of Maryland, College Park).
- Suzuki, Y. (2017). Validity of new measures of implicit knowledge: Distinguishing implicit knowledge from automatized explicit knowledge. *Applied Psycholinguistics*, 38(5), 1229-1261.
- Suzuki, Y., & DeKeyser, R. (2017). The interface of explicit and implicit knowledge in a second language: insights from individual differences in cognitive aptitudes. *Language Learning*, 67(4), 747-790.
- Sweet, H. (1899). *The practical study of languages. A guide for teachers and learners*. London: Dent.
- Sweller, J. (1988). Cognitive load during problem solving: Effects of learning. *Cognitive Science*, 12, 257-285.
- Sweller, J. (2011). Cognitive load theory. In B. Ross (Ed.), *Psychology of learning and motivation* (pp. 37-76). Academic Press.
- Syodorenko, T. (2010). Modality of input and vocabulary acquisition. *Language Learning & Technology*, 14(2), 50-73.
- Taguchi, E., Gorsuch, G., Lems, K., & Roszell, R. (2016). Scaffolding in L2 reading: how repetition and an auditory model help readers. *Reading in a Foreign Language*, 28(1), 101-117.
- Teng, F. (2018). Incidental vocabulary acquisition from reading-only and reading-while-listening: A multi-dimensional approach. *Innovation in Language Learning and Teaching*, 12(3), 274-288.
- Tomlin, R. S., & Villa, V. (1994). Attention in cognitive science and second language acquisition. *Studies in Second Language Acquisition*, 16(2), 183-203.
- Tragant, E., & Vallbona, A. (2018). Reading while listening to learn: young EFL learners' perceptions. *ELT Journal*, 72(4), 395-404.
- Tragant Mestres, E., & Pellicer-Sánchez, A. (2019). Young EFL learners' processing of multimodal input: examining learners' eye movements. *System*, 80, 212-223.
- Turner, M. L., & Engle, R. W. (1989). Is working memory capacity task dependent? *Journal of memory and language*, 28(2), 127-154.

- Tuzcu, A. (2023). *Unimodal and bimodal input in incidental vocabulary learning: Cognitive processes and the development of different knowledge types*. (Doctoral Dissertation, Michigan State University).
- Uchihara, T., & Clenton, J. (2023). The role of spoken vocabulary knowledge in second language speaking proficiency. *The Language Learning Journal*, 51(3), 376-393.
- Uchihara, T., Webb, S., & Yanagisawa, A. (2019). The effects of repetition on incidental vocabulary learning: A meta-analysis of correlational studies. *Language Learning*, 69(3), 559-599.
- Uchihara, T., Webb, S., Saito, K., & Trofimovich, P. (2022). Frequency of exposure influences accentedness and comprehensibility in learners' pronunciation of second language words. *Language Learning*, 73(1), 84-125.
- Ullman, M. T. (2004). Contributions of memory circuits to language: The declarative/procedural model. *Cognition*, 92(1-2), 231-270.
- Ullman, M. T. (2006). The declarative/procedural model and the shallow structure hypothesis. *Applied Psycholinguistics*, 27(1), 97-105.
- Vafae, P., & Suzuki, Y. (2020). The relative significance of syntactic knowledge and vocabulary knowledge in second language listening ability. *Studies in Second Language Acquisition*, 42(2), 383-410.
- Ver Hoef, J. M., & Boveng, P. L. (2007). Quasi-Poisson vs. negative binomial regression: How should we model overdispersed count data? *Ecology*, 88(11), 2766-2772.
- Vidal, K. (2011). A comparison of the effects of reading and listening on incidental vocabulary acquisition. *Language Learning*, 61(1), 219-258.
- Vitta, J. P., Nicklin, C., & McLean, S. (2022). Effect size-driven sample-size planning, randomization, and multisite use in L2 instructed vocabulary acquisition experimental samples. *Studies in Second Language Acquisition*, 44(5), 1424-1448.
- Wang, M., Koda, K., & Perfetti, C. (2003). Alphabetic and nonalphabetic L1 effects in English word identification: a comparison of Korean and Chinese English L2 learners. *Cognition*, 87(2), 129-149.
- Waring, R., & Takaki, M. (2003). At what rate do learners learn and retain new vocabulary from reading a graded reader? *Reading in a Foreign Language*, 15(2), 130-163.
- Webb, S. (2007). The effects of repetition on vocabulary knowledge. *Applied Linguistics*, 28(1), 46-65.
- Webb, S., & Chang, A. C. (2012). Vocabulary learning through assisted and unassisted repeated reading. *Canadian Modern Language Review*, 68(3), 267-290.
- Webb, S., & Chang, A. C. (2015). Second language vocabulary learning through extensive reading with audio support: How do frequency and distribution of occurrence affect learning? *Language Teaching Research*, 19(6), 667-686.
- Webb, S. & Chang, A. (2015). Second language vocabulary learning through extensive reading with audio support: how does frequency and distribution of occurrence affect learning? *Language Teaching Research*, 19(6), 667-686.
- Webb, S., & Nation, P. (2017). *How vocabulary is learned*. Oxford University Press.

- Webb, S., Yanagisawa, A., & Uchihara, T. (2020). How effective are intentional vocabulary-learning activities? A meta-analysis. *The Modern Language Journal*, 104(4), 715-738.
- Wesche, M., & Paribakht, S. (1996). Assessing second language vocabulary knowledge: Depth versus breadth. *Canadian Modern Language Review*, 53(1) 13-40.
- Willingham, D. B., Nissen, M. J., & Bullemer, P. (1989). On the development of procedural knowledge. *Journal of experimental psychology: learning, memory, and cognition*, 15(6), 1047.
- Wray, A. (2002). *Formulaic language and the lexicon*. Cambridge University Press.
- Yanagisawa, A., & Webb, S. (2021). To what extent does the involvement load hypothesis predict incidental L2 vocabulary learning? A meta-analysis. *Language Learning*, 71(2), 487-536.
- Zahar, R., Cobb, T., & Spada, N. (2001). Acquiring vocabulary through reading: Effects of frequency and contextual richness. *The Canadian Modern Language Review* 57(4), 541-572.
- Zareva, A. (2005). Models of lexical knowledge assessment of second language learners of English at higher levels of language proficiency. *System*, 33(4), 547-562.
- Zhang, S., & Zhang, X. (2022). The relationship between vocabulary knowledge and L2 reading/listening comprehension: A meta-analysis. *Language Teaching Research*, 26(4), 696-725.
- Ziegler, J. C., & Goswami, U. (2006). Becoming literate in different languages: Similar problems, different solutions. *Developmental Science*, 9(5), 429-436.
- Ziegler, J. C., Bertrand, D., Tóth, D., Csépe, V., Reis, A., Faísca, L., Saine, N., Lyytinen, H., Vaessen, A., & Blomert, L. (2010). Orthographic depth and its impact on universal ring and predictors of reading: a cross-language investigation. *Psychological Science*, 21(4), 551-559.
<https://doi.org/10.1177/0956797610363406>