Most deaf children (95%) are born to hearing parents (Michael & Karchmer, 2004). These children often do not have access to sign or spoken language, even with hearing aids; children may not get adequate linguistic input (Hall et al., 2019). In such cases, these children (i.e., late signers) acquire sign language late, possibly until they enroll in a deaf school. By contrast, deaf children with deaf parents (i.e., native signers) learn sign language from birth onwards from their deaf parents (e.g., Lillo-Martin & Henner, 2021). Previous studies have shown detrimental effects of late sign language exposure when late signers are compared to native signers on several linguistic capabilities, such as grammatical judgment (Boudreault & Mayberry, 2006), mean length of utterance (Berk et al., 2012; Cheng & Mayberry, 2019), and spatial descriptions (Karadöller et al., 2017, 2021, 2013). Less is known about how late-signing children acquire lexical signs upon their first exposure and whether lexical properties of the signs, such as iconicity, that is, the resemblance between the sign form and what it refers to in the real space (Pernis et al., 2010) and phonological complexity (Ortega & Morgan, 2015), influence this acquisition process. Here, we investigate the lexical development of late-signing children via an intervention study over a mobile-compatible web app that provides a consistent and accessible platform to teach early acquired lexical signs in Turkish Sign Language (Türk İşaret Dili, TİD).

Participants consist of deaf children who acquired sign language late (currently n = 12; Mean Age in months = 83,67; Age Range in months = 54-114). The intervention is carried out via an application developed to teach lexical signs in TİD, consisting of 14 semantic categories (e.g., animals, food, vehicles). For each category, the app has exposure and test modules (see Figure 1 for examples). In the exposure module, children saw a video of a sign and an image corresponding to that sign. In the test module, children saw a video of a sign and two images from the same category, and then, they were expected to choose the correct answer. Videos used in the app were obtained from TİD-CDI (Sümer et al., 2017). At the start of the intervention, children received a general test that measured their baseline accuracy. This task was also repeated at the end of the intervention. Iconicity and phonological complexity ratings of the signs were determined as part of a bigger project launched to create a lexical database for TİD. Iconicity ratings were obtained from hearing Turkish speakers on a 7-point Likert scale based on Caselli et al. (2017). Phonological complexity ratings were calculated following Ortega and Morgan (2015).

Results of the glmer models on the preliminary data based on eleven children showed that children significantly developed in their TİD knowledge after 8-week intervention ($p < .001$). This development is more pronounced for learning signs that are high in iconicity ($p < .001$) and irrespective of the phonological complexity of the signs ($p > .05$).

Summarizing, these results showed that children can develop their TİD vocabulary when they are provided with suitable intervention programs. Moreover, their vocabulary expansion can be facilitated for signs that are high in iconicity. However, the phonological complexity of the signs does not facilitate or hinder this acquisition process. Overall, our findings corroborate evidence for iconicity's effect on language acquisition (Caselli & Pyers, 2017; Ortega & Morgan, 2015; Pernis et al., 2010; Sümer et al., 2017; Thompson et al., 2012) and call for multiple practices to help establish alternative platforms of exposure for late-signing children to facilitate their language acquisition (Hall et al., 2019; Lillo-Martin & Henner, 2021).

Figure 1

Examples from (a) exposure and (b) test modules

a

b
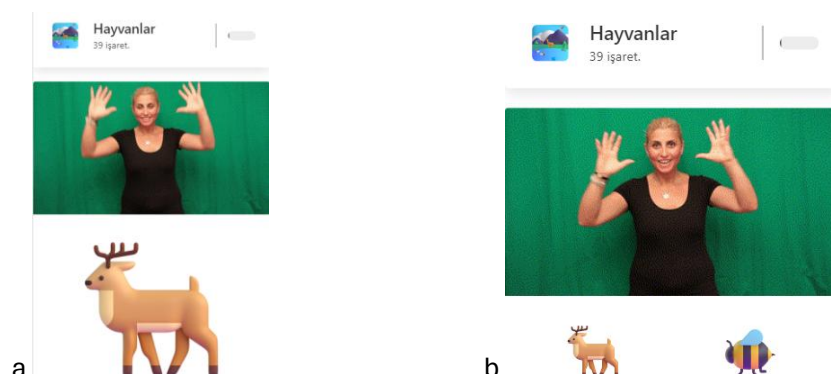
References

Berk, S., & Lillo-Martin, D. (2012). The two-word stage: Motivated by linguistic or cognitive constraints? *Cognitive Psychology, 65*(1), 118-140.

Boudreault, P., & Mayberry, R. I. (2006). Grammatical processing in American Sign Language: Age of first language acquisition effects in relation to syntactic structure. *Language and Cognitive Processes, 21*(5), 608-635.

Caselli, N. K., & Pyers, J. E. (2017). The road to language learning is not entirely iconic: Iconicity, neighborhood density, and frequency facilitate acquisition of sign language. Psychological science, 28(7), 979-987.

Caselli, N., Sevcikova Sehyr, Z., Cohen-Goldberg, A. M., & Emmorey, K. (2017). ASL-LEX: A lexical database of American Sign Language. Behavior Research Methods, 49(2), 784-801. doi:10.3758/s13428-016-0742-0

Cheng, Q., & Mayberry, R. I. (2019). Acquiring a first language in adolescence: the case of basic word order in American Sign Language. *Journal of Child Language, 46*(2), 214-240.

Hall, M. L., Hall, W. C., & Caselli, N. K. (2019). Deaf children need language, not (just) speech. *First Language, 39*(4), 367-395.

Karadöller, D. Z., Sümer, B. & Özyürek, A. (2021). Effects and Non-Effects of Late Language Exposure on Spatial Language Development: Evidence from Deaf Adults and Children. *Language Learning and Development, 17*, 1-25.

Karadöller, D. Z., Sümer, B., & Özyürek, A. (2017). Effects of delayed language exposure on spatial language acquisition by signing children and adults. In G. Gunzelmann, A. Howes, T. Tenbrink, & E. Davelaar (Eds.), *Proceedings of the 39th Annual Conference of the Cognitive Science Society (CogSci 2017)* (pp. 2372-2376). Austin, TX: Cognitive Science Society.

Karadöller, D. Z., Sümer, B., Ünal, E. & Özyürek, A. (2023). Late sign language exposure does not modulate the relation between spatial language and spatial memory in deaf children and adults. *Memory and Cognition, 51*, 582–600.

Lillo-Martin, D., & Henner, J. (2021). Acquisition of sign languages. *Annual Review of Linguistics, 7*, 395-419.

Mitchell, R. E., & Karchmer, M. (2004). Chasing the mythical ten percent: Parental hearing status of deaf and hard of hearing students in the United States. *Sign Language Studies, 4*(2), 12 138-163.

Ortega, G., & Morgan, G. (2015). Phonological development in hearing learners of a sign language: The influence of phonological parameters, sign complexity, and iconicity. *Language Learning, 65*(3), 660-688.

Perniss, P., Thompson, R. L., and Vigliocco, G. (2010). Iconicity as a general property of language: evidence from spoken and signed languages. *Frontiers in Psychology*, 1-15.

Sümer, B., Grabitz, C., & Küntay, A. (2017). Early produced signs are iconic: Evidence from Turkish Sign Language. In the 39th Annual Conference of the Cognitive Science Society (CogSci 2017) (pp. 3273-3278). Cognitive Science Society.

Thompson, R. L., Vinson, D. P., Woll, B., & Vigliocco, G. (2012). The road to language learning is iconic: Evidence from British Sign Language. Psychological Science, 23(12), 1443-1448.