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Vowel Acquisition in Hungarian: A First Look at Developmental Data

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1. Vowels: The orphans of speech research

Vowel acquisition in children is a poorly researched area of speech development. Studies of phonological acquisition and theories of phonological development assumed that vowels develop early. Until recently, vowels were no more than the "poor relations of consonants" (Ball and Gibbon 2002:xi). Phonological assessments of children with typical and atypical speech development routinely ignored to mention the status of vowel production.

However, recent investigations have revealed that the path from the emergence of quasi-vowels in babbling to more adult-like vowel production capabilities of older children requires an awareness of the underlying vowel system of the target language as well as articulatory learning. While the age at which vowels are fully acquired is unknown, data suggest that the major steps of vowel development occur during the first six years of life.

2. On the necessity of studying vowel development

One serious limitation of prior research is that, while developmental changes in children's vowel perception, discrimination and representation have been given considerable attention in several languages, studies on vowel acquisition have focused almost exclusively on English. Because the vowel systems of diverse languages vary along several dimensions, there is a clear need for investigating vowel development in children from various language communities.

So as to expand our knowledge about normal tendencies in the development of children's speech sound (and specifically vowel) production in general and to contribute to remediation techniques of vowel disorders in children and adults, the careful formulation of a general theory of vowel acquisition appears to be in order. Developing a theory of vowel acquisition should not, however, be viewed merely as an end-product of summarizing our current knowledge of the matter. Rather, this process should, in a step-like fashion, guide us further in exploring issues that explain both the approaches of the individual as well as the general tendencies in the acquisition of any one particular or several vowel systems. In

order to account for distinct patterns that may occur while acquiring all the available (phonologically diverse) vowel systems of the world's languages, a theory that can equally accommodate the different paths that might be taken while developing various vowel systems is required. Such a theory must, unquestionably, be based on cross-linguistic developmental data.

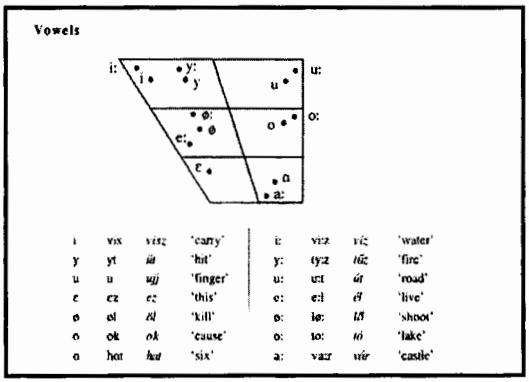
3. The present study

To facilitate the process of generating a wide knowledge base of vowel developmental patterns in languages other than English, this project is aimed at determining developmental tendencies in vowel acquisition in 2 to 4-year-old monolingual children, acquiring the standard dialect of Hungarian as their first language. It is hoped that the results of this inquiry will constitute a much-needed step towards furthering our knowledge in the right direction, so as to contribute to the emergence of a general theory of vowel acquisition, both in children and adults.

3.1. The vowel system of standard Hungarian

The vowel inventory of the standard dialect of Hungarian contains fourteen monophthong vowels that are perceived by native speakers as seven vowel-pairs. The vowels are differentiated along four dimensions: (1) front and back tongue-positions; (2) high, half-closed, half-open or open tongue-height (only the vowel /a:/ belongs to this latter category); (3) rounded or unrounded lip-position; (4) short or long duration.

(1) The vowel system of the standard dialect of Hungarian (Szende, 1999).



3.1.1. Vowel-pairs differentiated primarily by quantitative features

Five of the pairs (the high vowels /i/ - /i:/, /y/ - /y:/ and /u/ - /u:/, and the mid vowels /ø/- /ø:/ and /o/ - /o:/) are differentiated primarily by their duration, being relatively similar in other aspects. The average ratio of short and long vowels is

quite pronounced in the adult language: it has been documented to be around 1:2 in spontaneous speech (e.g. Kassai 1979, Tarnóczy 1974).

3.1.2. Vowel pairs differentiated primarily by qualitative features

The members of the vowel-pairs /ɛ/ - /e:/ and /ɑ/- /a:/ are differentiated primarily by qualitative features though they are both qualitatively and quantitatively different. The vowel /ɛ/ is described as short half-open nonlabial front, whereas the vowel /e:/ is a long half-closed nonlabial front vowel. The /ɑ/ sound is a low back vowel, whereas the central vowel /a:/ is the only vowel produced with the lowest jaw-position. The /ɑ/ - /a:/ pair also differs in the lip-position required during their production: while the former is slightly labial, the latter is nonlabial.

3.2. Research methods

Speech data were gathered from 3 age groups of children, at the ages of 2;0, 3;0 and 4;0, years. At the time of testing, subjects were within a 15-day interval of their designated age. Each group included 8 subjects of each gender to allow for cross-gender comparison, accounting for 48 child participant.

Children and their parent(s) were recorded in two 30-45 minute sessions (both sessions were divided into two sub-sessions) occurring within a 14-day time frame. Participants were given 28 puppets (7 at each sub-session) with pre-assigned $C_1V_1(:)C_1V_1(:)$ structured names. To allow for examination of the effects of consonantal environment, all 14 Hungarian vowels were included in two tokens, each one with a different consonant. Target tokens are listed in (2).

(2) Target tokens

Session 1A *Nonsense tokens*	Session 1B *Meaningful words*	Session 2A *Nonsense tokens*	Session 2B *Meaningful words*
/gɑgɑ/	/bɑbɑ/	/kɑ:kɑ:/	/pɑ:pɑ:/
/bɛbɛ/	/pɛpɛ/	/de:de:/	/le:le:/
/titi/	/pipi/	/mi:mi:/	/pi:pi:/
/toto/	/lolo/	/no:no:/	/lo:lo:/
/pøpø/	/gøgø/	/bø:bø:/	/kø:kø:/
/dudu/	/bubu/	/tu:tu:/	/pu:pu:/
/mymy/	/nymy/	/ly:ly:/	/my:my:/

Parents were asked to involve the child in a free-play situation while modeling and thereby "teaching" the child the puppet names. Elicitation strategies were oriented to imitated and spontaneous naming. Children were expected to readily learn the puppet names and produce them, not only in immediately imitated forms but also by deferred imitation (that is, in spontaneous speech.) Parents were asked to provide the child with as many occasions as possible to produce the required tokens. Caregivers were instructed to make every attempt to have their child produce each token at least five times, if at all possible.

Both sessions were divided into two sub-sessions with a break between them. An attempt was made to generate tokens that contain early acquired speech sounds, in order to keep the task relatively easy even for the youngest children. Meaningful tokens were both disyllabic words and one-syllable morphemes in a reduplicated format.

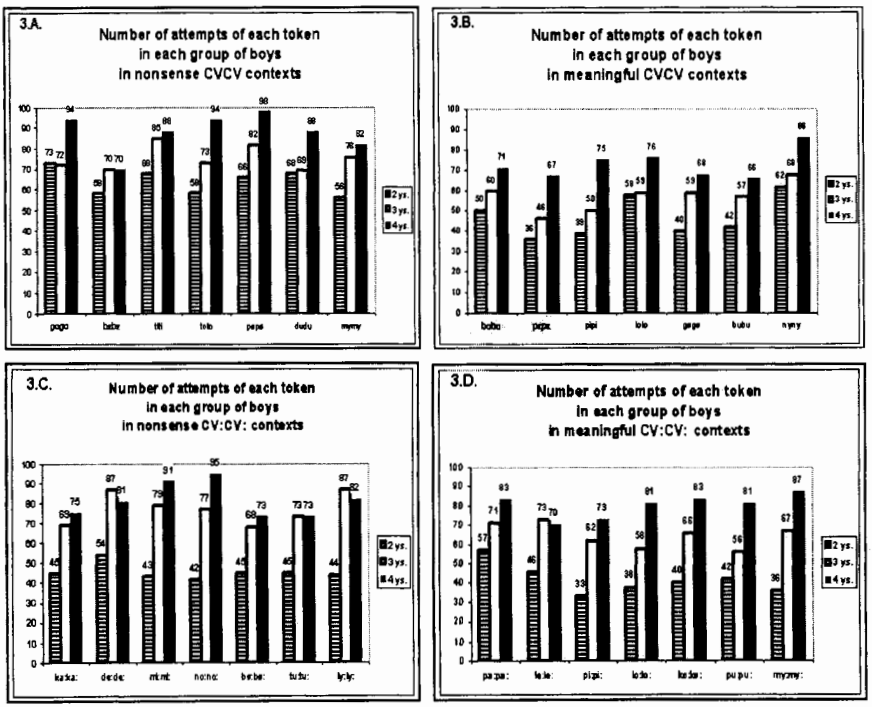
A monolingual native Hungarian speaker analyzed the tokens perceptually. Correct production of a disyllable represented an utterance in which both vowels were perceived to be identical to those in the target token; no consideration was given to consonants. It is argued that acceptable production of both vowels (the first in stressed and the second in unstressed position) is a good indicator of the acquisition of a particular vowel.

3.3 Results

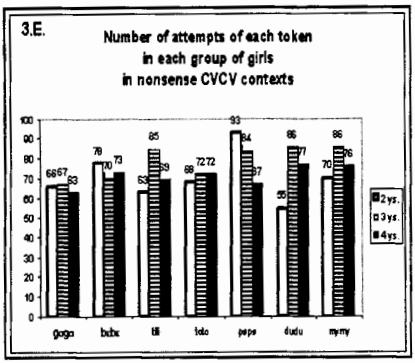
3.3.1. Number of attempts

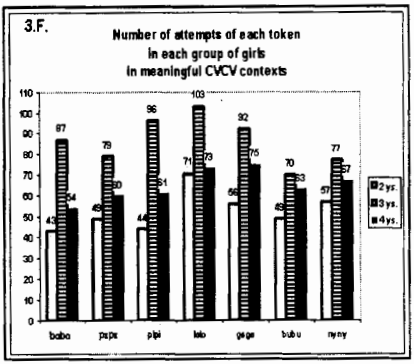
The data reflect several tendencies of speech development. As expected, in general the youngest children attempted to produce the targeted tokens the least times.

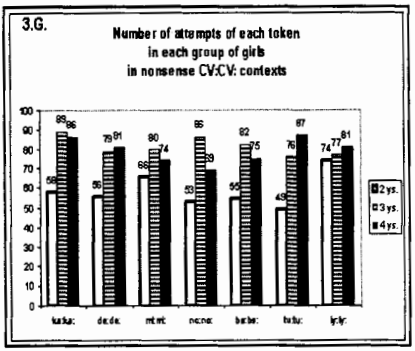
(3a-d) Data for boys displayed by vowel duration and nonsense vs. meaningful targets

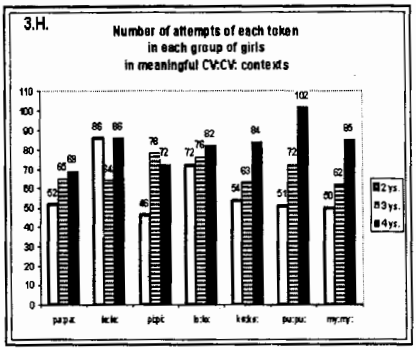


(3e-h) Data for girls displayed by vowel duration and nonsense vs. meaningful targets









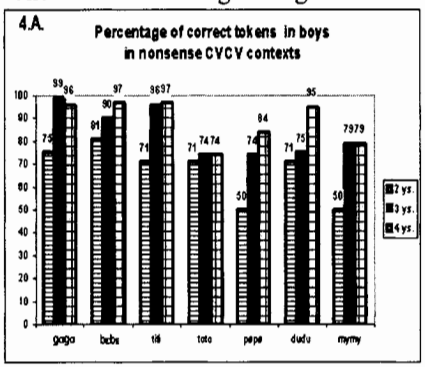
Specifically, there appears to be a major difference in the number of times targets with short vs. long vowels were attempted. While disyllables with short vowels were produced more frequently, puppet names containing long vowels were uttered less. This pattern of "selective production" is well documented in the literature (e.g. Stoel-Gammon and Cooper 1984, Vihman 1976). Ferguson and Farewell (1975) refer to this strategy as "great selectivity ... in picking the words [a child] attempts to say" (p. 433). That is, some children only attempt to replicate sound sequences with those speech sounds that they perceive to be part of their own sound repertory. In other words, sounds that are not yet acquired are less likely to be attempted. This acquisition pattern appears to be strongly present in children at 2;0 years; to a lesser extent, it also operates in 3;0 years old children. By the age of four, it seems that the avoidance of producing tokens with long vowels disappears. This developmental pattern probably reflects a maturation process of the speech mechanism that (due to physiological, neurological and speech motor development) becomes increasingly suitable for producing vowels with longer duration. Thus one conclusion that we may draw from the results is

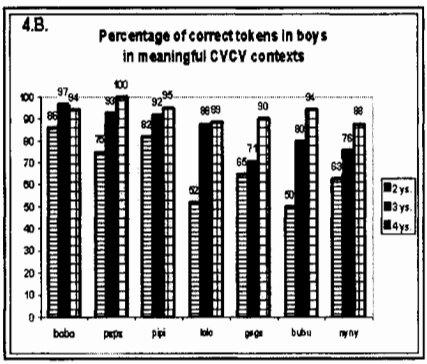
that, in the early stages of speech development, the production of long vowels appears to be more challenging than that of the short ones. However, by the age of 4;0 years, children's production level of the two vowel sets appears to be comparable. An avoidance pattern may also provide an explanation for the lower number of attempts at producing tokens with some of the rounded vowels. Further analysis will provide an answer in this respect.

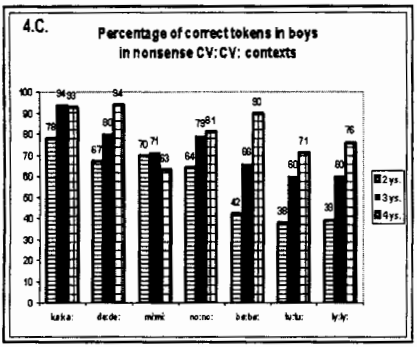
Another tendency in the results is the difference between boys and girls in willingness to produce the target forms. This phenomenon is also strongest at the age of 2;0 years. In general, girls' production data reflect a more developed skill level of vowel production at 2;0 years of age. It is more difficult to formulate a judgment about production level differences at 3;0 years of age on the basis of our data set since the group of 3;0 year-old girls did an outstanding job, as reflected by the high number of attempts through all conditions. Therefore, this question will be revisited at a later point during data analysis. At the age of 4;0 years, however, no major difference between the two genders is reflected by the results. Consequently, if boys appeared to have lower skills at vowel production at the age of 2;0 years as measured by the number of attempted targets, it appears that this gender difference disappears by the age of 4;0 years.

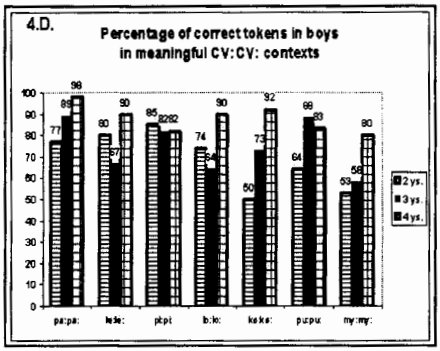
3.3.2 Percentage correct values

(4a-d) Percentage of correct tokens in boys displayed by vowel duration and nonsense vs. meaningful targets

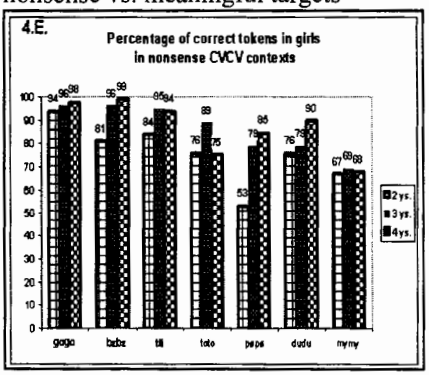


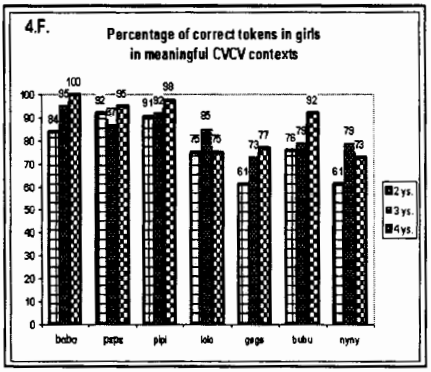


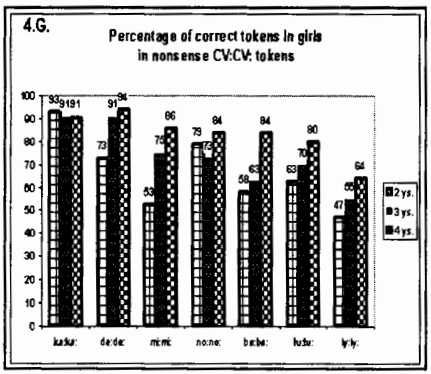


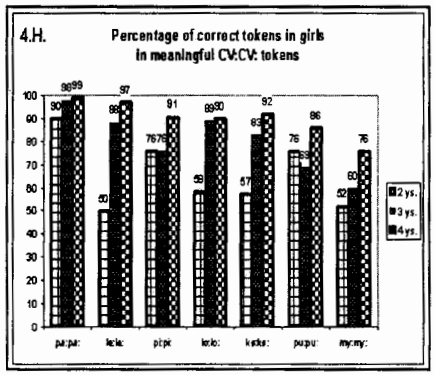


(4e-h) Percentage of correct tokens in girls displayed by vowel duration and nonsense vs. meaningful targets





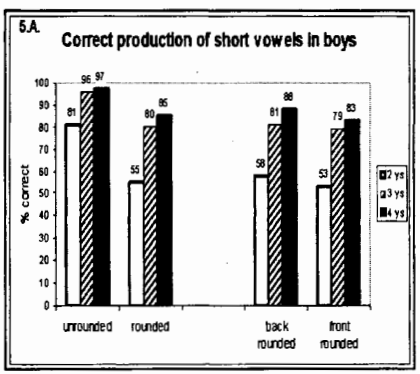


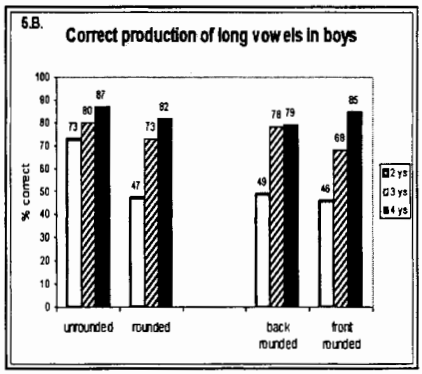


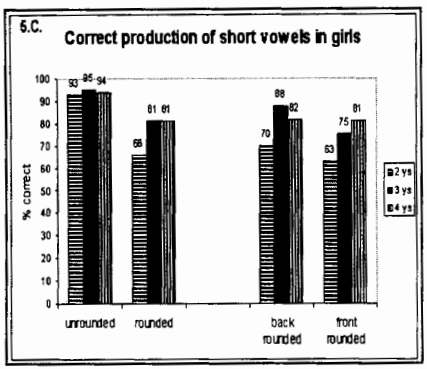
Data displayed in (4) suggest two main tendencies in children's speech development. The first one is that the effect of the sound environment (e.g. consonantal context) is a major determinant of young children's success at reproducing target tokens with the appropriate quality of vowels. For example, the vowel */e:/* (usually acquired later during speech development) has a 50 % success rate in 2;0 year-old girls if surrounded by the voiced lateral approximant */l/* (also a later acquired speech sound); however, with the voiced alveolar stop */d/* (an early acquired speech sound), the same group of girls manages to produce correct vowels in 73 % of productions. In some cases, it is more challenging to reason about the source of difficulty a child experiences due to the effect of consonantal environment on vowels. Even though similar tendencies of consonantal effect on the success rate of vowel production are mirrored in 2;0 years old boys' data, (e.g. the target */tu:tu:/* is successfully produced only 38% of the time; however, the target */pu:pu:/* has a higher success rate of 64%), it is difficult to explain this difference by acquisition order factors. One interpretation of the data is that a higher level of exposure and practice with the latter, meaningful word may result in a higher success rate in vowel production. Alternatively, ease of articulation between a labial stop and a rounded vowel may also be a factor in the higher success rate of */pu:pu:/*. Consonantal effect on vowel production also appears to operate, at a lesser extent, in 3;0 and 4;0 year olds. In short, children's production of vowels is heavily affected by the sound environment in which the vowels are embedded.

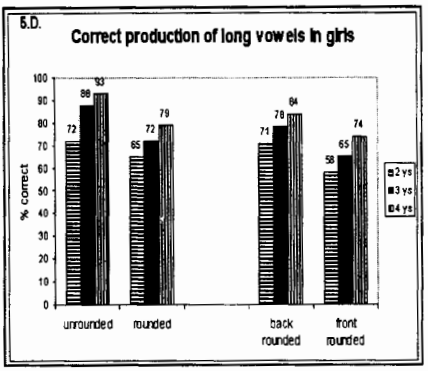
The second main tendency these data suggest is children's difficulty with the production of rounded vowels. Low success rates of rounded vowel production in both genders indicate that lip rounding activity is a major challenge to overcome during vowel acquisition. Re-grouping the data in (5) clarifies the tendency.

(5) Percentage correct values of vowel production in both genders (rounded vs. unrounded; division of rounded into back vs. front rounded sets)









The production of rounding appears to be hardest for boys at 2;0 years, especially in long (as opposed to short) vowels. One interpretation of this finding is that the motor challenges of lip rounding are enhanced by the difficulties of producing a long vowel. These processes, when faced with simultaneously, result in low levels of vowel accuracy, especially in the youngest children.

Difficulties with producing an appropriate level of rounding[1] appear to be substantial in the older age groups as well. In both genders, production accuracy of rounded vowels lags behind that of the unrounded ones. While girls at 2;0 years of age are somewhat more successful with formulating rounded vowels than their male peers, at the age of 3;0 years both genders experience similar difficulties with these sounds. At the age of 4;0 years, both genders' success levels in rounded vowel production are very similar and accuracy is comparable in short and long vowels (another indication of the similar levels of acquisition in short and long vowels).

A further division of the rounded vowels according to tongue position aids a deeper understanding of the matter. The data suggest that the production of front rounded vowels is more demanding for both genders in both vowel sets than that of the back ones. It is to be noted that, in adult speech, the front rounded /y/ and /y:/ sounds seem to require the most exaggerated lip protrusion that may correspond to the most sophisticated skill level of lip posture control. The front vowels /ø/ and /ø:/ and the back vowels /u/ and /u:/ also require a considerable level of lip rounding. Among the rounded vowels, /o/ and /o:/ are the least rounded[2]. Accordingly, in children it is the front vowels that should develop at a slower pace as compared to the back ones, due to a supposedly higher level of skill needed for their production. Overall, while the production of all rounded

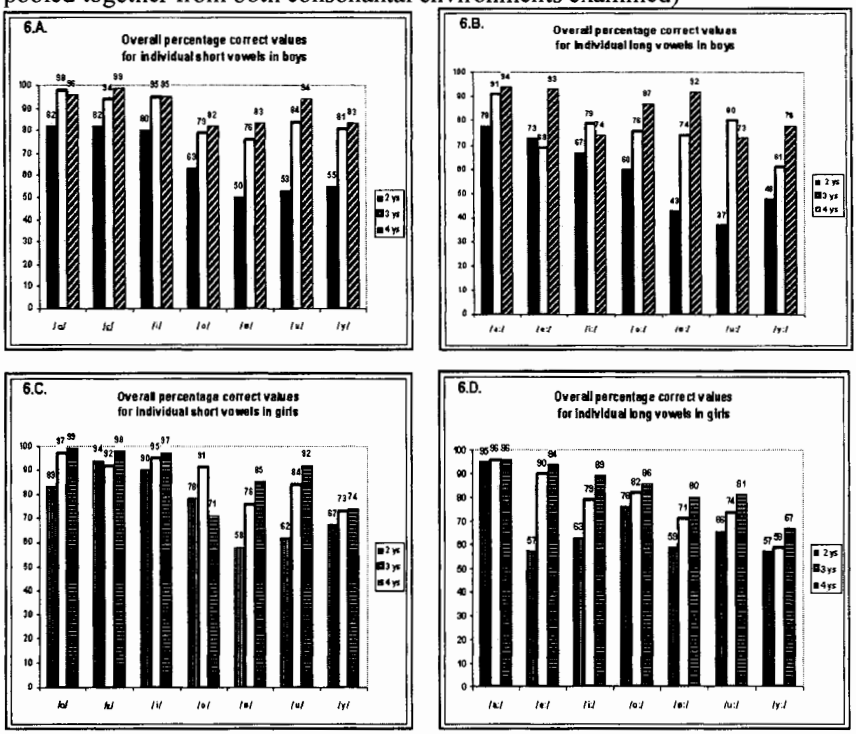
[1] To date, no study has documented the motor development of lip-rounding in children. In adult Hungarian, rounded vowels are "more rounded" than their English counterparts (Szabados 1990).

[2] Even though the vowel /ɑ/ is SLIGHTLY rounded, it frequently lacks rounding in running speech. Therefore, the calculations in this study included it as a non-rounded vowel.

vowels appears to test the motor abilities of children, it is the production of front rounded vowels that proves most challenging.

To develop a general understanding of vowel production development in Hungarian, it is interesting to examine the data set by pooling percentage correct values of individual vowels across different consonantal environments to generate an overall picture of vowel acquisition processes. Of course, the validity of these measures is limited, due to the effect of different consonantal environments on vowel production success. Keeping in mind the limitations of this interpretation, some general tendencies of vowel development may emerge through these calculations (see (6) below).

(6) Overall percentage correct values of vowel production (percent correct values pooled together from both consonantal environments examined)



To aid the interpretation of the data, three (somewhat arbitrary) categories of vowel acquisition level were selected: (1) a vowel that is perceived correct in 65% of the cases or less is in the "*emerging*" stage of acquisition; (2) a vowel that is identified correct in 66 to 89 % of the time is a *"established"* one; (3) a vowel that is identified correct 90 % or more of the time is *"mastered"*. Values in (7) on the next page are rounded to the closest whole number.

(7) Categories of vowel production displayed by vowel duration

7.A. BOYS, Short vowels

	% correct	2 ys.	% correct	3 ys.	% correct	4 ys.
a	82	ESTABLISHED	98	MASTERED	96	MASTERED
ɛ	82	ESTABLISHED	94	MASTERED	99	MASTERED
i	80	ESTABLISHED	95	MASTERED	95	MASTERED
o	63	EMERGING	78	ESTABLISHED	82	ESTABLISHED
ø	50	EMERGING	76	ESTABLISHED	82	ESTABLISHED
u	53	EMERGING	84	ESTABLISHED	94	MASTERED
y	55	EMERGING	81	ESTABLISHED	83	ESTABLISHED

7.B. BOYS, Long vowels

	% correct	2 ys.	% correct	3 ys.	% correct	4 ys.
a:	78	ESTABLISHED	91	MASTERED	95	MASTERED
e:	73	ESTABLISHED	69	ESTABLISHED	92	MASTERED
i:	67	ESTABLISHED	79	ESTABLISHED	74	ESTABLISHED
o:	60	EMERGING	76	ESTABLISHED	83	ESTABLISHED
ø:	43	EMERGING	74	ESTABLISHED	92	MASTERED
u:	37	EMERGING	80	ESTABLISHED	73	ESTABLISHED
y:	48	EMERGING	61	EMERGING	78	ESTABLISHED

7.C. GIRLS, Short vowels

	% correct	2 ys.	% correct	3 ys.	% correct	4 ys.
a	84	ESTABLISHED	97	MASTERED	99	MASTERED
ɛ	94	MASTERED	92	MASTERED	98	MASTERED
i	90	MASTERED	95	MASTERED	97	MASTERED
o	78	ESTABLISHED	91	MASTERED	71	ESTABLISHED
ø	58	EMERGING	76	ESTABLISHED	85	ESTABLISHED
u	62	EMERGING	84	ESTABLISHED	92	MASTERED
y	67	ESTABLISHED	73	ESTABLISHED	74	ESTABLISHED

7.D. GIRLS, Long vowels

	% correct	2 ys.	% correct	3 ys.	% correct	4 ys.
a:	95	MASTERED	96	MASTERED	96	MASTERED
e:	57	EMERGING	90	MASTERED	94	MASTERED
i:	63	EMERGING	79	ESTABLISHED	89	ESTABLISHED
o:	76	ESTABLISHED	82	ESTABLISHED	86	ESTABLISHED
ø:	59	EMERGING	71	ESTABLISHED	80	ESTABLISHED
u:	66	EMERGING	74	ESTABLISHED	81	ESTABLISHED
y:	57	EMERGING	59	EMERGING	67	EMERGING

One tendency that is easy to detect is that, in general, boys at the age of 2;0 and 3;0 years are less skilled at vowel production than girls. Girls have already mastered two short and one long vowels at the age of 2;0 whereas boys at this age have not mastered any vowels yet. Rounded vowels are still at the lowest level of acquisition in boys at the age of 2;0; girls already have one vowel pair, /o/ and /o:/, that is well established at this age. At the age of 3;0, level of mastery is still higher in girls, with four short and two long vowels mastered. Boys at the age of 3;0 have the three front unrounded short vowels and a long one acquired. However, at the age of 4;0 vowel production success in the short vowels are identical for the two genders; in terms of vowel acquisition in the long vowels, boys are more skilled than girls. So, by the age of 4;0, the boys who lagged behind during the previous years appear to catch up.

4. Summary

Results suggest that, in general, as it is reflected by data from 2;0, 3;0 and 4;0-year-old children,

- Long vowels are produced with less accuracy than short ones;
- Rounded vowels are produced with less accuracy than unrounded ones;
- At the age of 2;0 years, consonantal environment has a strong effect on vowel accuracy but this effect decreases with development;
- Girls' vowel accuracy is higher than boys' at 2;0 and 3;0 years of age;
- Boys' and girls' vowel accuracy is similar at the age of 4;0 years;
- Mastery of vowels is not complete in either gender at the age of 4;0 years.

Acknowledgements

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