# The Typhlocomments Rules for Audiodescription System of the Video Content Formation for People with Visual Impairments

Andriy Demchuk[1][0000-0001-5710-9347] and Olga Lozynska[2] [0000-0002-5079-0544]

[1]Information Systems and Networks Department, Lviv Polytechnic National University, Lviv, Ukraine, Andrii.B.Demchuk@lpnu.ua

[2]Information Systems and Networks Department, Lviv Polytechnic National University, Lviv, Ukraine, Olha.V.Lozynska@lpnu.ua

**Abstract.** This paper introduces the rules of constructing typhlocommentars for audiodescription system of the video content formation for people with visual impairments. This system can be considered as an intermediary between the available video content from the one side and the visually impaired user from the other. The process of forming the rules of typhlocomments is discussed. This rules are formed in the form of a proposal function, the truth of which is verified on the facts and the rules obtained as a result of psychological research. The use case diagram that describes the functional appointment of the system is suggested. The resulting use case diagram contains seven cases for use and two actors, among which the inclusion and extension relations are set. Tasks that require further research are defined.

**Keywords:** Video content, People with visual impairments, Typhlocomments, Typhlocommentar, Audiodescription.

## 1 Introduction

The development of human language and writing provided the undoubted help for visually impaired people. Partly, information holes can be filled in with a virtual description, oral or written language.

It can be assumed that the typhlocomments arose immediately after the appearance of the human language and at the same time with the appearance of the first person with visual impairment. There were three compelling reasons for this:

1. The presence of the visually impaired person, for whom there is a need to pass the information about the world by linguistic means.
2. The possibility of using the language that it enables the verbal method to describe a living entity, object, space or action in such a way that it can be understood without "seeing".

3. The presence of a sighted person who possesses the abilities to describe a verbal description for visually impaired persons (this person must be specially trained for this work).

Due to blindness, such persons have a problem with obtaining visual information and satisfaction of their educational-cognitive, cultural-aesthetic, integration-communicative and other socio-personal needs.

The typhlocomments is the targeted information specially prepared for people with visual impairment for replacement (or addition) of visual information perceived by a sighted person and which is unavailable (or inaccessible) to such persons due to loss of vision. Nevertheless, there are many known scientific articles on this issue. However, the problem of video content adaptation for persons with visual impairments has not been resolved yet.

The paper discusses an actual scientific and practical task of developing the typhlocomments rules for audiodescription system of the video content formation for people with visual impairments.

## 2 Related Work

Scientific research in the field of complementing video content with typhlocommentars to provide access to the video content for persons with visual impairments, began in the 80s of the last century and intensively evolve.

The basic theoretical foundations of the audiodescription are given in [1, 2]. S. Vanshin [3] introduced the notion of typhlocomments on post-soviet space, which is close to the concept of audiodescriptions in the rest of the world. In [4-6] methods of the adapted video content construction and its possible ways of development are given.

The scientists [7, 8] worked on information accessibility for visually impaired people in video format, but adaptation of the video content (finding places for insertion of typhlocommentars) has always been performed with the person help.

Development of science and using multimedia technologies have led to the creation of computer systems that provide access for people with visual impairments to information. Therefore, this situation can be overcome by developing methods and means of the video adaptation for visually impaired people.

## 3 Main Part

The audiodescription system can be considered as an intermediary between the available video content from the one side and the visually impaired user from the other.

There are three participants in forming of the video content for visually impaired people: the video content $V$ (its owners), the visually impaired people $K$ (clients) and the system for developing such content with the use of the audiodescription. For each



COLINS'2018, Volume II: Workshop. Lviv, Ukraine, June 25-27, 2018, ISSN 2523-4013
http://colins.in.ua, online

of representatives of these sets $k$, $(k \in K)$ and $v$, $(v \in V)$, their relations will be formed as suggestions and wishes for each of parties. Consider the main features of these objects.

The initial video content (without audiodescription) $V$ has its own specifics, namely, it consists of the following elements:

- the total video content time;
- the non- dialogue time, where you can insert the audiodescription;
- the difficulty of describing events.

*The total video content time* clearly recognized by video content developers and contain information about the begin and the end of video and the soundtracks. It is described by the set of facts – logically true expressions that can be presented, for example, in the following form:

$Begin\_of\_sound \quad (v, 200\,s)$, $End\_of\_movie\,(v, 1\,hour\,20\,min)$.

*The non-dialogue time* is the time where you can insert the typhlocommentars. It determines the number of the parameters and the relates to the main possibilities of the developed system: the *S*-intervals for inserting typhlocommentars, the time of the typhlocommentars, the difficulty of the plot, the speed of reading. They are given by the set of pronouns in the form of predicates and each of them characterizes some property of the video content. Such relations are described with the use of the predicate constants:

$$Non-dialogue\ time(v, t <= 20s),$$

$$Time\ interval\ for\ audiodescription(v, 22\min, 24\min).$$

In round brackets, there are no arguments of the corresponding propositional functions, because their number and meaning depend on the particular predicate.

*The difficulty describing events (plot).* The typhlocommentar is formed during the revision of the video content. The peculiarity of forming the plot description is that it is mostly difficult to formalize the video content, but rather, it is necessary to describe it in some way in general. Such a description may be limited by statements of approximately this type:

"*All mass scenes need to be described with audiodescription*".

Uncertainty in user terminology and wishes requires the creation of the intellectual subsystem of the plot descriptions based on ontologies [9-11] and the participation of the expert to formulate and refine based on user suggestions rules [12-29]. The formulation of such rules is an important moment, since further approaches to the audiodescription should take into account the wishes of users (visually impaired persons) [30-39].

The suggestions and wishes of users *k* consist of:

- the objectivity of the plot description;
- no overlapped the audiodescription on dialogs.

The task of developing a high-quality video content for the user $k$ based on the $V$ following in satisfaction the above rules that give the true value of the logical function:

$$Video\ content\ OK(v,k).$$

During the practical implementation of the video content for visually impaired people, the system of audiodescription puts and takes into account in the further activity its experience in the form of knowledge about the user's psychology based on the perception of the sounding movies. Taking into account such knowledge may consist in the formation of some set of the rules. Such rules are formed in the form of a proposal function $D(v,k)$, the truth of which is verified on the facts and the rules obtained as the result of psychological research.

Finally, the success of the resulting video content for visually impaired people is to prove the truth of the goal function:

$$W(v,k) = Video\ content\ OK(v,k) \wedge D(v,k).$$

The conceptual model of the complex system, using use case diagram shown on Fig. 1.

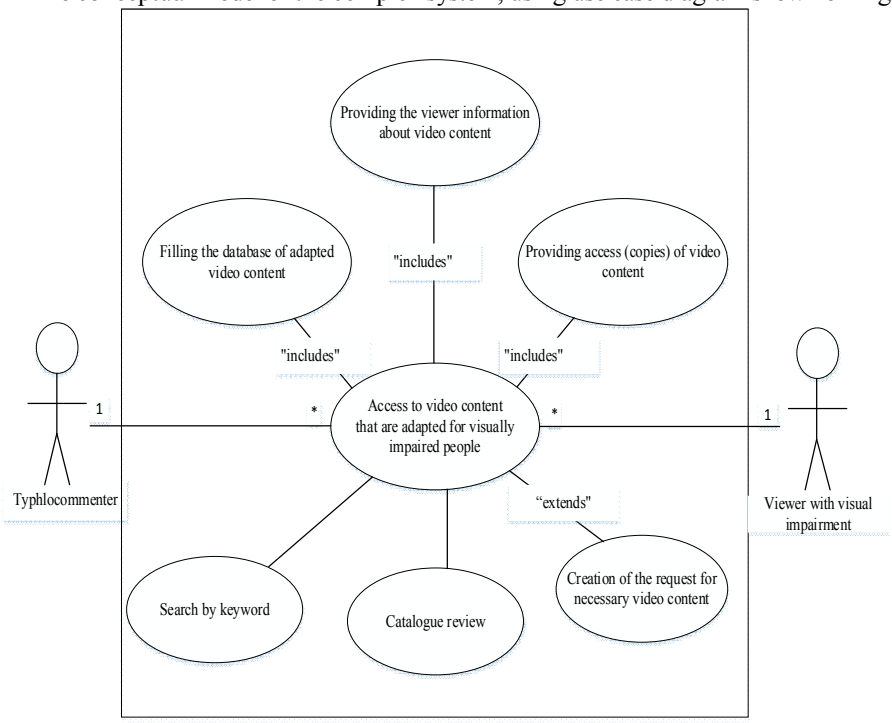


**Fig. 1.** The use case diagram of the audiodescription system

The use case diagram describes the functional appointment of the system. The goal of this diagram is that the projected system is presented in the form of the set of actors that interact with the system with using of so-called variants of use. In this case, the actor is called any entity that interacts with the system from the outside. This can be a

person, a technical device, a program, or another system that is a source of action on the simulated system. This action is defined by the system developer. In turn, the use case diagram is to describe the services that the system provides to the actor. In other words, each use case determines some set of actions carried out by the system during dialogue with the actor.

## 4 Results

The resulting use case diagram contains seven cases for use and two actors, among which the inclusion and extension relations are set. Access to the video content for viewers with visual impairments is realized through three cases: the keyword search, the catalogue review or the creation of the request for the necessary video content that must be adapted. Next, the viewer chooses the necessary action: gets information about the video content, gets access to it (opens / downloads it).

The audiodescription system is the part of program and algorithmic complex of video content adaptation for people with visual impairments. The approbation of program complex implementation results is made. The use of the rules of typhlocomments for the video content plot description allows to increase up to 30 % the perception of video content by people with visual impairments.

## 5 Conclusion

Loss of vision becomes a perceptible information barrier for people with visual impairments when visiting the museums and the exhibition halls, the theaters, the cinemas, the sports and the other cultural events, and makes it impossible to completely perceive the beauty of the works of art, the architecture, the literature, which is cultural and the historical heritage of mankind. The audiodescription system of the video content formation allows to partially solve this problem for person with visual impairments.

The process of forming the rules of typhlocomments is proposed. This rules are formed in the form of the proposal function, the truth of which is verified on the facts and the rules obtained as the result of psychological research. The use case diagram that describes the functional appointment of the system is suggested.
Further research can be focused on improving the audiodescription system.

## References

1. Cintas, J. D., Remael, A.: Audiovisual translation: Subtitling. Across Languages and Cultures, 9(2), 291-299 (2008).
2. Siegel, B.: The world of the autistic child: Understanding and treating autistic spectrum disorders. New York, NY, US: Oxford University Press, (1996).
3. Vanshin, S. N., Vanshina, O. P.: The verbal description for the blind. M.: Logosvos,62 (2011).

4. Szarkowska, A.: Auteur Description: from the director's creative vision to audiodescription. Journal of Visual Impairment & Blindness, Vol. 7, 383-387(2013).
5. Frederick, W.,Moss, Jr.: Quality of Experience in Mainstreaming and Full Inclusion of Blind and Visually Impaired High School Instrumental Music Students. Michigan: University of Michigan, 258 (2009).
6. Audio Description for people with vision Loss. A Guide for Performing Arts Settings. John F. Kennedy Center for the Performing Arts, (2013). mode: http://www.kennedy-center.org/accessibility/education/lead/2013KC_AudioDescripGuide.pdf.
7. Igune, G. W.: Inclusion of Blind Children In Primary Schools: A case study of teachers' opinions in Moroto district – Uganda. Norway: University of Oslo, 108 (2009).
8. Inclusion: Creating an Inclusive Environment. A Handbook for the Inclusion of People with Disabilities in Nationaland Community Service Programs. – Access mode: http://www.service andinclusion.org/handbook/inclusion.pdf.
9. Demchuk, A. B.: Videocontent for the blind: the method of typhlocomments. Radio Electronics, Computer Science, Control: Scientific Journal Zaporizhzhya National Technical University,1 (30), 146-149 (2014).
10. Davydov, M., Lozynska, O.: Spoken and sign language processing using grammatically augmented ontology. Applied Computer Science 11(2), 29-42 (2015).
11. Vysotska, V., Chyrun, L., Lytvyn, V.: Methods based on ontologies for information resources processing. Germany: LAP LAMBERT Academic Publishing (2016).
12. Vysotska, V.: Tekhnolohiyi elektronnoyi komertsiyi ta Internet-marketynhu. Saarbrücken, Germany: LAP LAMBERT Academic Publishing (2018)
13. Vysotska, V., Lytvyn, V.: Web resources processing based on ontologies. Saarbrücken, Germany: LAP LAMBERT Academic Publishing (2018)
14. Vysotska, V., Shakhovska, N.: Information technologies of gamification for training and recruitment. Saarbrücken, Germany: LAP LAMBERT Academic Publishing (2018)
15. Vysotska, V.: Internet systems design and development based on Web Mining and NLP. Saarbrücken, Germany: LAP LAMBERT Academic Publishing (2018)
16. Vysotska, V.: Computer linguistics for online marketing in information technology : Monograph. Saarbrücken, Germany: LAP LAMBERT Academic Publishing (2018)
17. Lytvyn, V., Vysotska, V., Chyrun, L., Smolarz, A., Naum O.: Intelligent System Structure for Web Resources Processing and Analysis. In: 1st International Conference Computational Linguistics and Intelligent Systems, COLINS, 56-74 (2017)
18. Lytvyn, V., Vysotska, V., Wojcik, W., Dosyn, D.: A Method of Construction of Automated Basic Ontology. In: 1st International Conference Computational Linguistics and Intelligent Systems, COLINS, 75-83 (2017)
19. Lytvynenko, V., Lurie, I., Radetska, S., Voronenko, M., Kornilovska, N., Partenjucha, D.: Content analysis of some social media of the occupied territories of Ukraine. In: 1st Inter. Conference Computational Linguistics and Intelligent Systems, COLINS, 84–94 (2017)
20. Shepelev, G., Khairova, N.: Methods of comparing interval objects in intelligent computer systems. In: 1st International Conference Computational Linguistics and Intelligent Systems, COLINS, 100–109 (2017)
21. Orobinska, O., Chauchat, J.-H., Sharonova, N.: Methods and models of automatic ontology construction for specialized domains (case of the Radiation Security). In: 1st Inter. Conf. Computational Linguistics and Intelligent Systems, COLINS, 95–99 (2017)
22. Hamon, T., Grabar, N.: Unsupervised acquisition of morphological resources for Ukrainian. In: 1st International Conference Computational Linguistics and Intelligent Systems, COLINS, 20–30 (2017)

23. Grabar, N., Hamon, T.: Creation of a multilingual aligned corpus with Ukrainian as the target language and its exploitation. In: 1st International Conference Computational Linguistics and Intelligent Systems, COLINS, 10–19 (2017)
24. Hamon, T.: Biomedical text mining. In: 1st International Conference Computational Linguistics and Intelligent Systems, COLINS, http://colins.in.ua/wp-content/uploads/2017/04/2017COLINS-THAMON-keynote.pdf (2017)
25. Lande, D., Andrushchenko, V., Balagura, I.: An index of authors' popularity for Internet encyclopedia. In: 1st International Conference Computational Linguistics and Intelligent Systems, COLINS, 47–55 (2017)
26. Lande, D.: Creation of subject domain models on the basis of monitoring of network information resources. In: 1st Inter. Conference Computational Linguistics and Intelligent Systems, COLINS, http://colins.in.ua/wp-content/uploads/2017/04/Lande.pdf (2017)
27. Protsenko, Y.: Intuition on modern deep learning approaches in computer vision. In: 1st International Conference Computational Linguistics and Intelligent Systems, COLINS, http://colins.in.ua/wp-content/uploads/2017/04/protsenko.pdf (2017)
28. Kolbasin, V.: AI trends, or brief highlights of NIPS 2016. In: 1st International Conference Computational Linguistics and Intelligent Systems, COLINS, http://colins.in.ua/wp-content/uploads/2017/04/CoLlnS_TuS.pdf (2017)
29. Kersten, W.: The Digital Transformation of the Industry – the Logistics Example. In: 1st International Conference Computational Linguistics and Intelligent Systems, COLINS, http://colins.in.ua/wp-content/uploads/2017/04/CoLlnS_TuS.pdf (2017)
30. Shalimov, V.: Big Data – Revolution in Data Storage and Processing. In: 1st International Conference Computational Linguistics and Intelligent Systems, COLINS, http://colins.in.ua/wp-content/uploads/2017/04/BigData_eng.pdf (2017)
31. Hnot, T.: Qualitative content analysis: expertise and case study. In: 1st Inter. Conference Computational Linguistics and Intelligent Systems, COLINS, http://colins.in.ua/wp-content/uploads/2017/04/Qualitative-content-analysis_expertise-and-case-study.pdf (2017)
32. Romanyshyn, M.: Grammatical Error Correction: why commas matter. In: 1st Inter. Conf. Computational Linguistics and Intelligent Systems, COLINS, http://colins.in.ua/wp-content/uploads/2017/04/Grammatical-Error-Correction-why-commas-matter.pdf. (2017)
33. Yukhno, K., Chubar, E.: Gamification: today and tomorrow. In: 1st International Conference Computational Linguistics and Intelligent Systems, COLINS, 139–140 (2017)
34. Pidpruzhnikov, V., Ilchenko, M.: Search optimization and localization of the website of Department of Applied Linguistics. In: 1st International Conference Computational Linguistics and Intelligent Systems, COLINS, 137–138 (2017)
35. Olifenko, I., Borysova, N.: Analysis of existing German Corpora. In: 1st International Conference Computational Linguistics and Intelligent Systems, COLINS, 135–136 (2017)
36. Kolesnik, A., Khairova, N.: Use of linguistic criteria for estimating of wikipedia articles quality. In: 1st International Conference Computational Linguistics and Intelligent Systems, COLINS, 133–134 (2017)
37. Kirkin, S., Melnyk, K.: Intelligent data processing in creating targeted advertising. In: 1st Inter. Conf. Computational Linguistics and Intelligent Systems, COLINS, 131–132 (2017)
38. Hordienko, H., Ilchenko, M.: Development and computerization of an English term system in the fields of drilling and drilling rigs. In: 1st International Conference Computational Linguistics and Intelligent Systems, COLINS, 129–130 (2017)
39. Gorbachov, V., Cherednichenko, O.: Improving communication in enterprise solutions: challenges and opportunities. In: 1st International Conference Computational Linguistics and Intelligent Systems, COLINS, 127–128 (2017)