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Semantic Analysis of Sign Language During Translation from Text to KSL

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Abstract

The article touches upon the topic of the semantics of the Kazakh sign language and its features. Semantics is a branch of linguistics that studies the meaning of expression and combination of signs. The author raises the question of how similar is verbal language with sign language and how they are differ from each other. Because, as everyone knows, words appeared when ancient people, showing some objects, imitated sounds. The main content of the research is the analysis of the properties of the parts of speech of the Kazakh language in SL, the rules for translating verbs and adverbs of time. Due to the fact that in sign language all words are used in the initial form there is necessary to know the order of words in a sentence, because sign language is a separate science for research. The sign language is a multimodal instrument of communication in which the speaker's body, head, gestures and facial expression play an important role. In this work, the formulas for translating from text into sign language are given in detail, and the subject-object-predicate is taken as the basis. As well as examples showing the relationship of subject-object relations - this is the designation of who the speaker is, the "object" or "subject" of the statement. But it is worth understanding correctly that it is still necessary first of all to know the meaning of the sentence, here, as in the verbal language, there are a lot of exceptions that still require further research.

Keywords

Kazakh sign language, semantics, sign language translation, parts of speech.

1. Introduction

Sign language is an independent language consisting of gestures, each of which is made by hands in combination with facial expressions, the shape or movement of the mouth and lips, as well as in combination with the position of the body. These languages are mainly used in the culture of the deaf and hard of hearing for the purpose of communication. The use of sign languages by people without hearing impairment is secondary, but it is quite common: there is often a need to communicate with people with hearing impairments who are users of sign language. The use of gestures, instead of voice communication, may be preferable in many situations where it is either impossible to transmit information by voice, or presents certain difficulties. However, it is not possible to call such sign systems formed sign languages because of their primitiveness. However, in the absence of the possibility of using a sound language, a person instinctively begins to use gestures for this.

Semantics is the meaning and interpretation of words, signs, and sentence structure. Semantics largely determines our reading comprehension, how people understand each other, and even what decisions they make as a result of their interpretations [5]. Semantics can also refer to the field of study within linguistics that deals with language and how everybody understand meaning. Sign languages provide a unique vantage point for investigating semantic phenomena such as index shift and tense adverbs and verbs [6]. Moreover, they challenge semantic theories as verbs of motion exhibit gradient properties (semi-continuous variations with semantic meaning). So the sign language itself is rooted in solid antiquity.

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Even during this time there were, for example, the so-called sign signaling systems, which gave rise to progressive sign languages. In particular, they were used for communication between the deaf and dumb. The first sign languages were noticed in the 18th century. Their creators were the Frenchman Charles Michel de l'Epe and the German Samuel Geinicke. The bulk of advanced sign languages, of which there are currently more than 120 in the world, are based on these first sign languages [2]. It is believed that Kazakh Sign Language belongs to the so-called French Sign Language family along with Irish and American Sign Languages. Quite a lot of the vocabulary of the Kazakh sign language was borrowed from the Russian sign language, and at one time the RSL took the Austrian sign language as the basis of its gestures. The grammar systems of the Kazakh sign language and the Kazakh verbal language differ in many ways. In sign language, grammar (particularly word order and formation) is stricter [4].

At the moment, there are special schools, various associations for the rehabilitation of hearing-impaired people. But these programs do not fully solve the problem of communication of people with hearing disabilities with society and government authorities. In this regard, there is a need to use multimedia computer systems that will translate speech into sign language, and vice versa.

2. Similarity and difference of sign language with verbal

Researches of the grammar of sign languages, be it phonology, syntax or semantics, show, on the one hand, how sign languages are similar to spoken languages, how the structures that is used in the grammars of spoken languages are also found in the grammar of sign language, if we abstract from the various modalities used in these languages (phonetic and visual); on the other hand, linguistic studies of sign languages also show how different they are from spoken languages: how traits that do not manifest themselves explicitly or rarely occur in spoken languages are clearly marked and quite common in sign languages [8]. By examining these similarities and differences, theoretical problems can be solved and important questions can arise regarding the form of natural language grammars.

An active discussion of the linguistic problems of the deaf aroused interest in sign languages among linguists. First of all, it is caused by the use of another channel of information transmission in sign languages – speakers of these languages communicate using vision, hands, facial movements and body, while spoken languages use a sound channel of information transmission [14]. Interestingly, such cardinal differences between languages that use different sensory organs to perceive information affect the internal structure of the language much less than it might seem at first glance.

Let's start with "what are gestures?" and “how to understand semantics in sign languages?”. Gestures occur in real life more often than we notice. In every conversation, people wave their hands to explain something, point to something, or show some direction. That is, does this mean that our non-verbal communication is similar to sign language? To some extent, they are similar, because the first languages in the world were formed on the basis of gestures - people pointed to objects with their hands and made different sounds, which later turned into full-fledged words [13]. Existing reseraches of various national sign languages indicate that verbal languages are similar in their fundamental features to sound languages: they are characterized by the conventionality of language signs, the presence of sign and unfamiliar units, the possibility of vocabulary replenishment due to derivation, word formation and borrowings, the presence of basic parts of speech, the presence of complex sentences; the processes of mastering sign languages are similar the processes of mastering sound languages [15].

However, it is also safe to say that verbal language and sign language are different from each other. The differences between the two perceptual mechanisms – hearing and vision – are reflected in the different internal structure of sound and sign languages. Vision is better adapted to perceive and process different information coming at the same time (for example, spatial relationships of objects), whereas hearing has the advantage of dividing information into successive temporal fragments (for example, the duration of a situation) [16]. Different mechanisms of perception cause a different degree of linearity/nonlinearity of language structures in sign and sound languages. In sign languages, there are significantly more non-linear language structures than in sound ones: phonological components of a gesture are produced mainly simultaneously, rather than sequentially; in sign languages, there is a greater number of morphological means related to the sphere of non-segmental morphology in

comparison with sound languages. In colloquial speech, one word follows another, for example, “ЖАСЫЛ ШЫНЫАЯҚ” (green mug). And in sign language, you can do it at the same time, with your right hand indicate “ЖАСЫЛ” (green) - making circular movements with your index finger around the face, and with your left hand show “ШЫНЫАЯҚ” (mug) - squeezing your palm in a horizontal position in front of the speaker's body. Sign and sound languages use different articulators to generate speech. In sound languages, speech is produced using the tongue, lips, jaw, etc. In sign languages, articulators are two hands, facial muscles, the head and the body of the speaker. Consequently, in sign languages, unlike sound languages, articulators are visible to the addressee and are paired. KSL is a kind of linguistic system that has its own vocabulary and grammar. The phrases “Kazakh sign language” and “Kazakh sign speech” are used to name the communication system of the deaf people living in Kazakhstan. Let us give an example of the statement of the KSS,

АНАМ СӨМКЕНІ ОРЫНДЫҚТЫҢ ҮСТІНДЕ ҚАЛДЫРДЫ. (Mom left the bag on the chair).

Two gestures are involved in the utterance, performed simultaneously with two hands: the ОРЫНДЫҚ (chair) gesture is performed with the left hand, and the СӨМКЕ (bag) gesture is performed with the right (Figure 1). Gestures, reflecting the actual position of the bag and chair, are performed to the left and closer to the narrator. This gestural statement can be written as follows:

$$\left\{\begin{matrix}\text{ОРЫНДЫҚ}(chair)\\ \text{СӨМКЕ}(bag)\end{matrix}\right\}\ (\text{бір уақытта}/at\ the\ same\ time) \qquad (1)$$

Figure 1: Designation “СӨМКЕ ОРЫНДЫҚТЫҢ ҮСТІНДЕ (bag on the chair)”

The main speech when performing the utterance (1) is missing, it is impossible to pronounce two words at the same time. Moreover, the statement (1) conveys all the necessary information about the spatial relationship of objects [1].

The possibility of using almost the entire body, as well as the wide possibilities of using space, determine a higher degree of iconicity compared to sound languages, manifested at all levels of the language system: phonological, morphological, lexical, syntactic.

2.1. The main aspects and parts of speech in sign language

Special methods of expression of different relations between objects or manifestations of actions (denotations), for example, spatial, subject-object relations, etc. were also found in the KSL.

Spatial relationships are most often expressed with the help of those or other characteristic localization components, more precisely, changes in these characteristics, attributing to the nominative gesture. Thus, by performing the gesture CHAIR left or right from the neutral space (where this is the nominative gesture), the meaning of "chair left" and "chair right" will be transmitted accordingly. In some cases, the quality of movement changes, as well as the direction of gesture.

And how many gestures in the Kazakh sign language? It is clear, no one knows how many gestures in KSL, as no one can say exactly how many words in Kazakh, English and other languages. Nevertheless, this question can be answered: there are as many gestures in the KSL as the KSS needs in order to successfully fulfill its function - to serve the needs of formal, informal communication of the deaf. The specificity of the function is one of the two main factors determining the peculiarities of the lexical composition of the Kazakh sign language [10]. The second factor - the peculiarity of the motor substance determines the structure of a whole class of gestures expressing certain meanings, transmitting any external signs of objects, actions, etc. (in linguistics, the term "denotation" is usually used - this is the direct meaning of the word, most often recorded in dictionaries) [9].

For a complete analysis of the text from the Kazakh language on the KSL it is necessary to understand "Are there parts of speech in the sign language?". It is impossible to answer this question. Many professors of the year discuss this topic [12]. But it is impossible to say for sure. However, by analyzing the words and gestures, it is possible to classify such parts of speech as gesture-nouns, gestures-verbs, gestures-adjectives, etc.

Some gestures are very easy to divide into classes, for example, in the group gestures-nouns can include: АНА (mother), БАЛА (child), КӨЛІК (vehicle), etc. However, it should be noted that gestures-nouns can be divided into singular and plural. Then the word is added – КӨП (many): АҒАШТАР (trees) – АҒАШ КӨП (many tree), ГҮЛДЕР (flowers) – ГҮЛ КӨП (many flowers). However, there are different gestures for БАЛА (child) and БАЛАЛАР (children). Here as the word КӨП (many) is not used, so it can be said that in the sign language there are also words exceptions. The second way of expressing the meaning of "multiplicity" is the repetition of the nominative gesture. Thus, gestures АҒАШ (tree), КІТАП (book), СӨЗ (word), repeated several times, mean "trees", "books", "words" and so on. It should be noted that in one-handed gestures (АҒАШ (tree), etc.) for the transfer of the meaning of "multiplicity" is often used parallel execution of the nominative gesture with two hands. In this case, the opposition of a single number (gestures with one hand, usually right) and a multiple number (with both hands) is especially expressed [1].

In the classification of gestures-verbs, it is necessary to stop at tenses. Due to the fact that gestures are used in the infinitive, it is very important to understand when it happened. Temporary meanings are expressed in two basic ways. First of all - with gestures БОЛДЫ (was/were), БОЛЫП ЖАТЫР (is being), БОЛАДЫ (will be). With this gesture БОЛЫП ЖАТЫР/БАР (is being) to communicate that the action applies to the present time, as a rule, is not used. In Table 1 illustrated translation from verbs to infinitive. In order to transfer the meaning of ДЕМАЛЫП ЖАТЫРМЫН (resting), ДЕМАЛДЫМ (rested), ДЕМАЛАМЫН (will rest), the corresponding gesture-nominative ДЕМАЛУ (rest), expressions ДЕМАЛУ БОЛДЫ/ӨТТІ (was rest) and ДЕМАЛУ БОЛАДЫ (will rest) will be used. In the second, gestures are attached to the gesture-nominative, denoting the time: КЕШЕ (yesterday), БҮГІН (today), АРҒЫ КҮНІ (the day after tomorrow), etc. [1].

Table 1

Translation from verb tenses to initial form

Tenses	Verbs	Adverbs/Verb
Present Simple/Continuous	Verb + ЖАТЫР/ОТЫР/ТҰР/ЖҮР In Kazakh language it calls Қалып етістіктері. It is more like constant verbs.	ad.: ҚАЗІР (now)
Past Simple/Continuous	Verb + ды/ді/ты/ті (Past Tense endings)	ad.: КЕШЕ (yesterday), АЛДЫҢҒЫ КҮНІ (the previous day), БЫЛТЫР (last year) etc. v: БОЛДЫ (was/were)
Future Simple/Continuous	Verb + а/й (suffix) + ды/ді/ты/ті (endings)	ad.; ЕРТЕҢ (tomorrow), АРҒЫ КҮНІ (the day after), КЕЛЕСІ ЖЫЛЫ (next year) etc. v: БОЛАДЫ (will)

In KSL, special methods of expressing all kinds of relations between objects or appearances of reality (denotations), for example, spatial, subject-object cases, etc., have also been revealed.

The spatial cases are most often expressed with the support of specific data of the localization component, or rather, the configuration of data inherent in the gesture- nominative.

The subject-object relationship is a designation of who the speaker is, the "complement" or "subject" of the statement, also expressed by the way the gesture is performed [11]. Different (in direction) characteristics of movement allow us to differentiate the roles of subject and object (movement from oneself: ҚАРАП ТҰРМЫН (I am looking), КӨМЕКТЕСІП ТҰРМЫН (I am helping); movement toward itself: МАҒАН ҚАРАП ТҰР (someone is looking at me), МАҒАН КӨМЕКТЕСІП ТҰР (someone is helping me) and etc.). Thus the roles of subjects and objects are distributed when performing many gestures: ОҚЫТУ (teach), АЙТУ (tell), СЫЙЛАУ (respect), КӨМЕКТЕСУ (help), ҚАРАУ (look), ХАБАРЛАСУ (call) and etc. Gestures that are able to convey various morphological meanings by changing the way of execution (localization, direction and quality of movement) often form paradigms. The paradigm includes a number of gestures with the same configuration, having some common basic meaning, but differing in the method of execution. Consider, for example, the paradigm of a gesture, the initial form of which is to ҚАРАУ (look). This paradigm includes both one—handed and two—handed gestures — when expressing the meaning of “multiplicity”, differing in the direction of movement: ҚАРАУ (look), ҚАРАП ТҰРМЫН (I am looking) — movement away from oneself, this gesture coincides with its initial form; СЕН ҚАРАП ТҰРСЫН (you are looking), МАҒАН ҚАРАП ТҰР (look at me) – movement toward itself; БІР-БІРІНЕ ҚАРАП ТҰР (look at each other) – movement two hands towards each other; ЖАН-ЖАҒЫМДЫ ҚАРАП ТҰРМЫН (I examine) — the hand makes a circular movement from left to right or a movement from top to bottom.

Since SL is a visual language, a recommended rule of thumb is to set the stage before showing the action [7]. This is why sign language interpreters may wait a few seconds before starting the translation. Their translation into Kazakh may mean that they will have to wait to see the full sentence structure and understand the exact meaning [17]. Since basically the subject comes first, then the definition (attribute), the next object is the object and the predicate. But it doesn't always work that way, and sometimes sign language translators may ask for clarifications in order to make an accurate interpretation. If in the Kazakh language the definition goes ahead, then in the sign language with the subject it will be located after it, that is, behind the object, and with the addition it remains in front. However, it is impossible to say for sure. Since the sentence, “КІШКЕНТАЙ БАЛА ҚЫЗЫЛ АЛМА ЖЕДІ (A little boy ate a red apple)”, can be interpreted in different ways:

1. БАЛА КІШКЕНТАЙ ҚЫЗЫЛ АЛМА ЖЕУ БОЛДЫ (A boy little red apple was eat).
2. КІШКЕНТАЙ БАЛА ҚЫЗЫЛ АЛМА ЖЕУ БОЛДЫ (A little boy red apple was eat).
3. БАЛА КІШКЕНТАЙ АЛМА ҚЫЗЫЛ ЖЕУ БОЛДЫ (A boy little apple red was eat).

In the first point it turns out, the subject – attribute – attribute – object – predicate SAAOP is obtained. And in the second version, attribute – subject – attribute – object – predicate ASAOP, and this is the most correct in meaning. So in the last sentence, subject – attribute – object – attribute – predicate SAOAP. In all three versions, if we remove the attribute, that is, the definition, you get the formula (2) and it is worth taking as a basis for translation.

$$SOP = subject - object - predicate \qquad (2)$$

In order to translate from text to sign language, translating all words to the initial form (infinitive) is not enough. Each sentence must be analyzed and in some places adverbs of time must be added, and the subject, attribute, and object are sometimes interchanged. For a complete understanding, let us translate the text, taking as a basis (2) the formula.

Main text:

ДАЛАДА ҚАР ЖАУЫП ТҰР. БАЛАЛАР ҚАРМЕН ОЙНАП ЖҮР. ОЛАР ҚАРДАН ҚУЫРШАҚ ЖАСАДЫ. БАЛАЛАРДЫҢ ҚОЛДАРЫ ТОҢДЫ. БІРАҚ ҚУЫРШАҚТАРЫ ӘДЕМІ БОЛЫП ШЫҚТЫ. ҚУЫРШАҚТЫҢ КӨЗІ КӨМІРДЕН ЖАСАЛДЫ.

It's snowing outside. Children play with snow. They made a doll out of snow. The children's hands froze. But the dolls turned out to be beautiful. The doll's eyes were made of charcoal.

Translation to SL:

ҚАЗІР ДАЛА ҚАР. БАЛАЛАР ҚАР ОЙНАУ. ОЛАР ҚАР БӨПЕ+ОЙЫНШЫҚ ЖАСАУ БОЛДЫ. БАЛАЛАР ҚОЛ СУЫҚ. БІРАҚ БӨПЕ+ОЙЫНШЫҚ ӘДЕМІ ШЫҒУ БОЛДЫ. БӨПЕ+ОЙЫНШЫҚ КӨЗ ҚАРАТАС ЖАСАУ БОЛДЫ.

Now outside snow. Children snow play. They snow baby+doll were make. Children hand cold. But baby+doll beautiful was turn out. Baby+doll eye black stone was make.

Based on this text, we can say that all sentences are practically translated as formula (2). However, it is the first sentence in the text that can have several forms: ҚАЗІР ДАЛА ҚАР (now outside snow) - ҚАЗІР ҚАР ДАЛА ЖАУУ (now snow outside was drop).

One more example for formula (2) with an augmented part of speech. There is locative (Figure 2), it means local case. It is characterized by the meaning of place and time, which relate to a certain action. Based on this, it is possible to quite accurately determine the meaning of the local case in syntactic terms. In this case, the subject /object within which this or that action takes place is used (in a sentence it is expressed by a predicate). So it turns out that a locative is added to formula (2) and a new formula is obtained as subject – attribute – object – locative – predicate SAOLP.

ӘПКЕМ АУЛАДА КӨК ДОППЕН ОЙНАДЫ (My sister was playing with a blue ball in the yard).

Translation to sign language:

ӘПКЕ КӨК ДОП АУЛА ОЙНАУ БОЛДЫ. (Sister blue ball yard was play).

In this example, we can also notice different types of gestures. One of them is dynamic and static gestures. Dynamic words include such words as ӘПКЕ (sister), АУЛА (yard), ОЙНАУ (play), БОЛДЫ (was). Figure 2 also shows arrows, which means that these gestures have movement. And such words as КӨК (blue) and ДОП (ball) are more static, that is, there is no need for additional hand movements.

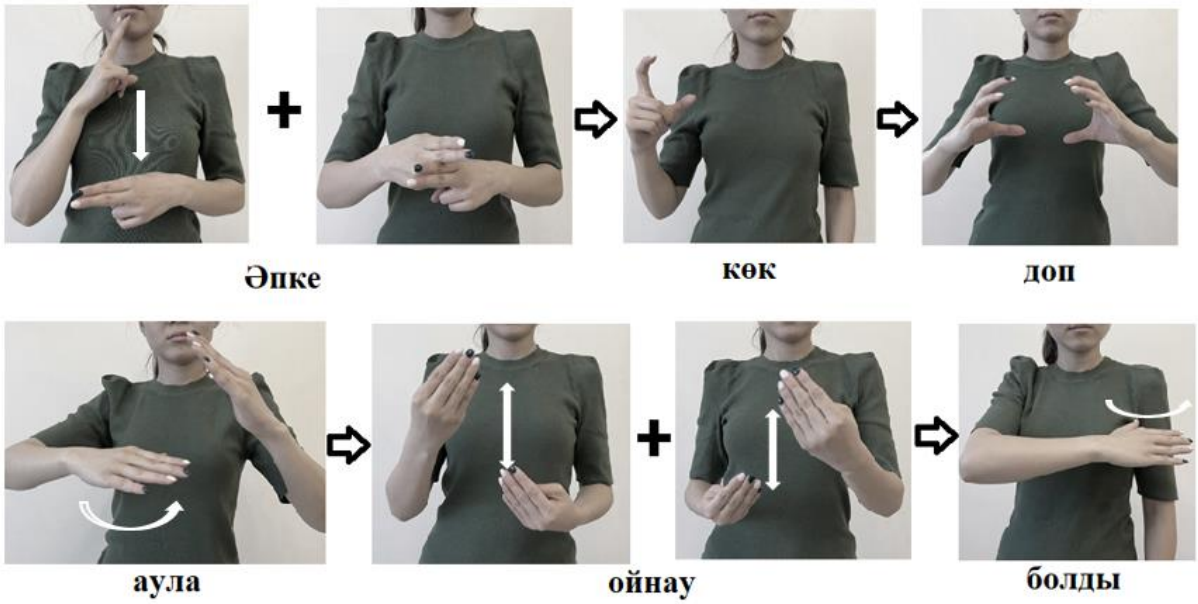

Figure 1: Designation “ӘПКЕМ АУЛАДА КӨК ДОППЕН ОЙНАДЫ. (My sister was playing with a blue ball in the yard)”

In addition, we can see that some gestures are one-handed, and some two-handed. The component configuration is characterized in one—handed gestures by the position of the fingers and the hand (usually the right), in two-handed gestures by the position of the fingers and the hand of each hand and the relative position of both hands. When performing some two—handed gestures, the configuration of the right and left hands is the same (as in the gestures ОЙНАУ (play), ДОП (ball)), in others it is different (ӘПКЕ (sister), АУЛА (yard).

All these arguments and researches are just the beginning of the analysis of the semantics of sign language. It should be understood that sign language is a separate language that requires scientific research, it is also a multimodal means of communication. The semantic load in it can be carried not only by gestures, but also by non-visual components: gaze, facial expressions, facial expression, the position of the speaker's head and body. Communication in a verbal language is also multimodular, but to a much lesser extent, in addition, it can have a single-modal version (written text). Written notations of sign language are not used as a means of communication [3].

In conclusion, KSL is a peculiar linguistic system with its own vocabulary and grammar. Because of the peculiarities of the language, before a correct and accurate translation of a verbal Kazakh text, the sign language interpreter must set the scene, that is, get the sentence in full, since different combinations of words and sentence members convey different information. In addition to this, the KJV is constructed according to the SOP formula (subject-object-predicate), verbs are translated into infinitive, adverbs of place, time and subject are additionally added, object and predicate are interchanged.

All these arguments and studies are just the beginning of the analysis of semantics of sign language. It is necessary to understand that sign language is a separate language, which requires scientific research, and it is also a multimodal means of communication. Not only gestures can carry a semantic load in it, but also non-meaningful components: gaze, facial expressions, head and body position of the speaker.

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4. References

[1] G.L. Zaitseva, Signed Speech Dactylology. Textbook for Students M., 2000, 189 pp.
[2] Sign languages of the world (2021), URL: https://ideaplus.pro/poleznoe/zhestovye-yazyki-mira
[3] Manueva, Y. S., Griff, M. G. (2016). Development of an algorithm for semantic analysis of speech (text) for translation into Russian sign language, Scientific Bulletin of NSTU volume 62, No 1, 2016, p. 106-119.
[4] Ramis Ganiev (2021), How ancient people invented words and learned to talk? URL: https://hi-news.ru/research-development/kak-drevnie-lyudi-pridumali-slova-i-nauchilis-razgovarivat.html
[5] S. A. Kudubaeva, B. T. Zhusupova, D. J. Alippaeva. Dictionaries of the Kazakh language as a basis for semantic analysis in the system of computer sign language translation. No 4 (78), 70-75, 2019. URL: https://doi.org/10.47533/2020.1606-146X.34
[6] S. A. Kudubaeva, B. T. Zhusupova, Designing a system of computer translation from Kazakh to Kazakh sign language with the ability to demonstrate gestures by a character. VII International Scientific-Practical Conference (2021), 29-38 pp.
[7] Kimmelman V. Russian grammar features in Russian Sign Language discourse // International Conference on Minority Languages XII «Language contact and change in multiply and multimodally bilingual minority situations». Tartu, 2009.
[8] Sandro Zucchi (2012), Formal Semantics of Sign Languages, Language and Linguistics Compass 6/11 (2012): 719–734, 10.1002/lnc3.348
[9] Waldemar Schwager and Ulrike Zeshan, Word classes in sign languages. Studies in Language 32:3 (2008), 509–545. doi 10.1075/sl.32.3.03sch
[10] Meir, Sandler 2008 – Meir I., Sandler W. A Language in Space: The Story of Israel Sign Language. New York: Lawrence Erlbaum Associates, 2008. 332 p.
[11] Meir 2012 – Meir I. Word Classes and Word Formation // Pfau R., Steinbach M., Woll B. (eds.) Sign Language: An International Handbook. Berlin: Mouton de Gruyter, 2012. P. 77–111.
[12] Brentari 1998 – Brentari D. A Prosodic Model of Sign Language Phonology. Cambridge: MIT Press, 1998. 376 p.
[13] Brentari 2002 – Brentari D. Modality differences in sign language phonology and morphophonemics // Meier R., Cormier K., Quinto-Pozos D. (eds.) Modality and Structure in Signed and Spoken Languages. Cambridge: Cambridge university press, 2002. P. 35–64.

[14] Aronoff et al. 2003 – Aronoff M., Meir I., Padden C., Sandler W. Classifiers Constructions and Morphology in Two Sign Languages // Perspectives on Classifier Constructions in Sign Langauges. Mahwah, NJ: LEA, 2003. P. 53–84.
[15] Aronoff et al. 2005 – Aronoff M., Meir I., Sandler W. The Paradox of Sign Language Morphology // Language. 2005. Vol. 81(2). P. 301–344.
[16] Kimmelman 2013 – Kimmelman V. Doubling in RSL and NGT: a pragmatic account // M. Balbach, L. Benz, S. Genzel, M. Grubic, A. Renans, S. Schalowski, M. Stegenwallner, A. Zeldes (eds.) Interdisciplinary Studies on Information Structure. Potsdam, 2013. Vol. 17. P. 99–118.
[17] Zucchi 2003 – Zucchi S. The semantics of FATTO: a case of grammaticalization.. Paper presented at the 14th Amsterdam Colloquim. Amsterdam, 2003.