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(Power Point Slide 1)

Do Only Hearing Impaired People Benefit From Subtitling?¹

Ladies and gentlemen

Last summer we visited Texas and watched the news and other programs on TV. Since English is not my mother tongue I had to concentrate very hard to understand what was being said especially when people spoke quite fast. Texans normally speak quite slowly, but some programs came from other parts of the US or from abroad.

The TV set was the cheapest we could buy so I did not expect too much quality. Suddenly I got the idea of checking whether this cheap TV set had subtitling, or, as it is called in the United States, „captioning“.

(2) Understanding a Foreign Language

We used the remote control and suddenly subtitles appeared on the TV screen. Now I realised that I could understand what was being said much better by reading the subtitles.

I am not hearing-impaired; or should I say „not yet“. But even as a so-called non hearing-impaired person I realised how much I could benefit from subtitling. For me it was a great help understanding a foreign language. But for hearing impaired people it is essential.

I represent the European Federation of Hard-of-hearing People whose vice president I am. For many years I have worked with hard-of-hearing people in Winterthur and other parts of Switzerland on a voluntary basis. By profession I am a theologian and presently work in a large nursing home for chronically ill people. Many of our patients are hearing-impaired and therefore I often have to deal with hearing aids, knowing that I cannot reach the „soul“ of a person if he or she does not understand me because the hearing aid is not working.

(3) What does it mean to be hearing impaired?

In order for you to understand what I mean, I have to make some clarifications. The general term “hearing impaired” mainly comprises three different categories of hearing impairment:

- 1) Deaf people (in German “gehörlos”)
- 2) Hard-of-hearing people (in German “schwerhörig”, in Italian “audiolese” ?)
- 3) Deafened people or Late Deafened People (in German “ertaubt”)

¹ Paper presented at the conference on eAccessibility by Voice: VOICE Recognition supporting people with hearing and other disabilities (European Commission. Joint Research Centre. Institute for the Protection and Security of the Citizen) in Ispra / Italy, 24./25. November 2003.

(4) Statistics of hearing impairment

In Switzerland there are about 700'000 hard-of-hearing people, 10'000 deafened people and 8'000 Deaf people. Statistical information from Austria shows that the number of hard of hearing people is 1'520'000 (age 14 and older) but there are only 10'000 Deaf people.

(5) Deaf people are born without hearing or have lost their hearing before speech acquisition. They generally communicate through sign language (in German “Gebärdensprache”).

(6) Hard-of-hearing people are born with a hearing impairment or have lost part of their hearing through a genetic predisposition, an accident (muzzle blast trauma, acoustic trauma), as a result of ototoxic medicine, or, most often, just as a result of aging. They communicate through speech as they have done all of their lives and not by using sign language. I presume that 95% of hard-of-hearing people do not understand sign language at all. Therefore a TV programme in sign language for them would be just like a TV programme in Chinese for me.

(7) Deafened people are hard-of-hearing people who have communicated through speech all their lives and whose hearing loss was progressive until the stage that they do not understand anything anymore. Because they were speech oriented all of their lives most deafened people do not understand sign language.

(8) Cochlear Implants. If deafened people decide to get cochlear implants they will be hard-of-hearing people again, using spoken language as they did before.

In my presentation I will concentrate only on the largest group: the “hard-of-hearing people”.

(9) Louder does not mean clearer

People whose hearing is not impaired often think that when speaking to a hard-of-hearing person you just have to speak more loudly. That is a big misconception.

I want to illustrate this with an anecdote. When my parent’s TV set broke down they bought a new one. Suddenly their next door neighbours complained because my parents turned their TV up much louder than before. The next time I visited my parents I realised that the technician who had installed the new TV set had turned up the “bass” quite strongly. When the news speaker talked you had this “bum, bum” sound, which annoyed the neighbours. I turned the “bass” to zero, turned the “treble” almost to maximum, and from then on my parents understood the TV speaker and nobody complained any more.

(10) “Speech banana”

This slide shows what it means to have a hearing loss. The horizontal yellow line shows the hearing threshold of normal hearing (0 dB). On the y-axis you can see the frequencies of our voice from very low to very high (125 to 8000 Hz). The so-called “speech banana” shows the frequencies of the vowels and the consonants. The dotted yellow line shows a person with a typical hearing loss. As you can see this person cannot hear the consonants d,t,s,f,sch.

When you listen to speech, the high frequencies are much more important than when you listen to music. Our speech consists of vowels and consonants. These have different frequencies. Generally the vowels a, e, i, o, u are in the low frequencies and the consonants (s, f, sch) in the high frequencies. Most often a hearing loss is in the high frequencies. Unfortunately treble sounds are much more important for speech intelligibility.

(11) The importance of treble sounds

I would like to quote my Canadian friend Beverly Biderman, who has been hard-of-hearing for many years and got a cochlear implant. She wrote a famous book about cochlear implants called "Wired for Sound". She says: "Treble sounds give 95% of the information used in understanding speech. Bass sounds, while they account for 95% of the volume of speech, provide only 5% of the information used for comprehension."²

(12) Signal-to-noise ratio

The big problem for hard-of-hearing people is listening in a noisy environment. The speech signal is blurred and they do not understand what is being said. The hearing aid industry has made a big step forward by producing digital hearing aids to replace the old analogous aids. With these new aids speech intelligibility is much better even in noisy surroundings. But we should not have any illusions about them, and we should not believe everything advertisements try to make us believe. Even with the best digital hearing aid, hard-of-hearing people still have great difficulty understanding speech in an environment with a lot of reverberation, background noise, or long distance-to-the-signal source.

(13) Erhöhte Anforderungen....

The problem lies in the so-called signal-to-noise ratio. People with no hearing loss can still understand what is being said even if the speech signal is 5 decibel (dB) lower than the noise. And now comes the salient point: For a hard-of-hearing person the speech signal has to be 15 decibel (dB) higher than the noise. The signal-to-noise ratio must be at least 15 dB! This explains why hard-of-hearing people have few problems understanding in a quiet environment but have enormous problems in noisy environments. I think the same is true for cochlear implant users.

Kurt Eggenschwiler, the Swiss specialist on room acoustics who produced this slide, shows that even people with good hearing need a speech signal that is at least 5 dB higher than the noise when they listen to a speech which is not in their mother tongue.

² Beverly Biderman, *Wired for Sound. A Journey into Hearing*, Toronto: Trifolium Books 1998, p. 12.

(14) The need for assistive listening devices

In an environment with a lot of reverberation (e.g. a Gothic church) or with background noise and with long distance-to-the-sound source (e.g. theatre or lecture hall of a university) hard-of-hearing people need so-called assistive listening devices and / or subtitling.

There are at present three systems:

- a) Audio Frequency Inductive Loop Systems (AFILS)
- b) Infrared Systems
- c) Frequency Modulation (FM)-Systems

(15) Induction Loop systems

For fixed installations I personally favour AFILS because they are the cheapest, the most user friendly, and the psychologically best systems. Practically all behind-the-ear hearing aids and some cochlear implants (e.g. Nucleus ESPRIT 3G) have a so-called "Telecoil" or induction coil as standard equipment.

(16) Beschallungsanlagen... The magnetic waves from the audio loop can be picked up by the telecoil of the hearing aid or cochlear implant. Since the microphone of the aid is deactivated they will not be disturbed by reverberation or background noise because they will hear only what is being spoken into the microphone by the lecturer.

(17) Room acoustics

Architects often plan buildings only with the aesthetic aspect but not room acoustics in mind. However room acoustics has a big influence on speech intelligibility. In class rooms or lecture halls the reverberation time should be very short because this influences the learning success of the students. There is a research project from Heriot-Watt University in Edinburgh about acoustics in class rooms which explicitly states a correlation between room acoustics and class achievement.

(18) Speech-to-text translation (Palantype)

If we want to be sure that hard-of-hearing people understand what is being said at a congress or at a lecture we should have specially trained speech-to-text translators, who are able to type the spoken language in real time and project it onto a screen with a video beamer. This is quite costly because palantypists are highly skilled professionals.

(19) Voice project

I have great hopes for the project of voice recognition via computer for hearing impaired people. Although I am a theologian I have been working with computers for 27 years.

At present I do not think that computers will completely replace speech-to-text translators (Palantype). But I am eager to hear about the success of the research here in Ispra.

I imagine that computers have similar problems in converting voice to text as hearing impaired people have listening to TV programs.

(20) Guidelines for TV producers

Since television plays such a predominant role in our world and is a medium well-suited to meet the needs of hearing impaired people, I would like to mention some important points for TV producers:

- Speakers have to articulate clearly.

One of the ills of our time is that people mumble, even on TV!

- There should be no background noise at all interfering with the spoken language.

I am aware that TV people will not like this. They want to have reality shows, live interviews on noisy roads or even background music. But that is all detrimental to speech intelligibility! I always listen to the radio when I drive my car. The silliest thing I experienced was a traffic warning about a driver on the highway driving in the wrong direction. Instead of clearly announcing this vital message the radio had car horns as “background music”, thus obliterating the clarity of the message.

- The simultaneous translation of live interviews superimposed on the original voice of the speaker, cannot be understood by hearing impaired people because of the poor signal-to-noise ratio.

Therefore, the best way would be to hear the original language of the interviewed person with the translation provided via subtitles. Everyone could benefit from this since most of us have problems listening to superimposed simultaneous translations on TV.

(21) Subtitling and sign language

- Let me conclude. Subtitling is an absolute necessity for hard-of-hearing people. In our globalised world it helps all of us understand programs in languages other than our native tongues (+5 dB signal-to-noise ratio!).
- As a closing remark I would like to mention that subtitling on TV should not be neglected in favour of sign interpretation. Subtitling on TV helps all hard-of-hearing people and also Deaf people. In addition, we can have sign interpretation for the small group of those for whom subtitling is too complicated to read. But we should never have sign interpretation *instead* of subtitling.

(22) Brochure

A teacher of the deaf from Germany told me a couple of weeks ago that in Germany the number of TV programs with sign interpretation is increasing, but at the same time the number of TV programs with subtitling is decreasing. That makes no sense.

With subtitling you reach 99% of hearing impaired people. With sign interpretation alone you

reach only 1% of hearing impaired people.

(23) Conclusion

Subtitling is a benefit to many of us: those who are hearing impaired, those struggling to understand a foreign language and those to whom the visual representation simply makes it easier to comprehend the spoken word.

(24) Thank you.