MODERN TECHNOLOGIES IN SUPPORT OF COMMUNICATION BETWEEN PERSONS WITH SEVERE HEARING IMPAIRMENTS AND PUBLIC ADMINISTRATION AUTHORITIES

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After many years of effort and work to improve the situation, eliminate barriers in the lives of the deaf, developed the law on sign language. It is defined as a milestone in the struggle to improve their situation. Assistive technology for deaf people an opportunity to communicate their alignment with the rest of society. In the era of computerization there are solutions, offers a chance for the abolition of such barriers. Access to the Internet and mobile devices deaf improve communication with its surroundings. The following papers attempts an approximation of deafness as a disability and social groups, and then present the technical and technological foundation that with support communication. The proposal is a response to statutory requirements in relation to public bodies.

Keywords: communication, disability, public administration, deafness, barriers, severe hearing impairments, modern technologies

1. Introduction

Disabilities have become a subject of broad public debates in modern times. According to WHO reports, the estimated number of persons with disabilities, globally, is close to one billion. Certainly, the effects of such disabilities in everyday social interactions may be varied, since this particular (and by far – the largest) minority in the world represents an overwhelming array of different categories of disabilities. In the second half of the 20th century, formal classifications estimated the percentage of impaired persons in the total population

at ca. 10%. More recent analyses, such as the World Health Survey, the Global Burden of Disease Study and a number of domestic publications suggest that their percentage is closer to the 15% mark. Among those, people with hearing impairments are one of the largest segments, globally, at ca. 70 million [11].

So far, the most significant benefit offered to people with hearing impairments was the formal and legal recognition of the sign language, a result of concerted efforts on the part of various associations and organisations representing the interests of persons who use sign language as a primary form of communication in their everyday activities. In addition, their efforts are also focused on promotion and protection of the sign language in public setting – particularly in education, judicial proceedings, administration and public services, the media, and the culture – as well as the provision of interpreting services. After many years of efforts and concerted activities intended to alleviate the communication gap and eliminate barriers to communication for the hearing-impaired, the formal status of the sign language in Poland was confirmed in an Act on the Sign Language and this was a milestone to improve the quality of life for people with disabilities.

Modern technologies offer a chance for the hearing-impaired persons (in social and professional context) with that of the rest of the society. Modern IT solutions may be employed with success to reduce barriers to interpersonal communication. Access to broadband Internet and the propagation of mobile devices, with support from dedicated centres of sign language interpretation services may virtually eliminate all barriers to communication with the deaf. This paper represents an attempt to define the properties and the characteristics of this particular type of impairment, and the qualities of the affected community (or social group). Based on the above, the authors postulated a number of technological and technical requirements in the design of modern instruments for support of communication with this segment of the general population, particularly in the light of provisions contained in the Act and addressed to public administration authorities in their contacts with persons with hearing disabilities and impairments.

The main objective of this paper is to identify the most fundamental barriers to communication faced by people with hearing disabilities in their contacts with public administration bodies in Poland.

2. Definition of deafness

'Deaf' is a common denominator in all definitions of persons with hearing disabilities or impairments. A deaf person is one who faces problems with unassisted learning of language and speech, resulting directly from congenital or acquired defects of the auditory analyser. This type of disability is inherently burdened with problems in social adaptation and requires third party assistance in all areas of education and development [3].

Formal classification of hearing impairments, as adopted and recommended by the International Bureau for Audiophonology, postulates a division into light, moderate, severe and total hearing loss. In everyday terms, this classification may roughly correspond with such terms as: weak of hearing, hearing-impaired, deaf, deaf without speech, etc. For our purposes, the above terms will be used interchangeably. However, it must be noted that, based on the adopted definition, 'deaf' should be perceived as the term of the highest order. Persons with light hearing loss are not limited in their social roles. They do not require any technical or medical assistance. Moderate hearing loss does pose communication problems, particularly hearing and interpreting speech under poor acoustic conditions. This type of defect may have a negative impact on social roles played. It may require the use of hearing aids and other devices. Persons with moderate hearing loss use speech as the most basic form of communication, but their speech is often impaired as a result of poor apprehension of vocal elements which leads to habitual speech errors [8]. Persons with severe hearing loss are unable to comprehend speech without a hearing aid, but even then, proper identification of sounds may not always be possible. People with total hearing loss will not understand speech, since no hearing aid can alleviate the impairment. The afflicted persons can only register a narrow spectrum of sounds or background noise. Cases of total hearing loss are fairly infrequent; this affliction is registered in ca. 2–4% of general population. Reports published by the Central Statistical Office estimate the number of persons with severe and total hearing loss in Poland at ca. 100 thousand, and ca. one million of Polish citizens suffer from moderate hearing loss. There are no available records on the proportion of general population suffering from light hearing loss, but it may be estimated at ca 3 million [1]. A loss of hearing may occur at any age and for various reasons. Depending on the type, the degree and the duration of the loss, the afflicted person may experience a sense of isolation from the social environment, since – by nature – this condition results in a deterioration and limitation of social contacts or even precludes any type of communication without affecting any motor or mental facilities. The most pronounced restrictions to communication are observed in cases of severe and total hearing loss manifested at birth or at infancy and early childhood [1].

3. The specifications of communication forms used by the deaf

The above limitations and restrictions to everyday social contacts have stimulated the research and development of alternative forms of social communication. To communicate with the rest of the population, persons with hearing loss may use a wide assortment of codes. Apart from the standards of Polish Sign Language (natural) and Signed Polish (coded), these include: dactylography (fingerspelling), a phono-gestural system (used to clarify lip-read messages), and individualised systems incorporating all the available forms of communication (often referred to as total communication systems).

Sign Language – the Polish Sign Language (PJM) is a form of communication based on a unique grammatical structure (not in any way related to the Polish grammar). The Signed Polish (SJM), on the other hand, is based on a direct transposition of the spoken Polish, and designed to accompany the articulatory and speech messages produced by the hearing-impaired. Despite being regarded as a form of the Sign Language, the Signed Polish is only used to support and clarify the speech production. Due to dual-channel communication – speech accompanied by simultaneous sign transposition – the hearing-impaired can improve their lip-reading accuracy. S. Prillwitz provides the following classification of signing [6]:

- family signing, a naturally evolved pattern of communication between hearing parents and their hearing-impaired child, employing non-verbal signals. This is the crudest form of sign communication, both formally and functionally, based on systematic use and improvement of natural gestures and facial expressions used by the hearing persons. Formal sign language use is fairly sporadic.
- the classical Sign Language, the language of choice in communication within the hearing-impaired community. This is the most economic form of sign communication for everyday applications.
- translated speech – a form of sign language used by interpreters, with clear and intentional references to the spoken language, designed to preserve (as far as possible) the natural flow of speech and the original word order, so that it can be used to supplement lip speech.
- the Signed Language – the most accurate representation of the spoken language, with strong emphasis on the preservation of all formal and grammatical elements of the spoken language.

W. Dykcik [2] postulates a different topology of communication methods used between the hearing-impaired and the general population:

- the signed method, based on the use of conventional signs representing general notions, characterised by a specific grammatical structure with no inflection forms.
- dactylography – fingerspelling, a form of communication based on a system of finger signs representing individual letters and digits. Fingerspelling retains the grammatical structure of the spoken language.
- phono-gestures, a system of arbitrary hand movements designed to supplement articulatory deficiencies. It does not replace the spoken content; it only helps interpret messages read from lip movement.
- combined speech, incorporating elements of: spoken language in graphical or auditory form, fingerspelling, and sign language.
- total communication is a form of communication utilising all the available channels and means of expression: auditory, gestural, manual coding, script, and graphical symbols.

4. Barriers to communication faced by the deaf

For the deaf, the most fundamental problems in social context result from their difficulties in communication with the hearing population, and their impaired access to information. Barriers to communication make it difficult for this group to adapt to social and vocational requirements. The problem of hindered communication with the deaf has not yet been resolved in a satisfactory manner, but the need to provide support for everyday communication for persons afflicted with hear loss has stimulated the development of various technical and technological solutions designed to alleviate the effects of impaired hearing. Two groups of such solutions can be identified: techniques in support of direct communication, and solutions designed to facilitate access to information. People without practical knowledge of problems typical for the deaf community tend to be biased in their perception of the deaf. Such negative attitudes towards persons using no other form of social communication save for the sign language are a direct result of communication difficulties, experienced by both parties [2]. The deaf have trouble passing messages to others, but the hearing person also feels frustrated in contacts with the deaf, finding it difficult to express their intended message. This phenomenon of reciprocated negativity is particularly evident in public administration, health services and other areas requiring frequent contacts with the deaf. By refusing to learn the sign language, the hearing members of such professions have no chance to gain a valuable insight into the needs of the hearing-impaired community. The deaf, on their part, face their barriers to communication with an anticipatory anxiety, trying to foresee potential difficulties and arrange the required activities in a manner that eliminates or limits the need for speech or gesture [6]. For instance, when shopping, they display strong preference for self-service stores. Such behaviour usually stems from the fear of social rejection and of being subject to negative reaction. It must be stressed that negative reactions to the deaf are very pronounced among hearing persons with no previous knowledge or experience of the deaf community and their problems. As a result, the deaf are immensely challenged in their social interactions. It is only natural that they seek support in their contacts with public authorities, bank clerks and providers of other services that require basic knowledge of legal or organisational minutiae. At the same time, they are often socially inhibited and cautious in their interactions with strangers – this is why it is so important to provide clear and precise markings of workstations manned by personnel equipped to communicate in sign language. A hearing person, when faced by the task of responding to the needs of the deaf, should be provided with basic knowledge of ways, methods and techniques of communication, as well as the capabilities and limitations of the hearing-impaired. They should be aware of the fact that communication capabilities of the deaf are directly related to the duration and the quality of their education. Reassuming, it must be emphasised that the duty to overcome barriers to communication rests on the hearing party – it is their responsibility to do their best to come to an understanding in contacts with the deaf. After all, any responsible and professional

employee of a public service institution should be equipped to utilise a wide spectrum of interpersonal communication strategies, also with respect to persons with hearing loss.

5. Social acceptance of the deaf

Social perception of persons with severe or total hearing loss is a prime example of the typically stereotypical and prejudiced approach to the unknown. The hearing community is not capable of perceiving the environment from the standpoint of a person with a hearing disability. Consequently, their evaluations of real-world encounters are naturally speculative. They may cover or plug their ears in an attempt to gain this type of insight, but they invariably tend to perceive deafness in terms of affliction or impairment. However, even by completely isolating from the surrounding sounds, they will never get to experience the world as the deaf do. The perception of the deaf – particularly those with cultural deafness – as people who had 'lost' their hearing and are 'doomed' to live 'in the silent world' is deeply fallacious. Persons with good hearing find it normal to be able to speak and hear; consequently, a prospect of losing this ability is perceived by them as a tragedy. Similarly, persons born with a hearing disability find it natural and normal to 'hear no sound'. People with hearing disabilities are not homogeneous in their social behaviours. Those with mild or moderate hearing loss typically identify themselves as members of the hearing community, and their social participation is influenced both by their own capabilities and the goodwill of others. Due to limitations of interpersonal contact under acoustic discomfort, they often choose to reduce their social contacts to the narrow circle of close relatives and friends who understand their problems and who have learned to adjust to them. Also the professional lives of such persons are largely dependent on goodwill of others. The ease of social adaptation and the effectiveness of the associated coping strategies for the deaf seem to be in reverse proportion to the degree of the hearing loss and the delay in its manifestation. Deaf persons born and raised by hearing parents are particularly vulnerable in their social lives, since they lack the support of 'like-minded' relatives. Consequently, they may develop a sense of 'complete loneliness', which has a detrimental effect on their professional and social encounters [8]. Knowledge of the sign language offers a significant improvement in the quality of social life for persons with hearing loss, both oral deaf and deaf without speech, since it largely facilitates social encounters, both within the non-hearing community, and with the outside world. The use of Polish Sign Language gives them a sense of belonging and serves as an instrument of social cohesion, improving their chance to develop meaningful relations (friendship, partnership, marriage) with 'like-minded' people.

6. The Act on Sign Language and other forms of communication

The Polish Act on Sign Language and other forms of communication, of August 19, 2011, entered into force on April 1, 2012 [9]. The Act contains regulations in three areas: sign language, techniques in support of communication with deafblind, and other forms of communication. For the first time in Polish legal system, the Act recognised the Polish Sign Language as a language for all intents and purposes, and a natural language at that. The provisions confirm the right of choice for the deaf to designate PJM as their first (native) and dominant language.

The regulations contained in the Act pertain solely to formal encounters between deaf and deafblind persons and the representatives of the following sectors: public administration, emergency and intervention services (police, fire and ambulance), and public health services (hospitals, clinics, dispensaries). Other areas of regulation include sign language training and support for the deafblind. In their formal contacts with public administration, the deaf (and deafblind) are given the right of interpretation by a certified PJM or SJM translator or a tactile translator. Public offices select translators from a formal register authorised by the governor's office. Fees are paid by the office in question. In their contacts with public services specified above, the deaf may also appoint their own intermediaries (with the only limitation being their statutory age of 16). In addition, the Act provides a classification of communication support instruments, such as instant messengers, text, e-mail, fax, and online services designed to offer remote access to public services for the deaf (and deafblind). Deaf and deafblind parents have the right to interpretation in all matters concerning education of their children. The deaf and deafblind may also demand to be informed on all administrative proceedings in a format accessible to them; for instance, they may choose to receive correspondence in the form of video recordings signed by an interpreter. Furthermore, the Act stipulates the right to gratuitous training in sign language and other support techniques, granted to deaf and deafblind persons, their relatives, and to those who require such training due to frequent contact with this group of general population. In addition, the Act established the national Sign Language Council, with ample representation from all vitally interested groups: the deaf and deafblind, sign language specialists, communication support technicians, delegates of ministry departments, and a delegate of the National Broadcasting Council. The newfound Sign Language Council is a body responsible for the promotion and dissemination of the sign language and for monitoring of the Act's implementation.

7. Modern technologies in support of the deaf

Information technologies (IT) and the associated mobile technologies can be defined as a set of data-processing instruments used in information systems. As such, they comprise of hardware, software, and methods of data organisation [4]. Owing to the rapid development of mobile technologies, this segment offers at

present the best potential for support of communication for the deaf in their contacts with public administration bodies.

With technological advance of the recent decades, general public has become the most important beneficiary of changes and improvements of communication processes. Broad access to mobile communication and mobile devices, improved data throughput, and elimination of 'the last mile effect' (physical access to network structure is no longer required) – all these changes will soon keep us online at all times, as a networked society [5].

In line with the approach presented by Turban *et al.*[10], in responding to the needs of people with hearing disabilities, it may be useful to place main emphasis on purely technological solutions, most importantly, the following parameters:

- information flow based on personal mobile devices – mobility,
- the use of wireless channels for circulation of information, available at all times and accessed from remote locations – accessibility,
- the use of devices capable of providing multimedia content – multimediality,
- organising the information flow around multidimensional database structures with precise identification of end recipients – individualisation,
- carrying certain areas of everyday activities over to the virtual dimension, with strong emphasis on sustained access to such services – virtualisation.

The social position of persons with hearing disabilities is a source of great discomfort, and the lack of solutions in support of their communication with public administration bodies only adds to the problem. Following are the most important areas to be addressed with the help of modern technological solutions to alleviate their discomfort [7]:

- with respect to public administration bodies (central offices, local administration), the most often postulated solutions include: organisational support for communication (a dedicated phone line, e-mail and fax, short message system, multimedia message system, instant messengers, remote access to interpretation services (accessed via instant messenger service, and technical support, typically in the form of a desktop PC with Internet access and/or tablet devices.
- for the National Medical Emergency Services (emergency wards, ambulatory care), equipment requirements are stringent to start with, but the reasonable minimum should include a dedicated desktop PC for stationary care centres and tablet devices with Internet access for mobile emergency teams.
- with health care providers, both integrated (health care centres) and private (surgeries), typical solutions addressed to public administration bodies can be employed.
- crisis management and non-medical emergency services.

A reasonable degree of comfort for deaf persons in their communication with public administration institutions, and in social contacts in general, may only be attained through comprehensive approach to the problem at hand. An outline of such a comprehensive IT system will be presented in the next section of this paper.

8. An overview of the postulated comprehensive IT solution

With a clear line of approach to the problem of communication between persons with hearing disabilities and various bodies of the public administration sector, we may attempt to postulate a comprehensive solution in the form of a dedicated IT system. Fig. 2 presents a schematic diagram of the postulated instrument.
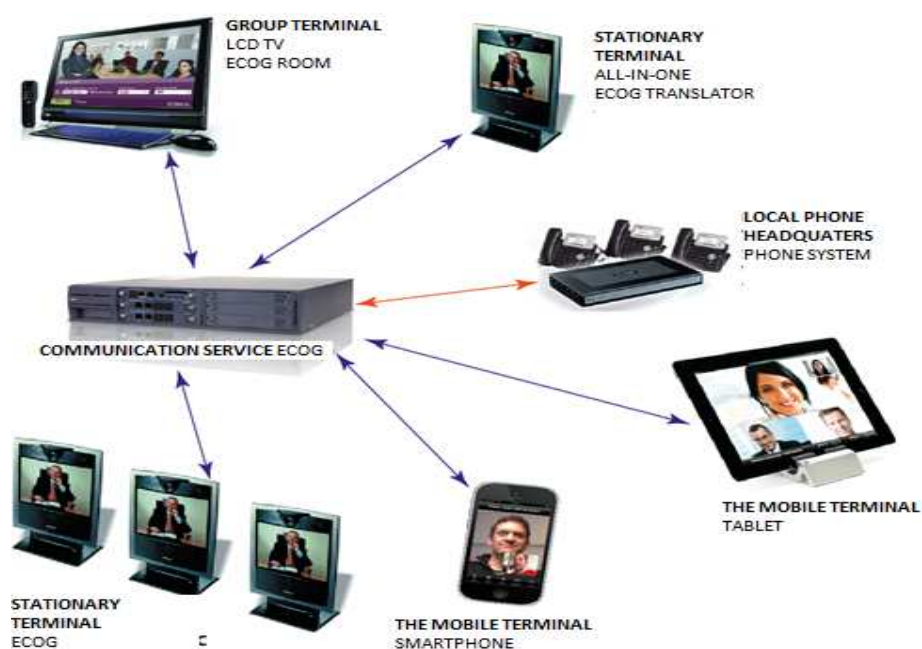

Figure 2. A schematic organisation of the ECOG System. *Source*: publications of the European Support Centre for the Deaf - ECOG, accessed in 2013

The ECOG system is designed in accordance with specific requirements of the deaf. The first stage of implementation is the needs analysis, with emphasis on the identification of personnel responsible for servicing the deaf and with

determination of potential load (with the view of determining the number of access points, device specifications, and so on). This is followed by an initial design – a draft solution based on the available information and analyses. In the subsequent iteration, the draft is used in the physical design of a prototype system implemented at the target institution of public administration. The next stage is the testing phase. It must be noted that, prior to final implementation of the system, all the minutiae are consulted with end users and other groups directly involved in the process – this includes the hearing-impaired community. The approach presented above offers a broad range of communication solutions in support of the communication processes characteristic for this group of users. The most important elements and features of the postulated system include a dedicated phone line, e-mail and fax, short message system, multimedia message system, and instant messengers based on P2P architecture. Remote access is available to interpretation services at all times, via instant messenger service and dedicated tele-conferencing equipment with support for the hearing-impaired, based on smartphone and tablet devices. The last part is comprehensive assistance and system maintenance services, accessible during the institution's working hours.

At this point, it may also be useful to present details of the two crucial elements of the postulated system that determine the unique character of the solution and warrant extensive and comprehensive support for communication of the hearing-impaired in their contacts with public administration bodies [7]. Online functionality is easy, rapid and reliable access to sign language interpretation services for all customers who declare their preference for this form of communication with public administration. Deafs have full access to public services, with understanding of the requirements, based on dedicated equipment, and adjusted to the specificity of services offered. Open access to videoconferencing rooms is possible for people with hearing impairments, offering privacy and ease of access to the whole range of services offered, including those that address sensitive and private areas of life, or – alternatively – providing access through personal mobile devices. On-site services supporting administrative and paperwork for all formal matters involved in servicing of the hearing-impaired customers. Existence a dedicated package of remote services that can be used in face-to-face encounters, based on the whole range of instruments specified in the Act, i.e.: SMS, MMS, fax, and e-mail; the package is tailored to the requirements of the ordering institution, and properly marked to ensure ease of access. Better access to office facilities for individual sessions, held with specialists appointed to service the needs of the hearing-impaired.

The main objectives of the system, specified by the system provider in accordance with the requirements of the Act of August 19, 2011 on Sign Language and other forms of communication, present as follows [7]:
- defending the rights and freedoms of people with hearing disabilities,
- improving social reception and proper recognition of the needs and the rights of people with hearing impairments,
- offering videoconferencing capabilities for the exchange of information and opinions as well as for building community support for service recipients.
- improved access to various forms of upskilling.

In the opinion of the system provider (and designer) [7], the postulated solution offers the following benefits for the hearing-impaired and institution of public administration:
- ensuring comfort of communication,
- eliminating barriers to interpersonal communication,
- offering unrestrained access to interpretation services.
- ensuring proper realisation of the stipulations of the Act on Sign Language and other forms of communication,
- offering ease of communication with hearing-disabled customers,
- product accessibility (by far, the most attractive solution of this type in Poland).

9. Conclusions

With rapid advance of technology, modern societies are offered a unique chance to improve their capability to respond and counteract the results of social exclusion, also with respect to the community of the hearing-impaired. Modern IT solutions have the potential of facilitating communication for the deaf in their social contacts, also with respect to formal contacts with public administration bodies. Persons with hearing impairments are often perceived as mentally inhibited, not only due to their inability to process speech messages, but also as a result of their specific approach to written documentation and formal pronouncements in writing. The postulated solution, based on modern technologies, is designed to improve the quality of communication for the deaf, but it also has the potential of responding to specific needs of other socially impaired groups. This paper focuses on the needs of the deaf community by emphasising barriers to communication faced by this segment of population. Proper identification of such barriers offers the chance for public administration bodies and other authorities to alter their approach to persons with hearing impairments and offer them proper support for the execution of their rights and freedoms, based on dedicated solutions and operated by gesture, tactile input or other intuitive forms of UI (user interface) input.

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