

A Collaborative Approach for Supporting Interaction among Hearing Impaired and Listeners

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Abstract

Hearing impairment was indicated as the second largest proven deficiency in world population. People with such disabilities face many obstacles in their communication and interaction with listeners, even with equal level of cognitive development. Collaborative tools offer the possibility to improve the interaction between listeners and hearing impaired subjects. This study presents an approach to support this type of interaction aimed to augment the participation of hearing impaired in collective activities. The approach has been materialized in a collaborative writing tool on which participants from both categories work together to produce a common document. The approach was evaluated by means of an experiment conducted with listeners and hearing impaired students in a learning environment. Analysis of the results obtained in the experiment show that the collaborative writing enhanced the interaction and contributes to a more harmonious and real coexistence among listeners and hearing impaired.

Introduction

The WHO (World Health Organization) estimates that 10% of the population of developed countries is composed of people with a disability. In developing countries this rate is estimated between 12 and 15%. According to Smith (2003) among the world's population under the age of 15, approximately 62 million have permanent and hearing loss. Olusanya (2005) indicated that two-thirds (41 million people), live in developing countries. The incidence of hearing loss in newborns, according to White (1993) is 1.5 to 5.95 per 1000 births. In the literature, we also found that *presbycusis* - hearing loss due to age - is the main cause of hearing impairment in the elderly, with an incidence of about 30% of the population over 65 years of age. The noise, especially in the workplace, is appointed as the second leading cause of sensorineural hearing loss among adults. Hearing impairment affects five percent of adult population in U.S., according to NCHS - National Center for Health Statistics. In Brazil Hearing impairment stands out as the second largest proven deficiency in Brazilian population.

Hearing impairment is characterized by total or partial loss of ability to hear. It manifests as mild to moderate hearing loss and severe or profound deafness. It is considered one of the main disorders that can interfere with language development and speech. According to the

American Speech-Language-Hearing Association it represents 60% of communication disorders. Thus, this difficulty interferes directly in the interaction with hearing individuals.

People with hearing impairment may have affected their learning and their integral development, since language plays an essential role in perceptual organization and the receipt and structuring of information, learning and social interactions of human beings. For Gatto (2007) the hearing is a pre-requisite for development and acquisition of language. Hearing and language functions are interrelated and interdependent.

Despite these data, the hearing impaired subjects are not easily recognized in society as people who have distinct needs. This recognition occurs when they need to communicate, because of the difficulty they present using oral colloquial language. This difficulty directly interferes in the interaction with listeners.

According to Capovilla (1998), technology should aim to solve human problems and the solution should not discriminate any type of person. It should look universally the situations faced by humans, assuring them full participation in the environment they live. Thus, we should also use technology to help those who have disabilities in having a life as normal as possible.

New technologies offer good alternatives to facilitate interaction among individuals communication. In this scenario, there is a powerful mechanism of interaction among individuals: the collaborative writing. This mechanism allows the diversity of knowledge and skills and helps individuals who have difficulty to formalize certain knowledge or build a solution alone. Thus, problems can be better solved by a group of individuals working collaboratively, than by a single individual (Howard, 2000).

The aim of this study is to analyze the contribution that collaborative writing can offer to improve the interaction among hearing impaired and listeners. To support this claim an experiment is proposed by mixing in each group listeners and hearing impaired subjects enrolled in a common task: the production of a document in a collaborative way.

This paper is divided as follows: Section 2 describes the communication aspects of hearing impaired persons. Section 3 presents the collaborative writing process and its features that help collaboration among individuals. Section 4 describes an experiment conducted to evaluate the benefits of technology supported collaboration in overcoming individual deficiencies. Section 5 analyzes

the results of this experiment and Section 6 presents the conclusions.

Hearing Impaired Communication

Social networking has had a clear impact in the world, connecting people to find and create new friends, share ideas and organize events. Although social interactions are activities that have always happened naturally, on the Internet this process becomes more open and fluid affecting the way people interact. These processes find their "natural" environment on the Internet, where social collaboration and dissemination of information is facilitated by recent innovations.

According to Adams (2008) "The driving social behaviour now though is collaboration. The networks are established and have become part of the scenery. As people become confident social agents in online networks they begin to act, to organise, to create."

Collaboration in social cooperation between individuals may have different objectives, both to make life more pleasant and to supply their deficiencies. The computer is seen as pro-cognitive activity of structuring knowledge representations and also on emotional development (Oliveira, 1996). It is a resource for children with learning difficulties despite its shortcomings and limitations develop their cognitive capabilities and possibilities of their own.

Hearing impairment is a kind of sensorial restriction, whose main symptom is an atypical response to the sound stimulus, being classified accordingly to the degree of hearing loss (Marchesi, 1996). However, Ciccone (1996) states that the hearing impaired is an individual with potential normal cognitive, although the hearing loss implies, often, in serious obstacles to its interaction with listeners.

According to Couto-Lenzi (1997), in interaction with hearing impaired, listeners should consider that among the hearing impaired, some are born with hearing loss and others lose their hearing after birth, during the pre-linguistic stage or after learning mother tongue, resulting then, in different prognosis in the learning process and development of writing.

This distinction becomes relevant when interacting with deaf people since it implies a greater or lesser degree of difficulty in the use of colloquial language oralized, practiced by individuals listeners.

In accordance to Northern and Downs (1999), any symbols that emerge in society are conditioned to a language of listeners. In the hearing impaired these symbols lose their meaning and sign language will always be the most prevalent.

This difficulty of interaction may also be reflected in collaborative writing, since the hearing perception is correlated with the acquisition of written language, due to the relationship of sounds to the graphic symbols that characterize the natural language. Thus, the formal writing produced by deaf people is based on a different way of thinking and basically sign languages.

As Gotti (1991) affirms, the phrase structure of the hearing impaired is disjointed, without connecting elements, often without verbs, due the deficiency in logic.

This is one of the major challenges of the interaction between deaf and hearing people through writing.

There are studies that link the technology-mediated communication as a facilitator of integration. As reported in the work of Santarosa (2003) with deaf and blind people, that integration is provided communication interfaces to facilitate and support the interaction among these subjects. , with evidence from a blind person that corresponded with a colleague, using technological resources, not knowing that this was deaf. In another study Santarosa (2002) stresses that the use of electronic means, primarily e-mail, allows the advance in development of the deaf, with a view to written communication and social interaction.

Collaborative Writing

The human is in continuous biological development, influenced and influencing the social environment where he lives and exercises their interactions. He has natural biological altruism as an individual and need to be part of human groups and to operate by consensus with them. This need acts as a motivating factor in interactions with other individuals and thus the hearing impaired seeks to overcome the difficulties of interaction. For this, the use of new technologies that facilitate this process is seen as a good alternative.

Many efforts have been made to develop solutions to facilitate this process. Among them, we highlight the development of multimodal interfaces, the use of tools that make the association between text and video and software that seek to provide collaborative practices, the groupware, more precisely the collaborative editors, object of this study.

The basic development concept in multimodal interfaces for the disabled is the idea of modality replacement, which is the use of information originating from various modalities to compensate for the missing input modality of the users (Moustakas, 2006).

The tools that make the association between text and videos can be used to associate texts in the mother tongue videos with the same text into sign language, accessible to the hearing impaired.

Among the groupware, we highlight the cooperative editors that allow the creation of texts in cooperation with two or more users.

Editing documents collaboratively or jointly with others is a common task. Often, the documents we produce are reviewed by someone or receive some kind of contribution (Tammaro and Mosier, 1997). The collaborative writing of documents allows participants to interact during the construction of texts, generating new ideas and modifying them still of development work (Howard, 2000). Thus, participants always have the possibility to suffer interference in textual exposition of his ideas, creating a new text composed by several participants. This context of interaction among participants in a cooperative process of editing promotes acceptance of differences that exist between individuals and could be further explored when we think of interaction between listeners and deaf people.

Besides promoting greater interaction among co-authors, collaborative editing environments can promote critical thinking, helping people to learn from each other and strengthen the social relationships of those who write together (Mailhot, 1968). Such benefits could also be targeted to facilitate interaction between deaf and hearing. Thereafter, the editing process could become a cooperative way for the development of a sense of cooperation and acceptance of hearing impaired by listeners.

However, it is necessary not only thinking on the benefits or problems that this approach represents, but also about the changes in the perception of reality and the changes that occur even in the way of writing. If writing together with individuals who use the same grammatical structure of language can become a complex process, with individuals who use different grammatical structures the level of complexity may increase further.

In contrast, once aroused the senses to the value of cooperation or interaction and understanding its validity, it will never be forgotten by an individual. Thus, the benefits of this interaction could overcome the difficulties presented.

These characteristics can become great allies in this process of interaction through collaborative writing. According to Ellis, Gibbs and Rein (1991), until they have established interpersonal relationships based on acceptance, interdependence and complementarity, the groups are not ready to develop a cooperative work.

The Experiment

Aiming to examine the contribution that collaborative writing can offer to improve the interaction between deaf and hearing people, was conducted an experiment that involved the production of a text in a cooperative manner between these two types of co-authors.

The experiment was conducted in the computer lab of the School Professor Olga Teixeira de Oliveira, pole of inclusion of students with hearing impairment located in Duque de Caxias in Rio de Janeiro.

The moderator of this experiment is a school teacher, who initially explained to the participants the process of collaborative writing. On this part of the experiment, the moderator writes: "They had the opportunity to better understand the reality of two worlds (hearing world and deaf world). Students listeners were impressed with the writing of deaf students, then had to explain about this condition of the deaf colleagues. In short, I explained that Libras (Brazilian Sign Language) is the first language of the deaf person and written Portuguese is a second language, and how they think in Libras have difficulty in organizing writing with the grammatical structure of Portuguese. But that does not make them worse than the listeners, but different." LM.

The Tool Used in the Experiment

According to Tammaro et al. (1997), a cooperative editor should provide mechanisms to assist in the interaction that occurs when people are working collaboratively on editing documents. Thus, their characteristics should include:

- Be flexible to meet the usability needs of users;
- Allow editing of synchronously and asynchronously;
- Maintaining the integrity of the document being edited by different users and the possibility of merging to combine the contributions;
- Have an access policy that defines roles and their permissions and restrictions on the handling of documents;
- Multiple versions of a document should be maintained so that someone can come back with a version where appropriate. It is also important that the record which was the collaboration of each co-author;
- It is important to offer options for comment where the user can make their comments to a document or specific parts of it;
- It is also important to allow communication between the co-authors, so that they can discuss and exchange ideas;
- Allow the creation of a workflow for the construction of the document and publication of the same co-authors;
- When a document is created and shared, users who have access to it should be notified;
- Similarly, when a document is changed, all users that share should be alerted; and
- Provide monitoring a document allowing, for example, who is now visiting, who never accessed etc.

With the aim of using a tool that would meet the largest possible number of the above characteristics, was chosen editor GoogleDocs® to be used in the experiment. It needs only a registration email and is a system for easy access.

Also, lets you invite others to join the work, being a tool of collective works, which also offers basic editing tasks with a desktop simple and easy to understand, also allows these operations can be performed in conjunction with other participants in real time, and, provides a synchronous or asynchronous editing.

According to Machado (2009), this tool fosters interaction, exchange of ideas and collective production of texts. The exchanges can be established positively enabling creativity, critical thinking, responsibility and collaboration.

Google Docs provides ease of use, storage and online editing of files, access via the browser on multiple platforms, gratuity, requires no software installation and simple interface and be accessible over the web (Machado, 2009).

Development

For the development of the experimental parameters were considered, as described below:

- The chosen theme for the activity;
- The age group of invited participants: 13-18 years old;
- The theme of the text to be produced: "A whole country in the World Cup." The choice of this subject consider the proximity of the 2010 World Cup and also the age group of participants. The theme is easy to

understand and refers to a subject widely reported and discussed in the media, serving as a motivating factor for the interaction of participants;

- The number of participants: ten co-authors, five and five deaf listeners;
- All deaf participants are congenital deafness, and they were born with hearing loss were illiterate and without the reference of phrasal constructions and sounds of their own natural language;
- The participants had a period of seven days to build the text in a collaborative way.

Following the construction of the text in GoogleDocs®, we observed that the interaction occurred both synchronously, whereas some young people interact within their school environment in the same place and at the same time, as asynchronous distributed, because other interactions were carried out at different times and places.

Regarding to the contributions of the co-authors, was noted that participants complemented and not changed the text of the other participants, i.e., took care not to modify the text of another. On that point, the moderator reports: "Initially I was a little worried about the way that listener students understand the writing of deaf colleagues. But, after the explanation, I noted the positive reaction of the group. Demonstrated a willingness to help and decided not to correct spelling and concordance of texts developed by deaf students. And on the other hand, the deaf were more attentive to the listener colleagues' writing, and sometimes tried to correct himself." LM.

The participants answered a questionnaire consisting of eight questions, which together with the historical contribution of the participants contributed to the tool used to analyze the following measures:

- The level of knowledge of participants on the theme chosen for the preparation of the text;
- The degree of difficulty in using the tool;
- The level of interaction between participants in the collaborative writing process;
- The level of interaction between listeners and hearing impaired.

Analysis of Results

Data collected through the questionnaire, as well as the history contributions of participants in the cooperative editor used, were analyzed in a qualitative way. Thus, it was possible to consider whether the collaborative writing process developed by the group contributed to improve the interaction among hearing impaired and Listeners who participated in the experiment.

As shown in Figure 1, the majority of participants, both listeners as hearing impaired, has at least some knowledge on the topic "A whole country in the World Cup", chosen for the construction of the text. This indicates that the level of knowledge of participants on the topic facilitated the group interaction in this experiment.

Figure 1 also shows that most listeners had no difficulty in using the tool and the majority of hearing impaired had little or no difficulty. It was possible to note that facility presented in using the chosen tool for this

experiment contributed to the group interaction during the editing cooperative process.

It was also noted that the difficulty that hearing impaired present to organize the writing, using the Portuguese grammatical structure, can be unknown even by listeners of the same social group, as is noted in the following testimony of a co-authors: "*I didn't know that deaf people write so differently.*" MVS (Listener). In this aspect, the experiment allowed the participants co-authors could learn about the different ways to use their mother tongue.

Participants of the experiment also report that has never participated in a collaborative writing process. However, all claim that the process of writing together facilitated the construction of the text. Regardless of the group is formed by people with different phrasal constructions, they note that the collective knowledge that allowed everyone to have gain knowledge on the topic: "*They spent more info for those who had little knowledge of the subject.*" JHM (Listener). "*Knowing the subject matter and passing colleagues.*" TF (Deaf). These reports demonstrate that the differences in the construction of phrases and expressions did not affect the group interaction.

Most deaf people said that interaction with the listeners was good and all the listeners said that interaction with the hearing impaired was excellent, as shown in Figure 01. This indicates a great level of acceptance and understanding of the listeners with respect to the difficulties in writing of the hearing impaired, as reported by the participants: "*To know a little deaf.*" LR (Listener). "*Listeners and deaf good relationship.*" SGO (Deaf).

It was observed that the collaborative writing process not only facilitated the group interaction in this activity, but also promoted greater acceptance of hearing impaired and contributed to the growth of the social bond, as reported by the participants: "*Learn to write better listener colleague.*" TF (Deaf). "*Because I met so my deaf friends.*" SK (Listener). "*As one completes the other.*" DAO (Deaf).

Conclusions

The experiment has achieved the goal of simulating a real situation of interaction between listeners and the hearing impaired. According to the moderator, "*this experiment has enabled work on the theme World Cup, writing, creativity, respect and appreciation of their own productions and those of their colleagues.*" This report confirms that it is very important that the effects of oral language on cognition are not overvalued by listeners about the performance of the hearing impaired, which would complicate its inclusion and real chances of a productive interaction. However, the experiment proved that through writing cooperative deaf participants were able to interact with listeners and together build a textual product, despite their differences in the use of the grammatical structure of Portuguese Language.

Regarding the phrasal construction, was observed in the experiment that participants did not change the sentences presented differently. This confirms that

although there is significant difference in the level of management of instrumental language, the process of communication between participants was not harmed. This validates the collaborative writing as a mechanism of interaction between deaf and hearing, and shows that this mechanism favored a greater acceptance of differences among individuals and helped to improve the cognitive development of participants. On that point, the moderator noted: "The result achieved was excellent, and I know that through this tool GoogleDocs® students can further develop their written productions. I consider this tool as another way in the pursuit of cognitive development of my students, and enjoyed both working with her, I'm thinking of developing a job with a new group, involving all students." LM. This report shows that through this experiment it was possible to extend the possibilities of interaction between deaf and hearing through collaborative writing.

The reports presented in this paper guides analyze of results and confirm the acceptance of the collaborative work proposed by the experiment. They clearly show that the experiment helped to improve the interaction between deaf and listener not only in the construction of the text, but in building a more harmonious and real coexistence.

Future Work

This work does not exhaust the subject and, therefore, points out some future work that may be performed in order to contribute more to the interaction between hearing and deaf people using collaborative editing:

- Conduct the experiment with a control group, allowing comparison of results obtained by the groups, enriching the analysis;
- Measure the level of contribution of the participants in relation to the interaction of the texts submitted by others, checking with the resources offered by the tool for collaborative editing, the ability to follow through the recording of interactions made, which can later be measured and analyzed;
- Conduct the experiment with a larger group of participants, allowing also perform a quantitative analysis of the subjects addressed in this work.

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