VARIABILITY AND CONSISTENCY IN THE SPEECH OF TYPICALLY DEVELOPING MONOLINGUAL SLOVAK CHILDREN AGED 5;07 TO 6;00 YEARS

doc. PhDr. Dana Buntová, Ph.D.[1]
doc. PaedDr. Jana Marková, Ph.D.[1]
PhDr. Zuzana Oravkinová, Ph.D.[1]

Dana Buntová

Jana Marková

Zuzana Oravkinová

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Abstract

Variable speech in children is considered a natural physiological phenomenon. This variability typically decreases as development progresses, leading to more consistent speech. If pathological phonological processes accompany variable production, inconsistent production can be a predictor of dyslexia. Analyzing the development of natural physiological variability and consistency is crucial for diagnosing speech inconsistency. The study aims to describe the performance of Slovak unimpaired monolingual children with appropriate speech intelligibility, aged between 5;07 to 6;00 years, regarding the consistency and variability of speech. In a study of 89 typically developing Slovak children aged 5;07 to 6;00 years, 75% exhibited consistent speech. The remaining 25% showed variability ranging from 3% to 17%. Consonant substitutions fell within natural physiological phonological processes. The findings suggest natural physiological variability can occur in children within this age range. Neither gender nor place of residence (rural/urban) significantly influenced speech variability and consistency. These data may inform diagnostic criteria.

Keywords

variability and consistency of speech, speech development, diagnostics

Introduction

According to Macrae et al. (2014), *Speech Variability* is an umbrella term encompassing *different implementations of a single target word or utterance in repeated production* [word variability]. According to other authors (Holm et al., 2005), speech variability is a sign of natural physiological development. Many authors (Holm et al., 2007; Macrae et al., 2014; Sosa, 2015; Bónová, 2018) point to the decrease in variable speech as children age, stating that the children's speech becomes *consistent i.e. repeated productions of the target word are the same. Albeit consistent, speech at the time of the phonetic-phonological development may not always be correct, and natural substitutions of sounds may appear in speech, always implemented in the same and consistent way.*

Many factors influence the decline in Variable Production and the onset of consistent speech. According to Holm et al. (2007), these are:

- phonetic factors such as phonetic context, the position of the sound in the word;
- maturation of motor coordination of articulatory organs;
- pragmatic context, if, say, the child has few opportunities for feedback on his production;
- the age and gender of the child. Younger children have a higher level of variability than older children, girls have more consistent production than boys.

If we look at the process of acquiring the phonetics and phonology from the point of view of the speech chain described by Stackhouse and Wells (1993), we can assume other factors affecting the consistency/variability of speech. If the child is learning a new word, s/he must listen to it in order to be able to memorize the phonological pattern of the word. Iuzzini-Seigel et al. (2017) draw attention to the fact that children can have different levels of *attention*, which is needed to perceive speech patterns. In the phase of listening and memorizing the phonological pattern of a word, the child's *phonological discrimination ability* developmental stage is significant. The child listens to the word, and at the same time the process of memorizing the phonological structure takes place,

[1] doc. PhDr. Dana Buntová, Ph.D., doc. PaedDr. Jana Marková, Ph.D., PhDr. Zuzana Oravkinová, Ph.D., Department of Speech and Language Therapy, Faculty of Education, Comenius University in Bratislava, Račianska 59, 813 34 Bratislava, Slovak Republic. E-mail: buntovadana@gmail.com.

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influenced by the *child's verbal-acoustic working memory capacity and the child's memory capabilities*. The more often the target word occurs in the child's speech environment the more it helps the child to better 'hear/listen and remember' the word, thus leading to more accurate, consistent word production (Ellis, 2002; Sosa and Stoel-Gammon, 2012). Studies by various authors (Davis and Velleman, 2000; Sosa, and Stoel-Gammon, 2006; 2012; Macrae et al., 2014; Brišáková, 2020) have confirmed the positive effect of a larger *vocabulary* on a lower incidence of variability in the child's speech. According to Barry et al. (2006), the *age of acquisition* of words also affects the level of variable production. According to the authors (ibid.) words acquired at an earlier age are produced more accurately. Macrae et al. (2014) explain the phenomenon that early-acquired words are produced by children more often than late-acquired words, which causes earlier-acquired words to have more stable representations. Conversely, Sosa and Stoel-Gammon (2012) argue that later-acquired words are more accurate, as the child uses a more mature phonological system during their acquisition. In our opinion, both findings may impact the level of variable production. It has been reported that gender may influence lower performance variability in girls compared to boys between the ages of three and five (Lewis, 1990; Holm et al., 2007). This difference was not confirmed by Brišáková (2020), researching Slovak children. To refer to the variable production that occurs during natural physiological development, Brišáková (2020) recommends using the terms '*physiological variability of speech*' or '*developmental variability of speech*'.

If variable production in a child after the age of three exceeds 40%, then according to Dodd et al. (2000) this may indicate pathological development. According to other authors (Broomfield and Dodd, 2005; Brišáková, 2020), it is more appropriate to use the term Inconsistent Speech (IS) to refer to pathology. Holm et al. (2007) characterized *inconsistent speech as a high percentage of different productions in the repeated production of words with a high number of different phonological errors that are not definable by natural physiological phonological processes.* Inconsistent speech is typical for children with Inconsistent Phonological Disorder (IPD) (Broomfield and Dodd, 2005; Holm et al., 1999; Flanagan and Eecen, 2018) and Childhood Apraxia of Speech (CAS) (Iuzzini-Seigel et al., 2017; Murray et al., 2015). A qualitative description of inconsistency in relation to CAS was described in more detail by Buntová (2021) and Červenková (2022). Diagnosis of speech inconsistency is an essential diagnostic criterion for diagnosing an inconsistent phonological disorder (Broomfield and Dodd, 2005; Holm et al., 1999; Flanagan and Eecen, 2018), which can be a predictor of dyslexia. Inconsistency of speech is also one of the important diagnostic signs of CAS (Shriberg et al., 2012). It is therefore important to know the natural physiological development of speech variability in children, as a starting point for the diagnosis of IPD and CAS. The first reports on the developmental 'waning' of natural physiological variability from speech and the onset of consistency in Slovak children were described by Bónová (2018) and Brišáková (2020; 2023). They mapped the development of natural physiological variable production in children up to the age of four. There is no description in the Slovak literature on the development of speech consistency and natural physiological variability of speech in children from 4 years of age until the end of the phonetic and phonological development.

The aim of the study is to describe the performance of Slovak monolingual, typically developing children, with age-appropriate speech intelligibility, aged 5;07 [five years and seven months] to 6;00 years, in terms of consistency and variability of speech. *We set out these research questions:*

1. What is the percentage of consistent speech and variable speech in a speech sample of typically developing monolingual Slovak children with age-appropriate speech intelligibility at age 5;07 to 6;00 years?
2. What are the qualitative manifestations of variable speech in the speech sample of the children monitored?
3. Does the attained phonetic-phonological level of development measured by the Percent Consonants Correct (PCC), Percent Vowels Correct (PVC) and Percent Phonemes Correct (PPC) affect the variability of speech and the consistency of speech in the children monitored?
4. Does gender and domicile affect the variability and consistency of speech in the children monitored?

We have established the following null hypotheses for the research questions:

- H1: We assume that the level of development of the phonetic-phonological level measured by the Percent Consonants Correct, Percent Vowels Correct, and the Percent Phonemes Correct will not be statistically significantly correlated with the percentage of consistent speech.
- H2: We assume that there will be no significant differences between the performances of boys and girls in the Percent Variable Speech.
- H3: We assume that there will be no significant differences between the performance of rural and urban children in the Percent Variable Speech.
- H4: We assume that there will be no significant differences between the performances of boys and girls in the percentage of consistent production.
- H5: We assume that there will be no significant differences between the performance of rural and urban children in the percentage of consistent production.

Research methodology

A speech sample to assess the variability of speech was obtained as part of the testing of children under the VEGA 1/0263/22 project. The parent signed off informed consent to participate in the research for each child tested. The ethics of the research was endorsed by the committee of the Faculty of Education of Comenius University in Bratislava.

The sample to research the variability and consistency of speech in children aged 5;07 to 6;00 years comprised 105 monolingual Slovak children aged 5;07 to 6;00. The heterogeneity of the sample was ensured by an equal representation of boys and girls and an equal representation of children from urban and rural domiciles. The children came from eastern, central and western Slovakia. The selection of children was random, from ordinary urban and rural kindergartens.

Course of testing and diagnostic methods

Testing was provided by trained speech therapy students or by speech therapists. All children in the sample were examined for speech intelligibility, personal and family history, and were examined by the ARTES articulation test and the variable speech subtest.

To assess speech intelligibility, the parent completed the Intelligibility in Context Scale (ICS): Slovak (McLeod et al., 2013).

The parent assessed the child's speech intelligibility with seven different communication partners on a five-point scale. From the total score obtained (maximum 35 points), an average score was calculated for each child (maximum 5 and minimum 0 points). The average score for each child was assessed according to normative data from Tužinská's diploma thesis (2023). A child with an average ICS score of 4.57 or less was excluded from the research sample due to reduced speech intelligibility in relation to age. Reduced speech intelligibility signalled atypical phonetic-phonological development.

The parent of each child filled out an anamnestic questionnaire [prior circumstances]. The questionnaire investigated the presence of bilingual upbringing, the child's health drawbacks, the child's care in a professional outpatient clinic, the child's family and personal history in relation to speech-production issues, as per Buntová (2021). Based on information from the anamnestic questionnaire, children with untoward personal and family history were excluded from the sample.

The ARTES test was developed under the VEGA 1/0263/22 research project. The validity and reliability of the test, and the interreliability of transcriptions of the speech sample from testing were verified by Buntová et al. (2024). The test is designed to assess the phonetic repertoire of Slovak monolingual children aged 4 to 6 years. The results of the test are indicators of phonetic development (Percent Consonants Correct – PCC and Percent Vowels Correct – PVC) and phonological development (Percent Phonemes Correct – PPC). The test contains 86 elicitations words that track the production of each consonant and vowel at the word level. Each elicitation word has a coloured illustration, presented in a PowerPoint presentation. The child names the pictures in just one word after being shown the picture and asked the elicitation question (for example: "What is it?" "What is it doing?"). Each speech sample from the test was recorded by Dictaphone, and the audio recording transcribed onto a diagnostic sheet, with a simple orthographical [spelling] transcription. Each child's test result was checked by a member of the research team. From the speech sample obtained from the articulation test, indicators of phonetic development, PCC, PVC and phonological development, PPC were calculated. A consonant that was supposed to be in the target word which the child produced in accordance with the orthoepic norm was counted as a correctly pronounced consonant. Any omitted consonant, replaced consonant and/or distorted consonant were not counted. Each vowel was judged in the same way. Any phoneme produced by the child in accordance with the target word was considered to be a correctly realized phoneme, and distorted phonemes were also considered to be correct phonemes. The Percent Consonants Correct, vowels and realized phonemes was calculated with reference to the number of target phonemes of the produced words according to the procedure of Nádvorníková (in Buntová, 2021).

The ARTES test includes a subtest for assessing speech variability. It was created based on the inconsistency subtest from the test of Dodd et al. (2000). The choice of test items, syllabic and phonetic structure copied to some extent the items from the Dodd et al. (2000) test. The Slovak subtest contains 5 more words (30 terms) than the English subtest, which increases the level of reliability of testing. In both tests (English and Slovak) one- to four-syllable words were used. There are more two-syllable words in the Slovak test (16) than in the English version (4). There are also more three- and four-syllable words (12) than in the English version (9). The English version has more monosyllabic words (12), the Slovak version has only 2. In the Slovak version of the test, we chose polysyllabic words due to the linguistic nature of both languages[2] and due to the conclusions of Brišáková's (2020) research. She recommended the use of multisyllabic words with a more demanding syllable structure for a more reliable measurement of variable production in Slovak children. The syllabic structure of Slovak items copied the occurrence of syllabic structures in the Slovak language. The English syllabic structure copied the characteristics of the English language and the following structures were used: CCV, CVCC, CCVC. These are rare in the Slovak language, so they were not used in the Slovak version. The resulting Slovak subtest contains 30 concepts, 2 four-syllable words composed of open syllables (CV), 10 three-syllable words composed of open and closed syllables (CV, CVC), 16 two-syllable words with a consonant group on the syllable boundary (for example: CVCCV), 2 monosyllabic words.

[2] There is a higher frequency of monosyllabic words in English than in Slovak.

The words were elicited by the speech therapist three times: at the beginning of the ARTES test, during the course of the ARTES test and after the end of the ARTES test. The child was presented with a picture of each concept and an elicitation question. The child named the picture in one word. The production of each word was recorded on a Dictaphone and transcribed by a simple phonetic transcription into a record sheet. After the third administration of the variable speech subtest, each subtest item was evaluated. Consistent or variable production was evaluated. We chose the same scoring of variable and consistent production as in the Dodd et al. (2000) test. If a child produced the target item three times and always phonemically the same, s/he received 0 points for the item, the production was consistent. Consistent production could be consistent and right, but also consistent and wrong. Consistent correct production meant all three words for the picture were without substitutions and omissions of speech sounds. For example: "žirafa, žirafa, žirafa" [giraffe]. Consistent incorrect production meant the child had produced the target word with substitution or omission of speech sounds, but always in the same consistency. For example: "žilafa, žilafa, žilafa". If the child made one, two or all three of the three productions of the target word differently, s/he was awarded one point for the item. The item showed variable production. For example: "žirafa, žijafa, žirafa" – one variable production is present – we awarded one point. We also awarded one point for three different productions: "žirafa, žijafa, žilafa". Dodd et al. (2000) recommend when looking for children with inconsistent production (pathological development) not to score as inconsistency any developmental substitutions that are due to natural physiological phonological processes. In our mapping of normal variable production in typically developing Slovak children, we counted as normal variable productions any variable production with natural physiological substitutions (phonological processes). For example: "žirafa, žilafa, žilafa", when the child was already in the process of stabilizing the correct pronunciation of the sound [r], but the natural physiological phonological process of alveolar [r]-[l] substitution was still occurring. A child could score a maximum of 30 points in the test (if each item in the test would be produced variably), a minimum of 0 points (no item would be produced variably). From the number of points obtained, the Percent Variable

Speech (PVS) was calculated according to the formula: (number of PVS points ÷ 30) x 100 = PVS. Subtracting PVS from 100, we calculated the Percent Consistent Speech for each child (PCS). For example, if a child produced variable 3 items out of 30, the calculation was as follows: (3 ÷ 30) x 100 = 10. The child had variable production at 10% and consistent production was at 90%.

After testing all the children, we included in the group of typically developing children those children who met the criteria:

- Slovak-speaking monolingual child;
- a child with age-appropriate speech intelligibility as measured by the ICS scale.

Children excluded from the sample were those:

- with untoward personal and/or family history in relation to disturbance of speech;
- with disabilities, or children in the care of a psychologist, psychiatrist, neurologist.

Quantitative data (PCS, PVS, PCC, PVC, PPC) from monolingual children with typical development were processed by the statistical program Jamovi. Percentile values were calculated from the percentage of consistent speech and the Percent Variable Speech. The correlation coefficient monitored the correlation between Percent Variable Speech (PVS)/ Percent Consistent Speech (PCS) and phonetic indicators of development (PCC, PVC) and the phonological indicator of development (PPC). Variable speech was evaluated qualitatively, by identifying phonological processes:

Research findings

Out of the 105 children examined, 89 children were selected who met the criteria for inclusion in the group of typically developing children while 14 children were excluded from the research sample due to the identification of Speech Sound Disorders (SSD). These were children who had reduced speech intelligibility assessed by the ICS scale and their average score was below the critical threshold of 4.57. Three children with an average score on the ICS scale at 4.0; 4.0 and 4.14 were left in the normative sample, as their Percent Consonants Correct (PCC), Percent Vowels Correct (PVC) and Percent Phonemes Correct (PPC) were at the maximum level – i.e. 100% and the Percent Variable Speech (PVS) was 0%.

The youngest child in the sample was 67 months old, the oldest was 72 months old, the average age was 69.2 months, the most common age was 69 months. There were 44 children from western Slovakia, 23 from central Slovakia and 22 from eastern Slovakia. Furthermore, 45 children lived in towns and 44 children lived in villages. Of the total number, 40 were boys and 49 girls.

Quantitative data were processed by descriptive statistics. Table 1 shows the minimum, maximum, average, most frequently occurring values of PCC, PVC, PPC, and PVS, PCS and Shapiro-Wilk test values from data distribution normality testing. All the data had an uneven distribution. For further processing, we used non-parametric tests: Spearman's correlation coefficient and the Mann-Whitney test.

	PCC	PVC	PPC	PVS	PCS
N	89	89	89	89	89
Mean	97.3	99.8	98.7	3.37	96.4
Median	98.6	100	99.2	0.00	100
Mode	100	100	100	0.00	100
Standard deviation	3.08	1.04	1.57	4.75	5.36
Minimum	87.2	90.8	93.6	0.00	83.37
Maximum	100	100	100	16.7	100
Shapiro-Wilk W	0.835	0.185	0.794	0.726	0.694
Shapiro-Wilk p	<.001	<.001	<.001	<.001	<.001

Table 1: ***Descriptive performance statistics***

1. *What is the percentage of consistent speech and variable speech in a speech sample of typically developing monolingual Slovak children with age-appropriate speech intelligibility at age 5;07 to 6;00 years?*

From the data obtained from the evaluation of the Percent Variable Speech (PVS) and the Percent Consistent Speech (PCS), we determined the percentile performances, which are in Table 2.

Percentile	PVS	PCS	PPC	PCC
5th percentile	0.00	83.3	95.3	90.6
25th percentile	0.00	96.7	97.8	95.9
40th percentile	0.00	96.7	99.0	97.0
50th percentile	0.00	100	99.2	98.6
60th percentile	3.33	100	99.7	99.0
75th percentile	3.33	100	100	100
80th percentile	6.66	100	100	100
90th percentile	10.7	100	100	100
95th percentile	13.3	100	100	100
100th percentile	16.7	100	100	100

Table 2: ***Percentile values***

As we can see in Table 1, the lowest PVS was 0%, the highest was 16.7%, on average children had variable production at the level of 3.37%, but the most common value was 0%. Consistent production was the lowest at 83.37%, the highest consistent production was at 100% (all items produced consistently), on average, children achieved 96.4% consistency in speech, but the most common value was 100%. In Table 2, we see that more than half of the children in the sample had a completely consistent expression at the level of 100 percent. The children did not show any variable productions, although at the 50th and 60th percentile levels the children had a 100 consistency of expression. Probably not all productions were phonemically correct, since the PCC was 99.2 and 99.7 and the PPC was at the level of 98.6–99.0. This means that the items were produced consistently by some children, but not correctly so. The findings suggest that this represents natural physiological development of the establishment of sounds and the phonological system. In more than half of the children, there was variability ranging from 3.33% to 16.7%, which represents 1, 2, 3, 4, up to a maximum of 5 items produced variably out of a total of 30. More than half of the children in the monitored group had 0% variable production, i.e. their consistency was at the level of 100%. We were interested in a qualitative analysis of errors in the PVS.

2. *What are the qualitative manifestations of variable speech in the monitored children?*

Qualitative analysis of variable productions showed that all children from the sample of three productions of the target word produced one or two productions correctly and one/two productions incorrectly with the substitution of target sounds, which reflects the process of stabilizing acquired sounds and phonemes. Most often, we observed substitutions of late-acquired sounds, such as sibilants and the sounds [r], [l]. Physiological phonological processes (FP) occurred in the sample: sibilant fronting, sibilant backing, liquid elimination, liquid gliding, affrication, deaffrication, coalescence, stopping. All substitutions occurred in individual children with an incidence of the phonological process below 10% (fading phonological process). In the monitored sample of children, variable production was reflected in developmental processes. This indicates the natural physiological variability of speech within developmental trends.

We were interested in which factors affect the variability of speech and the consistency of speech.

3. *Does the attained phonetic-phonological level measured by PCC, PVC and PPC affect the variability of speech and the consistency of speech in the children monitored?*

To establish mutual correlation, we used the nonparametric Spearman correlation coefficient.

The null hypothesis H1 was confirmed only for the relationship PVC and PVS and for the relationship PVC and PCS.

We found no evidence of:

- a statistically significant relationship ($\rho = -0.11$, $p = 0.285$; $n = 89$) between PVC and PVS;
- a statistically significant relationship ($\rho = 0.117$, $p = 273$; $n = 89$) between PVC and PCS.

We rejected the null hypothesis H1 for the relationship PCC, PPC and PVS and for PCC, PPC and PCS.

We found:

- a statistically significant, strong, negative relationship ($\rho = -0.634$; $p<.001$; $n = 89$) between PVS and PCC;
- a statistically significant, moderate, negative relationship ($\rho = -0.485$, $p <.001$; $n = 89$) between PVS and PPC;
- a statistically significant, strong, positive relationship ($\rho = 0.632$, $p<.001$; $n = 89$) between PCS and PCC;
- a statistically significant, moderately strong, relationship ($\rho = 0.485$, $p <.001$; $n = 89$) between PCS and PPC.

The fewer correctly pronounced consonants and fewer correctly realized phonemes the child produced, the higher the incidence of variable production. The more correctly pronounced consonants and realized phonemes a child produced, the higher the consistency of speech.

4. *Does gender and domicile affect the variability and consistency of speech in the children monitored?*

We processed the data using the Mann-Whitney test. The null hypotheses H2, H3, H4 and H5 were confirmed.

We found that:

- in PVS for boys ($n = 40$; $Md = 3.33$) and in girls ($n = 49$; $Md = 0.00$) there is no statistically significant difference (U = 854; p =0.221);
- in PVS for urban children ($n = 45$; $Md = 0.00$) and for rural children ($n = 44$; $Md = 3.33$) there is no a statistically significant difference ($U = 822$; $p = 0.154$).

Influence of gender and domicile on the amount of variable speech was not confirmed in our sample.

We found that:

- in PCS for boys ($n = 40$; $Md = 96.7$) and for girls ($n = 49$; $Md = 100$) there is no statistically significant difference ($U = 858$; $p =0.234$);
- in PCS for urban children ($n = 45$; $Md = 100$) and for rural children ($n = 44$; $Md = 96.7$)

there is no statistically significant difference *(U = 822; p =0.153)*.

Gender and domicile had no effect on performance in the consistency of speech in the monitored children.

Discussion

We set ourselves the goal of mapping the development of variable/consistent production in monolingual Slovak typically developing children with age-appropriate speech intelligibility at age 5;07 to 6;00 years. We monitored variable/consistent production with a variable production subtest, which is part of the ARTES articulation test.

In the inconsistency test, Dodd et al. (2000) recommend that variable production terms should not include any that were produced variably, yet with substitutions that can be described by natural physiological phonological processes. According to these authors (in ibid.), this method of evaluation is the most suitable for capturing pathological inconsistent speech, which, in addition to a high percentage of variability, is also manifested by pathological substitutions of sounds. In our sample, we scored each inconsistent production, even if the substitution of sounds was carried out by natural physiological phonological processes, in order to capture the developmental trend of natural physiological variable production and the achievement of consistent speech among Slovak children. In children aged 5;07 to 6;00 years, we found consistency of speech in the range from 83.33 to 100%, the average being at 96.4%. This is very close to the average consistent production of English-speaking children at age 5;06 to 5;11 years from the research of Holm et al. (2007), which was at the level of 97.12%. Furthermore, 75% of the monitored Slovak children had consistent speech at the level of 100%. However, this does not mean that these children already had the correct pronunciation in all items. At the level of the 50th and 60th percentile, there is a fully consistent expression, but the performances in PCC and PPC are not at the level of 100%. This points to the fact that despite the fact that children have not yet mastered all the consonants, or do not use all the phonemes correctly, they already have consistent speech. Their speech errors are consistent. Holm et al. (2007) came to similar conclusions. They divided children's consistent productions into consistent correct and consistent incorrect. A consistency of less than 100% was reflected in the group we monitored at the level of the 25th percentile. This means that 75% of the monitored children did not produce even a single item variably and only 25% of the monitored children experienced variable production. It occurred in at least one item (PVS = 3.33) and at most in five items (PVS = 16.7%). Qualitative analysis of variable production showed that almost all children produced one or two attempts correctly and one or two attempts incorrectly in the production of variable items. The same results were recorded by Holm et al. (2007). They observed variable production with one or two correct productions ("with hits") and variable production without the correct production of the target word ("no hits"). Slovak children, like English children from the research of Holm et al. (2007), had at least one correct production within the variable production. Variable production with one or two correct word productions, and with natural physiological substitutions of sounds in the case of incorrect production of the target word, confirms that variable production in the monitored, typically developing Slovak monolingual children, is a positive developmental phenomenon.

A qualitative description of sound pronouns in the monitored children showed that all sound substitutions were within natural physiological phonological processes. If we chose to evaluate the inconsistency of speech according to the test of Dodd et al. (2000) and so natural physiological phonological processes were not being included in the variability of speech, the inconsistency of speech in our monitored sample in all children would be 0% and the consistency of speech would be 100%. Such an approach to performance evaluation will be suitable for the use of a variable speech subtest to search for children at risk in relation to pathological phonological development (inconsistent production) and subsequently possible dyslexia. From the point of view of describing the development of the phonetic level, we consider the approach of assessing the consistency and variability of speech inclusive of scoring natural physiological sound substitutions to be more appropriate. From a developmental point of view, the results indicate that in unimpaired monolingual Slovak children between 5;07 and 6;00 of age, a quarter of the children have natural physiological variable speech, which reflects the process of establishing sounds, mainly sibilants and alveolars, while within their variable production children already have correctly realized target words.

We were interested in whether the performance of variable and consistent speech is influenced by the level of development of phonetic and phonemic repertoire. In both cases, the relationship between correctly pronounced vowels and consistency and variability of speech was not confirmed. All children had already mastered vowels and used them correctly, so errors in variability and at the same time the level of consistency were more affected by consonants, which were still in the process of stabilization in many children. At the same time, a very strong relationship between PCC and variability and consistency of speech was confirmed. A slightly weaker, but also strong relationship was confirmed between PPC and the variability and consistency of speech. The correlation cannot be taken as linear, however. In practice, we can meet children who, with increasing PCC, PPC, will have a higher Percent Consistent Speech and a lower Percent Variable Speech, but also children who will have high PCC, PPC but may achieve lower performances within the consistency. We believe that this area deserves further investigation.

The last area we investigated was the influence of gender and domicile on the performance of consistency and variability of speech. In both cases, the influence of gender or residence on performance was not confirmed in the sample we monitored. In the follow-up of Holm et al. (2007), the influence of gender on performance in consistency and variability of speech was confirmed. The different result may be due to the age distribution of the sample. Holm et al. (2007) looked at the influence of gender on performance in 409 British children aged 3 to 6;11 years. Our sample included only children aged 5;07 to 6;00 years. This is the age period when the development of the phonetics and phonology ends and any difference in the performance of boys and girls can disappear. It can be that in the younger group the differences in performance in relation to gender will be confirmed, and this needs to be examined.

Conclusion

Variability of speech is a natural physiological phenomenon, it occurs during the development of phonetics and phonology, manifested by a different phonemic or syllabic realization of the target word during multiple production. It is characterized by natural physiological sound substitutions. Many developmental factors are involved in the 'waning' of variable speech during the child's maturation, such as the extent of vocabulary, the acquisition of phonetic repertoire, phonological discrimination, the maturation of motor coordination,

and the like. A decrease in variable speech causes an increase in consistent speech. The child always realizes the target word phonemically in the same way. In the case of SSD, inconsistency may appear in speech. It is characterized by a high proportion of variable production of target words, and errors in sounded pronouns are not natural-physiological. Knowledge of the natural physiological development of variable speech and consistency of speech is the starting point for further investigation and diagnosis of speech inconsistency in inconsistent phonological disorder and CAS. In 89 unimpaired monolingual Slovak children with age-appropriate speech intelligibility at age 5;07 to 6;00 years and no untoward personal and family history, the variability and consistency of speech were examined. We found that 75% of typically developing children at age 5;07 to 6;00 years had consistent speech at the level of 100%, they did not show a single variable production. Within this group there were children who had consistent and correct production and children who had consistent production, but not always correct. In 25% of the monitored children, we recorded 1–5 variably produced items out of a total of 30. Each variable production contained at least one phonemically correct production with developmental phonological processes. The picture of variable speech in the monitored children reflects their positive developmental phonetics and phonology. We did not record variable production with pathological phonological processes in any child. The findings can be used for the criterion diagnosis of the SSD of Slovak children. In the event that a child at the age of 5;07 to 6;00 years would show variable production higher than 17% (the weakest performance of an unimpaired child), or if pathological phonological processes are recorded in variable productions (even with a lower PVS below 17%), the child needs to be further diagnosed and offered therapy, because s/he is at risk of pathological phonological development and potential dyslexia. At the same time, a certain subset of typically developing Slovak monolingual children aged 5;07 to 6;00 years can produce certain variable productions in speech, but only in the image of natural physiological phonological processes. We found that the consistency and variability of speech is influenced by PCC, PPC. In many children, with an increasing number of correctly pronounced consonants and correctly realized phonemes, the consistency of speech will also increase and the level of speech variability will decrease. This fact can be applied in therapy. The influence of gender and residence in the monitored age group 5;07 to 6;00 years has not been confirmed. From the point of view of testing, this means that it will not be necessary to establish normative data separately for boys and girls and for children from urban and rural areas. The findings significantly shift the objectivity of the diagnosis of the phonetic-phonological development in Slovak monolingual children in relation to phonological disorders and the detection of children at risk in relation to dyslexia. This makes it possible to start early prevention. At the same time, the findings bring new theoretical information to our knowledge of the phonetic-phonological development of Slovak typically developing children.

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