The role of syllable structure: the case of Russian-speaking children with SLI

Darya Kavitskaya*, Maria Babyonyshev**
*Department of Linguistics, Yale University
**Child Study Center, Yale University

This study examines the role of syllable structure in Russian-speaking children, both Typically Developing (TD) and with Specific Language Impairment (SLI). We report results of a pseudo-word repetition task in which syllable number and syllable complexity are manipulated. The results show that children with SLI perform significantly worse than TD children on this task, indicating that Russian follows the general pattern in this respect. However, the factors affecting the difficulty of the task are the same for both groups, contrary to previous claims in the literature. The study demonstrates that both phonological memory and syllable structure play a role in determining children’s ability to remember pseudo-words.

1. Introduction

Specific Language Impairment (SLI) is a developmental disorder that is defined in the following way: while nonverbal IQ is within a normal range, the performance on various standardized language tests falls below 2.0 standard deviations limit for the child’s age, and there are no neurological, sensory or physical impairments that directly affect the use of spoken language (Bishop 1997, Leonard 1998). SLI is a heterogeneous disorder with several different profiles possible that can be responsible for the low performance on the standardized verbal tests.1

While there is a general agreement that phonology is frequently impaired in children affected by SLI, the precise nature of this phonological deficit is currently a matter of debate. There are two theories that are most relevant for the study presented below. The first theory (Gathercole & Baddeley 1990, Conti-Ramsden 2003) holds that the underlying cause of SLI is impairment in phonological short-term memory as revealed by poor performance in pseudo-word repetition tasks. The second theory (van der Lely & Howard 1993, Marshall et al. 2002, 2003) argues against the directionality of causation assumed by Gathercole & Baddeley (1990), proposing that the underlying cause of SLI is a phonological deficit, which results in an impairment of phonological memory and therefore poor performance on pseudo-word repetition tasks.

An important point made by Marshall et al. (2002), Roy & Chiat (2004), van der Lely (2004), van der Lely et al. (2004) is that the limitations on phonological memory

---

1 Preparation of this article was supported by the Award R01 DC007665 as administered by the National Institute of Deafness and Communication Disorders (PI: Elena Grigorenko). Grantees undertaking such projects are encouraged to express freely their professional judgment. Therefore, this article does not necessarily reflect the position or policies of the National Institutes of Health, and no official endorsement should be inferred.

1 For example, van der Lely and colleagues have identified a separate class of SLI, called G-SLI, which is characterized by “a primary, domain-specific deficit in the computational grammatical system” (van der Lely 1994, 1998, 2000, among many others).
alone cannot explain the whole range of the findings on pseudo-word repetition for SLI and Typically Developing (TD) children. Such factors as syllable structure, word-likeness, stress, and articulatory complexity have been claimed to affect children’s performance on the pseudo-word repetition task (see Roy & Chiat 2004 for overview). One such claim, advanced by Marshall et al. (2002), holds that only the most unmarked syllable structure (Consonant-Vowel, henceforth, CV) is available to SLI children. For example, non-words such as [ðɛ.pɐ], consisting of two unmarked CV syllables, are predicted to be easier to represent and therefore repeat for SLI children than [ðɛmp], consisting of the same number of phones, but comprising one CVCC syllable which is more marked than a CV syllable.\(^2\)

The study reported in this paper tests the hypothesis of Marshall et al. (2002) regarding the role of syllable structure representation in SLI phonological impairment. We do not consider the question of the direction of causality in phonological deficit typical of SLI children resolved and do not necessarily see our study as providing evidence which can be used to further this debate. However, the study does provide evidence against the most simplistic application of the theory that the cause of SLI is solely the impairment in phonological short-term memory measured by the number of phonemes in a word. The study shows that both phonological memory and syllable complexity play a role in determining children’s ability to remember pseudo-words. We also explore whether syllable complexity crucially relies on sonority, a factor that has not been adequately considered in previous studies.

2. Syllable structure and markedness

The syllable plays a central role in phonological theory as a constituent that represents phonologically significant groupings of segments (Zec 2007, 162). However, the topic is not altogether uncontroversial, as is emphasized by most chapters of this volume. As the point of departure, the present study assumes the theory of syllable structure widely used in the current phonological literature (for summary, see Blevins 1995, Zec 2007). A model of subsyllabic constituency utilized by the theory is illustrated in Figure 1. The syllable consists of onset and rhyme, which can be further subdivided into nucleus and coda. The nucleus is also referred to as the syllable peak, and onset and coda as the syllable margins.\(^3\)

\(^2\) Another possible reason for the difficulty of the second word as opposed to the first one is the presence of a consonant cluster in the second word. In what follows, we will attempt to distinguish between these two explanations.

\(^3\) While other representations of the syllable have been proposed in the literature (see Zec 2007 for an overview), the difference between them is not crucial to this study.
The notion of sonority is important in defining syllable structure. Intuitively, sonority is related to the overall acoustic energy of segments, however, the precise definition of sonority and the way it is incorporated into the grammar is still under debate (see Vennemann 1972, Selkirk 1984, Clements 1990, Zec 1995, de Lacy 2004, among others). The most general sonority scale, where the classes of segments are listed in the order of increasing sonority, is in (1):

\[(1)\quad \text{Stops} < \text{Fricatives} < \text{Nasals} < \text{Liquids} < \text{Glides} < \text{Vowels}\]

The segmental composition of onsets and codas exhibits striking regularities across the world’s languages. These regularities have been stated in terms of the Sonority Sequencing Principle (Hooper 1976, Kiparsky 1979, Steriade 1982, Selkirk 1984, Clements 1990, Zec 1995, Blevins 1995, among others):

\[(2)\quad \text{Sonority Sequencing Principle (SSP)}\]

Sonority increases towards the peak of the syllable and decreases towards its margins.

The sequencing of segments in Figure 1 exemplifies the SSP: in the syllable \([\text{d}i\text{m}]\), the initial consonant \([d]\) is less sonorous than the following \([i]\), that is in turn less sonorous than the syllable peak \([i]\), and the coda \([m]\) is less sonorous than the syllable peak, thus showing an increase in sonority toward the peak and its decrease towards the margins.

While the SSP can be taken as a tendency, it is by no means expectionless. For instance, English, which in general obeys the SSP, has some onsets of falling sonority, such as, for instance, \(/sp st sk/\) and some codas of rising sonority such as \(/ps bz ks/\), that violate the SSP. Russian is even more lenient with respect to the SSP, allowing such onset clusters as \(/lb l'd rt/\) and such coda clusters as \(/br tr bl/\), even though these are less frequent than the clusters that obey the SSP.

It has been noted that certain types of structures are typologically more common and acquired earlier in first language acquisition. These properties were taken to suggest that such structures are less marked than others, typologically less common and acquired later by children. For instance, CV syllables are taken to be less marked than CCV syllables and CVC syllables, since in the first case, the syllable has a complex onset,
more marked than a simple onset, and in the second case, the syllable is closed and thus more marked than an open one (see Rice 2007 for the discussion of markedness).

Recent literature has contained criticisms of the notion of markedness on the grounds that it is not precisely defined and as a result is used in too many different meanings. Haspelmath (2006, 26) lists twelve possible uses of the term markedness, such as markedness as complexity (including specification for a phonological distinction, semantic markedness, formal markedness), markedness as difficulty (in phonetics, morphology, and as conceptual difficulty), markedness as abnormality (textual, situational, typological, distributional), etc.

Even though we agree in principle with Haspelmath’s criticisms of the notion of markedness, we will continue using the term in the sense that has been traditionally used in the SLI literature. This corresponds to the Haspelmath’s subtype of markedness as abnormality, classified as “markedness as typological implication or cross-linguistic rarity” (Halpelmath 2006, 26). For instance, Russian has both /bl/ and /lb/ onsets, but since crosslinguistically /bl/ onset is widely attested and /lb/ is quite rare, in the typological sense of markedness the latter is more marked than the former. The notion of markedness in this sense is crucial in the formulation of the hypothesis advanced in Marshall et al. (2002), who claim that for SLI children only an unmarked CV syllable template is available. In the current study, we test the hypothesis of Marshall et al. (2002) and offer a new analysis based on our results.

3. Specific hypotheses

For the purposes of the current study, we manipulated two general factors: word length and syllable complexity. In the present context, word length is defined as the number of syllables in a word: monosyllabic, bisyllabic, and trisyllabic words were used in the experiment. There is a general agreement in the literature that there is an impairment of phonological memory in SLI children. Therefore, if Russian follows the general pattern, we expect TD children to be significantly better than SLI children in this respect.4

The second factor manipulated in the experiment was syllable complexity. We used the following syllable templates: CV, CCV, CVC, CVCC, CCVC, CCVCC. As was mentioned earlier, Marshall et al. (2002, 516) advance the following hypothesis: “We propose an interpretation of the data whereby children with G-SLI have only unmarked parameter values available to them, meaning that they have just a CV template. There is no room on this template for additional consonants.”

According to the model of syllable structure given in Marshall et al. (2002) (Figure 2), only the first consonant in the syllable-initial cluster is regularly available to SLI children presumably because only this consonant is structurally associated to the onset. No hypotheses are made as to the strategy of coda simplification.

---

4 Yet another possible factor that has been suggested in previous studies is stress. Given that stress in Russian is lexically determined so that there is no apparent regularity to its placement, we would predict that the location of stress does not affect the children’s performance on the pseudo-word repetition task. Other studies show the effect of stress in languages where stress is more regular than in Russian (see Sahlén et al. 1999 for Swedish, Marshall et al. 2003 and van der Lely 2005 for English). We believe that there is no reason to expect that the role of stress is going to be any different for TD children than for SLI children, but testing it experimentally is the topic for a future study.
In the current study we test the hypothesis with respect to onset cluster simplification as well as discuss our results with respect to coda cluster simplification. We think that it is more plausible for TD and SLI children to have similar phonotactic constraints governing syllable structure. We predict that the pattern of difficulty of cluster repetition will be similar for TD and SLI children. Whatever patterns we observe in TD children with respect to the SSP are expected to hold for SLI children as well.

Given the preceding discussion, we expect complex onsets to be harder than simple onsets and complex codas to be harder than simple codas for both groups. However, languages vary with respect to their preference of complex onsets to complex codas, and vice versa. For example, Dakota allows complex onsets but bans complex codas, and Klamath allows complex codas but bans complex onsets (Zec 2007: 165). On the other hand, some languages allow both complex onsets and complex codas but are analyzed as preferring one to the other (e.g., an analysis of Bulgarian as preferring complex onsets to complex codas was proposed on the basis of the site of vowel epenthesis (Barnes 1998)). The preference for complex onsets has been analyzed as an instance of onset maximization. The most general version of onset maximization principle holds that VCV sequences are cross-linguistically syllabified as V.CV rather than VC.V. This version of the onset maximization principle is virtually exceptionless. An extension of the onset maximization principle is the syllabification of intervocalic clusters. For instance, VCCV sequences syllabify as V.CCV rather than VC.CV, thus maximizing the number of consonants in the onset. Kodzasov (1990) suggests that there is a version of onset maximization present in Russian. Varlamov and Coté (this volume) show that the most likely syllabification of obstruent-obstruent clusters is heterosyllabic. Our results help to clarify this issue.
4. Method

4.1. Participants

This study was conducted with monolingual Russian-speaking children. The experimental group subjects come from a village in Northern Russia in which the presence of language disorders is significantly higher than in general population. This work is part of a larger study of familial Disorders of Spoken and Written Language (Grigorenko et al. In progress). The probands were identified through a screening of all children of ages 4 to 11 and then matched with a group of TD children from the same sample. All participants’ parents agreed that their child could participate in this and related studies conducted at the same time under guidelines approved by the Yale University Human Subjects Research Review Committee and Northern State Medical University.

Nineteen monolingual Russian-speaking children aged 4;7–10;7 took part in the experiment. The subjects were classified based on three measures of general language ability developed for use in Russian with normal and impaired populations.

The first measure, called the Assessment of the Development of Russian Language (ORRIA) (Babyonyshev et al., unpublished), was developed in conjunction with data collection on a larger sample from which a subsample was drawn. The ORRIA language assessment battery consists of seven subtests designed to evaluate the children’s mastery of the major subcomponents of grammar, namely, sentence structure, sentence repetition in context, expressive vocabulary, basic concepts, phonological awareness, word structure, and logical concepts. The test battery provides a measure of expressive and receptive knowledge in the areas of syntax, lexicon, morphology, and phonology, and allows for comparison of a given child’s receptive and expressive linguistic abilities.

Two additional measures of language ability were calculated for all subjects: Mean Length of Utterance (MLU) and Syntactic Complexity (SC). In order to calculate MLU and SC, narrative samples were collected by asking children to tell a story on a basis of a picture book. SC was defined as the percentage of complex structures, e.g., relative clauses, embedded clauses, adjunct clauses, conjoined clauses, passive structures, and wh-questions. It was previously shown that MLUs and SCs collected using the frog stories are an effective tool for diagnosing SLI (Reilly et al. 2004).

The scores on the MLU and SC were combined into a standard score on the same metric as the ORRIA. Then, a cutoff for impaired status was established based on the percentile associated with two standard deviations below the mean for the TD group on either the ORRIA or the MLU/SC combined. Six of the subjects were classified as SLI (age range 4;7–10;7, mean age 8;0) and thirteen as TD (age range 4;10–10;6, mean age 8;5). Non-verbal IQs for SLI children were ranged 66–98, mean IQ 80 and for TD children, the IQ range was 69–130, mean IQ 90.

---

5 We used the so-called frog stories, which are frequently utilized for this purpose. Note that the MLU was calculated in terms of words, rather than morphemes, as is customary for highly inflected languages, like Russian.
4.2. Study Design

This study was designed to test the hypothesis regarding the unavailability of the marked syllable structures to SLI children and to explore the importance of phonotactics in general for SLI children. To achieve this goal, we manipulated syllable complexity with respect to the number of consonants in the syllable onset and coda and the total number of syllables in presented words. Taken together, these parameters allowed us to examine the effect of the general working memory load, the complexity of syllable structure, and the interaction of these factors. Additionally, we examined the effects of the SSP as evidenced by children omitting certain consonants in consonant clusters.\(^6\)

The experiment utilized a pseudo-word repetition task. In constructing pseudo-words, the following factors were manipulated:

1) The number of syllables in a word (1 vs. 2 vs. 3);
2) Syllable structure (CV, CCV, CVC, CVCC, CCVC, CCVCC).

Note that the syllable structure factor can be viewed as a combination of onset complexity (one-C onsets: CV, CVC, CVCC vs. two-C onsets: CCV, CCVC, CCVCC) and coda complexity (no coda: CV, CCV vs. one-C coda: CVC, CCVC vs. two-C coda: CVCC, CCVCC). The manipulated syllable in a word was stressed; all the unstressed syllables were of the CV form.\(^7\)

The dependent variable was the number of correct repetitions of pseudo-words. An example of the relevant conditions for a one-syllable pseudo-word is in (3):

\[(3)\]
\[\begin{array}{ll}
\text{a. CV; 1 syll} & \text{PA} \\
\text{b. CVC; 1 syll} & \text{PAK} \\
\text{c. CCV; 1 syll} & \text{PRA} \\
\text{d. CVCC; 1 syll} & \text{PASK} \\
\text{e. CCVC; 1 syll} & \text{PRAK} \\
\text{f. CCVCC; 1 syll} & \text{PRASK} \\
\end{array}\]

The 144 pseudo-words were presented in a pseudo-random order to the subjects, who were asked to repeat the words exactly as they were pronounced by the experimenter. Before the start of the experiment, the children were told that the words they would hear were not real, but made up, so they should not be surprised if they sound unfamiliar or strange. If a child failed to provide a response for five seconds, the experimenter repeated the word once. No other repetitions were allowed; the

---

\(^{6}\) It is stands to reason that the frequency of onset and coda clusters violating the SSP is less than of those clusters obeying the SSP in Russian. However, there are no studies that support this observation experimentally.

\(^{7}\) Given the peculiarities of Russian syllabification, it is not always possible to determine the syllabic affiliation of consonants within clusters in intervocalic positions (see Kodzasov 1990). As was mentioned above, we made an assumption that intervocalic obstruent-obstruent clusters are heterosyllabic. We have also treated intervocalic obstruent-liquid clusters as onsets and intervocalic liquid-obstruent clusters as codas. This assumption, while seeming circular at the first glance, is supported by the cluster simplification data discussed in section 6.2.
experimenter did not provide any corrections or other reactions, regardless of the child’s performance.

The experiment was administered to the children individually, in a quiet room, by an experimenter who spoke the same dialect of Russian as the children. The experiment was recorded on a digital voice recorder (Olympus DSS Player 2002). The responses were phonetically transcribed by a linguistically trained native Russian listener. In certain ambiguous cases the data were analyzed acoustically, through examining spectrograms and wave forms in Praat (Boersma and Weenink 2007). A second native Russian listener checked the reliability of the transcription in 20% of the data, and the discrepancy rate between the two judgments constituted less than 3%.

5. Results

A set of factorial analyses of variance was conducted in order to assess the difference in mean levels for the levels of the factors described above, as well as their interactions, on the number of correct repetitions. The analyses were conducted using standard statistical routines for the general linear model (Proc GLM) in SAS (2003). Omnibus tests for all of the models were significant (p < .0001). The findings for all main effects and interaction effects are reported individually below.

A three-way ANOVA (2 x 3 x 6) showed three significant main effects and two significant two-way interactions. A significant main effects of Group on number of correct repetitions of pseudo-words (F(1, 306) = 8.9, p < .01), of Syllable Number (F(2, 306) = 126.2, p < .0001), and of Syllable Structure (F(5, 306) = 17.4, p < .0001) were shown.

In addition, the analysis shows a significant interaction of Group by Syllable Number (F(2, 306) = 5.9, p < 0.01), illustrated in Figure 3.

![Correct repetitions for TD and SLI groups depending of the number of syllables](image)

**Figure 3.**

There was also a significant Syllable Number by Syllable Structure interaction (F(10, 306) = 5.53, p < .0001), shown in Figure 4.
However, the interaction of Group by Syllable Structure was not significant (F(5, 341) = 0.74, ns.). The three-way interaction of Group by Syllable Number by Syllable Structure was also not significant (F(10, 341) = 0.45, ns.).

Third, in a more fine-grained analysis of Syllable Complexity, this factor was further operationalized into two separate factors: Onset Complexity and Coda Complexity. Specifically, a three-way ANOVA (3 x 2 x 2) showed main effects of both Onset Complexity (F(1, 306) = 8.8, p < .01) and Coda Complexity (F(2, 306) = 38.6, p < .001). The main effect of Group remained significant in this model, as anticipated (F(1,306) = 8.9, p < .01).

Two interactions of theoretical interest were evaluated: the Group by Onset Complexity interaction was not significant (F(1, 306) = 0.72, ns.), and the Group by Coda Complexity interaction was also not significant (F(2, 306) = 0.36, ns.). There were no other significant interactions in the analysis.

6. Discussion

6.1. General results

As predicted, the results show that the number of syllables in a word greatly affects the children’s performance on the pseudo-word repetition task. Words of one syllable are reproduced more accurately than words of two syllables, and words of two syllables are reproduced more accurately than words of three syllables for both TD and SLI children. The interaction of syllable number by group (TD and SLI) is also significant, showing that SLI children perform worse than TD children with respect to the task that varies syllable number. This result supports the hypothesis that working memory capacity is an extremely important factor in word storage and recall in Russian, as in other languages.

The second factor that affects the accuracy of the children’s performance on the task is syllable structure. It is more difficult to represent and recall a word with complex...
syllables. There is also a significant interaction of syllable number and syllable structure, which means that it is more difficult to repeat more complex syllables in longer words. However, the interaction of group by syllable structure is not significant demonstrating that SLI children have the same access to the full inventory of syllable templates available in Russian that TD children have. Note that this result mirrors the findings of Marshall et al. (2002), which also did not show a significant interaction of group by syllable structure (cluster number in their terms). 8

Additionally, our results show a main effect of both onset complexity and coda complexity. For onsets, syllables with one consonant in the onset are significantly easier than syllables with two-consonantal onsets. For codas, open syllables are significantly easier than syllables containing one consonant in the coda, which in turn are significantly easier than syllables with two consonants in the coda. There is no interaction of onset complexity by group and coda complexity by group, which demonstrates once again that both TD and SLI children have access to the same phonotactics constraints.

6.2. Cluster simplification

We also examined the types of errors made by children when repeating pseudo-words containing onset and coda consonant clusters. We looked at the words that contained two-consonantal clusters in word-initial and word-final position. The clusters were of falling, rising, and equal sonority for both onsets shown in (4) and codas shown in (5).

(4) Onsets
   a. Rising sonority
      bl
      dr
   b. Falling sonority
      lg
      rd
   c. Equal sonority
      bd
      kt

(5) Codas
   a. Falling sonority
      rk
      lp
   b. Rising sonority
      tr
      pl
   c. Equal sonority
      kp
      kt

---

8 Regardless of this result, Marshall et al. (2002) develop a theory that SLI children have an impoverished syllable template compared to TD children.
We chose to examine these particular combinations of consonants because they represent relatively less marked structures (onsets of rising sonority and codas of falling sonority) and more marked structures (onsets of falling sonority and codas of rising sonority). Onset and coda clusters in which there is a sonority plateau are considered to be more marked than clusters in which sonority rises towards the nucleus and less marked than clusters in which sonority rises towards the margin. Table 1 summarized consonant deletions in complex onsets and complex codas.

<table>
<thead>
<tr>
<th>Onset</th>
<th>OLV</th>
<th>O_1O_2V</th>
<th>LOV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simplified as</td>
<td>LV</td>
<td>13 (100%)</td>
<td>O_1V</td>
</tr>
<tr>
<td></td>
<td>OV</td>
<td>0</td>
<td>O_2V</td>
</tr>
<tr>
<td></td>
<td>V</td>
<td>0</td>
<td>V</td>
</tr>
<tr>
<td>Total errors: 35</td>
<td>13</td>
<td>11</td>
<td>11</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Coda</th>
<th>VLO</th>
<th>VO_1O_2</th>
<th>VLO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Simplified as</td>
<td>VO</td>
<td>22 (51%)</td>
<td>VO_1</td>
</tr>
<tr>
<td></td>
<td>VL</td>
<td>17 (40%)</td>
<td>VO_2</td>
</tr>
<tr>
<td></td>
<td>V</td>
<td>4 (9%)</td>
<td>V</td>
</tr>
<tr>
<td>Total errors: 131</td>
<td>43</td>
<td>63</td>
<td>25</td>
</tr>
</tbody>
</table>

Table 1. The number of simplifications of complex onsets (syllable template CCV(C)(C)) and complex codas (syllable template (C)(C)VCC) (Note that O – obstruent, L – liquid, V – vowel).

While there are too few data points for a meaningful statistical analysis to be performed, the data still exhibit certain patterns that can be informatively interpreted. First, in onset clusters there are zero cases out of 35 (0%) where both consonants are deleted, as opposed to 12 cases out of 131 (9%) in coda clusters where both consonants are deleted. This is not surprising given that a universally unmarked core syllable is CV, and thus the deletion of both consonants in the onset would lead to a less preferred onsetless syllable. On the other hand, the deletion of both consonants in the coda results in a preferred CV syllable.

Note that in onset clusters of either rising or falling sonority it is always the first consonant that deletes (the prediction of Marshall et al. (2002) based on their chosen representation of syllable structure for SLI children is the opposite). The pattern seems to be the following: the child builds a core CV syllable, choosing an onset consonant that is closest to the vowel. The same pattern is observed in onset clusters of equal sonority, however, it is not exceptionless (the first obstruent is deleted 9 times out of 11 (82%), and the second obstruent is deleted 2 times out of 11 (18%).

A different pattern emerges from the behavior of coda clusters. In codas of falling, rising, and equal sonority, the choice of the deleted consonant in the cluster appears to be random (in the codas of falling sonority the obstruent is deleted 22 times (51%) and the liquid is deleted 17 times (40%) out of 43, in the codas of rising sonority the obstruent is deleted 14 times (56%) and the liquid is deleted 4 times (16%) out of 25, and in the codas with sonority plateau the first obstruent is deleted 37 times (59%) and the second obstruent is deleted 25 times (40%) out of 63). A possible explanation for the
pattern of errors observed is as follows: complex codas are marked and thus simplified to a simple coda. However, since the presence of a coda is not required by the core syllable template, the choice of consonant does not matter.

The data suggest that the more or less marked status of onset and coda clusters with respect to the SSP does not play a role in the patterns of cluster simplification. For example, more marked onset clusters of falling sonority are simplified as often as less marked onset clusters of rising sonority. It is likely that this pattern is due to the fact that Russian does not obey the SSP.

7. Conclusions

This study has made several important points. First, it demonstrated that phonological memory affects children’s ability to recall words. In most general terms, the results tell us that for both SLI and TD children it is always more difficult to represent and recall a longer word than a shorter word, as expected. Importantly, SLI children have been shown to have more difficulty than TD children in remembering longer words. This result also supports the findings of the previous literature.

Second, our results demonstrate that structural complexity is an important factor that affects the recall of pseudo-words. We should note that the effect on processing complexity cannot be explained by limitations on working memory capacity alone because the complexity is not determined by the number of phonemes in a word, but rather by the phonological organization of that word. Two metrics could be used in determining this notion of structural complexity: the organization of phonemes into syllables or the number of consonants in a consonant cluster. Importantly, we have shown that syllable structure matters in the patterns of cluster simplification. These patterns cannot be explained by reference to the number of consonants in a cluster without taking syllable structure into consideration. These findings lend preliminary support to the view that the syllable is not epiphenomenal, but rather a crucial part of the grammar.

Third, our results indicate that syllable complexity becomes more detrimental in longer words, two- and especially three-syllable ones. This shows that the overall complexity of the task is determined by the combination of length and syllable complexity rather than by either of these factors alone.

Forth, the hypothesis of Marshall et al. (2002) regarding the availability of only the CV syllable for SLI children as opposed to the full range of syllable structures available to TD children finds no support in our data. It is indeed true that the most unmarked syllable structure is easier to represent and recall than any other. However, our results demonstrate that there is no qualitative difference between this structure and all other structures. Rather, the results indicate that there is a continuum of complexity of syllable structure, with CV being the easiest and CCVCC being the hardest in our data. Moreover, this holds to the same degree for TD and SLI children. The fact that there is no interaction of group by syllable number, group by syllable complexity, group by onset complexity, and group by coda complexity conclusively demonstrates that the accuracy of repetition for SLI children is affected by the same factors as for TD children.

Fifth, the results reveal several suggestive patterns with respect to cluster simplification. Both TD and SLI children use the same strategy in simplification of onset
clusters, namely, they omit the first consonant in the cluster, building the core CV syllable by choosing the consonant adjacent to the vowel. In the simplification of coda clusters, the omitted consonant is chosen randomly. In addition, there are cases of omission of both consonants in the coda cluster, but never in the onset cluster. These facts also argue for the importance of the core CV syllable.

Several directions for future research look promising. We have no data on the frequency of specific consonant clusters in Russian. Gathering such data and examining our results in light of it is our next step. Also, the present study was conducted using pseudo-words. A similar study utilizing real words of Russian lexicon is currently under way. Such a study will address the interaction of cluster frequency and word frequency. Finally, there is a possible study that would either lend further support to the syllable view or refute it. An experimental study similar to the current one would need to be carried out with typically developing adults and analyzed using two models: one which assumes internal syllable structure and the other which posits that the only relevant factor is the length of the consonantal string. We expect an argument for a better approach to emerge through the comparison of the predictive power of the two models.

References


Steriade, D. 1982. *Greek prosodies and the nature of syllabification*. PhD Diss, MIT.


