Exploring developmental norms of vowel production in the Gheg dialect of Albanian

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Establishing developmental norms in speech production is essential in assessing impaired speech in children [cf. 8], but best practice guidelines also suggest that these should be language and/or dialect specific [2-9]. This is because norms are not necessarily transferable from one dialect to another, e.g. if they differ in vowel inventory size [1]. This study is a first step towards describing vowel production of typically-developing Gheg-speaking children, for whom no developmental norms have been established yet. Gheg, one of the two main dialects of Albanian, is spoken by 3.5 million people in central and northern Albania, including the capital Tirana, and Kosovo; developmental norms could thus benefit thousands of Gheg-speaking children. This study focuses on two indices often correlated with speech intelligibility and (a)typical development [e.g. 3-5-6-7-11]: a) vowel space area (VSA), and b) formant centralization ratio (FCR), both derived from acoustic characteristics of the corner vowels /i, u, a/.

The subjects were 48 Gheg-speaking children (24F) aged 6 to 8 years old who attended primary schools in the greater Tirana area, 26 of whom were recorded twice (1st and 2nd grades). This age group was prioritized because impaired speech tends to be diagnosed only when Albanian-speaking children enter primary school [10]. Additionally, 28 adults (24F) served as control. All speakers completed a picture-naming task that included words with stressed /i, u, a/, from which the first two formants were measured at the temporal midpoint.

Descriptive results for the VSA and FCR scores (Table 1) will be discussed in relation to norms in other languages. Sex differences in formant values of children's vowels despite minimal anatomical differences [4], the presence of hyper-articulation in children compared to adults (lower FCR and higher VSA), and measurable progression towards adult norms within a year (reduction of VSA) will also be addressed.

References

[1] Al-Tamimi, J., & Ferragne, E. (2005). Does vowel space size depend on language vowel inventories? Evidence from two Arabic dialects and French. *Proceedings of Interspeech 2005*, 2465–2468.
[2] Chung, H., Kong, E. J., Edwards, J., Weismer, G., Fourakis, M., & Hwang, Y. (2012). Cross-linguistic studies of children's and adults' vowel spaces. *Journal of the Acoustical Society of America*, *131*(1), 442–454.
[3] Kent, R. D., & Rountrey, C. (2020). What acoustic studies tell us about vowels in developing and disordered speech. *American Journal of Speech-Language Pathology*, *29*(3), 1749–1778.
[4] Fitch, W. T., & Giedd, J. (1999). Morphology and development of the human vocal tract: A study using magnetic resonance imaging. *Journal of the Acoustical Society of America*, *106*(3), 1511–1522.
[5] Liu, H.-M., Tsao, F.-M., & Kuhl, P. K. (2005). The effect of reduced vowel working space on speech intelligibility in Mandarin-speaking young adults with cerebral palsy. *Journal of the Acoustical Society of America*, *117*(6), 3879–3889.

[6] Pettinato, M., Tuomainen, O., Granlund, S., & Hazan, V. (2016). Vowel space area in later childhood and adolescence: Effects of age, sex and ease of communication. *Journal of Phonetics*, *54*, 1–14.
[7] Sapir, S., Ramig, L. O., Spielman, J. L., & Fox, C. (2010). Formant Centralization Ratio: A Proposal for a new acoustic measure of dysarthric speech. *Journal of Speech, Language, and Hearing Research*, *53*(1), 114–125.
[8] Schölderle, T., Haas, E., & Ziegler, W. (2020). Age norms for auditory-perceptual neurophonetic parameters: A prerequisite for the assessment of childhood dysarthria. *Journal of Speech, Language, and Hearing Research*, *63*(4), 1071–1082.
[9] Storkel, H. L. (2019). Using developmental norms for speech sounds as a means of determining treatment eligibility in schools. *Perspectives of the ASHA Special Interest Groups*, *4*(1), 67–75.
[10] UNICEF. (2018). *We All Matter! Situation Analysis of Children with Disabilities in Albania*. https://www.unicef.org/albania/reports/we-all-matter
[11] Vorperian, H. K., & Kent, R. D. (2007). Vowel acoustic space development in children: A synthesis of acoustic and anatomic data. *Journal of Speech, Language, and Hearing Research*, *50*(6), 1510–1545.

Table 1. Mean and (standard deviation) for vowel space area (VSA) and formant centralization ratio (FCR) scores. Higher VCA indicates expanded vowel space. Higher FCR indicates more centralization.

	cross-generational				longitudinal			
	men	women	boys	girls	boys Yr1	boys Yr2	girls Yr1	girls Yr2
VSA (Hz^2)	203 931 (52 081)	310 443 (74 188)	442 470 (118 245)	580 919 (121 509)	497 414 (76 874)	401 018 (100 376)	609 334 (113 523)	558 978 (141 000)
FCR	1.022 (0.071)	1.000 (0.060)	0.918 (0.059)	0.905 (0.046)	0.900 (0.047)	0.929 (0.060)	0.918 (0.044)	0.916 (0.048)