

Technologies of Teaching Spoken Georgian to Deaf Children

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Deaf and Hard of Hearing people (DHH) are the linguistic minority in Georgia and their language is Georgian Sign language (GESL). Georgian DHH has no national diversities inside this community and GESL is a united language for the all Deaf people in this country. I elaborated a few technological approaches for teaching spoken Georgian to DHH children at special schools. The main issues are the following items:

- Establishing a new Georgian dactyl alphabet in education system of DHH with support of local authorities;
- Elaborating Georgian dactyl font for the teaching-learning process to improve its results;
- Providing spoken Georgian e-learning material for home work (exercises and translated texts);
- Creating the multimedia material for teaching spoken Georgian and later inserting these materials in DHH studying process;
- Creating the multimedia (visual) material for improving the existed agrammatism;
- Elaborating the two-way dictionary GESL-Spoken Georgian using the new technologies - Leap Motion and Kinect data;
- Finalizing the elaboration of a new engine for Georgian dactyl and sign recognizing and establishing it in DHH studying process.

The presented paper describes the details of the used innovation technologies.

Keywords: Teaching language, Georgian, Georgian Sign Language, dactyls, Sing Language machinery translation, e-learning for DHH

1. Introduction

1.1. General information

Deaf and Hard of Hearing people (DHH) are the linguistic minority in Georgia and their language is Georgian Sign language (GESL). Georgian DHH has no national diversities inside this community and GESL is a united language for the all Deaf people in this country.

1.2. About Georgian Sign Language (GESL) researches

GESL has its individual grammar system, although there was a dominant Russian Sign Language in Georgia for a long time. Usually in the countries of the former Soviet Union Russian Sign Language had a big influence on the all sign languages of this area. In post-Soviet reality these sign languages began to reintegrate. The former Soviet Republics perform the investigations of these reintegrated sign languages in their countries. Georgia is typical in that and in the current period we are doing the first steps. Namely, a few scientific and teaching guides about GESL were published with the financial support of USAID and Save Children International Tbilisi Office. I investigated the grammar system of GESL and published a book “Georgian Sign Language”; in a close collaboration with the Georgian DHH I elaborated the first Georgian Dactyl Alphabet and introduced it to my colleagues at the International conferences. On spring 2015, I accomplished the GESL dictionary with the electronic version (www.gesl/iliauni.edu.ge). This project was supported by Shota Rustaveli National Scientific Foundation. Now with a small group of specialists at Ilia State University, I work on Sign Language (SL) computer translation engine developing the sign-recognizing systems, and at the same time we prepare GESL on-line course with free access for any interested parties. I believe that these projects create the base for considerable changes in DHH education system, but still till now there are a lot of problems that need to be resolved.

2. DHH Education in Georgia

The most important milestone for the Euro-Atlantic paradigm of values is a development of non-stop processes of the integration of disability people into the

civil society. In this light education of local DHH is very important and topical, as it meets the life demands of these people.

The state tries to solve their problems with the proper laws. The law "About Social Protection of Disabled Persons" says: "The State recognizes the sign language as the means for inter-person relationship and guarantees to provide the necessary conditions for its usage and development" (Article 15). The state organizations at different fields have the obligations to provide DHH citizens by the interpreters. Usually SL-s are used for education by DHH all over the world. Crucially, in Georgia some changes were made in educational law: "In the specialized schools of sensor disabilities where the Deaf and Hard of Hearing pupils receive the education the sign language is used and its analogs." (15.12. 2010. N4042; Georgian Education Law, article 4. The language of teaching)

In order to overcome the problem of communication for the DHH in Georgia, it is necessary to provide the deeper scientific investigations of GESL, to learn better its grammar providing the detailed typological analysis for the each grammatical category, elaborating GESL dictionaries, establishing the standards for GESL, identifying the language levels, working on the methodology of teaching GESL and spoken Georgian to DHH, etc.

Bilingual model is considered the best for DHH education word wide. Thus, teaching spoken Georgian to the Deaf children in Georgia is very important. Actually it is a basic language if education for local DHH.

3. New Approaches

3.1. Main issues

I elaborated a few technological approaches for teaching spoken Georgian to DHH children at special schools. The main issues of this approach are the following items:

- Establishing a new Georgian dactyl alphabet in education system of DHH with support of local authorities;
- Elaborating Georgian dactyl font for the teaching-learning process to improve its results;
- Providing spoken Georgian e-learning material for home work (exercises and translated texts);
- Creating the multimedia material for teaching spoken Georgian and later inserting these materials in DHH studying process;
- Creating the multimedia (visual) material for improving the existed agrammatism among DHH;

- Elaborating the two-way dictionary GESL-Spoken Georgian using the new technologies - Leap Motion and Kinect data;
- Finalizing the elaboration of a new engine for dactyl and sign recognizing and establishing it in DHH studying process.

3.2. *Used methods*

To resolve the engine-building problem, we used the Markov chain hidden model. The innovative solution for our project is to build GESL mini-corpora in 3D instead of 2D video filming with a few cameras. Filmed signs also can be attached to the material in order to have a clear visual format. The corpora will be performed in 3D with Leap-Motion data (<https://www.leapmotion.com/>). There are a number of very expensive devices to get hands' movements data. Leap-Motion is cheap and easy to use with great development API and community support. We had also tested Microsoft's Kinect (<http://www.xbox.com/en-US/xbox-one/accessories/kinect-for-xbox-one>, <https://developer.microsoft.com/en-us/windows/kinect?navV3Index=1>), although we found out that Leap-Motion was more suitable for our needs. For the final version of the core software will be prepared a combination of the parameters for Leap-Motion and Myo (<https://www.myo.com/>). The engine will be able to convert any exact data coordinates into relative, being an abstractly usable data. So-called «Bridge» will be written, in order to transmit the data from our soft to Avatar and/or text-to-speech engines. The existing solutions unfortunately don't work – still DHH have the communication problems word wide. Our innovative corpora building program /concepts will be easy to adopt for any SL.

3.3. *Sign classification*

Signs help DHH to understand words of spoken languages. The signs can be static or dynamic, one or two-handed. Two-handed signs may be symmetric or asymmetric. Besides, among two handed signs either both hands are producing dynamic or static signs, or one hand produces a static sign while another one does a dynamic sign.

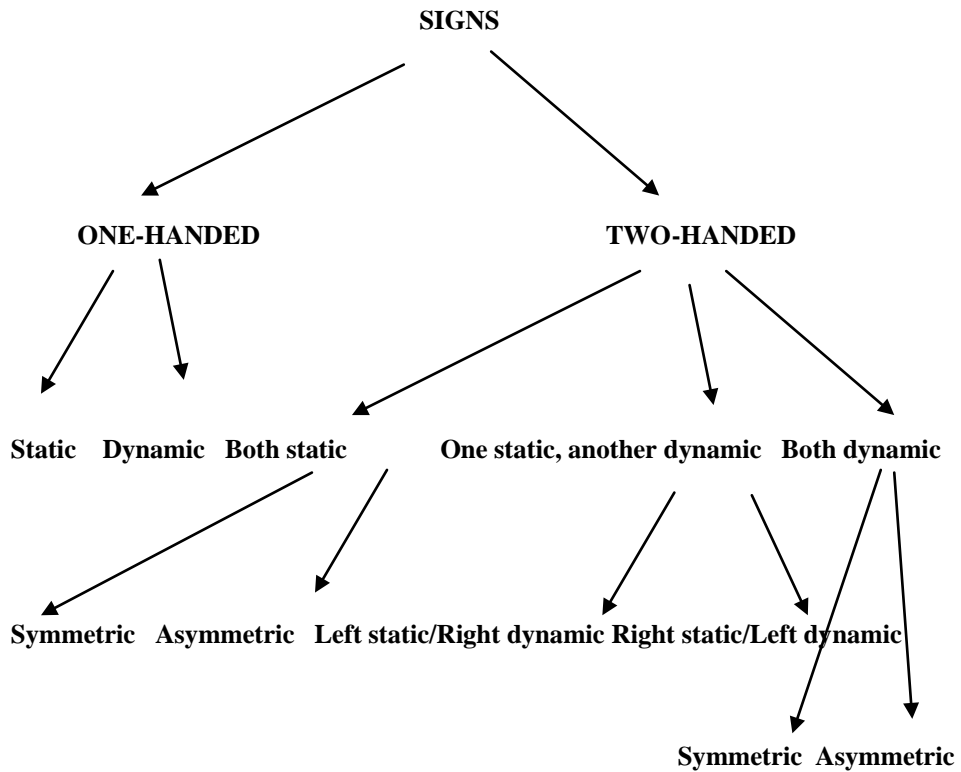
For sign classification we used the combination approaching:

- Dynamical gradation (with space and time parameters) - The signs are statistic or/and dynamic. Dynamic signs may have one, two or more movement /phases;
- Composition of a sign / sign structure – the signs may have one, two, three or four (very rarely can be five) elements or the independent signs with

(sometimes totally different) meanings. Signs may be as following $A=a$;
 $A=a+b$, $A=a+b+c$, etc.;

- For our description one-handed and two handed signs can be described in the same way. But it is worth to mention that there can be a significant difference between the sign producers and their moving/sign producing kinetics.

Classification of signs Schematically it looks as follows:



4. Spoken Georgian for DHH

DHH is considered as bilingual population word-wide, but in some cases these people may know only SL. Sometimes they may have very poor linguistic skills for SL, using so called home SL and staying isolated. The Georgian Union of Deaf tries to reveal such people across the country and to help them in integration to the local DHH community supporting the teaching GESL - as a basic communicative language.

Spoken Georgian is the main language for education for Georgian DHH and therefore, it is very important to have a good knowledge of spoken Georgian and to overcome the existed agrammatism among the community members.

Teaching spoken Georgian in Deaf schools will provide a good basic for future education process of DHH.

5. The Meaning of the Product

The final product will be the fully elaborated system for teaching spoken Georgian to local DHH via new technologies. This product will provide better possibilities to learn spoken Georgian for DHH. Thus, they will be able to improve their communication skills for successful integration to the civil society. A good knowledge of Spoken Georgian will also help to improve the level of social, cultural and economic life for local DHH.

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