What Do Asymmetries in Children's Performance Tell Us about the Nature of Their Underlying Knowledge?

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Abstract

This paper examines the course of acquisition of the semantic gender criterion by studying children's overregularization rates with two subtypes of Russian nouns: male kinship terms and male names in *–a*. These nouns are semantically masculine, while their morphology indicates feminine gender. Twenty-five Russian children aged 2;6-4;0 participated in this empirical study. The asymmetry found in their agreement production for the individual male kinship terms is explained along the lines of the Words and Rules model (Pinker 1999). That is, the asymmetry between the high- and low-frequency nouns is attributed to the input frequencies of individual nouns. Yet, frequency is not the only factor which responsible for the asymmetries in children's production. In addition, differences in the semantic representation of proper names vs. common nouns are argued to play a role.

1. Introduction

The question whether gender acquisition is a rule- or rote-based process has been considered in many studies in the previous century as well as more recently. There is a broad consensus among researchers that formal gender regularities (morphological and/or phonological) are acquired in a rule-based fashion (Henzl, 1975, Karmiloff-Smith, 1979, Mills, 1986, Müller, 2000, Kupisch, 2002, *inter alia*). Yet, it is not clear how the integration of the semantic (sex-based) criterion proceeds and what underlies this process. More specifically, based on the data from various languages it has been shown that children base their initial hypotheses about gender on formal criteria, and already at around the age of two exhibit an implicit system of formal assignment rules. On the other hand, the consideration of the semantic criterion increases slowly with age, based on which it has been concluded that two-year-olds lack cognitive clarity and the cognitive salience of gender (cf. Levy, 1983). The gradualism of this process raises the following important question: Is the semantic procedure a rule-based process from the start or does it involve some rote-based learning?

The purpose of this study is twofold. First, it aims to answer the question regarding the nature of the semantic procedure on the basis of empirical evidence from the acquisition of gender with two exceptional

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types of Russian nouns. They are male kinship terms like *papa* 'daddy' (henceforth *papa*-type nouns) and male names ending in *–a* (e.g. *Vanya* from full name *Ivan*). These nouns are of particular interest for this study, as their morphological properties point towards feminine gender, while their semantic properties suggest that they are masculine. Thus there is a conflict between two gender criteria. In reality these nouns are masculine, since they refer to male individuals. These nouns are reported to be problematic for Russian two-year-olds (cf. Gvozdev, 1961), who tend to erroneously assign feminine gender to them on the basis of morphology. Therefore, in this study I examine children's overregularization pattern in detail in order to shed some light on the acquisition of the semantic criterion.

Second, this study considers the implications of the empirical data for generative and cognitive-functional approaches to language acquisition, such as the Rules and Competition (RC) model (Yang, 2002) and the Words and Rules (WR) model (Pinker, 1999). As follows from their names, the theories have different views on the acquisition process. The RC model proposes a single, rule-based mechanism for the acquisition of morphology (e.g. English past tense). The WR model proposes a dual mechanism, i.e. a combination of rule and rote learning. The theories account for the course of acquisition, and children's overregularization pattern in particular, in terms of type vs. token frequency. Thus frequency factors will play an important role here.

In this study I will formulate the predictions with regard to the relevant class of nouns along the lines of these theories of morphological acquisition. The detailed analysis of error pattern in this study reveals a theoretically interesting asymmetry in children's agreement production between high-frequency and low-frequency male kinship terms. I claim that the less consistent production for the low-frequency nouns *mužčina* 'man' and *junoša* 'youth' provides an indication of a rote-based learning constrained by token frequency, which is compatible with the WR model's view on the acquisition process. Thus Yang's idea of a 'free ride' effect (presented below) is not supported. Yet, frequency alone cannot explain the course of acquisition of the semantic criterion, as it appears to have no impact on the acquisition of gender with male names ending in *–a*. I propose that the asymmetry in children's production between the rare male names and the low-frequency male kinship terms may be due to the differences in the semantic representation of proper names vs. common nouns.

The paper has the following organization. In the next section I present the test nouns and their input frequencies. In Section 3 I discuss the main

features of the WR and the RC models and formulate the specific predictions for this gender study along the lines of these approaches. Issues regarding the methodology are discussed in Section 4. The results of the experiment are presented in Section 5. Section 6 accounts for the asymmetries in children's overregularization patterns and discusses the implications of the novel data for the two approaches to morphological acquisition. In Section 7, I provide a summary of the conclusions.

2. The Nouns and Their Frequencies

As mentioned in the introduction, the subtypes of nouns which are the topic of this paper are exceptional in the sense that they exhibit morpho-semantic gender mismatches. Importantly, morphology has a larger scope than semantics in a gender system of Russian and children, who are known to be sensitive to the morphological properties of nouns from early on, can produce erroneous feminine agreement with these nouns, as illustrated in (1) (from Gvozdev, 1961).[1] According to Gvozdev, these errors persist until approximately the age of 3. Therefore, children's production before this age may be most revealing.

(1) a. moja papa (Zhenya 2;3.20)
my.F daddy(M)
'My daddy'
Target form: moj.M papa(M)

b. Zhenya pugovica otorvala (Zhenya 1;10.23)
Zhenya(M) button ripped.F off
'Zhenya ripped off the button.'
Target form: Zhenya(M) pugovicu otorval.M

In terms of frequency, the five male kinship terms that are tested here are supposedly different: *papa* 'daddy', *deduška* 'granddad', and *djadja*[2] 'uncle/man' should occur rather frequently in child directed speech, while *mužčina* 'man' and *junoša* 'youth' must be very rare. Admittedly, different children are exposed to different frequencies with these nouns, yet, it is the

[1] In the glosses, the gender of a noun (controller) is marked in parentheses, and the gender of the agreeing item (target) is marked after a period.

[2] It should be noted that the noun *djadja* can denote not only uncle but more generally a male person, thus it is common substitution for the noun *mužčina* 'man' used by adults in child directed speech. In other words, adults, when talking to children, will use *djadja* rather than *mužčina* in reference to a male, whether familiar or not.

general pattern which is important here, i.e. *papa*, *deduška*, and *djadja* are high-frequency nouns, while *mužčina* and *junoša* are low-frequency nouns. The frequencies discussed here are based on the sample of a mother's speech in the Protassova corpus, found on the CHILDES Database (MacWhinney and Snow, 2000).[3] The results are presented in Table 1. As expected, *papa* has the highest frequency in this sample of child directed speech. *Deduška* and *djadja* occur less frequently. In this sample of child-directed speech the noun *djadja* was used to denote a 'man' (i.e. not a relative) in all the occurrences. Finally, the nouns *mužčina* and *junoša* are not present in the adult's speech at all.

Table 1: Frequency of occurrence of individual nouns and agreeing forms in the sample of child directed speech, MOT in eight files of Varvara (age 1;6-2;10).

	N (nouns)	N (noun+Agr)
papa 'daddy'	54	27
deduška/deduka/deda 'granddad'	14	4
djadja 'uncle/man'	5	1
mužčina 'man'	0	0
junoša 'youth'	0	0

Note that Russian families have different traditions for addressing grandfathers. The child's mother used three variants, *deduška/deduka/deda*. In this study I decided to use the form *deduška* in order to achieve the syllabic and the sound balance between the high- and low-frequency test items.

To obtain a clearer picture of the nature of the semantic procedure, I included rare archaic male names ending in *–a* as well as a non-existing noun *obormoša* in the experiment. The novel noun has the same grammatical properties as the existing nouns in the study, i.e. its morphology suggests feminine, but it denotes a male creature, hence it is masculine. These nouns were used as a tool to assess children's grammatical knowledge independently of their lexical knowledge (cf. Berko Gleason, 1958). That is, if children can generalize the knowledge of natural gender to a word they have never heard in the input, this means that there must be a mental rule that allows them to do so.

[3] The child whose mother's utterances I analyzed was aged 1;6 - 2;10. The adult data taken for the analysis comprises eight files. The *kwal* command in the CLAN program was used to count the total number of tokens as well as the number of phrases containing agreement. The analysis command used for the calculation was computed for each of the five nouns and contained the noun's root, e.g. the formula 'kwal@+s pap*+t*MOT' was used to search for utterances with the noun *papa* 'daddy'.

In the next section I show how gender assignment of the male kinship terms can be examined in terms of WR and RC models.

3. Theoretical Perspectives on Gender Acquisition

The acquisition models that I consider below differ in principled ways. Importantly for us, they apply different mechanisms to language acquisition, such as rule-based vs. rote-based learning. In particular, they make different claims regarding the mechanisms that are operative for the acquisition of English past tense morphology. The WR model proposes a dual mechanism approach where regular morphology is acquired by rules, while irregular morphology is stored in the mental lexicon. The RC model proposes a single mechanism approach where both regulars and irregulars are acquired by rules. Both models regard frequency as a factor that constrains the course of acquisition. In the following subsections I provide the description of important features of the WR and the RC models and apply them to the acquisition of gender.

3.1. The Words and Rules Model

Within the WR model the two components 'word' and 'rule' represent two processes: rote learning for irregular morphology and rule learning for regular morphology. Hence regular past tense verb formation in English is subject to a rule application, namely the default phonological rule which adds the *–ed* suffix to the root (stem). Irregular verb forms, on the other hand, are claimed to be stored in the mental lexicon. That is, since these forms are unpredictable, they must be memorized or learnt by rote. Importantly, Pinker proposes that irregulars are not stored at random, but rather according to patterns. This means that lexical items with similar patterns are stored close together, e.g. *sing-sang* is stored in the neighborhood of *ring-rang*.[4] The WR model predicts that a child will initially memorize irregular forms of individual verbs, later s/he will discover patterns among these items in adult usage and make generalizations to new, similar verbs. Thus, the acquisition of irregular morphology starts as a rote-based process and later proceeds in a rule-based fashion. Token frequency is the crucial factor that affects this process. The model posits that irregular forms are memorized with a certain strength based on token frequency, i.e. the frequency of the occurrence of an individual verb in the input. If a verb has a high token frequency, this

[4] This idea is similar to the pattern associator of Rumelhart & McClelland (1986), which was proposed to derive both regulars and irregulars by means of associative memory.

enables it to be learnt faster and with greater accuracy. Since memorization takes time and experience to be perfected, the child can fail to retrieve an irregular form, and in this case the default *–ed* form will be used. According to Pinker, the more frequently an irregular verb is heard, the better the memory retrieval for that verb becomes, and the lower the overregularization rate.

3.2. The Rules and Competition Model

Unlike Pinker, Yang (2002) introduces a single component, i.e. a 'rule' component. In his model, English irregular past tense forms, as well as regular ones, are formed by rules that apply to a class of individual verbs (e.g. vowel shortening in the case of *feed*, *shoot*, etc.). Thus, in the RC model, it is the class membership that is memorized. The acquisition of an irregular past tense form is a process of competition between a certain irregular phonological rule (e.g. *–t* suffixation & vowel shortening as in *lose*, *deal*) and the default *–ed* rule, where overregularization errors result from failures to apply appropriate irregular phonological rules rather than the default rule.

Importantly, in the RC model, the performance of an irregular verb is determined by two factors: the correct identification of class membership and the probability of the irregular rule applying over the default *–ed* rule. Yang proposes the class-based frequency hierarchy: irrespective of the verb's individual frequencies, which can be rather low, its correct usage rate can be quite high, as long as other members of its class are frequently encountered. In other words, high weight phonological rules enable low-frequency verbs to be used with high accuracy, what Yang calls the 'free-rider effect'. He claims, for example, that the verbs *hurt* and *cut* occur with high accuracy rate in children's production despite their low absolute frequency, since they are in the same class as the verbs *hit*, *let*, *set*, *put*, etc., which have very high usage frequencies (totaling over 3000 occurrences), and every occurrence of such verbs increases the weight of the class rule.[5] Thus, the rule for this class, such as [-ø & No Change], has a very high weight, which enables low-frequency verbs *hurt* and *cut* to be used with high accuracy. In contrast, *blew*, *grew*, *flew*, and *drew*, which belong to the class [-ø & Rime → u] are problematic, since these verbs are infrequent in the same way as the other verbs in this class, such as *knew*, *threw*, etc. As

[5] The child data used by Yang (2002) comes from Marcus (1982) where four American children were studied (Adam 2;3-5;2, Eve, 1;6-2;3, Sarah 2;3-5;1, and Abe 2;5-5;0). In addition Yang analyzed the input sample of more than 110,000 adult sentences to which these children were exposed during the recordings.

Yang points out, the [-ø & Rime → u] class totals only 125 occurrences in the input sample. Hence the weight of the rule [-ø & Rime → u] is lower than that of the rule [-ø & No Change], which explains the asymmetry in children's performance with these verb classes reflected in the accuracy rates.

In sum, both the WR and the RC models focus on children's overgeneralization patterns in order to explain the asymmetries in children's production of past tense forms of irregular verbs. Within the WR model token frequency is claimed to have an effect on the rate of acquisition, hence rote-based learning must take place. Importantly, frequency effects are only predicted for irregulars, regular forms are acquired by the rule. Within the RC model, however, the differences in children's production for individual verbs are explained in terms of their class membership, so that their individual frequencies have no effect. Hence it is a rule-based process from the start.

3.3. Rule- vs. Rote-Based Gender Acquisition: Hypotheses and Predictions

According to the theories discussed above, we can expect the acquisition of the semantic principle to be either a dual or a single process. Along the lines of the WR model the semantic procedure should be a combination of both rote- and rule-learning. That is, the semantic criterion should be acquired in several stages. First, children learn the gender of individual nouns by rote, and then they formulate the semantic rule and begin to generalize. Thus, the integration of the semantic rule takes time, since it involves some rote learning. In the RC model the semantic procedure is a rule from the start which competes for dominance with the morphological rule in the course of acquisition. In both models the gradualism of the acquisition process is attributed to input frequency. However, in the WR model, it is token frequency, i.e. the frequency of the occurrence of a particular noun in child-directed speech, that underlies gradual learning, while type frequency, i.e. the occurrence of an item within a particular class, is argued to play a role in the RC model. More specifically, within the RC model low-frequency nouns should get a 'free ride' from high-frequency nouns in the same class, i.e. there should be no frequency-overregularization correlation for the individual nouns within a particular class.

Based on the input frequencies discussed in Section 2, I suggest that the class of *papa*-type nouns represents a good testing ground for both models, since on the one hand, it includes fairly rare items like *mužčina* 'man' and *junoša* 'youth' and on the other very frequent ones like *deduška* 'granddad' and *djadja* 'uncle/man', and especially *papa* 'daddy'. With

regard to these nouns, the following frequency-overregularization correlation can be expected. First, if the semantic procedure involves item-based learning, as the WR model predicts, I should find higher accuracy rates for the nouns *papa*, *deduška*, and *djadja*, which occur in the input more frequently than nouns like *mužčina* and *junoša*. In other words, the overregularization errors, i.e. feminine agreement, should occur more often for *mužčina* and *junoša* than for *papa*, *deduška*, and *djadja*. Second, if the semantic procedure is a rule-based mechanism, as the RC model predicts, there should be no discrepancy in agreement production between high-frequency and low-frequency nouns within the same class, i.e. low-frequency nouns *mužčina* and *junoša* should occur with high accuracy rates, since they are in the same class with the high-frequency nouns *papa*, *deduška*, and *djadja*. Note also that this frequency-overregularization correlation may be most visible for two-year-olds, who, according to Gvozdev's (1961) study, may not have full mastery (at the 90% level) of the semantic principle yet.

With regard to the rare male names ending in *–a* and the novel noun *obormoša*, children's productive use of masculine agreement with them should allow me to exclude the possibility that children's gender knowledge is a result of memorization. The reverse result will indicate that children learn the gender of each lexical item one by one.

Based on this two alternative hypotheses can be formulated:

Hypothesis I: The acquisition of the semantic principle proceeds in an item-based fashion, which develops into a rule (cf. WR model, Pinker, 1999).

Prediction 1: There should be differences in the accuracy rates between high-frequency nouns (*papa*, *deduška*, and *djadja*) and low-frequency nouns (*mužčina* and *junoša*), so that the latter are expected to be more error-prone than the former. In addition, the rate of acquisition for the rare male names ending in *–a* and the novel noun *obormoša* should be similar to those of low-frequency nouns *mužčina* and *junoša*.

Hypothesis II: The acquisition of the semantic principle proceeds in a rule-based fashion (cf. RC model, Yang, 2002).

Prediction 2: There should be no differences in the accuracy rates between high-frequency nouns (*papa*, *deduška*, and *djadja*) and low-frequency nouns (*mužčina* and *junoša*): the latter should occur with high accuracy rates, since they belong to the same class with the high-frequency nouns *papa*, *deduška*, and *djadja*). High accuracy rates are also expected for the rare male names in *–a* and the novel noun, as they are in the same class too.

4. Methodology

In the following subsections I present the participants of the study and three elicited production experiments, which were designed to elicit adjectival and/or verbal agreement with *papa*-type nouns, male names in *–a*, and the novel noun. The experiments were conducted on different days, each session lasted approximately 15 minutes with each child.

4.1. Population

The data used for the present study were collected at day-care center *Detskij Mir* in Ivanovo, Russia.[6] Twenty-five normally developing children (14 girls and 11 boys) between the ages of 2;6 and 4;0 took part in the study. All children were monolingual speakers of Russian. The subjects were tested individually in a separate room in their day-care center.

4.2. Experiment 1: Papa-type nouns

The experiment was designed to elicit adjectival agreement (e.g. *sinij papa* 'blue daddy' or *papa sinij* 'daddy is blue') and verbal predicate agreement (e.g. *papa upal* 'daddy fell down') with five masculine nouns: *papa* 'daddy', *deduška* 'granddad', *djadja* 'uncle/man', *mužčina* 'man', and *junoša* 'youth'. Other masculine, feminine and neuter nouns were used as fillers, e.g. *lev*(M) 'lion', *pingvin*(M) 'penguin', *mama*(F) 'mommy', *kurica*(F) 'hen', *koleso*(N) 'wheel', *vedro*(N) 'bucket', etc. All filler items had a transparent morphological form, i.e. their gender was easily derived from their formal properties. All nouns were presented in nominative singular.

The experiment was introduced as a game where cardboard characters of different colors were used to represent each noun. Each character appeared in five colors: blue, yellow, red, green and purple. Hence there were five fathers, five grandfathers, etc. Every test item was introduced in a separate trial together with three fillers: masculine, feminine, and neuter. Thus, there were five trials performed on five different days. The characters representing each noun were placed into small paper bags which were put on the table as well as some small objects, e.g. a book, a saucer, a cup, etc. The experimenter (the author of the paper) manipulating a puppet called Elmo explained to the child that Elmo was a silly puppet who could not remember the names of colors and who refused to listen to adults. The child was then asked to help Elmo learn the color terms. Next, the

[6] Pseudonyms were assigned to the day-care center, as well as all participants in the study, to protect their privacy.

experimenter took the characters out of the bags and put them in different places, e.g. under the book. The child had to tell Elmo what color character was where, e.g. *sinij papa pod knigoj* 'blue daddy is under the book'. The experimenter used the following lead-in statement: *Posmotri, vot papa. A po cvetu papa*? [Here is a daddy. And what color is daddy?] The character was then placed on the table and the experimenter asked: *Skaži Elmo, gde teper' papa*. [Tell Elmo where daddy is now.] If the child forgot to use the color term s/he was reminded that it was important to name the color of each character; otherwise Elmo would get mixed up. If the child used the wrong color adjective she was never corrected. Importantly, I controlled the order of colors and characters, so that the test item, i.e. a male kinship term, always followed after a neuter filler of a different color. This was done in order to avoid a "carryover" effect, i.e. the similarity of materials across experimental conditions.

4.3. Experiment 2: Male Names in –a

This experiment aimed at eliciting predicate agreement with hypochoristic forms of male names ending in *–a* and the past tense verbs. In order to exclude the familiarity effect, i.e. the possibility that children could know the gender of these nouns from before, very old-fashioned, rare names were used in this task, e.g. *Trenya*. Rare full male names (e.g. *Agap*), whose morphological form corresponds to their gender, as well as female names (e.g. *Luša*) were used in the task as filler items.

A set of pictures was made for the experiment. Each picture portrayed three children: two boys and a girl, or three boys. The pictures were paired: the first one introduced the characters and in the next picture they had performed some action, e.g. climbed a tree, etc. The children were first shown the characters in the first picture and heard their names. After that they repeated the names together with the experimenter. The children were also asked to call the characters by names. Next they were asked to say what each child had done in the picture that followed. The experimenter pointed to a single child, usually starting with the test item, and asked the following lead-in question: *Čto *sdelali*.PL (target: *sdelal*.M.SG) *Trenya*? [What did *Trenya* do?]. Note that the lead-in question is ungrammatical, since the verb has the plural form. The technique was inspired by Popova (1973) who used the same question form in her experimental design.[7]

[7] The technique proved to be successful, i.e. in general the children were not affected by the ungrammatical plural agreement in the lead-in question. I found only two plural verb forms in the speech of two children.

4.4. Experiment 3: Novel Nouns

In this storybook reading task I introduced the children to a novel (invented) noun *obormoša*. The noun was used to denote an animal of male gender that was invented for the purpose of this study. The sex of the character was explained to the children in the introduction. I have also tried to portray the animal as 'male looking'. Thus, this noun showed a form-meaning mismatch similar to that of *papa*-type nouns: its ending is typical of feminine nouns but semantically it should be masculine. The experiment aimed at eliciting attributive adjective agreement as well as verbal predicate agreement.

A set of pictures representing ten differently colored, but otherwise identical imaginary animals called *obormoša* was used in the task. The first picture showed a single *obormoša*. In the next picture all ten were shown sitting on a bridge. The child was then asked to help the puppet tell the story about these animals. The experimenter then showed a picture with nine animals in the background and one playing in the foreground. The following lead-in question was asked: *Čto slučilos' s obormošej*? [What happened to *obormoša*?] or *Čto* **sdelali*.PL (target: *sdelal*.M.SG) *obormoša*? [What did *obormoša* do?] The former question contained neuter agreement, where the verb *slučilos'* 'happened' agreed in neuter with the question word *čto* 'what'. The latter question was in plural. By doing so, I carefully avoided providing any clues to the noun's gender, except the animal's name. The procedure continued till no animals were left on the bridge.

5. Results

The results were counted by hand. When counting the children's responses, I excluded all unclear cases and counted every occurrence of an agreement target with or without a controller. For *papa*-type nouns and the novel nouns the agreement targets were adjectives, but also some verbs and pronouns. For the novel noun they were verbs, adjectives and pronouns. Finally, for the male names in *–a* they were only verbs. The issues regarding the differences in the experimental conditions are discussed further at the beginning of Section 6.

The likelihood of a carryover effect was rather small in Experiment 2 on male names, since the test items were presented first and the fillers followed after that. Note however, that since there was no proper introduction in this experiment, most of the children made mistakes with regard to the first picture. Therefore, these responses were excluded. With

regard to Experiment 3 on the novel noun, the test items did not follow immediately one after another: before the other test item was shown, the child had a break counting the animals together with Elmo. Finally, with regard to *papa*-type nouns (Experiment 1), where the test items followed after neuter fillers of a different color, I only included those agreement forms with the test nouns which differed from the forms used with the neuter fillers in either color or inflection of the agreement target or both.

Some examples of children's responses are given in (2). The structures in (2a and c) contain two tokens each, i.e. two agreement targets, while the structure in (2b) has just one. Occasionally, target-deviant and target-consistent forms could occur in the same utterance, as shown in (2a), where the first of the verb forms, *upala*, is target-deviant, while the second one, *perevernulsja*, is target-consistent.

(2) a. oj djadja upala u menja i perevernulsja
oops uncle/man(M) fell.F at me and flipped.M over
'Oops, my uncle/man fell and flipped over.' (Kolya 3;1)
Target form: djadja(M) upal.M

b. snegovika stroila (Lena 3,1)
snowman built.F
'(Jan'ka) was making a snowman.'
Target form: Jan'ka(M) stroil.M

c. obormoša zalez krasnyj na derevo (Petya 2;8)
obormoša climbed.M red.M on tree
'Red *obormoša* climbed the tree.'

Table 2 shows the overall result of agreement production for the three noun groups: common nouns, proper names and a novel noun. It is clear that the accuracy rates of common nouns and proper names satisfy Brown's (1973) criterion of 'use of grammatical structure in 90% of obligatory contexts', since they have correct agreement 92.0% and 96.0% respectively. The accuracy rate of the novel noun is 87.9% which is comparatively close. The error rates are quite low: 8.0%, 4.0%, and 12.1% with common, proper and novel nouns respectively.

Table 2: Overall agreement production with common, proper, and novel nouns (25 children, age 2;6-4;0).

Noun type	N corr. (%)	N err. (%)	N total 100%
common nouns (*papa*, etc.)	682 (92.0)	59 (8.0)	741
male names in *–a* (*Trenya*)	217 (96.0)	9 (4.0)	226
novel noun (*obormoša*)	357 (87.9)	49 (12.1)	406

In order to determine what role input frequency plays, I first divided the data by individual lexical items. Table 3 provides the overall distribution of agreement errors across the five common nouns individually.

Table 3: Overall number and percentage of target-deviant agreement forms for five common nouns (25 children, age 2;6-4;0).

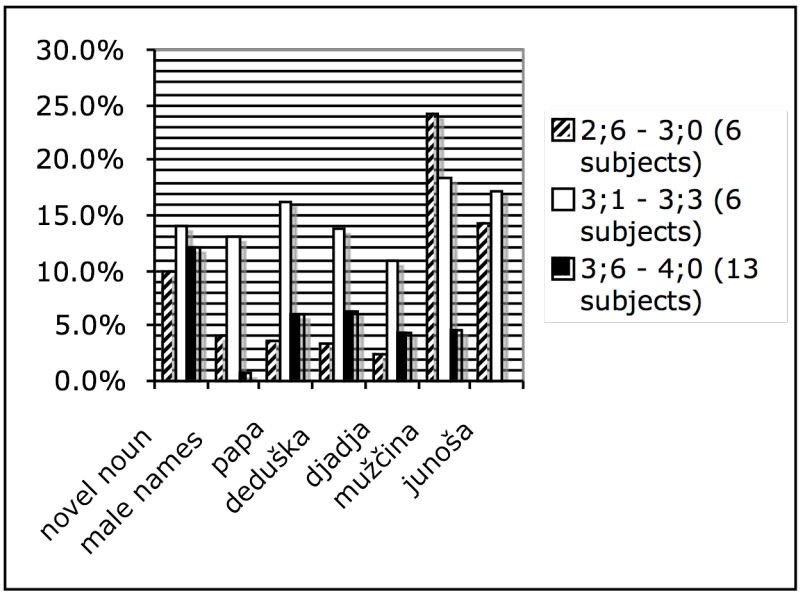
Noun	N err. (%)	N total 100%
papa 'daddy'	11(7.7)	142
deduška 'granddad'	10 (7.6)	130
djadja 'uncle/man'	10 (5.5)	180
mužčina 'man'	18 (11.7)	153
junoša 'youth'	10 (7.3)	136

It is clear from Table 3 that there is no serious discrepancy in agreement production for individual common nouns. On the whole the target-deviant forms occur at very low rates across the five common nouns. This may suggest that children have complete gender mastery. However, the developmental data presented in Table 4 and Figure 1 reveal a hidden asymmetry in the error rates across the individual nouns.

Table 4: Error rates of proper names, common and novel nouns expressed as number and percentage of the total production across three age groups (25 children, age 2;6-4;0). Each column includes number of errors/number of correct responses.

Age group	obormoša	male names	papa	deduška	djadja	mužčina	junoša
2;6-3;0	8/74	2/47	1/26	1/28	1/39	7/22	4/24
3;1-3;3	13/79	6/40	5/26	5/31	5/41	7/31	6/29
3;6-4;0	28/204	1/130	5/79	4/61	4/90	4/82	0/73

Figure 1: Error rates of proper names, common and novel nouns expressed as a percentage of the total production across three age groups (25 children, age 2;6-4;0).

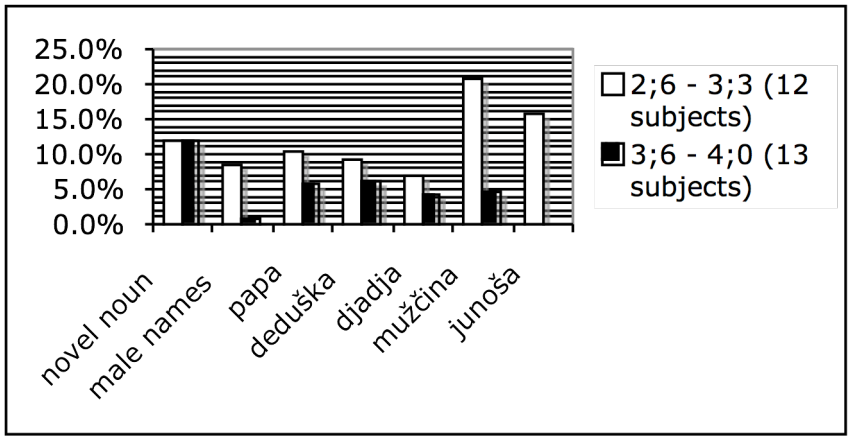


It is clear in Figure 1 that between the age of 2;6 and 3;0, the error rates for *mužčina* 'man' (24.1%) and *junoša* 'youth' (14.3%), are considerably higher than for *papa* (3.7%), *deduška* (3.4%), and *djadja* (2.5%), as well as for male names in *–a* (4.1%). At this stage the novel noun is also overregularized at a relatively low rate of 9.8%, which is within the 10% of the experimental error-margin. Thus on the one hand, there is an indication that children's overregularization tendencies are constrained by token frequency at this early stage, but on the other hand, children seem to be able to generalize the knowledge of the semantic criterion to the rare and novel noun.

The difference between the individual common nouns is not very pronounced at the next stage, i.e. between the age of 3;1 and 3,3, where a sudden increase of errors is observed for all nouns (but for *mužčina*). The error rates for *mužčina* (18.4%) and *junoša* (17.1%) still persist at the highest level as compared to other nouns. It should be noted that the majority of the errors, i.e. 37, were found in the speech of one child (Kolya 3;1), who thus appears to be strikingly different from other children in the middle age group. Since children are known to "acquire language at widely varying rates" (Brown, 1973:53), this could be an indication that the linguistic competence of this child does not correspond to that of the other children in the middle age group, but may be more similar to the level of grammatical development of the younger children.

Furthermore, if the data from the two earlier stages are collapsed, the asymmetry reported in Figure 1 remains. Specifically, the percentage of errors for the high-frequency common nouns *papa*, *deduška*, and *djadja* is within the experimental error-margin of 10%, while agreement production with the low-frequency nouns *mužčina* and *junoša* yields a higher percentage of target-deviant forms, i.e. 20.8% and 15.8% respectively. The error rates for *mužčina* and *junoša* are also higher than for the novel noun (12.0%) as well as for male names in *–a* (0.7%).

Figure 2: Error rates of proper names, common and novel nouns expressed as a percentage of the total production across two age groups (25 children, age 2;6-4;0).



In addition, a *t* test yields a significant result ($p=0.032$, $p\leq0.1$), i.e. the error rates of high-frequency nouns *papa*, *deduška*, and *djadja* are significantly different from the error rates for low-frequency nouns *mužčina* and *junoša*.

Both Figure 1 and Figure 2 demonstrate that after the age of 3;6, the asymmetry between the low-frequency common nouns (*mužčina* and *junoša*) and the other test items disappears. In particular, the error rates decrease considerably for all nouns, except the novel noun. Here the developmental pattern does not change much across the age groups; nevertheless, it reveals that masculine agreement is used correctly with the novel noun at a level of almost 90%.

In sum, the data presented in this section reveal two interesting asymmetries. First, there is a contrast between the individual common nouns, which is most explicit at the age of 2;6-3;0 (cf. Figure 1) and which is also clear when the data are divided into two age groups (cf. Figure 2). Second, children of all ages show near adult-like knowledge of gender assignment for the rare male names in *–a* in contrast to the rare common nouns *mužčina* and *junoša*.

6. Explaining the Asymmetries in Children's Agreement Production

Before I discuss the results of the study, a note concerning the differences in the experimental conditions is appropriate here. Recall that only verbal agreement was elicited with male names ending in *–a*, while both verbal and adjectival agreement were elicited with common and novel nouns. I suggest that higher success rate in the acquisition of male names is unlikely to be due to the differences in the experimental conditions, in the sense that it is easier for children to construct correct gender agreement on the verb than on the adjective. An analysis of the data with respect to different agreement types reveals that past tense agreement is not necessarily less error-prone than adjectival agreement. In fact, as shown in Table 5, children perform considerably better with adjectives than with verbs for common nouns; the error rates are 4.8% for the adjectives vs. 17.3% for the verbs. With regard to the novel noun, verbal agreement is marginally worse than the adjectival, 11.5% vs. 14.2%, as shown in Table 6.[8]

Table 5: Agreement production with common nouns across different agreement types (25 children, age 2;6-4;0).

Agreement type	N corr. (%)	N err. (%)	N total 100%
adjective	514 (95.2)	26 (4.8)	540
verb	129 (82.7)	27 (17.3)	156
personal pronoun	39 (86.7)	6 (13.3)	45

Table 6: Agreement production with the novel noun across different agreement types (25 children, age 2;6-4;0).

Agreement type	N corr. (%)	N err. (%)	N total 100%
adjective	121 (85.8)	20 (14.2)	141
verb	184 (88.5)	24 (11.5)	208
personal pronoun	52 (91.2)	5 (8.8)	57

With regard to the proportions of errors reported in Table 5 the difference between adjectival and verbal agreement is statistically significant ($p=0.0985$, $p\leq0.1$). This means that in the case of *papa*-type nouns, children perform significantly worse with verbs than with adjectives, i.e. contrary to the predictions mentioned above. Note, however, that the result here may be due to sampling, since the number of structures produced with each agreement type differs considerably. In Table 6, on the other hand, where the samples of verbal vs. adjectival agreement are

[8] Pronominal agreement was not taken into account here, since the sample size is very small compared to the other agreement types.

relatively similar in size, there is statistical evidence that the proportion of error rate is not different ($p=0.6836$, $p\leq0.1$). It is thus unlikely that children's better performance with rare male names ending in *–a* as compared to their performance with *papa*-type nouns and the novel noun may be due to the differences in the experimental conditions, i.e. verbal agreement vs. adjectival. In Section 6.2, I provide an account of the asymmetries in the children's agreement production with proper names vs. common nouns that bears on the differences in their semantic representation.

6.1. The (Non-)Effect of Frequency on the Acquisition of the Semantic Rule

The evidence presented in Figures 1 and 2 in the previous section supports Hypothesis I formulated along the lines of the WR model (Pinker, 1999), which predicted that children would show higher error rates for low-frequency nouns *mužčina* 'man' and *junoša* 'youth' than for high-frequency nouns *papa* 'daddy', *deduška* 'granddad', and *djadja* 'uncle/man'. Thus, the error pattern observed in Figures 1 and 2 is compatible with the dual-process view on the acquisition process. That is, the children first learn how to use the semantic information for some frequent nouns and later extract the semantic rule, according to which sex-differentiable nouns denoting males are masculine. Finally, they generalize it to infrequent nouns in the same class.

With regard to Hypothesis I it was also predicted that the error rate for the rare male names and for the novel noun should be higher than for the high-frequency nouns *papa*, *deduška*, and *djadja*. However, the evidence in Figures 1 and 2 does not support this prediction: The children's production of male names ending in *–a* is highly adult-like (the error rate is 13.0% at its highest across the age groups), and surprisingly good for *obormoša* (the percentage of errors does not raise above 14.1% across the age groups); moreover it is unexpectedly better than for *mužčina* 'man' and *junoša* 'youth'. Thus, the evidence with regard to Hypothesis I is not straightforward and needs further discussion.

The alternative Hypothesis II formulated along the lines of the RC model (Yang, 2002) predicted that the low-frequency nouns *mužčina* and *junoša* would occur with high accuracy rates, as they belong to the same class as the high-frequency nouns *papa*, *deduška*, and *djadja*. The same should be the case with the rare male names in *–a* and the novel noun *obormoša*, as they are in the same class too. In terms of evidence, only the second part of this prediction is borne out, which suggests that even at the early period, i.e. between 2;6 and 3;0, the child's mechanism for gender acquisition is not limited to initial rote learning. However, it is clear that

the low-frequency nouns *mužčina* and *junoša* do not get a 'free ride' due to the high-frequency nouns attested in the same class. Thus, children's overregularization tendencies seem to be constrained by the nouns' individual frequencies in the sense of Pinker (1999), but not by the frequencies of a noun class in the sense of Yang (2002).

To conclude, the findings are rather contradictory and do not point towards a single solution. On the one hand, the contrast between high-frequency and low-frequency common nouns suggests that gender acquisition is a lexically-specific process and that children are sensitive to the frequency of exposure. On the other hand, the high accuracy rates for the novel noun and rare proper names indicate that rule-based acquisition is involved. The fact that rare proper names are overregularized at very low rates in contrast to the rare common nouns suggests that token frequency may not be the only factor that constrains children's overregularization tendencies. In the next section I propose that the differences in the semantic representation of common nouns vs. proper names may account for the observed asymmetry.

6.2. Proper Names vs. Common Nouns in Gender Acquisition

In the previous section, I concluded that a noun's proneness to overregularization can be partially attributed to token frequency. However, frequency seems to play a role with common nouns but not with proper names. Why should this be so? My explanation is related to the fact that the semantic representation of proper names differs crucially from the semantic representation of common nouns. First, a proper name picks out a specific individual, while a common noun introduces a kind of individual (a member of a class). Second, unlike a common noun, which has an indefinite number of referents, a proper name has just one (cf. Bloom, 2000).[9] Most importantly, a proper name appears to lack internal semantic structure, i.e. it does not describe the object it refers to, the way a common noun does (cf. Burge, 1973). For example, if someone is called *Vanya*, the hearer can infer that the person called *Vanya* is a male, while it is not simply a male that is associated with *mužčina*, but an adult male. Thus proper names form a discrete semantic class, distinct from the class of common nouns.

[9] For example, if a dog in the corner is *Fido*, then another dog (or any other animal) that walks in cannot be *Fido*, regardless of how similar they are. Of course, there can be several dogs called *Fido*, but *Fido* is still a proper name that refers to just one individual. In this case *Fido* should be thought of as different words (Bloom, 2000:126).

In the acquisition literature it has been noticed that proper names have a special status in child grammar (cf. Macnamara, 1982, Gentner, 1982, Bloom, 2000): not only do they appear among the very first words of children learning different languages, "children learn their first proper names for people long before they learn any common noun that refers to these individuals (such as *person* or *parent*)" (Bloom, 2000:130). Children seem to be aware that an object gets only one proper name (Hall & Graham, 1997) and that if a word refers to more than one object, it is unlikely to be a proper name (Hall, 1996). Children also seem to know that proper nouns name objects but do not describe them. Naming specific entities is shown to be a characteristic feature of children's early vocabulary acquisition (Gentner, 1982). Thus, from early on, even before they utter their first words, children seem to be familiar with the concept of a proper name, such that it picks out a specific individual (human beings, as well as animals or toys), and to be able to distinguish it from a common noun, which has an indefinite number of possible referents.

It can thus be predicted that the semantic function of proper names and their special status in child language are factors that might facilitate gender acquisition with these nouns. As we know, this prediction is borne out by the fact that the error rates for the rare proper names are considerably lower compared to the rates for the rare common nouns. I would like to propose the following explanation of the phenomenon. Consider first that in order to assign masculine gender to proper and common nouns a child should establish their semantic content. Although all of them denote a male, *papa*-type nouns have additional meaning, while proper names do not. (*Papa*, *deduška*, and sometimes *djadja* are kinship terms, which imply a kind of family relation. *Mužčina* represents an adult male, and *junoša* a young male.) This additional semantic content cannot be learnt on a single exposure; therefore, frequency comes into play. Proper names, on the other hand, lack this ability to describe; therefore, they are usually learnt on a single exposure. As mentioned above, the concept of a proper name is familiar to the children from the outset. This knowledge, I suggest, helps more than frequency when acquiring the gender of these nouns. In other words, frequency does not play a role in the case of proper names, where the lack of additional semantic information ensures successful application of the semantic principle in gender assignment by children. With regard to common nouns, frequency and meaning seem to be interrelated. Recall, for example, that gender agreement with *mužčina* was more error-prone than with *djadja*. Both of them denote adult males, i.e. they have the same meaning but differ in frequency of occurrence. *Djadja* is frequent, therefore

its semantics is learnt first, and so is the gender. *Mužčina* is rare, therefore its mapping takes longer, and so does the gender.

Another possible factor that may have caused a difference between the rare proper names and the low-frequency common nouns *mužčina* and *junoša* could be children's sensitivity to certain combinations or 'frames' in the input, such as 'common noun+proper name'. It is a characteristic feature of Russian child-directed speech to use a proper name with nouns like *deduška* 'granddad' and *djadja* 'uncle/man' in order to distinguish between different individuals, e.g. *deduška Vasya* or *djadja Kolya*. Although this pragmatic reasoning does not apply to *papa* 'daddy', this noun is often used in combination with a proper name, e.g. *papa Miša*, in kindergartens when the teachers distinguish between the fathers of different children.[10] I suggest that the (frequent) occurrence of the nouns *papa*, *deduška*, and *djadja* in combination with a proper name in the input may be responsible for children's more accurate agreement production with these nouns as opposed to the agreement production with the nouns *mužčina* 'man' and *junoša* 'youth', which are never used in combination with a proper name. Comparing the error rates of the nouns *djadja* and *mužčina*, which share the same content, i.e. 'man', in Figures 1 and 2, reveals that between 2;6 and 3;3 the former is considerably less error-prone than the latter. This may be due to the fact that the former but not the latter is often used in combination 'common noun+proper name' by adults.

7. Conclusion

In this study, the course of acquisition of the semantic gender criterion is found to be a gradual process which involves some initial rote-learning. It has thus been suggested that token frequency in the sense of Pinker's (1999) WR model rather than class-based frequency in the sense of Yang's (2002) RC model plays a role in this process. Yet, frequency alone cannot

[10] In the sample of the mother's data from Varvara's corpus discussed in Section 2, I found three occurrences of the noun *deda* 'granddad' with a proper name, e.g. *a čto tebe deda Saša podaril*? 'And what did granddad Saša give to you?' However, in this corpus there were no relevant examples of *papa* and *djadja* used with a proper name.

A Google search for "papa Saša" reveals 3380 examples and for "djadja Saša" 82900. 'granddad+proper name' appears to be less frequent in Google: 585 for "deduška Saša" and 623 for "deda Saša". For "mužčina Saša" and "junoša Saša" it reveals 311 and 214 examples respectively, although the majority of those appear to be irrelevant after a closer examination, since e.g. the two words occur on the clause boundaries, i.e. they do not constitute a noun phrase.

account for the course of acquisition, specifically, for the more successful acquisition of gender with the rare male names ending in *–a* as compared to the low-frequency male kinship terms. This asymmetry has been attributed to differences in the semantic representation of proper names vs. common nouns. It has been proposed that the lack of additional semantic content in the representation of proper names may facilitate the acquisition of gender with this subtype of nouns.

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