IRINA OVCHINNIKOVA
Perm State University

SLIPS OF THE TONGUE IN CHILDREN'S NARRATIVES: CONNECTIONIST INTERPRETATION

The goal of the research is to clarify types of slips of the tongue in children's narratives. The interpretation of the different types of slips of the tongue during narrative production by Russian speaking children is based on the competition models of language processing. We compared frog stories generated by children at the age of 6 and at the age of 13-15, and found in the narratives of teenagers some cases of lexical self correction and resonance effect. Slips of the tongue in preschoolers' frog stories include cases of wrong lexical decision, incorrect or atypical argument structure, and wrong articulation. The paper deals with modeling language functioning in social interaction. "A complete language act" is analyzed "from its origin to its purpose" (according to Jacobson, 1985, p. 302). Both in Russian and in foreign psycholinguistics there exist various models of speech perception and speech production. Meanwhile, within the last decade new data have been collected which give a more precise definition of the classical postulates. These data were variously interpreted within different scientific approaches. In this paper we turn to one of the approaches in language behavior modeling, which has served in the usage-based model of language acquisition.

Key words: competition model, language processing, speech production, children's narratives, lexical decision, argument structure

The ultimate goal of scientific language investigation is a holistic model of the language faculty and of language activity of a person, modeling language functioning in social interaction, i.e. the analysis of "a complete language act from its origin to its purpose: intention, innervation, gradual production, transmission, listening, perception, comprehension" (Jacobson, 1985, p. 302). Obviously, achieving such an overall goal is possible through its gradual approximation, including solution of particular problems dealing with speech perception and speech production separately. Both in Russian and in foreign

psycholinguistics there exist various models of speech perception and speech production (for a review see Akhutina, 1989; Zalevskaya, 1999; Koubryakova, 2004; Leontjev, 2007; Sakharniy, 1994; Human Factor…, 1991; Shtern, 1992; Testelets, 2001; among others). Meanwhile, within the last decade, due to the application of sophisticated and high technology experimental methods new data have been collected which give a more precise definition of the classical postulates. These data were variously interpretated within different scientific approaches. It seems that those of considerable importance allow for all kinds of consistent interpretations, as any of such interpretations might be useful for a comprehensive vision of a "complete language act". We now turn to the description of one of the approaches in language behavior modeling which is modern connectionism represented in the competition model; this approach has served as a base for the usage-based model of language acquisition.

Connectionism: general view

The central object of connectionist investigation is the modeling of speech perception and speech production as well as that of language behavior capacity. Virtually, connectionism is the most comprehensive computer metaphor of language acquisition and language learning. Connectionist studies are aimed at the creation of a language faculty model, one which would have an explanatory force and be used for the solution of applied tasks in language teaching, speech correction, designing of computer programs for speech signal processing, etc. The computer metaphor and programs are based on the notion of a single system of mental representations in the human mind.

Connectionists act on the premise that all cognitive processes are interconnected and involved in a single associative net. According to O. Dosnan, "connectionism is presented as a general theory, based on the association of cognitive elements which are equal neither to notions nor words but are fundamental units preceding the origination of any meaning" (1997, p. 70). Connectionist models are viewed as competition models; all variants of connectionist models are based on the concept of competition of language units and mental representations in the language behavior of a person. To be more exact, competition occurs between neuron connections: the one which wins the competition is activated by the implementation of certain units in speech perception and production processes. Connectionist models have a probabilistic character.

Connectionism is sometimes called revisited behaviorism and associationism (Fodor & Pilishin, 1996). Connectionism is similar to behaviorism in the implementation of stimulus-reaction connections in language behavior interpretation and mental representation formation underlying language behavior. Connectionism differs substantially from behaviorism in its attention to the external scope of the stimulus-reaction connection; it also takes notice of perception experience and

probabilistic factors determining connection strength. The opposite approach in cognitive science postulates modular representation of language, since the suppositions concerning brain structure should obviously not be viewed as a hypothesis of cognitive organization (Fodor & Pilishin, 1996). In other words, brain structure is considered to be the material substrate of cognitive activity but does not predict the structure of the activity proper.

The central aspect of the connectionist modeling of language behavior is language acquisition, and approaches to language competence formation based on input influence, i.e. perception experience which includes communication experience. Communication experience includes not only those acts of communication where a person is an immediate participant in speaking/listening (writing/reading) but also in background communication: non-directed to a person in everyday communication, mass media discourse, etc. Communication experience is accumulated when speech is perceived or produced in various communication situations, including the perception of one's own utterances and their correction in light of the interlocutor's reaction. Speech perception precedes speech production in both first and second language acquisition (Lepskaya, 1997).

Within the connectionist approach processes of speech perception and production are viewed in the network of a single model, which is a real advantage. In actual communication acts participants constantly have to switch between speech perception and speech production. Production and perception occur simultaneously in any speech act: a person who is speaking (writing) is inevitably at the same time listening (reading). This happens because auditory and visual control of speech programming is a necessary part of language behavior (see, for example, Akhutina, 1989).

Characteristics of two basic connectionist models

Let us now describe the basic points of connectionism taking into account both the classic model and its updated unified version, with examples from child speech.

Interconnection between lexicon and grammar as the main principle of connectionism

One of the basic connectionist assumptions is the artificial division of lexicon and grammar as independent modules of language mental representation. This division is artificial since the brain is a single neuron system, where connection strength is determined by the frequency of neuronal joint activation (Bates & Goodman, 2001). The frequency of joint activation of neurons reflects the frequency of joint occurrence of signals in perception experience: the more frequently elements are connected in experience (spatial contiguity, time sequence, or other),

the more likely the occurrence of one element will activate in the mind another element connected with it. As far as grammatical forms of lexical units are determined within syntactic structures, each form has a priority "partner", i.e. a grammatical form that occurs most frequently with a given form in speech. This mechanism enables grammar acquisition in ontogenesis and is triggered by a critical lexicon size (Bates, Bretherton, & Snyder, 1988).

Cognitive activity also presupposes the formation of a system for handling incoming information as well as a system of units to be processed and stored. The first system refers to procedural knowledge, the second to declarative knowledge. The discrimination of grammar and lexicon based on the procedural-declarative opposition leads to a modular representation of language in the mind. Within the connectionist approach the interdependence of grammar and lexicon is stressed; as well as the derivative character of procedural knowledge which depends on the size and structure of the lexicon, i.e. units referring to declarative knowledge. The close interconnection between lexicon and grammar has been mentioned not only by connectionists. J.S. Koubryakova maintains: "Still today our concepts of lexicon origin and functions should be revisited and attention should be paid not to the opposition of grammar and lexicon but to its inherent relationship, "flowing" one into the other and, obviously, conventionality of their discrimination" (Koubryakova, 2004, p. 378). J.N. Karaulov within an analysis of the associative-verbal network shows the interpenetration of lexicon and grammar (to be more precise, syntax) with attention to grammaticalized associative connections (Karaulov, 1993).

Slip of the tongue as the reflection of the psychological adequacy of the competition model

Language mental representation in classic connectionist theory is presented as the interconnection of three maps: phonological, semantic and argument. The key notion here is of competition which refers to the relationship between language units activated during speech perception or production. On the phonological map, auditory and articulatory images compete while on the semantic map meanings are ascribed to the sound signal (or the articulatory sequence); and, finally, on the argument map arguments of a predicate and variants of word order compete. Competition of auditory images can be seen in self-correction, i.e. correction of slips of the tongue including replacement of sounds similar in their articulation parameters, or words that are phonologically similar, e.g.,

(1) *Oni   perelezli cherez* **rebro** *...   cherez pohozheje na* **rebro**
     they   climbed   over   rib-SG.ACC over similar   to   rib-SG.ACC
     brevno.
     log
     'They climbed over a rib…over a rib looking like a log.'

In (1) 6-year-old Maxim corrects himself telling a story based on a series of pictures about a boy searching for a frog that ran away (in the picture a boy and a dog climb over a tree trunk lying in the water). The speaker while executing control over the programme of utterance accomplishment finds that a certain place in the speech chain is occupied by a "wrong" element, and then the speaker substitutes another phonological form choosing one that is associated with a meaning more adequate to express the author's intention. The reason why the wrong articulatory sequence might appear in speech could be its high frequency in the nearest context of the *re* syllable (*pe**re**lezli che**re**z* 'climbed over'). It is also possible that, for a city dweller who has been brought up in a family of doctors as was Maxim, the articulatory sequence *rebro* 'a rib' is more frequent in his communication experience than the word *brevno* 'a log'. As children get older such slips of the tongue become less and less frequent.

Competition of meanings refers to failures in lexical choice. Maxim speaks about the frog's escape from the jar:

(2) *Viprignula iz   akvariuma   malenkaya   zhabka...   zhaba...*
    jumped   out of aquarium   small   toad-DIM... toad...
    lyagushka (hems).
    frog.
    'Out of the aquarium jumped a small little-toad... toad... frog.'

This utterance contains two failures of lexical choice. First, the jar from which the frog has escaped is called by the boy an aquarium using the correct name for a special vessel used for keeping amphibians and fish, though in the picture we see a glass jar. In this competition the meaning referring to a real situation of keeping at home fish, frogs, etc. wins. Second, at the beginning the boy calls the frog *zhabka* "a small toad", then he calls it 'a toad', and finally the boy comes to the variant 'a frog' which has already been used for nomination. This case illustrates the self correction of a wrong lexical choice.

Let us now consider competition of predicate arguments and competition of various word orders, i.e. competition on the argument map. Six-year-old Anton narrates:

(3) *Potom malchik s...sel na...na zemlu.   I   uvidel   parohodov*
    then   boy   s...sat on...on ground. And   saw   ships-ACC.ANIM
    i   obezjan.
    and   monkeys-ACC.ANIM
    'Then the boy s...sat on...on the ground. And saw ships and monkeys.'

The predicate *uvidel* 'saw' gets direct objects as its arguments and Anton marks both objects grammatically as animate ones whereas only *obezjan* 'mon-

keys ACC' is animate in Russian. In Russian, the accusative case forms of animate nouns are marked with endings different from the nominative case. Inanimate nouns have the same form as the nominative case and the accusative case. In (3) the competition between grammatical forms is won by the one that does not coincide with the nominative case, marking the theme of the utterance, i.e. the form containing the ending for animate objects *parohodov* '*ships* ACC ANIMATE' instead of *parohodi* '*ships* ACC INANIMATE'. Word order competition is seen in (4), as produced by six-year-old Sima:

(4) *Vdrug   oglyanulas   sobachka, a   malchika   netu.*
     suddenly   glanced back   dog   but   boy   no.
     'Suddenly the dog glanced back but there was no boy there.'

The girl uses inversion that is probably unnecessary here (V-S). Though Russian has free word order the most neutral variant is considered to be S-V-O (Shvedova, 1980). We come across inversion (O-V-S) in six-year-old Lada's story:

(5) *A malchik, ego ispugala   sova, i   on upal v metr ot   luzhi,*
     boy   he   was frightened by owl   and he   fell   in meter from puddle
     i   pochti   na   seredinu
     and   almost   into   middle.
     'And a boy, he was frightened by the owl, fell down in a meter from the puddle and almost into the middle.'

Inversion here is determined by the topic given in the previous sentence *a malchik* 'and a boy'. Lada's narration contains one more example of inversion. In the picture we can see a dog trying to reach the wild bees' or wasps' house, and the girl says:

(6) *A   sobachka vse prigala   na   dvuh nogah vozle pchelinogo*
     and dog   all   was jumping on   two   legs   near   bees'
     uleya… gde   on visel,   sobachka zastryala dvumya   lapami,
     hive   where it hanged dog-DIM got stuck two-ISTR   paws-INSTR
     derevo, gde   visel   uley.
     tree   where   hanged   hive.
     'And the dog was jumping on two legs near the bees' hive where it was, the dog got stuck with two paws, tree, where it was.'

Example (6) contains a lexical failure *na dvuh nogah* '*on two legs*' instead of *lapah* '*paws*' . Besides, there is syntactic failure in the compound sentence formation: the embedded clause precedes the main clause. An interesting example representing word order competition can be seen in a story by six-year-old Lisa:

(7) *Potom… malchik, kogda zalez   na bolshoj kamen' olen' ubezhal.*
    then… boy   when climbed on big   stone   deer escaped.
    'Then… the boy, when he climbed on a big stone, the dear escaped.'

Lisa starts with the topic *malchik* '*a boy*' which is typical of Russian neutral word order (S-V-O), and then she produces an embedded clause with a subject representing the given topic. *Malchik* '*a boy*' is separated from *kogda* '*when*' with a pause and descending tone.

Such examples of inversion can be seen in narrations of 6-7-year-old children and practically never occur in older children's stories.

Functions of the phonological map

The phonological map is the base for "phonological modification", which is formatted on the basis of articulatory and auditory images of a word in processes of perception standards and the motor program formation. The phonological map probably refers to the perception and articulatory bases of a language. During the accumulation of communication experience each unit on the phonological map is ascribed a certain meaning reflected on the semantic map. B. MacWhinney and K. Plunkett mention that learning words in language acquisition includes the development of two maps, one designed for auditory images (perception standards), the other for semantic images. Then these two maps get interconnected by means of associative nets (MacWhinney & Plunkett, 2000, p. 21). Reciprocal associative connections emerge and strengthen due to various perception phenomena. The association mechanism or, in other words, the method of setting connections between any content of the mind on various bases is one of the most important cognitive mechanisms providing, according to N.I. Zhinkin, the "physiology of language". The association mechanism is probably the central mechanism in connectionist models of mental representations of language.

It is interesting to notice that auditory images segmented in the speech chain in the process of speech perception become a source for articulatory image formation and for the design of the phonological map in general, since in ontogenesis articulation emerges as a kind of training for speech apparatus movements, aimed at the formation of a certain auditory image (Lepskaya, 1997; Tseitlin, 2000).

Functions of the semantic map

All meanings are organized within the semantic map formed on the basis of lexical meanings. In the first variant of the connectionist model, the semantic map is not restricted to lexical meaning only. It also reflects the meanings of morphemes. Lexical meanings proper are retrieved from the talk spurt in the argument frame (MacWhinney, 2000 a, p. 141). In other words, in the

process of speech perception each sound image matches a certain position in an utterance, typical of a certain argument of a proposition (for a certain syntactic role). Such a position of the argument frame is linked with lexical meaning. As we can see, grammar (in its linguistic sense) is a necessary condition for the acquisition of the lexicon since, on the basis of the grammatical (to be more exact, syntactic) role, sound images of word forms are recognized, and as a result of further categorization they group into a lexeme. Lexical meaning is associated with a certain auditory image and, according to MacWhinney, children are less restricted in the creation of symbolic connections between sound and meaning than are adults (MacWhinney, 2005, p. 103). This circumstance provides rapid formation of connections between the phonological and the semantic maps, successful input processing in natural language acquisition.

In the process of language use the semantic map is modified: there occurs a reciprocal adaptation of meanings connected in the speech chain. Lexical meanings are semantically modified due to the regular joint occurrence of certain auditory images through which meanings are represented. Joint occurrence of auditory images is the reason for creating lexical connections. Due to lexical associations the phonological image is immediately projected on the argument frame.

Thereby, connections between language units are established on the basis of their joint occurrence in the talk spurt and the stability of their positions in the argument frame. Variability of the speech flow is restricted by a person's communication experience. New connections are produced through the processing of the incoming speech signal: within this signal phonological words are identified, and their joint occurrence optimizes their projections on the semantic maps. A new phonological word is projected on the semantic map due to the position occupied in the argument frame, first, in relation to other phonological words, and second, due to lexical associations with phonological words which have already been acquired and projected on the semantic map.

Masking and buffering processes as providers of the argument map formation

Two processes are important in speech perception and speech production: masking and buffering (MacWhinney, 2000 a, pp. 139-140). They are essential for both speech perception and production since they enable perceiving one's own speech and controlling the implementation of the author's intention. Masking is thought to be a trigger for the acquisition of argument relations. In other words, the argument map is built on the basis of a specific process which provides simultaneity of perception, primary processing of the current signal, and keeping online the already handled syntagmas that are relevant for the current communication act.

Masking adds up to deactivation of a perceived auditory image with a corresponding meaning. Deactivation does not mean exclusion of the lexical meaning from memory; for successful comprehension of an utterance it is necessary to keep a perceived and identified unit separated for a given time, so that it would be possible to implement it at any moment during the process of speech signal perception. Deactivation of a unit allows the combining of two processes: a person is able at the same time to perceive a speech signal, setting connections between auditory images and semantic map units on-line, and at the end of an utterance to process it as a whole.

Evidence of the psychological reality of masking and buffering processes come from examples of child speech. A six-year-old girl, repeating after her mother poems for children by K.I. Chukovskiy, inserts into the text a character which does not exist in the original poem

(8) *Prishli mne kaloshi, i mne, i zhene, I Totoshe s Kokoshej.*
'Send me galoshes, for me, for my wife and for Totosha with Kokosha.'
(example from Krougkyakova, 2006, p.8)*.*

The girl ads *Kokoshey,* though there was no such character in the original. Deformation of the speech program has obviously occurred during the semantic processing of the incoming signal and activation of information stored in long-term memory. The masked element kept in buffer memory was misrepresented under the influence of old speech stereotypes which the girl had (*Totosha and Kokosha* from another poem by Chukovskij "Mojdodir").

Argument relations are impossible to set for a single lexeme. They are identified on the basis of masking and buffering a signal. This mechanism provides argument map formation. Such buffering allows combining units on-line in the process of identification as well as their interpretation as slots in the argument frame. A part of one's own utterance, kept in buffer memory, serves during speech production as a basis for correction of the semantic program of the utterance. Buffer, or episodic memory, is a short-term storage different from long-term storage (semantic memory, mental lexicon). Verb morphology studies have shown that buffer memory (referring probably to short-term memory) contains ready lexical units which are retrieved from long-term memory when necessary for communication (Gor & Chernigovskaja, 2003).

How does the mental lexicon correspond to the semantic map?

The semantic map corresponds to the mental lexicon. The mental lexicon is the storage of declarative knowledge, of which the organization is determined, among other factors, by the probability of joint occurrence of units in the communicative experience of a person. Individual units of the mental lexi-

con correspond to a lexeme, a word form, a morpheme of a given language. For each unit of the semantic map its immediate context is reflected. Syntagmatic links between language units are essential for the semantic analysis of a verbal message. It is precisely the joint occurrence (text associations) of language units together with procedural knowledge (including masking and buffering) that provide the acquisition of syntax and the formation of the argument map.

Unified connectionist model: arenas for competition in addition to maps

Let us now turn to a modern version of the connectionist model described by MacWhinney (2005, pp. 81-110). The unified version takes into account first language acquisition, as well as natural and school bilingualism. The model also contains new components. The notion of competition of activated units, trying to gain a proper place in the semantics of a decoded verbal message or to occupy a position in the speech chain during speech production, is still central for the model. Competition is seriously influenced by resonance: one of the 'applicants' gets support as it coincides with the parameters of a communication situation, with the verbal context of a discourse.

Different arenas for speech perception and speech production

Competition of language units takes place in language arenas. The arenas correspond to traditional psycholinguistic levels: phonological, lexical, morphosyntactic (grammatical) and conceptual (ibid., p. 84). During speech production these arenas turn on message formation, lexicon unit activation, morphosyntactic structuring and articulatory planning. During speech perception the arenas provide processing of auditory complexes, lexical unit activation, decoding of their grammatical role and the interpretation of meaning. Processing of the speech signal in different arenas is subordinated to different combinations of neuron paths. In addition to the enumerated 8 arenas adult native speakers have two more for spelling competitions: one for reading and one for writing. Thus language competence includes two functionally different but interdependent kinds of competence: competence of a speaker (writer) and competence of a listener (reader).

Self correction as evidence of the speaker's control under language form competition

The language sign is a correlation between form and function, reciprocal correspondence on two maps: phonological and semantic. In speech production, forms compete for adequacy in the expression of a speaker's intention, while in speech perception functions and interpretations are chosen depending on the signals of surface forms. Winning the competition depends on the relative strength of candidates. Relative strength, according to the connectionist model, depends on the

frequency of a signal, as well as other factors. Generally, mapping (matching of form and function) is the result of a social convention which should be acquired for all arenas, including lexicon, phonology, morphosyntax and mental representations (ibid., p. 85)

We can now illustrate competition of language forms suitable for expressing a speaker's intention with examples from child speech.

In narrating, six-year-old children often correct their lexical choice if the form which won does not fully represent the speaker's intention. A new variant may appear on the stage of realizing control over the speech program (see examples above). This method of trial and error is less typical of teenagers; and its usage is usually connected with subtle distinctions between competing units, which might be interpreted as a result of the greater language competence of teenagers compared to young children. Fifteen-year-old Oleg corrects his choice and prefers an utterance about the frog's intention and not about something that has already happened:

(9) *V   eto   vremya   e   malenkiy   lyagushenok   neza[]   reshil*
in   this   time   hm   small   young frog   didn't no[tice]   decided
nezametno   ubezhat.
unnoticedly   to escape.
'At that moment …hm a small young frog unno[ticeably] decided to escape unnoticed.'

Fifteen-year-old Anton (we have given some examples from his story told when he was 6) says:

(10) *Potom   on   zalez   na   visokiy   kamen'   i   tam   natknulsya   na*
then   he   climbed   on   high   stone   and   there   came across   on
roga   olenya,   kotoriy   unes   ego   ee   sbrosil   sbrosil
antlers   deer-GEN   which   took   him   hm   threw down   threw down
ego   s   obriva   v   vodu.
him   from   steep   to   water.
'Then he climbed a high stone and then he came across deer's antlers, which took him and threw down…threw down into the water.'

Trying to implement the argument frame of the verb, to find the most suitable form corresponding to actions of the deer with respect to the boy, Anton after hesitation keeps the first variant and repeats the form *sbrosil 'threw down'*.

In the narration by Sima recorded when she was 14 (we have cited some examples from her six-year-old story), we find the following:

(11) *Mm... zatem nastalo utro   i   malchik..., kogda prosnulsya*
mm… then came morning and boy   when woke up
malchik, on uvidel, chto lyagushki net, on nachal, ejo iskat.
boy   he saw   that frog-GEN no he began her to look for.
'Mm… then the morning came and the boy when woke up the boy he saw that there was no frog.'

Example 11 illustrates competition of word orders; first, the most frequent model SVO wins: the subject put first is *malchik* '*a boy*', but then the girl changes the initial program for a less frequent construction. Let us now illustrate the competition of verb forms in a story by fourteen-year-old Anna who substitutes a neutral and more frequent verb *vernetsya 'will come back'* for a verb with limited compatibility *priskachet ' will come hopping'*:

(12) *Malchik   stal   zvat   lyagushku, dumaja, chto ona…*
boy   began to call frog-ACC thinking that she
prisk[achet]...   nu vernetsya k nemu, esli on eje pozovet.
will come ho[pping]... will come back to him if he her calls.
'The boy started calling the frog, thinking that she will… come ho[pping]…will come back to him if he called her.'

The verb *priskachet* '*will come hopping*' is the first winner in the competition possibly because it is determined by a text association with the word *lyagushka* '*the frog*' that was used before. The correction of choice may be determined by the importance for the narrator of certain properties of the communication situation (it was recorded with a dictaphone by an adult experimenter). Such a situation presupposed the usage of stylistically neutral language units.

The size of certain mapping: chunking in competition with language units

Acquisition of new mapping of a new unit involves both long-term and short-term memory. Short-term memory, as we can see, provides masking and buffering. It is also involved in remembering the phonological image of a word and its matching of meaningful lexical units, as well as in the process of syntactic mapping on-line (identifying arguments of a proposition on the basis of word order and morphological markers on the surface syntactic structure).

The size of certain mapping – search for a correspondence between form and function – is determined by the process of identifying parts, segmenting speech flow into components. Speech flow contains various segments of different length, the process of their identification that MacWhinney calls chunking

(ibid., p. 85). A chunked segment is separated from its neighbors and is processed as a whole. Segmenting creates a unit for making a decision concerning meaning. For example, chunking of the word *moj* 'my' by a three-year-old boy leads to the activation of more fractional (and inadequate) units of the semantic map:

(13) *Eto ne moj Dodir, eto malchikov Dodir*
    'It is not my Dodir, it is boys' Dodir.'
    (example from Krouglyakova, 2006, p. 8)

The name of a character *Mojdodir* was segmented into *moj* referring to '*my*' in Russian and a separate word *Dodir* which does not exist. Consider the following:

(14) *Pokoj nam tolko snitsya*
    'We can only dream of rest.'

The first two orthographic words of the phrase unified by a single stress get a wrong interpretation when a child hears them, the child interpreting them as
(15) *Pokoinim tolko snitsya.*
    'Dead can only see it in a dream.' (ibid.)

B. MacWhinney reminds us of the fact that children rely both on combinations of linguistic units and holistic segments in the processes of syllable, word and sentence formation (2005, p. 85).

It is natural that the chunking of segments of various lengths changes competition: as new candidates appear. In (13) while identifying the segment *moj* wins a meaning 'possessive pronoun of the first person' but not an imperative of the verb *myt'* '*to wash*' having the form *moj* (the name of a poem character is composed of three stems corresponding *to Wash-up to-holes*). In (15) one of the case forms of the adjective *pokojniy* '*dead*' won instead of *pokoj nam* '*peace to us*'.

The role of resonance in the process of language unit activation

Finally, code activation of the phonological map (and connected to it the spelling map) and access to mental representations is determined by resonance. B. MacWhinney, citing L. Vigotskiy, makes an example of non-interiorized speech of a child acquiring the first language: non-interiorized speech causes resonance between verbalization and action (MacWhinney, 2005, p. 100). Another manifestation of resonance is repetition of an activated signal in any suitable context: the candidate which won once is activated faster than others. The reaction of the brain to units of different frequency or those which have lately been activated in a situation is different (Sekerina, 2006, p. 30). An example of

resonance repetition can be seen in the narration of fifteen-year-old Oleg who chose once an utterance about the character's intention and now he uses this utterance very frequently:

(16) *V eto vrema e… malen'kij lagushonok* **reshil** *nezametno ubejat'. Pospav do pozdnego utra, kogda…solnce uje svetilo jarko…prosnuvshis, malchik I ego pes obnarujili… chto lyagushonka uje ne bulo v banke. Oni byli ochen' udivleny I* **reshili** *… vydvinutsa….na poiski. E… v to vrema kak…e…pes   ohvatil   …komnatu…malchik odelsa…e…i…* **reshil** *…vyglanut'…vo dvor. Vo dovre malchik I ego pobnarujili…malen'ko…ee…lyagushonka,   poetomu…one* **reshili** *…pojti….ee…na poiski v les. Malchik…e…v ego ogromnyh sapogah I evo lubimec pes. E… v lesu oni …krichali I …vyzyvali lyagushonka, no nikto … ne otklikalsa…na ih…vyzovy. Malchik reshil… uznat u obitatelej lesa , ne vidili li oni malenkogo lyagushonka. On* **reshil** *nagnutsa k nore I sprosil u… malenko…krysy, ne videla li ona lyagushonka. Ta otvetila ukusom…ta otvetila…ukusom. Hm…a…sobaka* **reshila** *uznat', ne vi-de-li li …pchely…dikie pchely malenkovo lyagushonka. Oni tak je … n…ne smogli otvetit'… rechju. Zatem e…. malchik* **reshil** *…vskorabkatsa na derevo I …i… zadal vopros ee… v glubokoe… duplo…naschet…vopros naschet lyagushonka. Mm… ottuda vuskochila s…sova, I …ee…malchik… I uronila nechajanno malchika. A pes vse eto vrema begal vokrug, spasajas ot tuchi… pchel…kotoryh on privlek na seba. Malchik* **reshil** *vzobratsa na ogromnyj kamen', shvativshis za betvistue vetki…*

‘Meanwhile … eh…a young frog secr … **decided** to escape secretly. Having slept till late morning, when…the sun was shining brightly…having waken up the boy and …his dog found out that…there was no young frog in the jar. They were very much surprised and **decided**…to go…to look for him. Eh….when the …dog looked through …the room…the boy got …eh…and…**decided**…to look out …into the yard. In the yard the boy and his dog haven't found…the young…eh…frog, that is why….they **decided**… to…search…for him…in the forest. The boy…eh…wearing his huge boots and his favourite dog. Eh…in the forest they… have been screaming…and calling for the young frog, but there…was…no reply. The boy **decided**… to ask foresters whether they have seen the young frog or not. He **decided** to bend down to the hole and asked…a… little… rat whether he had seen the young frog. The rat answered with the bite… The rat answered… with a bite. Hm… the dog…**decided** to a-s-k bees…the wild ones…whether they… have seen the young frog. They didn't… answer with speaking… either. After that eh… the boy **decided**…to climb the tree…and….and asked the question eh… through…a… deep… hollow… the question… about…the young frog.

Mm …an o…owl …suddenly appeared from the hollow, and… eh…the boy… and it dropped the boy accidentally. Meantime the dog was running around , escaping from…the cloud of… of the bees… he ..had attracted. The boy **decided** to climb a huge stone with the help of branchy branches…'

In competition in the lexical arena the winner was one word that remained activated over the period of storytelling.

In certain cases whole chunks are activated due to resonance. Fifteen-year-old Artem narrates:

(17) *Oni poshli iskat ego. M…no po puti oni vstretili ee…ulej s pchelami…gde…m…malchika uzhalila osa. Malchik iskal bukvalno na kazhdom shagu: v derevjah…vezde, gde tolko mozhno.*
'They started searching for him. M…but on the way they met a hive with bees where …m…the boy was stung by a wasp. Malchik was searching almost at every step: on trees…everywhere where he could.'

In Russian the word combination *na kazhdom shagu* means '*everywhere*'. As far as we are concerned, in Russian there is no such idiom '*iskat na kazdom shagu*' '*to look everywhere*' but there is another idiom *vstrechat na kazhdom shagu* '*to meet everywhere*'. In addition, the associative link between the verbs *vstretit' 'to meet'*, *najti 'to find'* and *iskat 'to look for'* is noted in Russian association dictionaries (Karaulov, 1994, pp. 51, 114, 172). Activation of a certain word (here *vstretit'*) causes the activation of the whole field. The "winner" stays active and due to resonance participates in competition again; that is probably why a fixed expression got changed and there appeared a chunk in Artem's speech.

New components of the unified model

Finally, one can say that the unified model introduces several new components in connectionist modeling: chunking, resonance, correlation of codes important for bilingualism, and switching from oral to written communication and vice versa. Within the unified model conceptual representation (mental representations free from language implementation) and lexical meaning are distinguished. Speech production and speech perception are represented not as different types of activity but as different outlets to "playing grounds", which get signals from external (speech chain) and internal stimuli (the author's intention), and those stimuli are involved in complicated interaction in language behavior. Phonemes and graphemes are elements of different codes providing access to the lexical arena, the grammatical arena and, finally, to conceptual representations. Arenas are regarded not as separate modules but

as "playing fields" ready to receive input from another arena as soon as such input becomes accessible. On the lexical arena, competition takes place within topological maps, on which words are organized according to their semantic and lexical types. On the morphosyntactic arena we can see competition of word orders and grammatical markers (ibid., pp. 86-87). The arena of mental representations is considered to be a phenomenon called semantic memory in cognitive science. It provides the perception and production of a verbal message. Nevertheless, neuron paths going into this arena are different for the processes of speech perception and speech production.

Achievements and limitations of the connectionist model

It is obvious that the connectionist interpretation is not exhaustive. All examples given here might be interpreted within other models (interpretation of narration development by children within Akhutina's model is in Ovchinnikova et al, 1999). While conscious of the limited nature of the connectionist approach we still find it essential to mention its undeniable achievements, particularly "development of an algorithm explaining how native speakers learn to identify connection strength between elements and to produce new elements" (Elman, 2001, p. 298). Elman notes that the possibility of language acquisition in principle is determined by the limited capacity of children to process incoming information: children "are able to process only simple speech patterns of input, later these patterns provide critical grounds for making more elaborate generalizations" (Elman, 2001, p. 304). The source of new connections is neither formation of new cognitive operations, nor ready "cognitive prerequisites" allowing for interpretation of input in a new way. It is self-organization of the neuron net and the correction of representations on the basis of the growing store of data which provide such a source. In fact, narrations of older children reflect wider abilities of choice among possible language units to realize the author's intention

Connectionist models describe speech perception and speech production not as a sequence of steps and operations but as activation of neuron paths. The connectionist model stresses not the reasons for a wrong choice but the parameters of meaning winning in competition. Language form is not so much chosen by a speaker as arises in his mind due to the interaction of various factors and their hierarchy is not yet clear. A speaker chooses a unit only when a winning element does not satisfy the author's intention and does not provide the desired social interaction.

References

Akhutina, T.V. (1989). *Speech production. Neurolinguistic analysis of syntax*. Moscow: Moscow State University (in Russian).

Akhutina, T.V., Pilaeva, N.M. (2003). *Diagnosing of visual-verbal functions in development*.

Bates, E., Bretherton, I., & Snyder, L. (1988). *From first words to grammar: Individual differences and dissociable mechanisms*. New York: Cambridge University Press.

Bates, E. & Goodman, J.C. (2001). On the insuperability of grammar and the lexicon: Evidence from acquisition, aphasia and real time processing. In M. Tomasello & E. Bates (Eds.), *Language development: The essential readings* (pp. 134-162). Malden, MA: Blackwell Publishers.

Berman, R. & Slobin, D. (1994). *Relating events in narrative: a cross-linguistic developmental study*. Hillsdale, NJ: Erlbaum.

Fodor, J. & Pilishin Z. (1996). Connectionism and cognitive structure: a critical review. *Language and intellect*, 230-313. Moscow: Progress (in Russian).

Dosnan, O. (1997). Development of creativity. *Cognitive education: modern state and prospects* (pp. 65-82). Moscow: Institute of Psychology, Russian Academy of Science (in Russian).

Dourova, N.V., Jurjeva, N.M. (1998). Making a story by preschool children. *Language and psychological development of preschool children* (pp. 10-19). Moscow: Institute of Linguistics, Russian Academy of Science (in Russian).

Elman, J. (2001). Connectionism and language acquisition. In M. Tomasello & E. Bates (Eds.), *Language development: the essential readings* (pp. 295-306). Malden, MA: Blackwell Publisher.

Gor, K. & Chernigovskaya, T. (2003). Mental lexicon strucure in L1 and L2 acquisition: Russian evidence. *Glossos: The Slavic and European Resource Center*, issue 4.

The Human Factor in Language. Language and speech production (1991). Moscow: Nauka (in Russian).

Jacobson, R. (1985). Part and whole in language. *Selected papers* (pp. 301-305). Moscow: Progress (in Russian)

Karaulov, J.N. (1993). *Associative grammar of Russian*. Moscow: Nauka (in Russian).

Karaulov, J.N., Sorokin J.A., Tarasov J.F., Ufimtseva N.V., & Tcherkasova G.A. (1994). *Russian association dictionary*. Moscow Institute of Linguistics, Russian Academy of Science (in Russian).

Kharchenko, V.K. (2005). *Dictionary of modern child language*. Moscow: Ast (in Russian).

Krouglyakova, T.A. (2006). *Modifications of verse text in language behaviour of a child*. St. Petersburg: Russian State Pedagogical University (Herzen University) (in Russian).

Koubryakova, J.S. (2004). About mental lexicon. Lexicon as a component of human language faculty. *Language and Knowledge*, 378-389. Moscow: Languages of Slavonic Culture (in Russian).

Li, P., & Shirai, Y. (2000). The acquisition of lexical and grammatical aspect. Berlin & New York: Mouton de Gruyter.

Leontjev, A.A. (2007). *Psycholinguistic units and the production of verbal utterance*. Moscow: Jeditorial URSS (in Russian).

Lepskaja, N.I. (1997). *Child language (Ontogenesis of verbal communication)*. Moscow: Moscow State University (in Russian).

MacWhinney, B. (2000a). Connectionism and language learning. In M. Barlow & S. Kemmer (Ed.), *Usage-based Models of Language* (pp. 121-150). Stanford: CA: Center for the Study of Language and Information.

MacWhinney, B. (2000b). *The CHILDES project* (3rd Edition). Mahwah, NJ: Lawrence Erlbaum.

MacWhinney, B. (2005). New directions in the Competition Model. In M. Tomasello & D. Slobin (Eds.), *Beyond Nature-Nurture: Essays in Honor of Elizabeth Bates* (pp. 81-110). Mahwah, NJ: Lawrence Erlbaum.

MacWhinney, B. & Plunkett, K. (2000). Lexicalist Connectionism. In Broeder, P. & Murre, J. (Eds.), *Models of language acquisition. Inductive and deductive approaches* (pp. 9-32). New York: Oxford University Press

Meaning Perception of Verbal Message (in Mass Communication Situations) (1976). Moscow: Nauka (in Russian).

Ovchinnikova, I.G., Beresneva, N.I., Dubrovskaja, L.A., & Penyagina, J.B. (1999). Narratives of Russian children (based on the series of pictures "Frog where are you?"). Sounding reading book. *Newsletter of the Russian Phonological Fund*. Supplement 10. Perm-Bohum: Ruhr University (in Russian).

Pinker, S. (1991). *Words and rules*. New York: Basic Books.

Pinker, S. & Ullman, M. (2002). The past and future of the past tense. *Trends in cognitive science*, 6(11), 456-462.

Sakharniy, L.V. (1994). Man and text: two grammars. In N.A. Kupina & T.A. Matveeva (Eds.), *Man. Text. Culture*. Yekaterinburg: Ural State University (in Russian).

Sekerina, I.A. (2006). Method of evoked potential of brain in experimental psycholinguistics. *Problems of Linguistics* 3, 22-45 (in Russian).

Shtern, A.S. (1992). Perception aspect of language behavior. St. Petersburg: St. Petersburg State University (in Russian).

Shvedova, N.U. (Ed.) (1980) *Russian Grammar*. Moscow: Nauka (in Russian).

Sutton-Smith, B. (Ed.) (1981). *The folk stories of children*. Philadelphia, PA: University of Pennsylvania Press.

Testelets, J.G. (2001). *Introduction to general syntax*. Moscow: Russian State University for the Humanities (in Russian).

Tseitlin, S.N. (1989). *Child speech: form building and word building innovations in Russian*. Doctor of philology thesis. Leningrad: Russian State Pedagogical University (Herzen University) (in Russian).

Tseiltlin, S.N. (2000). *Language and the child. Linguistics of child speech*. Moscow: Flinta (in Russian).

Word Frequencies in Written and Spoken English: based on the British National Corpus (2003). Leech Geoffrey, Rayson Paul, & Andrew. London: Longman.

Zalevskaja, A.A. (1999). *Introduction to psycholinguistics*. Moscow: Russian State University for the Humanities (in Russian).