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ASSESSING EARLY COMPOSITIONALITY OF RUSSIAN VERB DERIVATIVES IN L1 ACQUISITION WITH KENDALL RANK CORRELATION COEFFICIENT

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Abstract. This paper studies children's sensitivity to derivational patterns of Russian verbs reflected in the speech data of two boys (ages 1;5–2;8 and 1;7–3;0 respectively). Kendall rank correlation coefficient (KRCC) analysis of three verb groups – morphologically unrelated (elementary), morphologically and semantically related (derived), and morphologically related but semantically opaque verbs – demonstrates that the number and share of derived verbs steadily increases over time, whereas both elementary and semantically opaque verbs behave differently under varying conditions. KRCC applied to child-directed speech did not show any significant increase for any verb groups, reflecting their stable general distribution in adult speech. This means that children are sensitive to morphological distinctions between the respective groups. We discuss the use of KRCC for child language research and the role of derivational patterns in the acquisition of the Russian verb.*

Keywords: derivation, Russian verb, language acquisition, Kendall Rank Correlation Coefficient, L1, Russian

1. Early stages in the acquisition of verb morphology

This paper considers early indirect indications of children's sensitivity to the morphological compositionality of Russian verbs. We expect that with the growth of their verbal repertoire, children will learn the meaning of frequent verb prefixes and suffixes. However, this process is only manifested at later stages by innovative verb formation when they have a good command of derivation models. We are striving to find indications that little children process derived and non-derived verbs differently much earlier than they start to use verb prefixes and suffixes productively. According to the theoretical model of pre- and protomorphology proposed by Dressler (Dressler, Karpf 1995, Dressler et al. 2003), the process of

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early acquisition of the morphological system is represented by three distinct subsequent stages: premorphology, protomorphology, and core morphology (Bittner et al. 2003: xviii–xx). At the first, premorphological, stage children do not use any morphological marking, uttering all nouns and verbs in one and the same "frozen" (mostly base) form. During the second stage, children "detect morphology as a means of decomposing and composing meaning and form, even if only partially" (Dressler et al. 2017: 6–7). "Morphology detection" as predicted by the pre- and protomorphology model should happen simultaneously with verbs and nouns of the same language, whereas the acquisition of an overt nominal paradigm usually precedes that of verbs (cf. the data on Lithuanian in Savickienė 2003 and Wójcik 2003; Finnish in Laalo 2003, 2009; Croatian in Katičič 2003 and Kovačević et al. 2009; Austrian German in Klampfer 2003 and Korecky-Kröll, Dressler 2009; and Russian in Poupynin 1998, Gagarina 2003, Gagarina, Voeikova 2009). In all those languages children start to decline nouns two to three months earlier than they conjugate verbs.

Another source of discrepancy is the gap between inflection and derivation. Children start to use inflectional oppositions and miniparadigms earlier than they begin to productively use derivational patterns (cf. the acquisition of compounds in Dressler et al. 2017). However, the detection of morphology may happen earlier than when children start to produce novel words or forms, as shown in Ceitlin (2009) for Russian.

The goal of this paper is to uncover some implicit evidence for the decomposition of derived verbs by children at the early stages of language acquisition before they start to use novel verbs.

This process manifests itself in different percentages of derived words at varying subsequent stages, and in the steadily increasing use of transparent decomposable verb forms. Thus, we assume that the detection of both derivational and inflectional morphology in verbs and nouns happens simultaneously, but is not explicitly observable with verbs. We check this hypothesis against longitudinal data for two Russian boys (more details below). The main research question of the paper is to find out whether children treat semantically transparent and opaque derived verbs in different ways, thus showing early detection of derivation. We also apply a new statistical method to the child speech production data.

The paper is structured as follows: first, we sketch the inflectional and derivational system of the Russian verb (section 2), including the relatedness between derived and nonderived lemmas (section 3). In section 4, we highlight the mechanisms underpinning the acquisition of the Russian verb system by children. Section 5 describes our data and outlines the analytical procedure. The results are provided in section 6, followed by a discussion and conclusions (section 7).

2. Inflection and derivation in the Russian verb system

Russian is an inflecting synthetic-fusional East Slavic language[1]. In the full paradigm, the number of forms of some verbs can reach 235 (including participles and converbs) (Fomenko 1996: 233). Some of these are rarely used in everyday conversation, and thus are irrelevant for child and child-directed speech (CS and CDS respectively). But even this simplified system is much richer for verbs than it is for nouns, with only 12 case and number forms; no wonder, then, that verbs normally emerge and start to be used productively two to three months later than nouns are (see Gagarina 2003, 2008, Gagarina, Voeikova 2009 for Russian; Childers, Tomasello 2006, Bittner et al. 2003, Stephany, Voeikova 2009 for several other languages).

Russian, as all Slavic languages, is also known for its rich system of verb derivatives formed both by prefixation and suffixation. Recent investigations on Slavic verb prefixes describe their functions as follows: "prefixation induces perfectivity and telicity, affects argument structure and case-assignment properties of the base predicate and can change the meaning of the base verb" (Biscup 2019: 8). Although the semantic and grammatical changes induced by verb prefixes are rather sophisticated and abstract, children start to use them quite early – mostly between 2;0 and 3;0 years but sometimes even before 2;0 (Kazakovskaya, Voeikova 2021: 183). The early prefixed forms used by little children bring us to the idea that they should somehow start to distinguish between derived verbs and their simplicia much earlier than they start to produce them.

Most specialists in verb prefixation distinguish between lexical prefixes that change the meaning of the verb and grammatical ones that only modify their aspectual characteristics, see the definition and references in (Biscup 2019: 9–12). Others treat lexical, superlexical and empty prefixes separately showing that lexical prefixes have different degrees of semantic predictability (Carre 2014). Lexical prefixes change the meaning of the verb dramatically, e.g. *bit'* 'hit' → *u-bit'* 'kill'; so that the meaning of the derived verb may be unpredictable; superlexical prefixes cause predictable semantic changes, e.g. *pet'* 'sing' → *za-pet'* 'start to sing' (inceptive *aktionsart*), purely perfectivizing (empty) prefixes change only the aspect of the verb but not its meaning.[2] Thus, the high number of derivational patterns in the Russian verb system is partly due to the special verb aspect characteristic of Slavic and certain other languages[3]. Two different verb lemmas are used for completed actions and ongoing processes. For example *čitat'* 'read.IPFV' expresses the process of reading, and several prefix derivatives are formed from it to express different completed actions: among others, *pročitat'* 'read_through.PFV'; *perečitat'* 'read again.PFV'; *dočitat'* 'read to a certain part.PFV'; *začitat'* 'read loudly to the end.PFV'. Here, we deal mostly with lexical and superlexical prefixes changing the meaning of the verb with a certain degree of semantic predictability. Every perfective verb, in turn, can be used to form a secondary imperfective: for instance, *pročit-yva-t'*

[1] Being predominantly synthetic-fusional in its inflectional system, Russian uses a great deal of agglutination in its derivation: verb prefixes may be combined as in *po-na-exal-o gost-ej* lit. already-too_many-come-PAST:SG:NEUT of guest-PL:GEN 'too many guests came' where the first verb prefix *po-* has an aspectual terminative meaning and the second *-na-* is saturative and shows that the number of guests was too high.

[2] According to Janda et al. (2013), the "empty" prefixes function as verb classifiers.

3 Although aspectual distinctions are manifested in verb systems of most languages, (see Dahl 1985 for a detailed overview), the specific lexico-grammatical category of aspect is characteristic of Slavic languages. A semantically oriented and language-specific definition of the Russian aspectual system is given in Bondarko (2017: 74–115).

('use to read through.IPFV'); *perečit-yva-t'* ('use to read again.IPFV'), for further details sketched in English, see Timberlake (2004: 398). Imperfective suffixes are semantically empty and express only that the same action took place habitually or several times. In the next paragraph, we concentrate on the compositionality of such derivatives. Compositionality may be defined as a potential capacity of the complex linguistic sign to be understood as a sum of the meanings of its parts, e.g. if we know that *čitat'* means 'read' and *pere-* is a prefix meaning 're-, or doing smth. for the second time', we will understand the verb *perečitat'* 'reread' as a composition of the meanings of the stem and the prefix. Compositionality allows the speakers of a language to understand complex linguistic signs as a combination of their parts without keeping in mind every meaning of every word. However, not all derived verbs are as transparent as the examples given above. Many derivatives are morphologically and semantically opaque, having lost connections to their simplicia, e.g. *sbyt'* 'get rid of smth.' is connected to the verb *byt'* 'be' but semantically unpredictable from the analysis of its root and prefix. Native speakers differ in their ability to analyze the meaning of morphologically opaque derivatives depending on their linguistic experience. Thus, verbs can be divided into derivational subclasses according to their transparency and compositionality. In the next section, we address some derivational subclasses of Russian verbs that can be relevant to the structure of children's mental lexicon.

3. Morphological and semantic relatedness of verbs

We have grouped all the verbs in our data into three derivational subclasses, following the division proposed in Smolka et al. (2015) for German: 1) morphologically unrelated (elementary) verbs (MU) include short monosyllabic or disyllabic verbs like *sest'* 'sit down.PFV', *spat'* 'sleep.IPFV', and *xotet'* 'want.IPFV'; 2) morphologically and semantically related verbs (MR:SR) are derived from other words and have a transparent relationship to the initial stem like in *pro-čitat'* 'read through. PFV' ← *čitat'* 'read.IPFV', *peresmtotret'* 'watch, see again.PFV' ← *smotret'* 'watch, see.IPFV'; 3) morphologically related but semantically unrelated (MR:SU) verbs contain nontransparent or historical derivatives, for example, *sadit'sja* 'sit down' is related to *sadit'* 'plant' or *posadit'* (causative of 'sit down, plant'). However, the modern form of the causative is *sažat'* 'sit', which is not directly connected to *sadit'sja* 'sit down'. Most of these verbs contain easily definable affixes (Tikhonov 1990); however, their combination with the root of the initial verb is unpredictable, for instance, *na-devat'* 'put on' from *devat'* 'hide' or *ot-byt'* 'leave' from *byt'* 'be'.

The division into MR and MU verbs was executed based on Tikhonov's (1990) *Derivation Dictionary*. According to the calculations by Garšin (2012) based on this dictionary, verbs are the most productive source of derivation with a mean number of 23 derivatives per lemma. Examples are *est'* 'eat.IPFV' → *s'-est'* 'eat up.PFV' and *pere-est'* 'eat too much.PFV'. Further secondary imperfectives built with special suffixes are: *s'ed-a-t'* 'eat up.IPFV' and *pereed-a-t'* 'eat too much.IPFV' (Tikhonov 1990: 332–333). All such derivatives were considered MR.SR.

The verbs that make up an MR pair may drastically differ according to the frequency of use. For instance, the verb *upast'* 'fall down.PFV' is stylistically neutral

and very frequent in CS and CDS (121 items per million, ipm, in the Russian National Corpus, RNC). It is derived from the elementary verb *past'* 'fall down' that has almost fallen out of use in everyday conversation and is limited to the clerical description of original sin, or to certain phraseological expressions (55 ipm in RNC). In modern Russian *upast'* 'fall down.PFV' is rather related to the verb *padat'* 'fall down.IPFV' that is also derived from the same archaic stem *past'*. We analyzed such cases as MR:SU. However, it is not clear to what extent adults – let alone children – are able to understand the morphological relatedness of the verb in the absence of semantic motivation.

4. Early manifestations of morphological sensitivity in children's speech

Children's sensitivity to the morphological decomposition of Russian word forms and lemmas was first described on the basis of diary studies (Gvozdev [1949] 2007, Eliseeva 2015) and targeted observations (Čukovsky 1928/2001, Ceitlin 2009), then later on in the investigations of spontaneous speech production (among others, Gagarina 2003, 2008). The verb derivatives are more frequent and regular than the nominal ones even before 3;0 years. The earliest derivatives in children's speech are the phonologically opaque past form of the perfective prefixed verb *u-past'* 'PFV-fall down' ← *past'*/*padat'* 'fall down' and the opposition *ot-dat'* 'PFV-give back' ← *dat'* 'give'. These forms were not yet realized by children as semantically connected with their simplicia. The next step is the simultaneous occurrence of several verb derivatives, e.g., inchoative *po-exat'* 'start going by vehicle' ← *exat'* 'go by vehicle', resultative *u-kus-it'* 'PFV-bite_once' ← *kus-at'* 'bite' showing that children accepted the necessity to modify words (Kazakovskaya, Voeikova 2021: 182). The detection of inflectional morphology in children manifests in the occurrence of morphological oppositions and miniparadigms in their speech (Dressler et al. 2003). The acquisition of early derivation patterns in the verb domain starts with the use of prefixed derivatives of the same model, e.g. *poexat'* 'start moving' ← *exat'* 'moving by vehicle' and *pojti* 'start going' ← *idti* 'go' (Filipp, 1;8), as well as with the construction of different derivatives from the same stem: *da-vat'* 'give several times' and *ot-dat'* 'give back' ← *dat'* 'give' (Kirill, 2;2–2;3). The early manifestation of derivational decomposition was found in children's speech innovation: nonexistent forms or derivatives being used by children were interpreted as clear evidence of their creativity in the use of inflectional and derivational patterns (Ceitlin 2009).

The most frequent verb derivation model is prefixation involving both lexical and aspectual prefixes. The share of prefixed verbs is about 80% of all verb derivatives both in types and in tokens (Kazakovskaya, Voeikova 2021: 182–183). The most active prefixes express motion into certain direction (*pri-exat'* 'arrive' ← *exat'* 'go by vehicle'), detachment (*ot-rezat'* 'cut off' ← *rezat'* 'cut'), transportation (*perevezti* 'transport' ← *vezti* 'move by vehicle'), as well as the start of movement (*po-bežat'* 'start runing' ← *bežat'* 'run') or any telic action (*na-risovat'* 'draw-PFV' ← *risovat'* 'draw-IPFV'). Several months after the emergence of the first derivatives, children demonstrate a preference for polysemantic prefixes, e.g. Kirill at 2;6 uses the following derivatives with *po-* in different functions: terminative: *po-vesit'*

'hang_on.PFV' ← *vešat'* 'hang_on.IPFV', *po-pisat'* 'piss-pfv' ← *pisat'* 'piss.IPFV'; ingressive: *po-exat'* 'start moving' → *exat'* 'move by vehicle' , *pojti* 'start going' ← *idti* 'go'; delimitative: *po-čitat* 'read_for a while' ← *čitat'* 'read'. Although all these verbs were used in appropriate contexts, we have observed a general cumulative increase of the *po-* prefix in the data.

However, the emergence of novel forms in CS must be preceded by latent manifestations of children's sensitivity to the morphological decomposition of words: the innovative use of inflectional and derivational patterns is impossible without detection of the boundaries between stems and inflectional endings, roots, and derivational suffixes. This new ability results in the steady growth of morphologically complex and semantically transparent word forms in children's speech production. We expect that the share of transparent MR:SR forms should increase more quickly compared to that of opaque but semantically decomposable verbs MR:SU. To check this hypothesis, we used the Kendall rank correlation coefficient (KRCC) for the precise evaluation of children's progress in the use of MU versus MR verbs.

5. Method

5.1. Data

For the analysis of verb derivation, we used the longitudinal corpora of two Russian boys (Filipp between ages 1;5 to 2;8 and Kirill between ages 1;7 to 3;0),[4] growing up in educated, middle-class families. The audio and video data were collected by mothers at maximum three-week intervals in home settings during the course of typical daily activities such as pretend play, picture-book reading, mealtimes, and similar. Observations were merged into monthly transcripts (16 transcripts of Filipp's data and 18 of Kirill's), then transcribed and morphologically tagged using CHILDES conventions (MacWhinney 2000). The exact number of analyzed verb types and tokens can be found in Table 1 below, while the growth curve of verb lemmas is shown in Figure 1 also below.

The data presented in our corpora cover the pre- and protomorphological stages of language development in two children as defined by Bittner et al. (2003: xvii–xxiv). During the premorphological stage, both children did not use morphological oppositions in the verb domain and limited every verb paradigm to one form – mostly infinitive or imperative (see also, Gagarina 2003: 136–140). This period is manifested by the low number of verb types (>10) in their speech: for Filipp it continues from 1;5 to 1;7, whereas Kirill stays at this stage from 1;7 to 2;2.

[4] The reference to the age of children is given according to the CHILDES format (MacWhinney 2000): 1;5, for example, thus stands for 1 year 5 months old.

Table 1. Verb types and tokens extracted from the corpora

Age	Kirill		Filipp	
	Adult	Child	Adult	Child
1;5	–	–	134/376	4/88
1;6	–	–	248/773	7/73
1;7	92/134	2/37	201/621	5/53
1;8	320/676	8/49	231/510	40/122
1;9	105/187	44630	216/465	72/123
1;10	180/349	44703	60/102	31/39
1;11	42/66	44676	191/353	50/74
2;0	61/101	44662	163/301	69/104
2;1	28/43	44566	263/608	131/215
2;2	58/100	4/42	282/637	108/160
2;3	94/160	44854	175/511	95/150
2;4	124/215	17/30	257/562	129/215
2;5	93/152	35/56	172/388	88/137
2;6	71/93	43/96	160/329	87/133
2;7	87/113	44/80	268/505	135/190
2;8	48/57	38/79	210/306	162/257
2;9	145/218	96/141	–	–
2;10	121/205	79/145	–	–
2;11	135/190	91/136	–	–
3;0	120/191	121/245	–	–
Total	1924/3250	605/1229	3231/7347	1213/2133

At the next stage, protomorphology, morphological oppositions and miniparadigms start to develop. The first miniparadigm consisting of three forms of the verb *exat'* 'go, ride' in Kirill's speech is registered at the age of 2;4. From then onward the number of oppositions and miniparadigms grows rapidly. Therefore, in Kirill's language data the boundary between the pre- and protomorphological stages can be drawn between 2;3 and 2;4. Filipp starts to produce inflectional oppositions and miniparadigms from the age of 1;9, using three or more forms of a number of verbs simultaneously (*prygat'* 'jump'; *s'est* 'eat up'; *upast* 'fall down'), so the change of stages happens between 1;8 and 1;9. This is close to the boundary set in Poupynin (1998) for the same corpus: 1;7–2;0. The next section describes the processing of the data extracted from the corpus for month-to-month and stage-based analysis.

5.2. Procedure

The tagging of verbs in the recorded data was conducted in two steps. First, all verb forms in CS and adult speech (CDS) were categorized as either MU or MR following the principles described in section 3. MU (elementary) verbs appear early on, and include a number of high-frequency lexemes – such as *byt'* 'be'; *dat'* 'give'; *idti* 'walk':

(1) Dat' njam-njam. (Kirill 2;02)
give.INF eat_ONOM
'Give (me something) to eat.'

(2) Konfetu dat' (Filipp 1;09)
Candy give.INF
'Give (me) a candy.'

Later other MU verbs appear, such as *guljat'* 'go for a walk', *stroit'* 'construct', *dostat'* 'fetch', *podnjat'* 'pick up, lift'.

MR verbs were then extra coded as semantically related (MR:SR) to their root word or as bearing no such relation (MR:SU). Contentious issues were treated according to Tikhonov (1990).

The MR:SR verb group in the speech of the children is represented by a wide variety of lexemes:

(3) Ih možno budet po-njuxat. (Kirill 2;09)
They.DAT can be smell_a_bit.INF
'It will be possible to smell them.'

(4) On dolžny eshe za-pit'. (Kirill 2;09)
They must yet drink_after.INF
'They have yet to wash (it) down with a drink.'

(5) Mjau ot-dat'. (Filipp 1;08)
Meow.ONOM give_back.INF
'Give back the cat.'

(6) Ja pri-dumal garaž stroit'. (Filipp 2;08)
I come_up_with garage build.INF
'I came up with an idea to build a garage.'

Morphologically related and semantically unrelated (MR:SU) verbs comprise the least numerous group:

(7) Botinok na-del. (Filipp 1;09)
Shoe put_on.PST
'(I) put on a shoe.'

(8) ADU: volk čto delaet?
'The wolf, what does he do?'
CHI: na-padaet
On_fall.3S
'(He) attacks'.

Three groups of verbs (MU; MR:SR; MR:SU) were then counted separately in lemmas, types, and tokens in CS and CDS in order to analyse their relative frequencies and distribution.

Lemmas represent the number of distinct verbs used by a speaker, types indicate the number of distinct forms of the same verb used, while tokens depict the number of actual occurrences of a verb regardless of its morphological form.

Figure 1 presents the number of verb lemmas per observation (412 in Kirill's speech and 883 in Filipp's speech in total), as well as the size of each verb group in absolute numbers. We chose the lemmas for an exemplary overview of the data; the shares of verb groups calculated in tokens can be found in Figure 1 below.

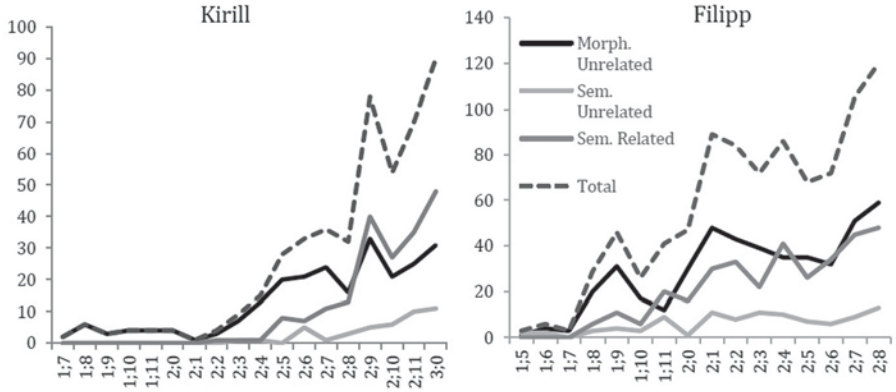

Figure 1. Total number of verb lemmas in CS per dataset and the size of each verb group in lemmas (absolute numbers)

As can be seen from Figure 1, absolute numbers do not help identify any distinct tendencies in the relative growth of the three groups for both boys, except for the fact that MR:SU verbs are infrequent in both children's corpora. Whereas in the data of Kirill the number of MR:SR verbs exceeds that of MU verbs starting from 2;8 (as predicted), the data of Filipp are not as transparent: starting from the age of 2;4, we do not notice any distinct preference in this domain. Figure 2 gives the share of these groups in percentages calculated based on verb tokens for the speech of both the boys and of their caregivers. The total number of tokens per observation can be seen in Table 1.

Here, we already see the difference between SR verbs and the other two groups. The share of SU verbs is unpredictable in all four corpora, whereas that of SR verbs increases in both children's speech in contrast to both caregivers. Thus, some extra analysis is needed to reveal the expected regularity for all three groups of verbs. This was offered by the use of KRCC for both datasets.

Figure 1 shows that the overall use of verb lemmas increases over time in both datasets. However, in order to assess and compare growth across the two datasets for the three verb groups described in section 3 (as well as, separately, in types, tokens, and lemmas), we chose Kendall's *tau*: a nonparametric rank correlation coefficient. Dodge describes KRCC as follows:

> Consider two random variables $(X;Y)$ observed on a sample of size with pairs of observations $(X_1;Y_1)$, $(X_2;Y_2)$, [---] $(X_n;Y_n)$. An indication of the correlation between X and Y can be obtained by ordering the values X_i in increasing order and by counting the number of corresponding values Y_i not satisfying this order. Q will denote the number of inversions among the values of Y that are required to obtain the same (increasing) order as the values of X. (Dodge 2008: 278)

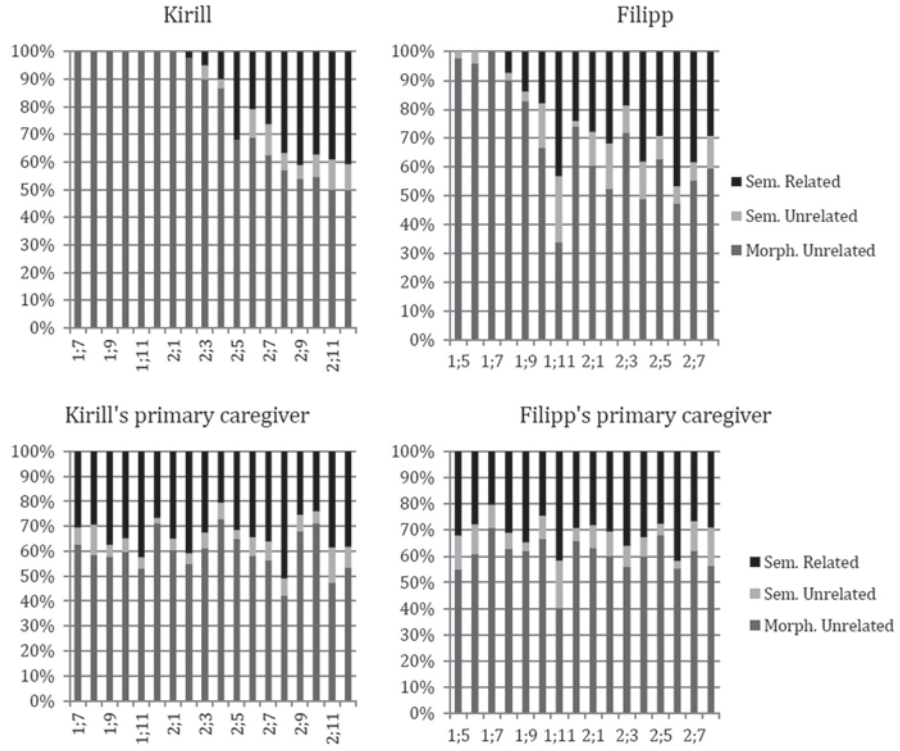

Figure 2. Share of verb tokens in three verb groups in the speech of Filipp, Kirill, and of their caregivers

Therefore, KRCC is defined as: $\tau = \mathbf{1} - \frac{\mathbf{4}Q}{\boldsymbol{n}\,(\boldsymbol{n}-\mathbf{1})}$

where Q is the number of inversions needed to achieve the same ranking positions between two samples and n is the sample size.

We apply KRCC to assess the fluctuation in verb usage over time. The implementation of KRCC in time-series analyses has already been described at length by El-Shaarawi and Niculescu (1992), Bandt (2005), and Bandt and Shiha (2007). While these analyses were conducted on the basis of biological and environmental data, we wanted to apply the same method to a linguistic dataset. Time-series examinations of linguistic data are often conducted using growth-curve analysis (Mirman et al. 2008), but we argue that a rank correlation provides enough insight to assess the fluctuation of word usage (while at the same time being easy to apply).

KRCC can acquire a value from –1 to 1, where –1 is a perfect negative correlation and 1 is a perfect positive correlation. Within our time-series analysis, a KRCC of 1 would mean that with each new observation there were more verbs of a given group in use than in the last observation. In the opposite case, when each new observation results in fewer verbs being detected than the last time around, KRCC is –1. Thus, we interpret a KRCC of 1 as steady growth and a KRCC of –1 as steady decline.

We used Kendall's τ rather than Pearson's *r*, another often-used rank correlation metric, due to its reliability with outliers as well as with relatively small sample

sizes. Croux and Dehon (2010: 509) point out the higher reliability of Kendall's τ in comparison to Spearman's *rho* as well. KRCC was computed using the *stats* package in RStudio (R Core Team 2019).

We implemented Kendall's correlation coefficient to numerically express and thus compare the increased use of verbs belonging to the different verb groups. Our hypotheses are therefore operationalized as follows:

Hypothesis 1. The total number of verbs used will steadily increase in both CS datasets (KRCC value > 0.50), as will the raw number of verbs stemming from all three groups.

Hypothesis 2. The share of MU verbs used will decline over time, whereas MR:SU and MR:SR verbs would occur with increasing frequency.

Hypothesis 3. MR:SR verbs will show the steadiest increase in use in both raw numbers and percentages, whereas MR:SU verbs may behave unpredictably.

First, we calculated the coefficient to compare the observation sequences of the three verb groups. We did this by calculating the rank correlation of the raw number of verbs used in each session to the sequence from 1 to the number of sessions. In a further stage, we examined the correlation between the percentages of the verb groups featuring among the total number of verbs used. Last, the number of verbs used from each verb group in the data of Filipp and Kirill was compared to the verb usage in CDS in order to observe whether the caregivers' data followed a similar pattern.

6. Results

6.1. Steadiness of growth for different verb groups in raw numbers and percentages

In Table 2 below we list KRCC values for the increased use of all verbs in total to assess the change therein over time without the division into verb groups. All correlations are statistically significant, which means that the total amount of verbs used steadily increases across all measures. The differences between lemmas, types, and tokens follow a similar pattern for both children: lemmas show the steadiest and tokens the least steady increase. The difference between measures depends on the topic and genre of communication. For example, the number of types (as compared to lemmas) will increase when children discuss the actions of different protagonists, as with the use of several different forms of the verb *xotet'* ('want') here:

(9) Kirill 2;10
CHI: net, ja xoč-u počitat'.
No I want-PRS:1SG to read.
'No, I want to read a bit.'
CHI: xote-l by ja etu.
Want-SUBJ:SG:MASC PTL I this.
'I would like to have this one' (about a toy car he wanted)

CHI: xot-ite pokatat'sja?
Want-PRS:3PL drive_around?
'Do you want to drive around?' (speaks with his toys).

As we see, the diversity of forms (types) strongly depends on what is discussed and whether other participants take part in the game. The number of tokens may increase due to the repetitions of one and the same form, like in this instance:

(10) Filipp 2;4
CHI: Nu s toj storony kto sid-it?
PTL from that side who sit-PRS:3SG
'And who is sitting on that side?'
CHI: I na stule babushka sidit.
And on chair granny sit-PRS:3SG
'And the granny is sitting on the chair.'
ADU: A čto obez'jana dela-et?
And what monkey do-PRS:3SG
'And what does the monkey do?'
CHI: Sidit.
sit-PRS:3S
'(She) is sitting.'

The number of tokens increases due to frequently used forms, which are not numerous but are used throughout the whole observation period. Thus, this measure is the least stable.

Table 2. Steadiness of growth (KRCC), (CS, total verb amount, raw numbers)

Child	Lemmas	Types	Tokens
Kirill	0.78	0.75	0.61
Filipp	0.74	0.70	0.54

The KRCC values presented in Table 2 confirm what we saw in Figure 1: within the observed time period both datasets show an increase in the total verb usage. This is not surprising, because one's vocabulary is developing rapidly at this age. According to Gries (2008: 155), a KRCC above 0.50 can be interpreted as strong correlation; in our case, as steady growth. Kirill's data on lemmas show an even higher rank correlation than Filipp's. A glance at the raw-data visualisation (Figure 1) helps us to contextualise the abstract KRCC values: Kirill's overall verb number declines four times (at 1;9, 2;1, 2;8, and 2;10) and Filipp's five times (at 1;7, 1;10, 2;2, 2;3, and 2;5). While KRCC does not solely measure the number of declines, they influence it very strongly. The number of observations, which is slightly smaller in Filipp's case, plays a role as well.

KRCC reflects an overall tendency of the data to grow or decline, but due to its ranking nature, it does not consider exact values. This can lead to curious results: for example, the raw data on SU lemmas in Kirill's case show that within the first eight months of observation he never uttered a SU verb. He did afterwards, and the number of such verbs used grew steadily from one to eleven over the next ten months. However, the correlation coefficient does not reveal that this growth occurs in the second half of the observation period.

Table 3. Steadiness of growth (KRCC) (CS, raw numbers)[5]

Verb groups	Child	Lemmas	Types	Tokens
MU	Kirill	**0.70**	**0.68**	**0.57**
	Filipp	**0.64**	**0.60**	*0.23*
MR:SR	Kirill	**0.87**	**0.87**	**0.88**
	Filipp	**0.85**	**0.81**	**0.77**
MR:SU	Kirill	**0.80**	**0.81**	**0.76**
	Filipp	**0.52**	**0.48**	**0.55**

For both datasets, the values vis-à-vis the three verb groups rose over the course of the observation periods: KRCC was positive throughout all observations, and in all cases (except for two) it was higher than 0.50. Filipp's data show a lower KRCC twice: first, for the tokens of MU verbs (0.23) and, second, for the types of SU verbs (0.48). A significance test reveals that in the first case Filipp's usage of verbs shows no statistically significant increase over time (p-value = 0.2065), while in the second case the increase is statistically significant (p-value = 0.01).

SR verbs show the highest KRCC for both datasets and are thus rising most steadily. This was expected, as overall there are more MR:SR verbs used than there are verbs stemming from the other two groups. Thus, verbs belonging to the voluminous open class have more chance of seeing a steady increase in usage.

In both datasets, MU verbs show a steadier growth in lemmas and types than they do in tokens. Our explanation for this is that both children cannot avoid using primary MU verbs: these verbs make up a large share of the basic vocabulary both in terms of lemmas and of types. The calculations based on raw numbers for two different corpora show an increase in all verb groups' usage, but may not explain all the intricate details of the acquisition process. Table 4 is based on the percentage that each group constitutes, and thus demonstrates the development of the verb groups in relation to each other.

Table 4. Steadiness of growth (KRCC) (CS, percentages)

Verb groups	Child	Lemmas	Types	Tokens
MU	Kirill	**–0.87**	**–0.87**	**–0.90**
	Filipp	**–0.40**	*–0.33*	**–0.58**
MR:SR	Kirill	**0.83**	**0.82**	**0.85**
	Filipp	**0.62**	**0.68**	**0.67**
MR:SU	Kirill	**0.63**	**0.65**	**0.65**
	Filipp	*–0.20*	*–0.23*	*0.25*

Here, the results are very different from those based on raw numbers. MU verbs show a strong negative correlation in Kirill's dataset: over the course of the observation period, the share of MU verbs steadily declined in comparison to the two MR groups. Filipp's data is more complicated: here, KRCC is negative as well; however, the coefficients for lemmas, types, and tokens are more scattered and range from –0.58 to –0.33. In the case of the types (KRCC = –0.33), the correlation between time and the number of verbs used ceases to be statistically significant. SR verbs

[5] Here and in subsequent tables statistically insignificant results (p-value ≥ 0.05) are written in italics, while statistically significant KRCC values are marked in bold.

show a different tendency: in both datasets their number increases (in Kirill's data even more steadily with a KRCC over 0.8; Filipp: 0.65 ± 3).

A puzzling picture presents itself with regard to SU verbs: while Kirill's data show a steady and statistically significant increase in lemmas, types, and tokens (KRCC = 0.64 ± 1), Filipp's shows an insignificant negative correlation for lemmas and types, and a similarly insignificant positive correlation for tokens. Thus, Filipp's usage of SU verbs fluctuates without a clear pattern to it. In order to make a conclusion about the share of SU verbs used, we would need to acquire more data.

6.2. Comparison with the language of the mothers

We calculated KRCC for the mothers' data and assessed the results on the basis of a significance test. The idea here was to determine whether there was a significant increase of certain groups of verbs within CDS, which might have caused the dynamics observed in CS. Table 5 presents data on the steadiness of all verb groups' usage irrespective of the stage of development (corresponding to Table 2 based on CS).

Table 5. Steadiness of growth (KRCC) (CDS, raw numbers)

Verb groups	Adult	Lemmas	Types	Tokens
MU	Kirill's mother	*0.01*	*0.04*	*–0.04*
	Filipp's mother	*0.09*	*0.26*	*–0.23*
MR:SR	Kirill's mother	*0.12*	*0.11*	*0.13*
	Filipp's mother	*0.01*	*–0.07*	*–0.06*
MR:SU	Kirill's mother	*0.17*	*0.15*	*0.21*
	Filipp's mother	*0.03*	*–0.02*	*–0.13*

The comparison of CS to CDS shows that, unlike children, their mothers saw no significant growth of verb vocabulary: in all measures based on raw numbers, correlation to the number of recordings is insignificant. The same is true for the percentages (see Table 6 below); however, negative correlation does occur more frequently. These comparisons show that the differences in children's verb vocabularies do not directly mirror their mothers' speech forms.

Table 6. Steadiness of growth (KRCC) (CDS, percentages)

Verb groups	Adult	Lemmas	Types	Tokens
MU	Kirill's mother	*0.07*	*0.05*	*0.17*
	Filipp's mother	*0.03*	*0.33*	*–0.12*
MR:SR	Kirill's mother	*–0.11*	*–0.06*	*–0.05*
	Filipp's mother	*–0.12*	*–0.31*	*0.06*
MR:SU	Kirill's mother	*0.09*	*0.13*	*0.20*
	Filipp's mother	*0.00*	*–0.10*	*–0.13*

7. Discussion

This study shows that Kendall Rank Correlation Coefficient (KRCC) has several applications for the analysis of spontaneous language data in developmental studies. The implementation of Kendall's *tau* allowed us to assess growth tendencies in child speech. We were able to obtain statistical evidence for the growth of the total number of verbs used in both child speech datasets (KRCC value > 0.50), as well as for the raw number of verbs drawn from all three groups thereof.

We also obtained statistical evidence that the group of morphologically and semantically related verbs shows the steadiest increase in use in terms of both raw numbers and of percentages. This is an indirect indication for children's selectivity vis-à-vis their lexicon, although it might also be an effect of the high frequency with which such verbs are used. Other results were also interpretable. Morphologically related and semantically unrelated verbs revealed different tendencies in the speech patterns of our subjects. This might be due to the fact that children start to enrich their verb vocabulary at different times, and Filipp is not yet mature enough to cope with semantically opaque verbs. The number and share of verbs in child-directed speech is stable, and does not increase either in terms of raw numbers or of percentages. We could expect a positive correlation if caregivers' speech demonstrated the growth of one's verb vocabulary as a result of fine-tuning to children, but this was clearly not the case.

The group of morphologically unrelated verbs indicated a steady increase in the raw number of types and lemmas used (less so in terms of tokens). However, their share as a percentage decreases with the development of both morphologically related classes: semantically related and semantically unrelated. The percentage of semantically related verbs steadily increases, whereas the share of semantically unrelated verbs manifests differently in the two boys' speech: increasing for Kirill, decreasing for Filipp. This has to do with the size of such verbs in the datasets: in Kirill's data, morphologically related and semantically unrelated verbs are numerous and make up an open class; meanwhile, Filipp is happy with a small group of such verbs, the number of which does not increase.

This investigation was our first experience with KRCC for the study of child speech. Our predictions were corroborated; furthermore, we could state that children treat derivational classes of verbs differently even before they start to conjugate. Closer analysis of different sets of data will allow us to obtain more accurate results concerning the demarcation of stages.

Abbreviations

1SG	first person singular
3SG	third person singular
3PL	third person plural
CDS	child-directed speech
CS	child speech
INF	infinitive
IPFV	imperfective verb
KRCC	Kendall Rank Correlation Coefficient
MASC	masculine

MR	morphologically related verbs
MR:SR	morphologically related and semantically related verbs
MR:SU	morphologically related but semantically unrelated verbs
MU	morphologically unrelated verbs
ONOM	onomatopoeia
PFV	perfective verb
PRS	present
PST	past
PTL	particle
SG	singular
SUBJ	subjunctive

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VENE KEELE VERBITULETISTE VARASE KOMPOSITSIONAALSUSE HINDAMINE ESIMESE KEELE OMANDAMISES KENDALLI ASTAKKORRELATSIOONIKORDAJAGA

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Artiklis uurime laste tundlikkust vene verbi tuletusmustrite suhtes Kendalli astakkorrelatsioonikordaja (KRCC) abil, mida rakendatakse kahe poisi (vanuses 1;5–2;8 ja 1;7–3) ja nende hoidjate kõneloome pikiuurimuse andmete analüüsis. Eristame kolme verbide rühma: morfoloogiliselt mitteseotud (alg-), morfoloogiliselt ja semantiliselt seotud (tuletatud) ning morfoloogiliselt seotud, kuid semantiliselt läbipaistmatud verbid. KRCC kasutamine kahe pikisuunalise andmestiku jaoks näitab, et morfoloogiliselt ja semantiliselt seotud (tuletatud) verbide arv ja osakaal suureneb aja jooksul pidevalt, ent nii alg- kui ka semantiliselt läbipaistmatud verbide kasutus vaheldub erinevates suhtlusolukordades. Lapsele suunatud kõne andmestikule rakendatuna ei näidanud sama mõõdik olulist kasvu üheski verbirühmas, mis peegeldab nende muutumatut üldist jaotuvust täiskasvanu kõnes. See tähendab, et lapsed on tundlikud vastavate rühmade morfoloogilise eristuse suhtes. KRCC abil kahe juhtumiuuringu kohta saadud tulemused erinevad algandmetest morfoloogiliselt mitteseotud (alg-) verbide rühmas, mis ühes andmekogumis pidevalt vähenevad ja teises ei näita selget tendentsi. KRCC rakendamine spontaanse kõne andmetele näitab seega väikelaste varjatud eelistusi sõnade ja sõnavormide valikul.

Märksõnad: tuletusmorfoloogia, esimese keele omandamine, pikiuurimus, Kendalli astakkorrelatsioonikordaja, vene keel

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