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Collection of Abstracts

MASARYK UNIVERSITY
Teiresiás, Support Centre for Students
with Special Needs

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Contents

Preface

You are holding in your hands a collection of extended abstracts for the Universal Learning Design Track, which is a part of the 13th International Conference on Computers Helping People in Linz. It is a second international gathering with this particular focus; the first was held as a conference at Masaryk University in Brno, 8–11 February 2011 (http://www.uld-conference.org/conference/brno-2011-en).

Masaryk University has been providing services to hundreds of students with various disabilities for years. During the whole existence of the Support Centre for Students with Special Needs that was established as the University's central servicing institution more than ten years ago, providing study conditions of administrative, IT, and technical nature, besides the pedagogical and psychological ones, has not been understood by the University as a service related to a particular student or even as service for the student, but as educational standard that the school is obliged to offer to the public due to its own interests and academic traditions. Thus, it is not primarily a question of individual students' needs, it is rather in the interest of the school and the teacher. It is a question of the design of the academic environment. It is not my intention to consider at this point which is a more relevant term under which conditions in the academic environment, whether it is Design for All, Universal Design for Learning (or Learning Design), or even Universal Design for Instruction (Instructional Design). Our long-standing experience as well as the mere fact that more than a half of university students with sensory disabilities in the country opt for a study programme offered at Masaryk University have convinced us that the differences among the concepts behind the various terms should, or even must, give way should we overcome much more serious obstacles related to specific human needs: the dramatic differences between the approach of human-oriented teachers or psychologists and the technically oriented IT services providers; between research and practice; between theoretical possibilities and everyday experience; and between the seeming variability of commercial offers and the prevailing provisional or ad hoc solutions in educational practice.

The success of the first international conference on Universal Learning Design has inspired us to offer the topic to the organizers of ICCHP, which has been a long-standing meeting place for both researchers in social informatics and providers of various technological services in a field that is more or less identical with our own. People responsible for designing an environment that does not a priori exclude anyone from the academic community and enables them to gain education and participate on research disregarding their specific perception and working methods, do not always share their interests with the two groups of

the typical ICCHP participants. It still holds that there are methodological and technological possibilities that are not applicable in the conditions of common practice, or they are not compatible with some other, equally necessary working or teaching methods. The ULD Track aims to be the place to evaluate research results and market offers by the measures of education practice, do so without bias, free of the somewhat superficial optimism in this field which is often politically or commercially motivated, and be optimistic in a more pragmatic way, which is based on constructive scepticism, inevitable for any specialist when evaluating his or her own results as well as of others.

We would like to express our gratitude to all who have contributed to this idea. We are looking forward to the meetings during the ICCHP in Linz in 2012 and we present more details at http://www.uld-conference.org/uld-icchp-2012-en. We believe that we will have the opportunity to meet you again at the third ULD conference, which will take place at Masaryk University in Brno, 13–15 February 2013.

On behalf of the track organizers

Petr Peňáz

Head of the Support Centre for Students
with Special Needs, Masaryk University

Plenary keynote

Taking Responsibility for Accessibility: The Authorial Role in Document Creation

Kevin Carey

Chair of Royal National Institute of Blind People, United Kingdom

Kevin Carey is the Chair of the Royal National Institute of Blind People (RNIB) UK (www.rnib.org.uk), founder and Director of humanITy, the UK's leading eInclusion charity (www.humanity.org.uk), Chair of the Ofcom Community Radio Fund Panel (www.ofcom.org.uk/about/how-ofcom-is-run/committees/community-radio-fund-panel/), a Board Member of the Social Investment Business (www.thesocialinvestmentbusiness.org/) and a regular contributor the Managing Information (www.managinginformation.com) and Ability Magazine. He is currently Project Co-Ordinator for Go On Gold, raising public awareness of the eInclusion of people with disabilities through the London Olympic and Paralympic Games 2012.

Carey was one of the first global experts in eInclusion and has worked for the EU (including acting as Rapporteur for the Inclusive Communications (INCOM) group as part of COCOM), UK Government Departments (including pioneer work on myguide (http://learn.go-on.co.uk/) for the BBC iPlayer team and for British Telecom on the implications of broadband for people with disabilities. He was a Member of the Ofcom Content Board 2003–06, was awarded a NESTA (www.nesta.org.uk) Fellowship in accessible broadcasting 2004–05 and won a Royal Television Society Award for innovation in engineering (electronic programme guides) 2003. He has presented and/or published more than 100 major papers on eInclusion, disability, blindness and socio/economic trends and recently presented a series of five major lectures on blindness at Masaryk University, Brno, Czech Republic.

As Chair of RNIB, the UK's leading blindness charity, he has a major responsibility for the strategic direction of an organisation with an annual turnover of 150 m Euros per year, more than 3000 staff and 4500 volunteers. From 1994–2000 he was the Editor of the British Journal of Visual Impairment and his first career was with Sight Savers International (1978–92) during which he established the first major computer-based braille production system (The African braille Centre) outside the 'Western' world.

Cambridge and Harvard educated, Carey is a novelist, a published poet, a social commentator and a chorister; he is a former amateur dramatics actor/Director and classical music critic. He is a lay minister in the Church of England and a theologian.

In order to improve the accessibility of educational material for disabled people, it is necessary to create author-engineered public domain documents (PDD) where the accessibility is built into the initial production to optimise the consumption by the end user of the authorial intention.

1 Introduction

One of the strangest ironies in the special needs sector is that academic papers advocating "universal design" or "design for all" do not follow the principles they advocate but are designed – one might better say un-designed – as if for the printing press.

Indeed, one of the most salient features of the nascent digital era has been its tenacious adherence to redundant analogue practices necessary for making plates from lead type, including the use of boxes, the maintenance of right hand justification, the binding of text into read-only formats and, in a related field, the use of bifurcating menus and an adherence to the Dewey principle that any artefact can only be in one class. So much for word processing tools and hypertext.

What I will be proposing in this paper is that authors should take responsibility for the accessibility of their work by using the tools already at their disposal and developing new tools to improve the flexibility and accessibility of digital learning materials.

I will propose that we need to develop the concept of a public domain document (PDD) where the author may keep initial work on a read-only format for the purposes of archiving but that any material specifically intended of public access on a non-discriminatory basis should be so constructed and supported by such tools as will make it as flexible and as accessible as the current state of technology will allow. This central rule should apply in the first instance to all materials produced by the public sector – and therefore funded by the tax payer – all material produced by agencies supported by public money and all agencies whose publicly stated purpose is to provide goods and services to citizens on a non-discriminatory basis. It is my contention that there is a fundamental contradiction between authorial hegemony and the publication of material in the public domain either for the purpose of informing citizens and/or for making a profit. An author who produces a document should not have the right, under these conditions, to render it in such a way that it is not accessible on a non-discriminatory basis by a person acting either as a citizen or a consumer.

In this presentation I will briefly describe:

- The history of the document
- The Technologies of Adjustability
- Text Characterisation & Transparent Rules and

- eLearning Design
- Intertextuality

2 The History of the Document

The genius of Guttenberg was to see that the document is not the document. Up until his time in the Mediterranean world and Western Europe inscription on stone or ink on skins or parchment produced a finished document in one process which could only be reproduced by repeating the whole process from scratch. Guttenberg saw that a meta-document could be produced from which many copies could be obtained and to which amendments could be made and a new version number attributed. Correcting the errors in led type that had been bound into plates was expensive but it was much cheaper than re-tooling stone or amending writing on skins or papyrus.

In spite of this technological breakthrough, the tendency to produce one-off documents persisted in the typewriter which could impress multiple copies on carbon paper but which did not normally produce a meta-document although this was a relatively simple operation, as demonstrated by the mimeographduplicater (e.g. Gestetner). The photocopier was a welcome arrival but the real breakthrough came with the word processor.

But in parallel with this technological history there was also a political history of the document which began, not altogether surprisingly, with the perceived ecclesiastical necessity of controlling the publication of bibles, followed and closely related to the political urge both to control printing and to turn a nice profit by licensing it. The recent attempts by the Chinese to muzzle search engines and by Apple and Facebook to build extremely lucrative walled gardens are only the latest manifestation of a long history of attempts to exercise political or monopolistic control over the means of self-expression.

But licensing and censorship led to the concept of copyright which closely paralleled legislation on land and property holding; and the whole scenario was completed by the quite preposterous assertion of copyright by the public sector on intellectual property paid for with taxation.

The public sector is a good starting point for a discussion on the nature of the private and the public because on the surface public documents should be public. There was a brief period when the document processor choice was Word when public documents were not only theoretically but actually adjustable but the emergence of PDF brought the whole issue of adjustability into focus because there is a direct conflict between document integrity and accessibility.

Before drawing this historical section to a conclusion, just a word about the relationship between document technology and the authoring process. I remarked

earlier that digital document authors have been very conservative in document design and processing; and this is mirrored in a conservative understanding of what documents are. The prevalent understanding, even in the public sector, is that documents are authorially owned, uniquely authored artefacts; but this is to confuse how documents are made with what they are. Documents in the public domain are created to convey an authorial intention to a consumer; and so when an author creates a barrier to consumption then she is frustrating her own supposed purpose.

3 The Technologies of Adjustability

It ought to be obvious by now, a quarter of a century after the first word processing packages for small business and cosmetic use, how authors can take simple measures to achieve a substantial degree of adjustability but it is surprising how little good practice there is.

Let me start with a definition of adjustability as: ***The ability of consumers to realise an authorial intention through the use of technologies to alter the style of an authorial production***.

It is important to note at this point that any such adjustability has to be optimal rather than total, a point to which I will return later.

In terms of standard text output on screen and in documents, the following adjustments should be available as standard:

a) Data Characteristics:

- Granular
- Defaulted to simple for incremental enhancement
- Accessibility features on
- Multi modal
- User interface neutral

b) Print:

- Size
- Font
- Leading (distance between lines)
- Kerning (distance between characters)
- Relative n height
- Right hand justification on/off

c) Colour:

- Background/foreground
- Brightness

It might be thought that these characteristics are obvious requirements of adjustability but the root problem is that there is not an authorial requirement to ensure that these features are available or even, with the appropriate tools, realisable. Thus, we have a four-step sequence of possible barriers to realising the authorial intention:

- The author partly or wholly lacks a knowledge of adjustability features
- The Author has knowledge of some or all features but does not possess them or the ability to facilitate them
- The author makes digital information potentially totally adjustable by a consumer with appropriate tools
- The consumer lacks the appropriate tools

In short, there is no authorial responsibility for adjustability built into the authoring process.

Before returning to this subject to discuss solutions, it is important to look at another aspect of accessibility which is the ability of the consumer to apprehend the authorial intention lexicographically and syntactically.

4 Text Characterisation & Transparent Rules

A text which wishes to convey an authorial intention must necessarily take its reception, its consumer facility, into account. This issue was clarified for me many years ago during a language engineering project struggling with user response when we began to analyse consumer segments. We took as our example a United Kingdom government pronouncement on state income and expenditure, the annual budget. Here are some propositions about a budget:

- It deeply affects all citizens
- It is announced to citizens by the Chancellor of the Exchequer (Minister of Finance)
- It is reported to citizens largely by journalist intermediaries
- It is enacted in legislation

The four parties respectively require the following:

- Citizens – A clear statement of measures and their consequences
- Politicians – A statement which puts the best possible interpretation on the measures
- Media – Reports which engage the reader/viewer/listener to fulfil the mission and maintain/improve audience
- Legislators – Require a clear legal text which enacts their intentions with as little ambiguity as possible.

Not all these requirements can be met from one text and so the elegant approach would be to start either with a very simple text which met publicly stated requirements or a legalistic text which could be easily and transparently simplified. In reality such a document is assembled from all kinds of sources and texts but the elegant approach should clarify the basic necessity for rules-based systems.

Let us start with a primary requirement which I will call "consumability": ***A text should maximise the extent to which the author's intention is realised by the primary audience.***

If we think again about our budget text we will see that it is not easy as a matter of principle to decide on the primary audience; is it the legislator, the journalist or the citizen? I suggest that this should not be considered as a matter of principle but rather as a matter of practice as the necessary precondition to a reversibility principle; that: ***It is much easier to simplify a complex document with a set of transparent rules than to enrich a simple document with the same reversed rules.***

Underlying this pragmatic approach is the principle of reversibility, namely: ***The authenticity of any simplified form of a document should be verifiable through the publication of associated rules.***

In other words, no simplification of a public document should be published without the intermediary showing how the author's initial text was amended. As a guarantee, of course, there is a final principle that: ***Access to an amended document with its modification rules must be accompanied by access to the original document.***

Political problems arise with budgets because the legal and the simplified versions appear in parallel without any such rule making.

The reason that this discussion is so important in the field of accessibility is that there are many citizens, notably those with impairments, who find it difficult to apprehend an authorial intention which means that documents fail on the ground of consumability. We qualified this concept earlier by talking about a primary audience but it is difficult, as we also noted, to rank lawyers over citizens, or vice versa, as the primary audience for a substantial citizenship document.

My key proposal, therefore, in the context of what I will come on to describe as a public domain document (PDD) is that responsibility not only for its adjustability but also for its consumability should be the responsibility of the author who can, for example:

- Tag the ranking of portions of text to produce a ranking of priority in verbosity
- Certify a set of lexicographic equivalences or 'translations' from the technical to the non-technical

It should be noted in this context that the use of technical terminology often

decreases verbosity and so simplification does not always mean shorter documents.

Nonetheless, it is now possible to imagine a Public Domain Document which offers various degrees of verbosity and lexicography.

In summary, then, a Public Domain Document (PDD) is: ***A document which is optimally accessible through the facilitation by the author to the consumer of adjustability and consumabilitytools in association with document delivery***.

This definition somewhat unconventionally extends the concept of accessibility from its near equivalence with adjustability and gives it a postmodern dimension of consumer reception. It also uses the term "optimal" as opposed to "total" or "universal" which imposes an impossible level of cost. In this instance "optimal" is defined as: ***The affordable balance between the cost of provision and the degree of consumption***.

Finally, the definition speaks of "facilitation" because it is the responsibilityof the author to ensure tools not necessarily to duplicate their provision.

5 eLearning Design

I have so far used the political arena for a discussion of PDD because that is where the most obvious case lies for its implementation, in the case where public-sector information is financed from taxation.

eLearning falls into a slightly more contested category.

There are five grounds for implementing PDD in eLearning document design:

- Good practice
- Law or regulation
- Public sector provision
- Private purchase
- Customer flexibility

The first three of these grounds are simple and need no explanation but I would like to spend some time on the last two.

Historically, ever since Plato regretted the development of writing as a dangerous abridgment of teaching through dialogue (and even in that case there is more than a suspicion that the questioner was simply a 'fall guy') the content of instruction has been teacher and not student defined. This initial Greco-Roman model was reinforced in turn by:

- Religion – Theological and doctrinal, moral, philosophical and scientific content

- Etiquette – Class obligation, manners, warfare
- Vocational – Ecclesiastical, law, public administration, teaching, medicine
- Craft & occupational – Reading, writing, calculation
- Services – human relations, psychology, social science

This modernist, public sector provision reached its hegemonic and client peak at the end of the 20th Century but with increasing and parallel shifts:

- Of economic power from state provision to private purchase
- Of cultural emphasis from modernist rigidity to postmodern fluidity
- From vocational and occupational to generic skills
- From location-based to distance learning
- From passive to participative involvement and
- From stratified to multi-level learning environments

The 'top/down' didactic model is beginning to break down.

The earliest and greatest changes will naturally occur where the above factors are most salient and that is bound in almost all cases to be in our universities and places of higher education. It will be a much longer time before the conservative bastions of state secondary and even more so primary education will be affected but all these six trends are inevitable.

The connection between provider flexibility and purchaser power is obvious: if purchasers exercise their power over providers then providers will be unable to impose their agendas on purchasers. This is a daunting prospect for a fundamentally conservative educational environment (remembering that radical content has been dispensed in conservative teaching and learning environments for more than 500 years in Europe, since the foundation of universities) and it will seriously damage monopolies and cartels. The counter movement of standards competition generated by a global skills market will somewhat retard this postmodernist development but it is too strong to be resisted.

From the perspective of people with impairments which affect their ability to consume educational material, my point on flexibility goes well beyond the economic.

Here are examples involving:

- Language
- Lexicography
- Syntax and
- Verbosity
- Complexity

Let me take as an example, related to my earlier discussion of budgeting, a piece of historical text about the financial conduct of the administration of King Henry VIII of England or King Louis IV of France.

4a) Language. The first question is whether the learner needs to learn the language in which the monarch's documents were written or whether, in the view of the teacher, the source material does not possess those nuances of language which must be understood but which cannot be translated in order to grasp the essence of the case. As the source material refers to financial rather than, say, emotional, matters, access to the source material in its initial language seems marginal rather than central.

4b) Lexicography. Let us say that at some period a monarch was short of money because he was spending more than he raised in taxation. A financial technician would say that he was running a current account deficit which required fiscal tightening but a generalist would say that he either needed to spend less and raise more, or both. The question for the information provider is whether the task of the learner is to understand the monarch's situation or to understand technical terminology, what some people would call jargon. Again, the ability of the learner to grasp the essence of the case is not dependent on the grasp of technical lexicography which, some would argue, has been developed to 'protect' professional oligarchies from intrusion.

4c) Syntax. At this point we reach an area of pedagogy which is much more complex, relating to the relationship between "what" and why". complex syntax is usually associated with "why" rather than "what"; and we need to be careful to distinguish between the two. Does our learner need to know about the fiscal policies of monarchs or about why they got into situations and why they chose one solution or another for putting matters right, if that is what they did. Or, to put it another way, are all those complex subordinate clauses entirely necessary to the task in hand?

4d) Verbosity. As we saw earlier, reducing verbosity does not necessarily produce simplicity.

4e) Complexity. Underlying all of these issues is the matter of complexity and how far the learner – over and abovea contemporary postmodern suspicion of grand narrative – is required to account for an action of a monarch by recounting a complex set of speculative factors including:

- Notionally measurable factors such as income and expenditure
- Optional factors such as the need or otherwise to wage war (expenditure) or to avoid civil unrest (lowering taxation)
- Apparentlycontingent factors such as the monarch's sexual and emotional state of well-being or otherwise

- Contemporaneously unknown factors such as the monarch's possible underlying state of health

From this discussion it can be seen why an eLearning document should conform to a Public Domain Document standard.

6 Intertextuality

Finally, a short note on intertextuality. The best example I can think of where intertextuality would have been of immenseservice to European Citizens in the case of the Infamous Maastricht Treaty of 1992 which is a series of what look like instructions to a printer to add certain clauses and delete others. This pattern of statement, response and emendation is a hangover from analogue printing and hand writing whereas current technology offers an opportunity for both authorial and consumer intertextuality so that a piece of work can be considered as a working progress rather than as a final word. This method also allows the learner to stay close to the text and comment on it instead of having to generate a parallel or responsive text that must, in essence, stand alone.

7 Conclusion

In summary, the use of a Public Domain Document strategy will give users greater flexibility but it will also facilitate a much more refined approach to learner requirements. It is quite difficult enough to be a disabled person in a learning environment without being forced to learn what you do not need nor want.

It is time to transfer the responsibility for accessibility from the consumer as a post-production operation to the author as part of a standard document preparation process.

Section 1

Linguistic Competence of the Hearing Impaired and the Role of Sign Languages in Tertiary Education

The section focuses on:

- *The issue of native language and language of communication among persons with severe hearing impairment; the issue of official, instruction, foreign and world languages of persons with severe hearing impairment compared to other linguistic minorities.*
- *Linguistic standard and linguistic diversity in speaking and writing of persons with severe hearing impairment.*
- *Language instruction and the achievement of prescribed linguistic competences of persons with severe hearing impairment.*
- *Spoken language visualisation, speech-to-text reporting, and other systems of communication for persons with hearing impairment usable in tertiary education.*
- *E-learning systems, videoconferencing and instant messaging in sign languages.*
- *Sign language as a tool in tertiary education and specialized communication, its stylistic diversity and standards.*
- *Application of the Common European Framework of Reference for Languages on sign languages and testing of linguistic competences in these languages.*
- *Phonology, morphology and syntax of sign languages, their interference with spoken languages and influence on communication within a university environment.*

- *Lexicology and lexicography of sign languages, development of vocabulary, issues with terminology and internationalisms.*
- *Sign languages recording and noting systems, creation of databases and linguistic corpora, software tools for handling databases and corpora.*
- *Linguistic, organizational, didactic and legal issues of translation and interpreting in academic settings.*

SignLEF: Sign Language European Frame

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Application idea

SignLEF is a project of the Lifelong Learning Program and represents an innovation in sign language research.

Project coordinator is the University of Barcelona – partners are Istituto Statale Sordi di Roma and the Centre for Sign language and Deaf communication, Klagenfurt University. SignLEF started in January 2011 and is expected to be completed within three years.

The aim of the project is to develop a common basis for studying the sign languages of Europe in accordance with the guidelines of the Common European Framework of Reference (CEFR) for Languages. The whole project is based on Information and communications technology: all documentation and instruction will be done via internet and respective software, users will have complete access to it.

Thanks to CEFR the official instructions for learning and teaching languages in the European Union have been unified. A set of language levels has been developed, making it easier to standardise all the various qualifications.

The six levels are:

- **A** Basic speaker
  - A1 Breakthrough or beginner
  - A2 Waystage or elementary
- **B** Independent Speaker
  - B1 Threshold or intermediate
  - B2 Vantage or upper intermediate
- **C** Proficient Speaker
  - C1 Effective Operational Proficiency or advanced
  - C2 Mastery or proficiency

For further information see Council of Europe: http://www.coe.int/t/dg4/linguistic/

The state of the art

In September 2011 an ESF exploratory workshop took place in Zurich in order to setup a Europe-wide collaborative network. The aim was to share existing knowl-

edge related to sign language instruction, learning and assessment and to prepare a collaborative research project. In the last few years second language learning and teaching methods have been changed as well as the examination of attained language skills. This development has led to the introduction of the CEFR and its implementation in the educational system but until now only spoken languages benefit from it. Although different innovative Sign language projects in this field are happening in the United Kingdom (http://www.bslqed.com), Switzerland (http://www.hfh.ch/gebaerdensprachdolmetschen/), Ireland (http://www.tcd.ie/slscs/cds/) or France.

The methodology used

Based on Breakthrough we tried to develop a concept that might save as the basis for SignLEF. In cooperation with deaf colleagues we worked out a concept for a demo version. Lexis, dialogues and exercises were filmed. We furthermore decided that CEFR has to be adapted to Austrian Sign Language. We tried to compare the levels in the original version with the German version of GERS (Goethe Institut), LSF and BSL QED. In a first step the common description of the levels was translated and filmed by one of the deaf colleagues.

Unfortunately we soon found out that it took us a very long time to realise the demo concept – one chapter done by each project partner – and tried to find a way to make working more efficient. Our aim was to produce teaching material, not based on written dialogues.

As the speech act list is the basis for the comparison of languages we decided that it should be the primary goal of work. We therefore determined to realise single speech acts and to shift their connection into dialogues to a later stage of work. The advantage of this strategy is that every single speech act can be looked up whether there is a sign language realisation or not. We excerpted the speech act list from *Profile Deutsch* (the German counterpart to CEFR), which concerns levels A1 to B2 and distributed these speech acts to the respective levels, using the examples of CEFR English and German.

A selection of 17 speech acts related to A1 was handed over to our deaf colleagues and they were asked to realise them. The realisations will be translated and later also analysed by a sign language interpreter. This is a trial for the method to be applied. If we have the impression that the most simple variants of speech acts are not produced yet, we will discuss the criteria for simplicity and then consciously produce the "easiest" variants for the first level where the realisation of the respective speech act appears. By that we want to secure a hierarchy of complexity within different variants of speech acts.

To give an example: The speech act of giving the turn of a person signing/speaking to another one can be fulfilled very simple e.g. by using please and the

accompanying non-verbal behaviour – which would relate to level A1. In order to explicitly realise this speech act, one should be able to sign a sentence like *Please, take your turn now!* or *You are the next!* – which would relate to either level A2 or B1. That means that we have the possibility of producing very simple utterances which can be identified to represent a certain speech act within a given context but can also serve to represent very different speech acts within other contexts. And we have the possibility to produce utterances which explicitly represent only the speech act intended. Along this dimension we have to hierarchy different realisations of speech acts related to levels A1 to B2. In other words: When assigning speech acts realisations to levels, the grammatical-lexical complexity of the respective realisation has to be evaluated.

Parallel we started cooperation with the Department of Translation Studies at the University of Graz in order to be able to do all the translation work needed for the adaption of CEFR to and into Austrian Sign Language. Students of the Department of Translation Studies were asked to do translation work within the course of *Discourse Analysis and Translation Techniques Austrian Sign Language*.

The course introduces students to a range of text genres as well as specific problems of translation (metaphor, culture-specific references etc.) to allow them to further develop their research and terminology management and translation skills, text and discourse analytical skills and self-assessment skills.

First of all research work was done to get an overall view of the topic. GERS Texts were adapted to Austrian Sign Language and deaf culture whereas some texts had to be discussed in class several times. The students tried to filter he most important parts of GERS as we wanted to make the CEFR more user friendly. Chapter 1 and 3 were worked out. Chapter 2 was not taken into consideration as there are so many repetitions. Then texts were filmed and edited.

Work and results

Until now we have completed

- an analysis of best practice sign language courses for hearing people
- a Demo version containing the first parts of level A1 and a common project description
- an adaption of the common level description to and into the three sign languages
- a first draft for a webpage
- 17 speech acts
- two chapters of GERS to and into Austrian Sign Language

The impact or contributions to the field

1

SignLEF supports linguistic diversity of sign languages in the European Union and helps to improve the quality of the structures and systems involved in language teaching. The result of this should be greater respect and similar treatment for sign languages in Europe, the strengthening of users´ rights as citizens and improved access to equal opportunities.

SignLEF aims at the adaptation of the CEFR for sign languages (LIS, LSC, ÖGS) and the organisation of a respective course. Furthermore these initiatives will help sign languages to attain the same status as spoken minority languages. SignLEF's basic aim is to promote the awareness, teaching and learning of the sign languages of each participating country.

Conclusion and planned activities

Until the end of the project we will try to

- realise as many speech acts as possible
- complete our translation work of GERS to and into Austrian Sign Language
- get our webpage online
- inform the public and especially the target groups about our project and offer them the project results
- start new cooperation with researchers and institutions in Europe

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Specifics of the Specialized Science and Medical Programs Terminology Development in the Czech Sign Language

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Integration of students with hearing impairment in tertiary education and especially in science and medical programs includes two important areas – possibilities of integrating the hearing impaired into the common system of university education and possibilities of integrating them into a vocational training so that they are able to work independently when they graduate.

The language of communication of the majority of hearing impaired students at the Faculty of Science and the Faculty of Medicine at Masaryk University is the Czech sign language, which is a natural tongue for them. Czech sign language is not equipped with scientific sign language terminology for historical reasons. Most specialized signs were initially solved as loans from spoken languages (fingerspelling). The need to expand the Czech sign language vocabulary is growing together with students' need to understand specialized topics. For this reason, systematization of creation of specialized terminology began. General issues of this systematization, number and composition of teams and the procedures of their work are presented in a lexicographic paper by Tomáš Sklenák and Jan Fikejs, which is why in our paper we focus on the specifics of the work of the science and medical programs group.

A long-term and exceptionally close co-operation of deaf students as sovereign sign language carriers and users with interpreters and expert teaching staff including teachers whose knowledge of the Czech sign language makes it possible to use sign language as the language of instruction in specialized subjects are among the specifics of the MU terminological group for science and medical programs. Knowledge of the structure of the specialized terminology in Czech together with knowledge of the structure of the Czech sign language allows for an insight and a more accurate evaluation of meaning of a specialized sign, while being able to discover possible risks of interference and confusion with other similar signs with a different content.

The process of the Czech sign language terminology creation pays respect to the visuality of sign language and adequacy of content. Signs for specialized terms are either created by a terminologization of an existing sign, by its transfer to an analogous field based on the visual shape, function and properties, or they are completely new signs. An example of a created sign based on a similar shape is the sign for the genus of bacteria *Staphylococcus*, which appears in a

microscope as a bunch of grapes (the sign for a bunch). Sing language users thus proceed in the same way as creators of the Greco-Latin terminology (σταφυλή), albeit independently. Another example of a sign created according to the shape and structure is the sign for the DNA molecule, which has been presented as a double helix ever since the discovery of its structure (a hand movement indicating a double helix, the movement also presents spiralization). Examples of signs derived from the function are the stages of the gene expression – *replication*, *transcription* and *translation*, or signs for the stages of mitosis, whose signs include information about the situation inside a cell during mitotic segregation. An example of a proposal for a new sign is the sign for the term *bacteriophage*. Despite the fact that a bacteriophage (a virus infecting bacteria) may have various shapes, it has a standard shape in literature illustrations. Unlike with other terms, it is, however not possible to derive the sign from the structure of the organism as such due to the risk of confusion. Nor is it possible to proceed from the definition or function of the organism as the signs for virus and bacteria are very similar in the Czech sign language. An expert with a knowledge of the Czech sign language can operatively show to the terminological group the limitations of the proposed solutions or possible confusions with other signs, and he/she can also add explication in sign language. A specialized term proposed by the terminological group is then maximally visual and respecting sign language grammar, but it is at the same time adequate in content and in harmony with other proposed specialized signs.

Interpreters with a previous knowledge from these fields form an integral part of the terminological group. Interpreters are required to give an accurate translation which preserves the level of expertise (adequacy of content) as well as considering non-standard conditions in laboratories or hospitals, which students of science and medical programs are expected to visit. Some of the theoretical rules that stand as recommendations for interpreters had to be modified according to emerging situations. Examples are the color of clothes (a white cloak in the labs), a higher level of co-operation with a student incapable of carrying out experiments, take notes and look at the interpreter all at once, and a higher level of co-operation with a teacher due to temporal and spatial conditions in the labs. The result is a full and natural integration of hearing impaired students to specialized departments of the University.

An emphasis on the specialized terminology development not only helps to save time, which is important in the specific conditions in the labs, but above all, students have a greater possibility of practical specialized communication. Spontaneous specialized communication in CSL using the created terminology naturally prevents forgetting and the usage reduces the risk of confusions. A close co-operation of expert teachers, interpreters and deaf students has proved to be

an indispensable part of adapted tuition in science and medical programs, which aims at respecting the specific requirements for students and at the same time integrating sign language users into departments with a hearing majority.

A Virtual Character based Italian Sign Language Dictionary

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This paper presents a novel Italian to Italian Sign Language Dictionary that displays word translation by means of a virtual character. The Dictionary is linked to MultiWordNet, a lexical and semantic database which includes several languages. The objective is to use it as a learning tool for Deaf people to enhance the learning of written languages.

1 Introduction

Sign language is a gestural visual language with sign as lexical units instead, as words are in spoken languages. Sign languages have their own grammars which are quite different from oral languages [1]. Sign Language is not universal language; each country has its own Sign Language like American Sign Language(ASL), British Sign Language (BSL) and Italian Sign Language (LIS). In some countries more than one Sign Languages are also used e.g. in Switzerland, Swiss-German, Swiss-French and Swiss-Italian Sign Language(s) are used [2] .

Users can not be restricted to a single platform in the sense of operating systems or hardware. As an equal opportunity to everyone, everywhere we have to facilitate deaf users on each platform by providing same facility with same interfacing. In this paper a Platform Independent LIS Dictionary (henceforth referred to as Dictionary) is proposed to support Deaf learning of both Sign Language and written language. It provides full set of lexemes and videos data set and an online interface with MultiWordNet synsets.

This paper is organized as follows: in section 2, related work is described. In section 3, the ATLAS lexicon dataset is explained. In section 4 abstract architecture of the Dictionary is presented. Section 5 concludes the paper.

2 Related Work

There is considerable work in progress on Sign Language dictionaries but many of them have limitations by providing limited functionality i.e. only for a word-to-sign search and only limited lexicon data set is available usually recorded with the help of some signer [3, 4]. A large lexicon project was started for American Sign Language which facilitated large lexicon data set but the purpose was to find similar signs in database by taking new video sign [5]. Although American Sign Language and British Sign language dictionaries are available online but they are just web based dictionaries showing prerecorded videos [6, 7].

3 ATLAS Lexicon Dataset

The Platform Independent LIS Dictionary is part of the Automatic Translation into Sign Languages (ATLAS) Project which aims at automatically translating sentences of the Italian language in the corresponding sequences of signs. The target domain is weather forecast news. Lexemes are basic unit of sentences; each individual lexeme comprises a dictionary. Our Sign Language dictionary has 3082 signs as set of Avatar animations which are rendered through a graphic engine. Each sign is linked to a corresponding Italian lemma. 2689 video animations were created using standard Lingua dei Segni Italiana dictionary. 393 Signs are custom created by a team consisting of expert signers and deaf. The existing corpus contains the translation of 55 Italian to LIS weather forecasts collected from bulletins of national broadcasting network RAI.

Concept mapping is the process to form meaningful relationship in words. It is argued that the concept mapping process promotes and assists meaningful learning by encouraging learners to identify key words, establish relationships with other words and relate new concepts to prior concepts [8]. In MultiWordNet concept mapping is achieved by interlinking nouns, verbs, adjectives, and adverbs through semantic relations of synonymy which are called synsets. Our dictionary is composed of a limited corpus but by linking it with MultiWordNet will enrich the possibility to find a sign by searching the sign for synonym lexeme [9].

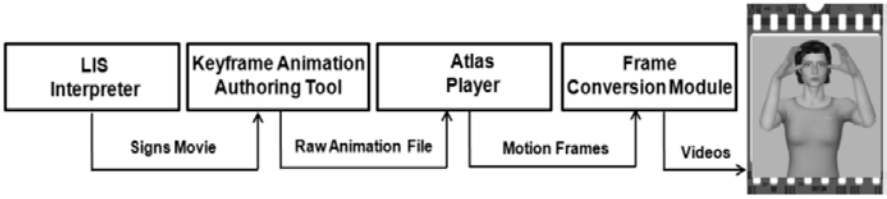
4 The LIS Dictionary Architecture

The Sign Language Dictionary accepts Italian lemmas as input and provides as output their representation in the Italian Sign Language. The process for the generation of avatar based signs in the LIS Dictionary is defined as follows (See Fig 1):

1. A LIS interpreter is recorded signing the lemma of each LIS sign.
2. A raw animation file is produced through the keyframe animation technique.
3. The raw animation file is played within the ATLAS player in order to produce virtual character based motion frames.
4. The frames are converted in movies by means of an automatic procedure. Figure 1, shows the process of signing a lemma.

Input Italian words are linked to the correspondent movie in a database.
The signs are rendered through the ATLAS Player developed at Virtual Reality and Multi Media Park which is able to perform several functionalities such as the blending of signs in one sentence and the application of procedural trans-

formations on the sign to manage relocation [10]. Below a short description of the visualization module and of the procedures applied in order to produce LIS Dictionary lemmata.



[Fig. 1] The process for the generation of avatar based signs

4.1 The ATLAS Visualization system

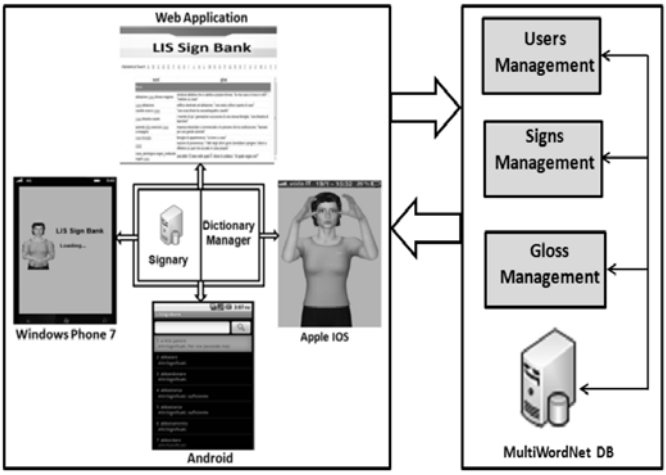
The module used for the signs generation is system that generates real-time animations, display them in a player and export them as picture frames. It takes as input the symbolic form of LIS called ATLAS Written Extended LIS (AEWLIS) [11], a sequence of lemmata and a description of the meaning, syntactic number and other semantic, pragmatic and articulatory information.

The signing space in front of the interpreter is structured with locations where the items mentioned in the sentence are positioned and kept for further references in the sentence.

Signs are described by a default animation (stored in a repository, the "signary"), that has to be parametrized with respect to the context given by the specific sentence. When the player receives a sentence in AEWLIS form, it plays the signs in sequence adding manual and non-manual components with well defined priority strategies [12]. To some extent the LIS Dictionary involves the aforementioned Signary and links it with additional information provided by MultiWordNet.

The LIS Dictionary is implemented in such way that its functionality is enhanced according to the availability of resources. For offline users lexicon data set along video signs is stored locally while for online users dictionary is mapped with MultiWordNet synsets in client server fashion. Figure 2 shows an abstract architecture of the Platform Independent Italian Sign Language dictionary.

The dictionary provides same interface for mobile and web users in which user input or selects word from preloaded list of lemmas. LIS video animation is displayed against selected lemma and if the video of desired lemma doesn't exist user can see any word from synset existing in dictionary to understand the meaning. Availability of signary database locally maximizes the performance as no streaming is required. Browsing through synonyms helps to enhance the usage of same sign for different lemmas.



[Fig. 2] Abstract Architecture of Platform Independent Italian Sign Language dictionary

5 Conclusion and Future Work

In this paper we discussed the platform independent Italian Sign Language dictionary which is capable to run on several devices and is linked with MultiWordNet. It is available as a Web application and for Phone7, iPhone and Android mobile. Our dictionary contains a large video data set and its structure is flexible to include further signs in future. The Italian Sign Language dictionary is part of he ATLAS project which aims at automatically translating Italian sentences into Sign Language. We plan to develop a web applications that take effort of the LIS Dictionary. The objective is to propose such an interface as a tool to enhance Deaf learning of written Italian Language in schools. Since MultiWordNet has multiple links with other languages such as Spanish, German and Portuguese, it could be helpful for written multi-language learning.

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Towards a Visual Speech Learning System for the Deaf by Matching Dynamic Lip Shapes

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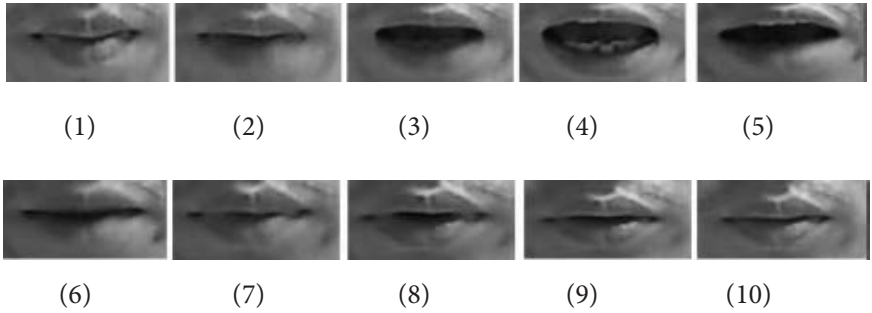
In this paper we propose a visual-based speech learning framework to assist deaf persons by comparing the lip movements between a student and an E-tutor in an intelligent tutoring system. The framework utilizes lip reading technologies to determine if a student learns the correct pronunciation. Different from conventional speech recognition systems, which usually recognize a speaker's utterance, our speech learning framework focuses on recognizing whether a student pronounces correctly according to an instructor's utterance by using visual information. We propose a method by extracting dynamic shape difference features (DSDF) from lip shapes to recognize the pronunciation difference. We have collected a database, which contains multiple persons speaking the selected words, to evaluate the performance of the proposed speech learning method. The preliminary experimental results demonstrate the robustness and effectiveness of our approach.

1 Introduction

About 35 million Americans today are deaf or hard of hearing. Approximately 12 out of every 1,000 individuals with hearing impairment are under 18 years of age, based on the most recently available data from the National Center for Health Statistics (NCHS). Recent research has demonstrated that even mild hearing losses can create significant challenges for children as they develop skills to interact with the world [5, 7].

The loss of auditory feedback poses significant difficulties on the speech learning for the deaf people, since they cannot know immediately if they speak correctly [1, 10, 12]. Some researchers propose to use animation as feedback according to audio signals [6, 11]. The animation can be helpful for the deaf people to know if they speak correctly. However, such animation does not provide feedback on how to correct their speech and how the incorrect speech different from that of the instructor.

On the other hand, visual cue often provides complementary information for speech recognition [8, 9, 15]. Figure 1 shows a lip movement in a video sequence when speaking word "apple". It is easier for a deaf person to visualize the difference between the incorrect and the correct utterances by simply looking at the lip movements.



[Fig. 1] Sample lip movements of a video sequence when speaking word "apple".

Potamianos et al. [9] have shown a significant improvement of speech recognition through both audio and visual modalities as compared to the approach of audio modality only. Matthews et al. combined lip contour and lip appearance information to recognize isolated letters A–Z [8]. Then the authors employ Hidden Markov models (HMM) as the classifier to model the temporal dynamics of a speech. The authors demonstrated the effectiveness of the speech recognition based on only visual modality. The visual based speech recognition becomes particularly useful in the noisy environment, in which audio signal is significantly degraded.

Zhou [15] recently captures temporal dynamics of a speech by extending Local Binary Pattern (LBP) to a temporal domain [14], which is also visual based speech recognition. Ten phrases are used for their speech recognition experiments. The experimental results also show a promising performance of visual based speech recognition.

[Fig. 2] The basic hardware configuration of the proposed interactive intelligent tutoring system, which includes a computer (desktop or laptop), a web camera with auto focus (face to the user), and a microphone.

Inspired by these advances on speech recognition, we propose a visual-based speech learning framework to aid deaf people. As shown in Figure 2, the system configuration is set up as an E-Tutoring system. A deaf student in front of a computer learns speech by following an E-tutor. A web camera is used to capture the student's face and lip movement. The video of the student is then processed in real-time by comparing the student's lip movements with those from the pre-recorded tutor. Interactive feedback is provided to students through easily understandable visual displays.

Different from the visual based speech recognition, which usually recognizes a few words, a practical speech learning system usually needs to handle much larger vocabulary. It would be extremely difficult to design a speech learning system if we have to recognize every single utterance between a student and an instructor. Hence, we propose a new framework by extracting dynamic shape difference features (DSDF) to directly measure the visual difference of lip shapes between two speakers, i.e. the student and the instructor. Therefore, we can reduce a multi-class recognition problem in a speech learning system to a binary class recognition problem, i.e. recognizing whether the student pronounce correctly according to the instructor's utterance.

We have collected a database which consists of 9 words spoken by four people respectively. By pairing up two subjects speaking same or different words, we generate "correct" or "incorrect" samples to evaluate performance of the proposed speech learning framework. The "correct" sample corresponds to the case when both subjects speak the same word, while the "incorrect" sample corresponds to the case when the two subjects speak different words. Our preliminary experiments have shown encouraging results of this approach.

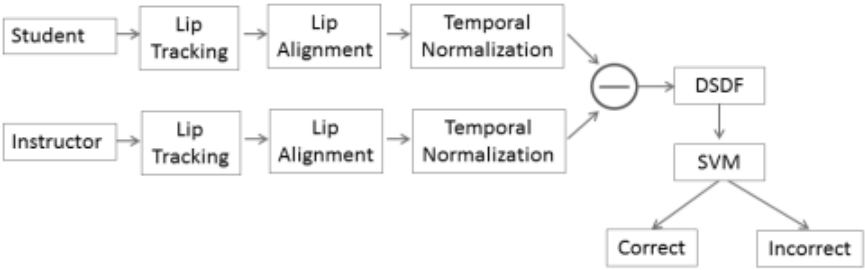
2 Visual Based Speech Learning Method

2.1 Overview

Figure 3 shows an overview of our speech learning framework. First, the lip movements of both student and E-tutor are tracked by an Active Shape Model (ASM) [4, 13]. Then we align the lip shapes to remove the head movements while speaking, i.e. translation, and rotation. In this step we also remove the lip shape variance caused by different subjects. Due to the time resolution difference when speaking a word, we perform temporal normalization over the extracted lip shapes in a video sequence, so that both student and instructor can have same speaking speed. The resulted features are defined as dynamic shape features.

Finally we calculate the difference of the dynamic shape features between the student and the instructor, i.e. dynamic shape difference features (DSDF), as the input to a Support Vector Machine (SVM) based classifier. The SVM classi-

fier then automatically determines if the lip movements of the student correctly follow the lip movements of the instructor based on the visual difference of lip shapes between the student and the instructor.



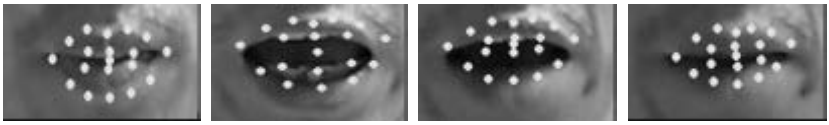
[Fig. 3] Overview of our proposed visual speech learning framework.

2.2 Lip Tracking

We employ Active Shape Model (ASM) [4, 13] to track lip movements. ASM is a shape-constrained iteratively fitting method, which utilizes prior knowledge of lip shapes in training images. The shape is simply the x and y coordinates of all landmark points on a lip after appropriate alignments, which is shown in Eq. (1).

$$X_i = [x_1, y_1, x_2, y_2, \ldots x_j, y_j, \ldots x_n, y_n], \qquad (1)$$

where n is the number of landmark points labeled for a lip. In our experiments, we choose 19 landmark points, including both outer contour and inner contour of a lip. For the simplicity, we use the built-in ASM model, which is trained using the 68 landmark points of the whole face including the 19 lip points [13]. Figure 4 shows a lip tracking example in a video sequence using the ASM model.

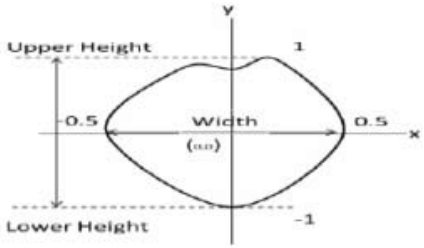


[Fig. 4] An example of lip tracking in a video sequence by employing Active Shape. Model (ASM).

2.3 Lip Alignment

In order to remove the effects of head movements and rotations during the speech, we perform an alignment procedure. The alignment procedure calculates the angle formed by the line connecting both lip corners and x axis. Then we rotate the shape by the calculated angle so that the left lip corner and the right lip

corner have the same y coordinate value. The mean x and y values are removed. The entire shape is then adjusted vertically to align the two lip corners on the x axis.



[Fig. 5] Typical neutral lip shape after the alignment and the normalization with the upper height, lower height, and width of the lip shape on the neutral frame.

Different subjects have different neutral lip shapes. To eliminate these subject dependent shape variations, we perform a normalization using the upper lip height, the lower lip height, and the width of the neutral lip shape for each subject. The neutral frame in our database is simply the first frame in the video sequence. Figure 5 shows a typically aligned and normalized lip shape on the neutral frame without the landmark points. The normalized lip shapes in a video sequence represent how the lip shape deforms from the neutral shape during the speech.

From the experiments, we find that the performance is usually improved by adding the upper height, the lower height, and the width of each frame's lip shape to the normalized shape vector as described in last paragraph. Finally, we perform the L2 normalization on the resulted feature vector in each frame.

2.4 Temporal Normalization

The time usually varies for different subjects even when they speak same words. In order to handle this time resolution difference, we temporally normalize the video sequence to a fixed number of frames by linearly interpolating each frame's feature vector along the temporal direction [2, 3]. We choose 30 as the number of temporally normalized frames in a video sequence.

Each frame's shape feature vector has the feature dimension of 41, i.e. 2*19+3. Therefore, a video sequence is represented by the concatenated frame feature vector with the total dimension of 1230, i.e. 41*30. The concatenated feature vector of a video sequence is defined as dynamic shapes.

2.5 Dynamic Shape Difference Features (DSDF)

By taking the difference of the dynamic shapes between the instructor and the student, we form the dynamic shape difference features (DSDF). The DSDF fea-

tures directly measure the pronunciation difference of the two speakers, regardless the words spoken.

Here, we do not recognize the words spoken by the instructor and the student individually to determine if the student speaks same word as the instructor, since this approach can quickly become too complicated to recognize every word accurately as the number of words increase in the speech learning system. By employing the DSDF feature to recognize the similarity between the utterances directly, our system is not limited to the number of words or utterances spoken, which is desirable for any practical speech learning system.

2.6 Support Vector Machine Classifier

Finally, we employ a support vector machine (SVM) as the classifier with the DSDF feature from the instructor and the student as the input feature vector. The output of the classifier is to determine if the student correctly follows the instructor's utterance regardless words they speak.

SVM is to find an optimal hyper-plane which can separates the opposite classes with the maximum margin. We employ the RBF kernel, which has demonstrated the state of the art performance in many applications, such as object recognition and detection etc.

3 Experimental Results

3.1 Database

We have recorded a database to study the effectiveness and robustness of the proposed speech learning framework. Nine words were chosen such that some words are unique, and some words are similar to each other. The selected words are "apple", "cruise", "find", "hello", "music", "open", "search", "vision", and "window".

In our database, each word is spoken ten times by each subject. There are four subjects in the dataset. The video is captured at frontal face by a web-camera with the entire head of the subject within the image frame, in order to ensure the face has enough resolution. The speaker begins a word with a neutral expression, says the word, and then returns to the neutral expression. Each of the chosen words takes an average of 1 second to complete. Depending on the speaker, some words take up to 2 seconds to complete.

All the videos have a spatial resolution of 640x480 pixels, with a frame rate of 30 frames per second. The videos are edited such that the first and last few frames (about 3-5) contain a neutral expression. The average video sequence is between 20 to 40 frames long. Figure 6 shows a sample video sequence of a subject speaking the word "apple".

[Fig. 6] A sample video sequence of speaking the word "apple".

3.2 Subject Dependent Results

We evaluate the speech learning framework by pairing up two persons from the database. If the selected two persons speak same word, then we know that one speaker has correctly followed the other speaker. Otherwise, one speaker has incorrectly followed the other speaker. Hence we have the ground truth, whether one speaker correctly follows the other speaker, by simply checking the words they speak. That is, if they speak same word, the ground truth is "correct". Otherwise, the sample consisting of the pair of speech has the label of "incorrect".

Each word is spoken 10 times by each subject, and there are 9 words in our database. Therefore, we have 900 possible pairs of utterances which speak the same word for each selected pair of subjects, i.e. we have 900 "correct" samples. Similarly, for each pair of subjects, there are 7200 possible pairs of utterance which speak different words, i.e. there are 7200 "incorrect" samples. We choose 900 out of the 7200 "incorrect" samples, so that the number of "incorrect" samples from every combination of different words is approximately equal. Then we divide the 900 "correct" samples and the 900 "incorrect" samples to the training and testing sets by the ratio of 9 to 1.

Our speakers include 1 American male (M), 1 Chinese male (S), 1 Chinese female (X), and 1 American female (K). The capital letter is an identifier for the person. We adopt precision and recall as our evaluation metrics, which are defined in Eq. (2) and Eq. (3).

$$Recall = \frac{TP}{TP+FN} \qquad (2)$$

$$Precision = \frac{TP}{TP+FP} \qquad (3)$$

where *TP* is the number of "correct" samples which are also predicted correctly. *FP* is the number of "incorrect" samples which are misclassified as "correct" samples. *FN* is the number of "correct" samples which are misclassified as "incorrect" samples.

Table 1a shows the average precision and the average recall over all words for each selected pair of speakers. That is to train and test the proposed speech learn-

ing framework by the same pair of subjects. Table 1b shows the detailed recall over the individual words for the corresponding pair of subjects. These results indicate the robustness of the proposed speech learning system.

There are some variations among different pair of speakers on the precision and recall. One explanation for this variation is the fact that different people say the same word differently. When collecting the database, we have observed some speakers open their mouse slightly prior to saying a word.

[Table 1a] Average precision and average recall over all words for each selected pair of speakers.

	Precision	Recall
M-S	95.2 %	87. 8 %
M-K	100.0 %	97.8 %
M-X	98.9 %	96.7 %
S-K	96.5 %	91.1 %
S-X	100.0 %	92.2 %
K-X	100.0 %	92.2 %

[Table 1b] Recall over the individual words for each selected pair of speakers.

	Apple	Cruise	Find	Hello	Music	Open	Search	Vision	Window
M-S	70 %	100 %	90 %	70 %	100 %	70 %	90 %	100 %	100 %
M-K	80 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %	100 %
M-X	80 %	100 %	90 %	100 %	100 %	100 %	100 %	100 %	100 %
S-K	30 %	100 %	100 %	100 %	100 %	100 %	100 %	90 %	100 %
S-X	70 %	100 %	80 %	100 %	100 %	80 %	100 %	100 %	100 %
K-X	80 %	100 %	100 %	90 %	60 %	100 %	100 %	100 %	100 %

3.3 Subject Independent Results

In order to evaluate the proposed speech learning framework for the subject independent case, we group all "correct" and "incorrect" samples from every pair of speakers as shown in Table 1. Then we just train a single model to recognize if one speaker correctly follows another speaker. The precision and the recall shown in Table 2 demonstrate that the proposed framework is also effective for subject independent case.

[Table 2a] Average precision and average recall over all words when grouping every pair of speakers in Table 1.

Precision	Recall
98.7 %	95.9 %

[Table 2b] Detailed recall of (a) over the individual words.

Apple	Cruise	Find	Hello	Music	Open	Search	Vision	Window
81.7 %	96.7 %	100.0 %	95.0 %	95.0 %	96.7 %	100.0 %	98.3 %	100.0 %

4 Conclusion

We have proposed a framework to help deaf people learn speech by visually comparing the lip movements of a student and an instructor. The framework utilizes lip reading technologies to determine if the student correctly follows the instructor in pronunciation of a word. Furthermore, our proposed framework is very practical by employing the dynamic shape difference feature (DSDF), which can avoid the large vocabulary problem in traditional speech recognition systems. The preliminary experimental results indicate that our proposed speech learning framework is robust in both subject dependent and subject independent cases. More extensive experiments and user interface study will be conducted in future.

5 Acknowledgement

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Teaching Support Software for Hearing Impaired Students who Study Computer Operation – Synchronized Key points Indication Tool : SZKIT –

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Introduction

Our university is a special one which admits only visually impaired or hearing impaired students. The division for the hearing impaired students has a department of synthetic design and the department has many lectures concerned with operating graphic design software, such as Adobe Photoshop or Illustrator. In these lectures, our teaching staffs are struggling every day to teach how to operate the software using sign language, power point materials, video resources et cetera. In general, the graphic design software requires a variety of combination keys and tricky mouse actions to operate it. Teaching such complicate operation to hearing impaired difficult. The main problem is that the students cannot read the instruction text (or the sign language) and the mouse cursor movement at the same time when they watch the screen which reflects the teaching staff's operation. Imagine watching someones operation of graphic design software without any voice information. It might be hard to understand what the operator does even if there is an instruction text on the corner of the screen.

Of course using video materials or giving precise preliminarily instruction is available when hearing impaired students learn something [1, 2] and our teaching staffs utilized such kind of education materials in usual case. Also speech recognition system [3] or summary scribing service is valuable to support hearing impaired students in these days, however, it seems they can not solve the problems of teaching computer operation because the instructing text information of these systems is not in the same place and not in the same time to the computer operation. Summary scribing service in usual case and its display area is separated. The delay and separation between the text information and the real time computer operation makes the students confuse especially in the complex operation mentioned above. Besides such background, one of the authors was just against this problem in his lecture class, and then, he thought up an idea to solve it.

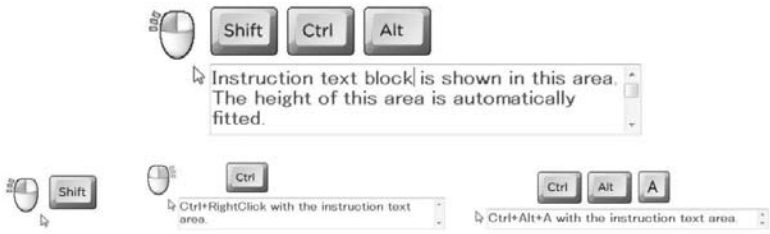
Basic Idea

The idea is really simple. It is to show icons of mouse clicks and pressed combination keys and to show instruction text in real time aside of the mouse cursor. We

started to discuss new supporting software based on this idea. The most important point is that the positions of each indicating components placed around the mouse cursor not far from it. Because the hearing impaired students cannot pay attention to the separated area at the same time. At first, we surveyed software which displays mouse clicking and pressing modified keys [4, 5]. However, they are not appropriate for our purpose. Then, we decided to develop an original software tool and named it as "Synchronized Key points Indication Tool: SZKIT."

Figure 1 shows an overview of SZKIT. It is composed of several icons and an instruction text area. To explain its function, the first figure shows most of components. Preparing icons are mouse click indicator and modified key indicators (Shift, Control, and Alt Key) and normal key indicator which appears in case of pressing it after modified key (it is not shown in this figure). Each icon is hiding under normal condition and the clicks mouse button or presses the modified key. On the other hand, the instruction text area is displayed all the time basically and the content of the text can be changed on appropriate timing by the operator. When the instruction text area is not needed, it can be hided arbitrarily by pressing Windows key + Ctrl key. To re-display this text area, the only thing the operator has to do is pressing Windows key + Shift key.

Other figures are example of display instruction texts. The first example shows "Shift Key + Left Click" without the text area. The next figure is an example of "Ctrl Key + Right Click" with the text area. The difference of right click and left click is not only the shape of the icon but also its color. The last example is "Ctrl Key + Alt Key + A." As shown in this example, every combination key with modified keys is displayed.



[Fig. 1] An overview of SZKIT and examples when it works.

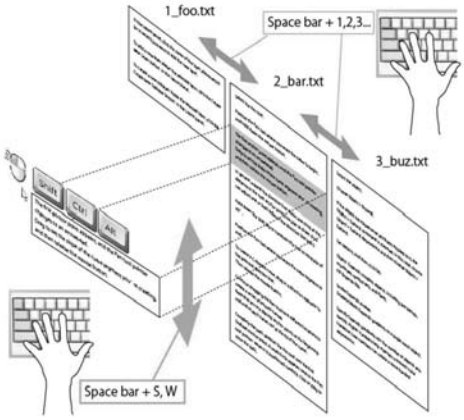
Functions of showing in struction text

Addition to the basic function of showing icons related to the actions which operator makes, SZKIT has a function to display a series of instruction text blocks sequentially. The text contains explanations how to operate target ed graphic de-

sign software and is prepared by the teaching staff in advance. Each text block should be separated by a blank line in the text file and SZKIT displays from the first text block after loading all contents of the file.

Here, this text blocks should be changed in appropriate timing during the lecture like subtitles in the movie film. To implement this changing function, SZKIT should accept triggered key action which causes forwarding or rewinding the text blocks. We were annoying this point because SZKIT runs simultaneously to the target graphic design software and the focus of the operating system is not on SZKIT, but on the targeted one. It means that the key action to control SZKIT must not be the same as anz operation of the software. In usual, graphic design software has so many combination keys and it is difficult to find a combination which no software use. After several discussions and try and errors we finally decide to implement hooking of space bar. As shown in Figure 2, "Space bar + S" causes forwarding and "Space bar + W" causes rewinding the in struction text blocks. Besides the assignment, "Space bar + number" is implemented for changing the series of text files which file name starts with numbers. Space bar works normally when the operator doesn't press any key after pressing space bar, therefore this key hooking doesn't disturb normal operation of space bar using this key assignment, the operator can change the instruction text block in appropriate timing without being out of focus on the targeted software. He/she can also show to hearing impaired students mouse click and modified key operations without any special actions as a matter of course.

In addition, it is possible to modify or fix the instruction text after pressing "Windows + Shift Key". The fixed instruction text is automatically saved when the file changes or SZKIT ends. With help of this function, the teaching staff can make improvements in the instruction text during the lecture.



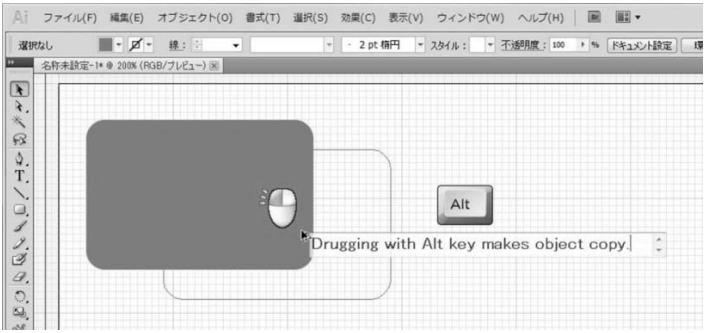
[Fig. 2] Key assignment of changing instruction text blocks.

Estimation

1

In the autumn semester of 2011, one of the authors uses SZKIT in his class and it is now continuing. All students of the class have hearing impairment, including severe one. We have a plan to take an interview and some questionnaire to the students at the end of the semester. Therefore it is not clear the results of estimation still now but he reported he feels surely that the students understand the graphic design software well compare with last lecture without SZKIT. The tangible effect is that there is less question about operations from students and less miss operations. More precise estimation results will be reported in camera ready paper.

Figure 3 is an example of screen shot which shows operation of Adobe Illustrator with SZKIT. It is a case of dragging an object with pressing Alt key. It is clear what operation is done by the teaching staff and it is easy to get information for the hearing impaired students.



[Fig. 3] A screen shot which shows operation of Adobe Illustrator with SZKIT. Every operation of mouse clicking and pressing modified key is displayed in real time.

Conclusion

To solve the problems of teaching computer operation to hearing impaired students, we developed a support software tool which displays mouse clicking and modified keys and instruction texts. With this software, instruction texts and its operation is clearly displayed on the screen in the same time.

Moreover, this software is also available for e-learning as a by-production. Only recording the operation using this software makes e-learning contents because all required information is into the screen. In this manner, we think software is not only for the for elderly person or novice person when they learn the computer operation.

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Deaf university students as foreign language learners in mainstream settings

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Teaching foreign languages to the deaf still can be treated as a relatively new educational phenomenon that still needs to be thoroughly searched. Today the teaching process is mainly organized in mainstream institutions, both at primary, secondary and tertiary level. Together with the ideas of normalization and inclusion majority of the deaf students is educated in mainstream institutions and this has to be taken into account by the researchers in the field.

Foreign language is an obligatory subject in Polish schools for pupils in every form, beginning from the 1st grade. English is the favorite language for majority of students. Since 2001 foreign language classes are obligatory also for pupils with hearing impairment. Simultaneously with the educational practice, the theoretical reflection on teaching foreign languages to the deaf started and has been continuously developing (Domagała-Zyśk 2001, 2003, 2005, 2006, 2009, 2010; Harań 2005), creating the body of a new science discipline, *teaching and learning foreign language by the deaf individuals*.

The main approach used in Poland in education the deaf it is an oral approach and this idea is also visible in teaching English to the deaf: They are taught all four language skills, reading, writing, listening and speaking. The main methodological idea is to use in teaching languages to the deaf the same approach, the same methods and differentiate only the techniques: way of communication with the students and different prompts used in the classroom. CIT serves a lot as a way of modifying the language environment and creating an accessible classroom.

So far the research has concentrated on the students themselves, their cognitive skills (Domagała-Zyśk 2008, 2010c), learning styles (Domagała-Zyśk 2011), vocabulary acquisition (Domagała-Zyśk 2009) or reading comprehension skills (Domagała-Zyśk 2010b). However, there is not a single study known that would touch the problem of the teachers' preparation to undertake this job. The issue is the more difficult because language teachers in mainstream schools has more often than in the past to work with the disabled students, but the education the teachers possess has not prepared them to perform this job and does not enable them to work effectively with the disabled students.

Thinking about the aim of teaching a foreign language to the deaf the teacher should have a much wider perspective than only achieving a certain level of language skills. Learning foreign language for a deaf person is sometimes a means of

creating one's own attitude to learning in general. On the other hand during the lessons we do not only obtain some information but also develop our personality. It is very important to be aware of the fact that foreign language learning has also a therapeutic value, as it compensates the state of deprivation experienced by our pupils. Hearing impairment is first of all a language impairment that is why each English language lesson is first of all a language lesson, it creates an occasion to learn something about a nature of language in general. Deaf students, even after several years of learning, usually have some problems with using their national language perfectly, even being almost adults they make mistakes. While learning a new language they revise grammar (e.g. the names and functions of the different parts of the speech), become more aware of creating some basic structures, have the chance to compare their language and the newly learnt language. At the first stages Polish students often conclude: *English is easier than Polish*. There seem to be a grain of truth in it: Polish inflection, all the exceptions from the rules make it for the deaf almost impossible to use Polish language correctly. English is more predictable for them, so at the beginning they feel better at it. I try to communicate with my students in English and I must admit that their sms'es or e-mails in English are sometimes more correct that their Polish ones. I also remember one lesson, when we did the second conditional. Just after giving the rules of creating the sentences I asked a student of mine to give me his own example of the second conditional and I received a sentence: *If I were a monk I would live on an uninhabited island, I would swim in a sea and I would play with exotic animals*. I am almost sure that even now he would add some improper suffixes to the Polish version of it. It is worthy to add that during foreign language lessons the students enlarge their general knowledge and also get some new vocabulary, learn synonyms and antonyms of the words. It sometimes happens that I give them the Polish translation of a word and I am asked to explain what the Polish word mean, the examples I remember may be as following: *chauffeur, manor, spa, bossy*, and a lot of others.

Taking into account both the contemporary psycholinguistic knowledge and the accounts about successful attempts of teaching foreign language to the deaf, it must be stressed that there are no psychological or methodological obstructions to teaching a foreign language to the deaf. To prove that many psychological research may be cited, e.g. Krakowiak (1995), MacSweeney (1998), Parasnis (1998), Marschark, Lang, Albertini (2002), in which deaf students present intellectual abilities similar to these of hearing students, in some areas reaching even better results (Bavelier 2006, Parasnis et al. 1996, Rettenbach R., Diller G., Sireteanu R. 1999), although the danger of over-generalisation of these results should be avoided. In pedagogicial literature there are also described some successful experiments of teaching a foreign language to the deaf (Domagała-Zyśk

2001, 2003, 2005, 2006, Harań, Gulati 2006, Janakova 2005, Allen 2005, Valgerdur 1999, Zabajewska 2004, Kennedy, Cohn 1992, Batyra 2004). It is worth noticing that the students presented different degrees of hearing loss and different methods of teaching were used. Taking this into consideration it may be pointed out that surdoglottodidactics[1] in general does not differ from a classical foreign language learning methodology, neither as far as the approach nor as far as the method of teaching is concerned. Moreover, the author's view is that creating a special methodology would mean creating a special "language ghetto", that is why it is advisable to try to do the opposite: foreign language learning should be treated is a tool to open the deaf peoples' minds, to give them a tool to communicate with others, to provide access to different sources of information (e.g. Internet) in order to help them feel integrated with the society.

While teaching the deaf a teacher can use the approach which he or she thinks most suitable: be it communicative approach, humanistic approach, self-directed learning approach or Total Physical Response, just to name a few most common ones (Harmer 1991). The methods of teaching (understood as a way of selection and portioning the material to be thought into didactics units and individual lessons), are also not different from these used in a regular classroom. They depend on a teacher' intuition or style of work, and are usually based on the approach chosen by a teacher. The only things which are different are the techniques of teaching, understood as the teacher's and the student's activities during a lesson. During a lesson we use textbooks and class equipment similar to these used in the classes for the hearing students. Generally the techniques used in a classroom should be modified according to the abilities and disabilities of a particular deaf child, that is why the ideal solution seem be to work with the students individually or in small groups of 3–4 people. Teaching the deaf, a teacher must know a special way of communicating with his or her deaf students, bring special prompts to make the clues for learning visible, much more often use writing as a way of communication, be careful about his or her position in a classroom, speak more clearly than usual, etc. (Domagała-Zyśk 2003a, b, c, 2005a, b, 2006a, b).

In the classroom practice with EFL deaf students the teacher must take into consideration the following issues:

- The basic thing should be to present the exact meaning of the new word precisely, which means that it should be checked whether the student know the native equivalent of it, is able to use the new word in a proper context and can operate it: construct its family, find synonyms and antonyms, explain their usage in different grammar context. A teacher should remember that a deaf student lack the possibility of spontaneous EFL

1 Surdoglottodidactics – the science of teaching a foreign language to the deaf (*surdus* (lat.) – deaf, *glottis* – language). *Surdoglottodydaktyka* was a term first used in Poland in 2001.

learning outside the classroom, so the EFL lesson provides the basic opportunity to get accustomed with new words.

- A deaf student should be also assisted in creating his/her own EFL learning strategies, like *mind mapping*, using pictures, drawings, tables, graphs, searching the Internet for new ways of using the words (comp. e.g. Lawton 2005, Sun Y., Dong Q. 2004; Sun, Dong 2004) or writing SMS in English (comp. e.g. Power, Power 2004).
- Psychological research teaches us that the deaf people find it easier to learn single items than collocations. It is helpful for the students if they are taught not how to *recite* language, but how to *operate* it. Here the question of the students' work assessment arises: language correctness cannot be the aim of its own, because in the case of the deaf students it sometimes means that the students rather use ready-made structures than produce meaningful sentences of their own, as they are afraid to make a mistake. Reading comprehension or writing exercises should be treated as an occasion to use language creatively, even if it means making mistakes.
- EFL deaf students should be provided with more classes of EFL than the hearing persons, as both explaining new material and revising it systematically takes much more time than in case of the hearing students.
- Another important issue is the motivation to learn a foreign language. Generally deaf Polish students (as majority of Polish students nowadays) have high motivation to learn a foreign language. This primary motivation might be strengthen by creating a positive emotional atmosphere during the classes. At our university, as the classes are small, very personal relationship may be established among the teacher and the students. The student feel safe and emotionally engaged and that is why EFL may be personalized and the students can ask questions like: *How old is your daughter, What is your husband's name?*, etc. and comment on their own experiences: *My brother is quite lazy, my sister works half-time*. Thanks to that the main aim of language teaching, communication, can be easily achieved.
- Our experience taught us that pronunciation should also, to some extent, be taught, on the condition that the student wants it and he/she mastered to a certain extent speech in his/her national language. It is advisable to suggest the student which words are the most important to be learnt and base the work on the students experiences from his/her speech therapy classes: in many cases they are able to work consciously on pronouncing certain phonemes and reach good results in speaking English, especially in a well-known context.

Using information technology is one of the most effective techniques, and there are a lot of possibilities to use this tool in our work with deaf students:

- In order to use it they must know something about it. We must remember that deaf students usually do not pick up information spontaneously, listening to the radio programmes, watching TV, using computer games, freely sharing information with their peers – they usually *have to be taught* each piece of knowledge we want them to possess. Because of this fact it is advisable to help them e.g. in deciphering manuals and other usage instructions. My students were e.g. very surprised after reading one of specially prepared for them text that Internet was invented in the late eighties and they definitely could not understand how was it possible for people like me to study and graduate without using it!
- Internet is a rich source of information for deaf students, it enables them to be more independent in looking for what they are interested in. During our classes we check these web sites that give interesting information about the students' favourite film stars or sportsmen and sportswomen, life stories of deaf people, facts about deaf communities around the world.
- Internet provides an excellent opportunity for improving reading and writing skills, e.g. it makes it possible to read magazines on-line. Some students systematically do it and one of them, Łukasz was lucky enough to publish his life story (in English) in an on-line magazine *On Cue*.
- Students also spend some of their free time using English web sites, as during our classes they proudly inform me that they managed to chat or exchange e-mails in English with their peers, sometimes even with native speakers, thus developing better cultural understanding and cross-cultural communication skills.
- Our favourite media, however, is still a mobile phone. It makes it possible for me and my students to be in contact practically all the time. As the groups are small (2–3 people) I ask them to inform me (in English, of course) about each smallest change in our timetable. If they feel like they are going to be some minutes late I expect them to send me an SMS. Using this way of communication they can also cancel or postpone a class (*so see you on Tuesday at 5 pm*), inform me about their sudden illness or unexpected success during exams, check whether I am all right after my flu (*Will I meet with you on English today at 4 o'clock in afternoon?*) Not mentioning Christmas or Easter greetings!
- Occasionally typical English learning computer programmes (like e.g. *Polish Your English*) are also used, but generally they are used by students at home as their extra circular work.

- Television still appears to be the most common media used by majority of deaf students. All of them admit they spend a lot of time watching TV and it is definitely their favourite pastime. Fortunately, sometimes they choose films in foreign channels so they are "forced" to watch films with subtitles in English. Some of my students told me that they spend 3–4 hours a week watching films with English subtitles – it is pretty much and perhaps bad for their general development but definitely good for their English skills.

The aim of the paper is to show the special educational needs of the deaf and hard of hearing students in the context of foreign language acquisition in mainstream settings. Analysis of the learning and teaching reality and research results calls for significant actions to be taken so as to prepare the foreign language school teachers to work with different students, also with students with hearing impairment.

1

Early Language Development of the Deaf and Its Relation to Foreign Language Learning

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The paper deals with the complicated nature of mother tongue of the deaf[1] and the impact this has on their foreign language learning. Different approaches to mother tongue acquisition will be summarized, and the influence of age and language input on the process will be explained in the context of the linguistic situation of the deaf who often grow up with two languages. The effect of an already acquired language on learning other languages will also be mentioned. Finally, the paper will relate these issues to the linguistic situation of the deaf and apply its conclusions to teaching foreign languages to the deaf.

First of all we need to define the target group in question. The term 'deaf' is not easily defined since the group it defines is far from homogeneous. It can be viewed from two perspectives – biological and cultural. In terms of linguistic research, prelingual deafness seems to be the most remarkable, and there are two basic reasons for that. First, this group can be defined fairly clearly as profoundly deaf people who were born without hearing or lost their hearing before acquiring speech[2]. Second, considerable difficulties in the development of spoken language skills have been observed in this group. Nonetheless, taking into account the impact an individual's cultural characteristics have on language acquisition, the cultural perspective should also be considered. The above stated choice complies with this requirement as well, as the prelingually deaf form the culturally most distinct group.

The first challenge in the debate about teaching languages to the deaf is terminology. The common terms used in the field of teaching are first language (mother tongue) and second (i.e. foreign)[3] language (and possibly third, fourth, etc. language). However, in the case of the deaf, another issue comes into play: the complicated question of which language can be regarded as the mother tongue

1 The authors are well aware of the terminology used by and about deaf people. For the purpose of this paper the term deaf (rather than Deaf or d/Deaf) has been used as the medical aspect and/or type of impairment is of concern here rather than the social, cultural and political view.

2 Nevertheless, even the definition of prelingual hearing impairment is subject to different opinions, which concern especially the age at which speech and language development are considered as accomplished, and the extent of hearing loss. For more details, see Procházková and Vysuček.

3 For the sake of simplicity, bilingual hearing children are not considered here.

of the deaf and which language the particular deaf individual considers as his/her mother tongue (these two points of view can differ). Opinions differ as to what is the main criterion for determining one's mother tongue (e.g. the parents' language or the first language acquired). For example, the mother tongue of most of the deaf in the Czech Republic can be either Czech or Czech Sign Language (CSL). Another topic is the difficulties in the individual languages, such as the struggle of the deaf to fully acquire Czech or the limits of vocabulary in CSL and the fact that speakers of CSL often lack metalinguistic knowledge.

The discussion about the mother tongue of the deaf cannot be seen as purely theoretical if one bears in mind the significance of a fully acquired language for the thought and perception of every individual, as emphasized, for example, by Hans-Georg Gadamer. Furthermore, the level achieved in the mother tongue influences learning other languages. Cummins (qtd. in Spencer & Marschark, 2010, 102–103) postulates the linguistic interdependence hypothesis according to which fluency and high level achieved in one language encourages the development of skills in other languages. Yet this theory is not accepted by all scholars. Mayer and Wells (1996) contend that this theory cannot be applied to the relation between a sign and a spoken language due to their different modality (i.e. visual-spatial and audio-oral).

To return to the topic of language acquisition of the deaf, they often acquire two languages – the national sign language and the spoken language of the majority society. One of them can be (more or less) viewed as the mother tongue, and the other one as the second language. At present the language of the majority society is regarded as the second language (see e.g. Vysuček 2004). Therefore, a foreign language only comes third, which should be reflected in the terminology used (ESL, EFL, ESOL). The teacher should also be aware of the interaction of the two languages acquired and its impact on learning a foreign language.

Second Language Acquisition theories should be approached with these problems in mind as well, particularly the terms language learning and language acquisition. If acquisition is understood as a subconscious process in which the individual absorbs the language input, as it happens in the process of first language acquisition, it remains an open question whether and to what extent this term can be used when talking about the deaf, as in their case the language input is significantly restricted because the main sensory channel (i.e. the auditory channel) employed in perception of spoken languages cannot be used. According to Vaněk, this restriction is one of the main factors that affect the development of skills in Czech and English as far as the Czech deaf are concerned (Vaněk, 2009, 41).

This discussion leads us to several topics that are crucial for teaching languages to the deaf. First, there is the problem of early linguistic development,

which is deeply influenced by two factors – age and intake of language input (Vaněk, 2011, 26). Besides the impact of an acquired (first) language on learning other languages, discussed above, the critical period hypothesis should also be mentioned. According to this hypothesis, the ability to acquire a language is biologically linked to age: there is a certain phase during which learning languages is easier, while later it becomes much more difficult or even impossible. In this context, it is important to bear in mind that most deaf children are born to hearing parents who have no command of sign language or are at the beginner level, which means that many deaf children do not have access to sufficient amount of comprehensible language input in the early stages of their development. As Alena Macurova argues, "Although deaf individuals born into hearing families are endowed with […] innate mental dispositions for language, at the critical stages of their development they are often left without any language at all. […] This state of an early absence of language […] inevitably projects into the ability of the deaf to learn other languages" (2005, 32). The critical period hypothesis thus seems to be especially relevant when discussing language teaching to the deaf.

Other researchers (e.g. Castro-Caldas, 1998) argue that some neurological changes occur in the brain during the critical period in one's development. They claim that learning a certain skill as a child partly determines the structure of the individual's adult brain. While not all scholars concur with the views of an irrevocable impact of early linguistic development on deaf individuals, there is a consensus that even "if the critical period theories are incorrect, early intervention is an effective way to increase the auditory experience of the deaf" (Blamey, 2003, 241). These opinions play a vital part in teaching spoken languages to the deaf.

The question of the early stage of linguistic development of the deaf entails one of the three main differences between deaf and hearing students of English (as well as other foreign languages), as listed by Vaněk (2011, 41–42). Another difference is the insufficient metalinguistic knowledge of the deaf: unlike the deaf, hearing pupils become familiar with the structures of their mother tongue, they learn to describe and analyse it and can utilize this knowledge when learning other languages. The third dissimilarity involves the different modality of sign language and the target language. Whereas sign language is visual and movement oriented, the target language is audio-oral.

All of the presented issues influence language learning and should be considered by instructors of foreign languages for the deaf. They should not be perceived as insurmountable obstacles but as special challenges that should encourage educators to adjust the methods and techniques of language teaching to the deaf in order to compensate for the extra difficulties the deaf face in language learning. It is therefore important not only to continue the debate about the linguistic situ-

ation of the deaf, but also to share the experience of teaching practice and try to find means of identifying and strengthening the advantages and minimizing the disadvantages of these specific circumstances.

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1

Preliminary Survey on the Present Issues Regarding Cinema Subtitle for Hearing-Impaired People in Japan and Future Possibilities

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1 Introduction

The presences of cinema and television are indispensable in enriching our daily lives and in supplementing cultural activities. However, with the super aging society in Japan accelerating and the number of people with various physical characteristics (such as hearing or visual impairment) on the increase, there still lacks a substantial system that allows these people to enjoy these contents that serves as one of the ways of enriching their daily lives. Until now, film directors and producers, subtitle creators, audio descriptors, people with disabilities, welfare participants, and the authours have come together to discuss research and issues regarding concerning how cinemas should be presented so anyone can enjoy them with or without disabilities. In the process of that, it became clear that subtitling for hearing-impaired people is insufficient in that, domestic films usually do not come with subtitle data as in the case of foreign films in Japan and when it comes to animations even lip-reading becomes useless, resulting thus in the still high barrier that prevents hearing-impaired people from enjoying cinemas.

With an aim to reexamine cinema subtitling for hearing-impaired people in Japan used until now, a questionnaire survey was conducted under this study at a film festival showcasing subtitles created by film producers, with people both with and without hearing disabilities as survey subjects.

2 Methodology

Prior to the survey, hearing-impaired people, film directors and producers, and subtitle creators were interviewed about their views on the creation of subtitles for Japanese films. From the interviews we were able to confirm the following 5 elements pertaining to the overall picture of cinema subtitling for hearing-impaired people:

1. the amount of subtitles in one scene or throughout the entire film;
2. the method of indicating who is speaking the subtitled script;
3. subtitles that explain the voice tone and accent of the spoken script;

4. subtitles that explain environmental sounds or sound effects;
5. subtitles that explain the music being played.

Based on the above 5 elements the questionnaire was then created. There were 11 Japanese and South Korean films shown at the festival (5 film drams, 1 anime, and 5 documentaries), and the questionnaire was answered by 17 hearing-impaired people and 170 hearing people.

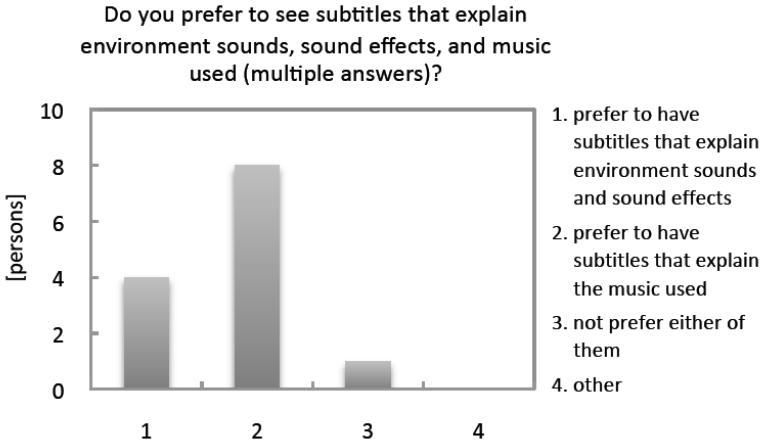
3 Results and Examination

As an example of the survey results, Figure 1 shows the answers given by hearing-impaired people in response to the question "Do you prefer to see subtitles that explain environment sounds, sound effects, and music used (multiple answers)?" While comments like "There is no need to explain the music as I can't hear it" were often given during past surveys, results of the survey conducted this time showed that a certain number of hearing-impaired people prefer to have subtitles that explain the music used. From this and from the results obtained for the question "What kind of information concerning music would you like to have subtitled?" it was revealed that most respondents requested for the subtitling of song lyrics. On the other hand, the results obtained from the responses by hearing people show that almost half of people (64 out of 137 (48 %)) respondents answering "Sometimes" or "Often" to the question "Do you ever find voices in films in daily life hard to catch?" Furthermore, responses given by the highest number of people concerning such specific aspects were "It's hard to hear what is being said because the background music is too loud", or answers to the "Other" section like "The actors' voices are not loud enough" and "The people speaking don't speak clearly". Furthermore, as shown in Figure 2, in response to the question "Are there any scenes where you find subtitles useful in the films watched this time?" 75 out of 95 (79 %) people who provided valid answers said either "Several times" or "More than 10 times".

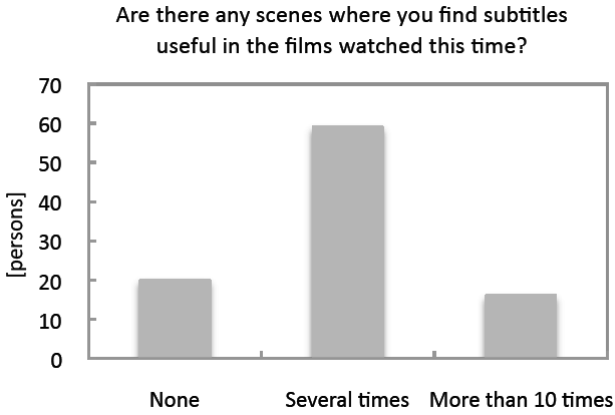
4 Summary

Under this current study an in-depth questionnaire survey was conducted on the content of subtitling with direct involvement by film directors and producers in subtitle creation. The results of the survey allowed us to grasp some of the specific elements required in subtitling or the needs of hearing-impaired people when it comes to the text representation of environment sounds, sound effects, or music that have hitherto been insufficiently described in Japanese films. Meanwhile, the survey results also suggest the possible advantages of subtitling, such as in helping not only deaf or hearing-impaired people and people suffering from medium or severe haring disabilities who hold a disability certificate, but also young to

senior people who are beginning to experience deterioration in their hearing understand information that is hard to catch by ear (such as the spoken script). From these, the following possibilities and issues of subtitling as a universal method in Japan's progressing super-aging society were obtained.



[Fig. 1] Results obtained from the responses by hearing-impaired people.



[Fig. 2] Results obtained from the responses by hearing people.

Integrated and Innovative Solutions to support Deaf Students during Class Attendance

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Motivation

The main idea of the innovative solution, named PoliLips, arose during conversations with deaf students, at the MultiChancePoliTeam (the service for students with disability at Politecnico di Milano). Students reported a strong difficulty in class attendance (and their scores, got at the end of courses, confirmed the problem).

Considering that students did not require the Sign Language Translation, we initially tried to adopt only an Automatic Speech Recognition (ASR) system for on-the-fly transcription of the teacher's voice, but we did not get reliable results. In particular, accuracy was deeply affected by the terminology adopted by the teacher; in fact, whenever the teacher used a highly specific technical lexicon during classes, the recognition accuracy decreased; this is the case, for example, of scientific- and technological-related courses, which often mix Italian and English words, and force teachers to make use of a very specific technical speech.

Several deaf students reported that lipreading was their preferred compensation mechanism, sometimes mixed with aural information even if, during classes, several factors affects lipreading effectiveness. Some words are inherently hard to lip-read; some people can be particularly hard to understand (especially who talks very fast, or mumbles, or covers the mouth when speaking); or, finally, the position of the speaker can prevent good observation of the facial movements.

Main Idea and Contribution

None of the aforementioned compensation mechanism provided an effective solution to the problem; thus, our idea was to mix the three information modalities we can collect from the teacher – visual (lipreading), aural, and textual (generated by an ASR) – in a single, integrated solution. In doing so our goal was twofold: first, we argued that each modality could have compensated for errors present in or induced by the others (for example, if the ASR had failed to transcribe a word, the student could have used lipreading to correct the error and understand the correct word); second, the resulting system could have been able to handle different degrees of hearing loss, and students' preferences in compensation mechanisms. The device could have been particularly useful for students with severe hearing impairment, where no aural information is perceived.

PoliLips captures, and sends to students' laptops via wired or wireless network, an aural/visual/textual stream composed of a video of the teacher's face, her/his voice, and a textual transcription performed by an ASR. The device is simple and relatively cheap to build and deploy. Moreover, PoliLips facilitates class attendance when the student cannot see the teacher's face (for example, whenever the teacher writes on the blackboard) or the teacher is too far, or she/he not in front of the student. Finally, PoliLips allows students to remotely attend classes, as the aural/visual/textual stream can be sent over the Internet. Of course, the device could prove useful not only in university classrooms, but in whatever context where a speaker talks to a large audience, and network connections are available.

Supporting Deaf Students

Several aids can support deaf students during classes. Voice recorders – coupled with ASR, for off-line voice transcription – are often used. This solution, however, is conditioned by the accuracy of the ASR, which is often sub-optimal. Magnetic induction loops can be used with students that wear a compatible cochlear implant, but are expensive to deploy (small, portable magnetic induction loops exist, but work well for very small audiences). Subtitling services – based on human experts in captioning – are often too expensive. Sign-language interpreters are also expensive and usually not required by deaf students (in our university, the office for students with disabilities didn't ever receive any request for sign-language interpreters in more than 10 years). PoliLips tries to address these issues, providing a simple and cheap, yet effective, solution.

The PoliLips solution

PoliLips is a hardware/software solution: the teacher wears a hardware device, while specific software applications are installed on teacher's and students' laptops. We designed and built the hardware, relying on off-the-shelf components, and developed the applications. ASR functionalities were provided by a commercial application.

The PoliLips hardware consists of a wearable device and a base station. The wearable device is composed of a tiny video camera, coupled with a high-quality, noise-cancelling microphone, and a transmitter unit. The weight of the camera/microphone mounting was 127 grams, and proved to be light and stable enough for the teacher to wear the device without any particular problem. Audio and video signals enter the transmitter unit, composed of two elements: a video transmitter and a high-quality audio transmitter, both powered by battery packs.

The critical components of the wearable device turned out to be the microphone and the audio transmitter. In fact, the cheap camera and video transmitter we used proved to be good enough for our goals; the lesson we learnt is that, once a decent resolution, frame rate, and signal/noise ratio are provided, increasing these specifications does not affect the lipreading ability of the person.

Conversely, the audio signal must be as clear as possible, in order for the ASR to properly generate the text. The cheap microphone (without noise cancellation) and transmitter we tested in our first prototype proved to be almost useless; switching to professional high-quality microphone and transmitter solved the problem.

The base station is composed of three elements: a video acquisition box and a high-quality audio receiver. The video acquisition box, which contains a video receiver and a video capture device, digitizes the video signal and provides a stream through a USB connector.

The video acquisition box and the audio receiver are connected to the teacher's laptop, where the ASR and the PoliLips server software are installed.

The PoliLips software is composed of two parts: server and client. The server is installed on the teacher's laptop (along with the ASR), while the client is installed on students' laptops; they communicate by means of a wired or wireless network.

The PoliLips server acquires the digital video stream and the audio, combining them in an audio/video digital stream; audio also comes to the ASR, which generates the text. Finally, the PoliLips server waits for connections from clients and, once a connection has been established, sends the visual/aural/textual stream. The PoliLips server application also provides a preview of the visual/textual stream (so that the teacher can check whether the camera is well positioned and the ASR is working fine).

In order to save money, we chose not to integrate the ASR into the PoliLips server (as the ASR Software Development Kit is quite expensive); instead, we used the regular, desktop ASR application, integrating it with the PoliLips server in a naive but effective way: the user interface of the PoliLips server application contains a text field where the teacher must click (giving it the "focus" of the user interface) before starting the ASR; then, simply relying on the dictation ability of the ASR, the generated text enters such a text field and is captured by the application engine, which adds newly inserted words to the stream.

The PoliLips client, once connected to the server, displays the aural/visual/textual stream.

Conclusions and Future Work

1

The PoliLips prototype – hardware and software – is ready to be tested with all the deaf students at Politecnico di Milano. Preliminary tests have been carried out, and results are encouraging. A controlled experiment is planned to gather quantitative measures about the effectiveness of the system. We plan to add new functionalities to PoliLips; in particular, the ability to save the aural/visual/textual stream on the student's laptop; integration with our note-taking application PoliNotes; and automatic compensation of the "barrel distortion" caused by the camera lens.

Section 2

Universal Design of the Documents Including Accessible Graphics in Tertiary Education

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The section focuses on:

- *Standards for digital documents intended for tactile or auditory perception, hybrid documents and the Digital Talking Book.*
- *Digital documents intended for reproduction of tactile, audio or visual documents, hybrid documents and DAISY.*
- *HTML, XML, MathML standards and digital tools for handling mathematical, physical, chemical and other symbolic notations via tactile or audio outputs.*
- *IT literacy of persons with special needs, its standardization for individual impairment categories and academic public's awareness of the specifics of such literacy.*

BiBiKit – A Bilingual Bimodal Reading and Writing Tool for Sign Language Users

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Deaf education as well as any form of training that rotates around sign language is facing a huge challenge today as so many European countries and US states are going towards drastic cuts in social infrastructures. At the same time all educational institutions – be they schools or universities – stress the importance and the advantages of 'globalization' and promote, at least in discourse 'global awareness' for their students. It is essential to work on ways to preserve deaf education, interpeter training and sign language training even in the face of this crisis.The great advances in technology provide us with the most important tools we can use to rise to this challenge.

The Bibikit software – to be completed at the end of 2012 – will permit training of different kinds to happen even in situations when instruction hours are being severely diminished (possibly even in-between countries) thus bypassing the tremendous cuts which we are witnessing. Indeed it will also be an exceptionally useful, practical and very inexpensive tool for accessibility projects in public spaces such as museums. Though it is born specifically to function as a tool in sign language contexts, it also has massive unexplored potential for other kinds of instruction that benefit on the use of visuals.

Having first researched what was on the market in terms of text and video linking software, the Bibikit team is working towards creating a software which can be friendly, flexible and extremely stable.

In the BiBiKit project, an easy to use authoring kit is being developed, that enables students, teachers, and everyone to write and read bilingual bimodal texts: Electronic productions, which link text to sign language video. The main purpose of the project is to develop software that enables the user to link text to video, at the word, phrase and/or sentence level. The software will be developed for sign language and vice versa users, but can be used to easily link text to any video: e.g. to add annotations, captions, or navigation points. The three priorities are: Software that is stable, easy to use, and foolproof so that it may be used in a variety of contexts and by a very wide variety of users.

BiBiKit is a European project that was made possible with the support of the Lifelong Learning Programme (KA3) of the European Union. It is a 2 year project, the starting date was January 2011. In the first year, the software will be developed. In the second year, the software will be tested by using it in different

contexts. In the BiBiKit consortium, 6 organizations from 6 EU countries work together. To involve more future BiBiKit users, colleagues and members of other EU consortia will be asked for their help. They are called 'associated partners'. Each organization has 4 associated partners from an EU country. Associated partners are very important because they help to develop the software. BiBiKit will be validated in over 30 educational settings in 14 countries, by deaf and hearing writers and readers.

The BiBiKit community website will have a web shop, a user forum and up- and download facilities. An international BiBiKit conference will be organized at the end of the project, as a launching pad for further and wider cooperation in this field.

About the software

The target group for BiBiKit is very diverse. Users can be 8 years old or 88 years old. Users can be children, parents, teachers, LIS and interpreting students, researchers, publishers. The wishes of these users are very diverse, too. They go from 'very easy, basic functionalities only' to 'very flexible, as many functionalities as possible'. For instance: Basic users want one text window, one video window, and an easy way to link text to video. Interterpreter trainers want to be able to film their students and use both video, audio and writing components – interactively. Researchers want more text windows, more video windows, and the option to link video to video, to link to sign libraries, maybe even to use SignWriting or HamNoSys. The Bibikit team has started from the basics: words or sentences in the text can be linked to sequences (parts) in the video. The video can be a translation of the text signed by the author, signed by a sign language interpreter or teacher, or even imported video of a signing 'avatar'. Documents can be saved in various formats. Readers can read text and click on a word or sentence to see the linked video. User requirements and software specifications will be written in cooperation with 25 associated partners from 14 EU countries. Each partner will focus on the user needs of a specific target group/educational context: Deaf children, deaf students in higher education, sign language interpreter students, sign language teachers, formal and informal adult learning, e-learning.

As said before, for BiBiKit the first priorities are:

- Stable: The software should not crash, and should work 2 or even 5 years from now.
- Easy to use: Children should be able to use the software, but also their grandparents. Users can use BiBiKit right away, they do not have to go to a training course first, or read a thick manual.
- Foolproof: Even when you make a mistake (you click on the wrong but-

ton, or you forget to click on a button), the programme should not crash, you should not lose your work. When you make a mistake, you should always be able correct it.

The BiBiKit Consortium

Main contractor and software development:

- Møller-Trøndelag kompetansesenter, Trondheim (NO)

Co-ordinator:

- Pragma, Hoensbroek (NL)

Partners:

- Hochschule HS MD-SDL-Stendal (DE)
- Siena School for Liberal Arts (IT)
- The Communication Centre for The Deaf and Hard of Hearing (IS)
- Department of Education and Social Science, University of Central Lancashire (UK)

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ILEX: http://www.sign-lang.uni-hamburg.de/ilex/.

Link-it: http://www.spsm.se/Startpage/Educational-materials/Deaf-and-Hard-of- Hearing/Products/Link-it/.

SignLink Studio 2.0: http://www.signlinkstudio.com/.

SignSmith: http://www.shh.is/FileLib/skjalasafn/Guidelines_for_teachers_Oct_2003.pdf.

SignStream: http://www.bu.edu/asllrp/signstream/index.html.

SignWriting: http://www.signwriting.org/.

TegnBehandler: http://www.acm.no/tegnbehandler/.

Tegnspiller: http://www.acm.no/materiell/support/tegnspiller/tegnspiller_lesmeg.htm.

VideoText.web: http://www.oegsbarrierefrei.at/.

The Hybrid Book – One Document for All in the Latest Development

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2

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Introduction

Hybrid Book is a document format which was created at Masaryk University and has been used by students of the University since 2002. It has been further developed and improved. It was originally an digital text synchronized with an audio recording and navigable through its hierarchical structure, primarily intended for visually impaired students. Over the last ten years, the Hybrid Book has developed into a mature document format enabling an undistorted access to information to students and other users with various disabilities – visual or hearing impairment, learning disorders and so on.

Development

The original text/audio data setup has been extended to the triad text/video/audio. This made it possible primarily to add a translation into sign language to an original text content (besides the mentioned audio recording). The extension by video data offers further applications. The designed data structure is moreover capable of synchronizing thus distinguished types of records and it allows to connect any type of record in any stage of document processing, not just during the creation process – the Hybrid Book viewer (available at http://www.teiresias.muni.cz/hybridbook), for example, allows to insert user commentaries directly into published documents.

Another innovation is an extended navigation in tabular data similar to that offered by a majority of screenreaders. Inclusion of further structures into synchronizing capacities of the Hybrid Book is planned – mathematical expressions, development diagrams, schemes, formulas, etc.

Principles

The descriptive structure is designed so that it allows synchronization of records of various types based on "synchronization points" only, i.e. if it is possible to describe a given record with a succession of points (e.g., timestamps in an AV recording), it is then also possible to add this record to a Hybrid Book document. It is also possible to add static records (such as images and graphs) in the form of links.

Individual records are bound in the Hybrid Book by an external description. Records as such are not altered. Thus, it is possible to add content to the document from any storage. Any type of record may be added mostly without a need of any special modification. A record or document which is being added must have the above mentioned properties: synchronization points must be applicable to the record/document. The HTML format may serve as an example. It is used in the Hybrid Book for storing text – for example, attributes such as ID or NAME may be used to mark individual synchronization points.

There are two ways to navigate in the Hybrid Book:

1. "linear" navigation, i.e. moving forward/backward by individual synchronization points;
2. "structured" navigation, i.e. by the hierarchical (tree) structure of the document.

It depends on the equipment of a particular browser which navigation steps will be at the user's disposal; most often, navigation by adjacent synchronization points and by chapter titles is used.

Reading the Hybrid Book

It is evident at first sight that individual types of records of the document content (text, image, sound) are equal and each of them represents an information channel. It is nevertheless possible to freely switch between these records or follow them simultaneously and thus take advantage of further properties of such arrangement: to comprise the final form of information from multiple sources. It is precisely this technique that we call "hybrid reading". It was the original aim of the Hybrid Book creators to offer this type of access to information. It is not our aim to create documents aimed directly at a particular user with all his/her needs and requirements; we are creating a virtual document described by a physical structure which enables the reader to choose his/her own access to it and the method of receiving offered information. For this goal, it is naturally necessary to provide them with a platform where they could read documents created in this way. This makes another part of our work. It is possible to find our results for example at the web site: http://www.teiresias.muni.cz/hybridbook, which offers further information about the project and the latest version of the Hybrid Book viewer with a set of sample documents.

Prospects and Outlooks

The Hybrid Book is presently run in the WWW environment and the above mentioned innovations are continuously being implemented into the system. There is an elaborate synchronization structure currently built exclusively on

XML format behind the documents, designed so that it allows simple addition of new elements, primarily of types of information media according to the current needs of creators and readers. The Hybrid Book of the third generation is browser independent – it is an open format allowing anyone to create a personalized specialized viewer of this document type.

2

Providing Digital Resources to Enhance Employability Skills for Disabled Students

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Introduction

In 2011, the employment rate of disabled people in the United Kingdom was 48.8 per cent, compared with 77.5 per cent of non-disabled people [1]. The rate for disabled adult employees has been rising consistently in the last 10 years and there is still a significant discrepancy compared to those without a disability. In addition youth unemployment at around 20 % [2], and one of the main indicators generated by the financial crisis in Western Economies, is of increasing concern.

The CBI's (Confederation of British Industry) Education and Skills survey in 2011 highlights the concerns of Employers in relation to the low level of numeracy, literacy and employability skills of many school and college leavers [3]. Although many of the skills as set out by the CBI are not those that can be addressed with traditional digital resources there are many technological solutions which can enhance and promote their use. For example, an individual's time and self management can be significantly improved by the use of scheduling applications.

In 2011 JISC TechDis were commissioned by the Department of Business Innovation and Skills to provide a range of resources to improve the employability skills of adults with disabilities and or difficulties. Employability Skills are recognised as "an essential precondition for the effective development and use of other, more specialist or technical skills required for particular jobs. And they are a key underpin to [your] effectiveness at work" [4]. To this end, the TechDis Toolbox was developed to hold a collection of digital resources aimed at improving the skills of adults with disabilities in order to increase their employability.

Existing Resources

JISC TechDis have a history of providing simple easy to use resources which focus on the need for teachers and tutors to be able to provide accessible teaching materials for their students. The most successful of these were 'Benevolent Bill – What Microsoft does for Accessibility' [5] and the 'Accessibility Essentials' Series [6]. The crucial factor in success of these resources is their highlighting of how everyday office applications such as Microsoft® Word and PowerPoint can be used to create accessible teaching material which can benefit all students.

All the JISC TechDis resources have so far been purposed with the tutor or lecturer in mind. They were written for academic staff using academic or more formal language.

Digital shorts

The advent of YouTube in 2005 transformed the way in which many young people access information as it allowed users to upload their own content. Much of this is of limited value and of an individual nature, but there is also a wealth of information on any given topic. Although it is possible to upload videos longer than 15 minutes the majority of the videos are short – less than 10 minutes long [7]. The statistics for the site are unprecedented – 48 hours of video are uploaded every minute and there is more video uploaded in 30 days than the 3 major US TV channels produced in 60 years [8].

In 2007 Michael Wesch produced a short video on 'A Vision of Students today' [9] in conjunction with his 'Introduction to Cultural Anthropology' class in 2007. He was aware that although the students attended his lectures, their attention was not completely on him and the information he was imparting [10]. The video highlights the anomalies between traditional academic practice and the way in which these students behaved. The video was viewed over a million times in the first month [11]. It highlighted that although the surveyed students would read 8 books in that year and write up to 42 pages for their class, they would also write 500 emails and view over 2300 web pages and 1281 Facebook profiles.

The increasing popularity of the microblogging site Twitter also shows the astonishing ability of the internet to disseminate information. Although only sending messages of 140 characters in length the site can spread news in a way previously unthinkable. In January 2009 when an aircraft crashed into the Hudson River in New York the news and images were spread by twitter users with the world's media desperately trying to catch up [12].

With this knowledge in mind we started to plan the sort of resources that would be of use and interest to the current 'digital consumers'. Our target audience for these resources were students with disabilities who would possibly rely even more on digital content than others to meet their access and inclusion needs. We therefore had to produce resources that were focussed, simple, short and linked. A crucial aspect of the project was the involvement of disabled students themselves in both using and commenting on the resources and disseminating them with their peers.

Student Centred

The first part of the process involved speaking to adults and young people about how they used technology. We conducted a number of short focus groups with disabled students in a number of different settings. These ranged from special schools, independent specialist provision for young adults, mainstream colleges and students from Higher Education with diverse needs.

In general the results showed that although most of the students used technology with the college or classroom situation, the technology itself was limited and usually dated. One group of 16 year old boys with learning difficulties and/or disabilities explained how the teacher had to be helped to use the virtual learning environment. They also talked about how they used their games consoles at home and had an informal network of friends and enthusiasts who helped each other out if they got stuck in a particular game. They were adept at manipulating these consoles and had received no formal training or instruction. They also had essentially developed their own online community where they shared music, videos and things they found interesting on the internet.

Developing the resources

It was vital to ensure that any resources created would be relevant to students and would directly influence their Employability Skills. An analysis of our existing materials identified gaps that required further resources. These included updates to Accessibility Essentials to encompass both Word 2010 and the Windows 7 built in accessibility features; the extensive accessibility feautures in both the Mac OS X (Mac operating systems) and the iphone/iPad operating system iOS; and basic information literacy.

JISC TechDis commissioned consultants with experience of teaching, an understanding of pedagogy and knowledge of the existing TechDis materials to produce the Toolbox resources. Although the production of the resources was done by external consultants there was a clear work flow for their development. Agreement on the language to be used, and approval of scripts for audio and video files, had to be given before any resources were created and this prevented unnecessary and time consuming editing of multimedia. Resources were created in the format deemed to be of most use to the users (an audio file, video file, step-by-step guide or a combination of these). Video and audio files were required to be less than 3 minutes in length and have little or no technical jargon.

Phase one resources

- Getting to know Google – 9 videos starting from absolute basics
- Mac OSX accessibility
- iOS
- Windows 7
- Windows XP
- Word 2010
- Reading PDF documents on screen

Phase 2 resources

- Self Management
  - Email
  - Calendar
- Planning
- Team working
- Free and Open Source Software
- Freemium Services
- iLife

Feedback

Once the resources were being produced we recruited further young people and adults to act as reviewers. These were in three distinct groups.

Digital Outreach Trainers

A European funded project in South Yorkshire supports a number of young people in further education to become Digital Outreach Trainers (DOTs) [13]. The project enables students in further Education to share their expertise using computers with friends, relatives and colleagues who may be reluctant or unable to get online. This is to further the Race Online 2012 agenda [14]. There are currently over 400 DOTs. The students complete a portfolio to show how they have supported or helped those previously without connectivity to engage with and use the Internet in a productive and useful way. JISC TechDis are working with this group of DOTs to encourage them to use the Toolbox resources. They have been used in ways in which we hadn't anticipated, for example, to help refugees in learning English as well as ICT skills with a basic series of videos on 'Getting to Know Google'. Other DOTs have used the resources to encourage siblings with disabilities to engage with Internet resources in a way which is meaningful for them.

Feedback from the DOTs has resulted in additional material being commissioned. They explained that a lot of the people they were working with did not have the most up-to-date hardware so would not have access to Windows 7 for example. As a result of this we commissioned accessibility guidelines for users of the Windows XP operating system. Despite our showcasing the options for reading word documents and PDF files on screen these videos remain the most popular with all our testers.

Ambassadors

TechDis have recruited a number of students from many educational backgrounds. These have varied from independent provision, work based learning providers, mainstream FE colleges and Higher Education. They have trialled some of the resources that were relevant to them and provided feedback. High quality videos to capture this feedback as case studies have been commissioned to further promote the Toolbox resources.

InBook

A secure social network tool has been developed with two Independent Specialist Colleges and a mainstream FE college in the North West of England [15]. This has been developed to promote good e-safety practice and to enable students with learning difficulties and/or more complex needs to be able to share their experiences and rich digital content. The system has been piloted with students aged between 18 and 24 in the three colleges and is proving to be very popular. The students have been asked to comment on the Toolbox resources and share those that they find useful with each other. This feedback process will begin in January 2012.

Hosting

The toolbox project resources will be hosted on a microsite of the main JISC TechDis site. http://tbx.jisctechdis.ac.uk. The materials will be available as standalone resources, but also will be linked in an easy to access format where appropriate. For example the Word 2010 videos on creating accessible documents work in conjunction with each other and the user will be able to easily browse from one to another. The site will also have each of the resources in context allowing the user to find the right resource for the information they need.

Dissemination

All the users mentioned in the previous section use various tools on the internet for communicating and sharing information. We will encourage them to share the toolbox resources using their own preferred methods which will include, twitter, facebook, Webdoc and possibly Pinterest.

Future work

Work done so far on the Toolbox project is only a start with further resources planned. These will include further resources on problem solving, information literacy and a section on Apps for accessibility. We anticipate that the communi-

ties fostered as part of phase 1 and 2 of the project will develop and continue to act as reviewing and steering process. The feedback we have received from them has been practical and relevant. They are our main audience and focus.

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On Producing Accessible Course Material

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In this contribution we describe briefly what accessible documents are, which ones are needed with respect to the type of reading/writing impairment of the final user and how they can be produced. The two major production paths nowadays are: (1) the use and conversion of existing electronic documents and (2) alternatively, scanning of existing paper documents.

In the latter case all of the structural content as well as tables, mathematical formulae, complex layout etc. generally is lost making it very difficult to use them as course material. In practice (examples given below) scanning is only to be used as a last resort or when immediate availability is requested.

1 Introduction

In many educational situations, PDF (sometimes PowerPoint) is seen as the major distribution format for electronic course material. However not all students can access and handle such documents. This group of reading/writing impaired students consists of persons with a visual impairment, blindness, dyslexia or a motor handicap that does not permit the manipulation of printed material.

To these categories of students (and staff members) other types of documents have to be made available. This is required not only by national and European law, but also by the United Nations Convention on the Rights of persons with disabilities [article 4, paragraphs (f) & (g)][1].

2 How many types of accessible documents are in use?

A short overview of the major types (together with some positive ▲ and negative ▼ comments) follows:

- **Pure text files**
  - ▲ easy to produce, universally readable on all platforms
  - ▼ no structure for navigation, systematic reading not possible, symbols and most foreign characters wrongly displayed
- **Microsoft Word files (DOC)/OpenOffice.org (ODF) files**
  - ▲ are generally usable on most platforms, also for blind students, but care should be taken to maintain structure. Guidelines for accessible

1 http://www.un.org/disabilities/default.asp?id=264adfa.

MS Word files do exist[2]. This format is preferred by blind students in Flanders also because software for handling for mathematical formulae is available (SensoMath).
- ▼ complex tables and pictures need alt-text encoding

- **HTML**
  HTML files (i.e. web pages) are almost as usable as word processing files. A huge literature does exist on producing accessible web documents and sites[3]. Mathematics can be included if MathML is used.

- **LaTeX**
  Latex files are basically text files, not meant for human reading due to the extensive number of codes put in between the text parts; however, Latex is sometimes used to represent linearized mathematical formulae.
  - ▲ is produced mainly by academic staff; good source format for large print production (as it is a word processing format)
  - ▼ internal format is much too complex for human reading of mainly text based documents

- **PDF**
  - ▲ generally readable and usable if tagged PDF is used (this is NOT standard if a document is produced by scanning/OCR)
  - ▼ editing and adding notes is complex (and/or expensive), not directly usable for students with dyslexia

Note: authors need to know which PDF export options are to be checked in order to export into tagged PDF from Microsoft Office or OpenOffice.org. There are no tools that export LaTeX to tagged PDF.

- **KES (Kurzweil) and enriched PDF (Sprint)**
  These formats are generally used by students with dyslexia. They are based on PDF but post-processing is necessary to get logical spoken output after-wards (cf. ADIBIB project below).
  - ▲ very easy to handle in the appropriate reading software. K.U.Leuven is equipped with sufficient licences of both programmes
  - ▼ two different reading suites are widely used in Flanders.

Editing the documents or adding student's notes is complex.

2 http://www.kuleuven.be/digitaletoegankelijkheid/documenttoegankelijkheid/inleiding-documenttoegankelijkheid.

3 See for example the K.U.Leuven guidelines at http://www.kuleuven.be/digitaletoegankelijkheid/webtoegankelijkheid/inleiding and a selection of other guidelines at http://www.kuleuven.be/digitaletoegankelijkheid/links/links/richtlijnenweb.

3 Production paths for accessible documents

3.1 Common path

Basically there are two major starting points for the production of accessible documents.

a) The use of existing electronic files. However in most cases some manual intervention or conversion will be needed (cf. above)
b) Scanning the paper documents and applying OCR to produce text containing files. Is the most rapid approach, but only admissible for simple text documents

Retyping texts (e.g. those with a very complex layout) is still necessary in some cases. This is clearly the most expensive way.

3.2 Specific paths

As stated above in most circumstances an extra conversion of source documents will be needed to come to a really accessible document. The number of approaches is huge and ranges from simple (e.g. RTF output of a .doc or .docx document) to very complex (Latex to correct mathematical braille e.g.). Describing all procedures is out of the scope of this contribution, but below a few approaches (focussing on students with a visual impairment & students with dyslexia) are detailed.

4 Approaches

4.1 K.U.Leuven

In the K.U.Leuven Digital Accessibility Support group for students, both scanning and source document conversion (requiring agreements with publishers) have been used in parallel. For Braille production, sometimes retyping is necessary. Several groups were involved in these processes.

From 2012 onwards a new organisational structure will be implemented.

Type of disability / Type of material	Course material (created by lecturer)	Book (printed by publisher)	Reader of printed articles and/or book chapters provided by lecturer
Visual impairment (esp. blind)	Accessible digital version should be provided; ideally in word processor format (e.g. Word or OpenOffice.org), which can be converted to Braille, large print or synthetic speech (daisy).	Accessible digital ver-sion should be pro-vided; ideally in word processor format (e.g. Word or OpenOf-fice.org), but usually only (poorly accessi-ble) PDF is available. PDF is not supported by all screen readers (for blind students). Converting poorly accessible (untagged) PDF to Microsoft Word leads to very low-quality Word doc-uments. For this reason, PDF documents are often converted to plain text files (TXT), with one file per chapter.	If the materials are not available in a digital for-mat, making these materials accessible is a very time-consuming and expensive proc-ess: OCR, add-ing heading structure, recre-ating logical reading struc-ture and tables, adding alt text to images, re-moving repeat-ing headers and footers, reposi-tioning foot-notes… This is typically done by specialised conversion centres, on special request by the student.

Type of disability / Type of material	Course material (created by lecturer)	Book (printed by publisher)	Reader of printed articles and/or book chapters provided by lecturer
Dyslexia	Accessible digital version should be provided; ideally in word processor format (e.g. Word or OpenOffice.org), but accessible (i.e. tagged) PDF is also acceptable. Software such as Kurzweil can work with PDF (e.g. read it aloud).	Digital version is re-quested from publisher; this is usually PDF. Nowadays also tagged PDF is possible (if Adobe InDesign is used properly when layouting a book).	Scanning and OCR are the most minimal requirements. These electronic versions have to be converted into KES or Sprint (e.g. using ADIBib software, cf. below)

4.2 ADIBib (Belgium)

The ADIBib consortium was created a couple of years ago in order to provide accessible electronic documents for primary and secondary school use in Flanders. Thanks to their collaboration with the Vlaamse Wetenschappelijke Uitgeversgroep (and support by the Ministry of Education), they can get the electronic versions of the schoolbooks (PDF, possibly Adobe Indesign) from the publishers, often even within a couple of days.

ADIBib's primary focus is on students with dyslexia, but they are expanding their support to all other reading and writing impairments. ADIBib caters for two types of conversions (scanning is NOT used anymore):

- **type A**: unprocessed PDF (mainly for large print or if type B does not exist yet)
- **type B**: processed PDF (tagged PDF, Kurzweil format, Sprint format)
  ADIBib has obtained a specially developed conversion tool (PDF editing software – from Jabbla company) to produce these formats, but manual inter-vention remains necessary for correcting structural scanning errors (facilities for doing so are built into the conversion tool). Social watermarking is used for (moderate strength) copyright protection

ADIBib is a not-for-profit organisation funded by the Flemish Ministry of Education. Conversions are mainly done by volunteers (parents, school teachers...). More on ADIBib can be found in their recent presentation at the AEGIS 2011 conference[4].

4.3 Danish central office for Educational material (DK)

They produce accessible documents for the whole Danish educational system and currently have 14000 books on file. Scanning/OCR is only used for urgent requests where students are willing to adapt the output themselves. Only two weeks can be gained from scanning as this is the time span needed to collect books from the pub-lishers and have them turned into truly accessible books[5].

4.4 ADOD project (International)

Recently the Inclusive Design Research Centre (IDRC) in Toronto has started an information collection project on the use, usability and accessibility of Office type documents. A large web database[6] has been created. For the moment most of the info is in English but some of it is also available in Dutch. More details about this project in their AEGIS2011 slide presentation[7]. This presentation also details their "12-General Techniques" for accessible document creation and also pays attention to cloud based Office documents.

5 Acknowledgements

This work was partially funded by KU Leuven's Support funds (AMF).

4 http://www.slideshare.net/aegisproject/20-adibib-aegis-paper.

5 source: discussion at Aegis conference Dec. 1, 2011.

6 http://inclusivedesign.ca/accessible-office-documents.

7 http://www.slideshare.net/aegisproject/28-accessible-digital-office-document-adod-project.

LATEX Based Notation as Computer Math Notation for Blind

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The agreement about the uniform computer mathematical notation for blind at Slovenian schools was made in 2006.

For accomplishing this goal a project group was founded. It brought together experts from The Institute for blind and visually impaired children Ljubljana and The Slovenian association of blind and visually impaired. The agenda of the project group was to find a way to allow blind learners and students to access mathematical expressions of all kind by computer.

As the most appropriate linear notation Latex was chosen. Latex is a document description language commonly used especially by the Internet community. The system provides a powerful set of instructions to describe mathematical expressions.

Before the introduction of the computer math notation into schools some adjustments were made.

It was necessary to define some missing characters in the 8-dot code table used by screen readers. The changes were essential only for mathematical notation.

For practical use some simplifications and deviations from Latex syntax were applied. Latex based math notation is therefore designed for all blind learners and students, for all levels of education. In Latex there is possible to create mathematical expressions in several different ways. In order to make the learning easier, as well as for the external exams, it is very important to define one variety all learners and teachers should know.

Some commands in Latex are very long and therefore unsuitable for Braille display. Some are too complex for learners in primary schools. In such cases, the learners and teachers should know and use the simplification, which can partly deviate from Latex syntax. Off course it is all right for learner to follow the correct Latex syntax.

The writing rules simplify the reading on Braille display. They are almost the same as the rules for the 6-dot Braille math notation used with typewriters. The rules ensure the exercises, tests and exams are written the same way regardless of the teacher.

MS Word is commonly used as Latex editor. Macros can speed up writing the math expressions. It is possible to write fractions, roots… quite fast with keyboard shortcuts. There is no need to translate and print expressions in a high

quality layout although there is an option for those who are able to use it.

Teachers write math exercises and tests in text editor that is well known to learners. Only Latex commands for math expressions are used and no formatting ones. From this point on teachers can always upgrade the file with formatting commands for the sighted learners.

For those learners who are using 6-dot math notation with Braille typewriter the transition to Latex based notation takes individual approach. The transition process can not be same for all. Learners get support from specialist teacher and from their teacher of mathematics as well.

At the beginning of practicing Latex based notation at Slovenian schools not all blind learners and students have used it. After six years Braille typewriters with 6-dot math notation are used only during first three years of elementary school or for those learners who are not able to use assistive technology. Not only for Braille users, Latex based math notation is suitably for some screen users as well. But according to experience it is rather difficult to use it only with a speech synthesizer.

Screenreader accessible footnotes in PDF documents – between high flying standards and grounded features of available assistive technologies

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1 Introduction

Digital Versions of scientific publications like papers, thesis, dissertations are usually published as PDF documents. For screenreader users these documents have to be made accessible. In this context screenreader accessible footnotes are a special challenge. There is a conflict between the requirements based on accessibility standards – like the PDF reference (ISO 32000-1) and the new PDF accessibility standard PDF/UA (ISO 14289-1) – and the real-life accessibility for users of screenreaders that do not support these standards yet. In this paper we want to clarify the requirements for accessible footnotes in PDF documents according to available accessibility and usability standards and according to available screenreaders. And we suggest a practical compromise how footnotes should be made accessible as long as conforming screenreaders are not available.

2 The State of the Art

We evaluated the newest versions of mainstream authoring tools and how they create footnotes in accessible PDF documents. The Result: Neither office programs like Microsoft Office 2010 and LibreOffice/OpenOffice nor layout programs like Adobe InDesign CS 5.5 can create footnotes in PDF documents that are conforming to accessibility standards or accessibility supported by available assistive technologies.

The problems are:

- how to identify the note referrer and the note
- the place of the note in the tag tree (inline, separate block level element)
- how it is possible for a screenreader user to jump back to the note referrer

3 Our Approach and results

Our starting point are the available document and accessibility standards: ISO 32000-1 (PDF 1.7), ISO 14289-1 (PDF/UA), Web Content Accessibility Guidelines (WCAG) 2.0. We describe and concretize the requirements for accessible

PDF footnotes according to these standards. Visually there is a note referrer in the text and a place for the corresponding note – for example at the end of the page or document. In the document structure the note tag as an inline level element is positioned at the same place where visually the note referrer is located. A note referrer is not needed in the tag tree anymore. The problem is, that there is no AT yet which supports that best practice solution. The goal is an implementation guideline for developer of conforming viewers and assistive technologies.

Our second approach consists in describing a real-life solution for accessible PDF footnotes based on screenreader usability. With support of the Swiss foundation „Access for all" and their blind experts we tested different ways of representing footnotes in an accessible PDF document. We differentiate between the visual presentation and the structural representation of the footnotes. The solution that footnotes appear visually in the usual manner at the bottom of a page, but in the tag tree at the end of the chapter or document marked as a numbered list with a heading "endnotes" turned out as best practice.

The goal is a practical guideline for authors and creators of accessible PDF documents.

The best way for conforming authoring tools would be to support both ways and let the author decide which way he wants to choose.

4 The Impact and future Work

We hope that this paper can be a first step towards a better support of accessibility standards by assistive technologies and by authoring tools.

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Tactile Images for Inclusive Teaching in Nature and Science

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Dedicon is the Dutch 'Reading for all' Library. The educational department provides accessible school- and studybooks for print impaired people. A major issue is how to make the many images in these books accessible. In this presentation I will show the results of a pilot with lessons in geography and world orientation in primary education. Two thesis students from the Utrecht University, Science of Education, work as an intern in this project.

The pilots were in primary education concerning 'nature and science' and geography. The question was what tactile images should be produced and/or described in order to enable inclusive teaching, that is (in this case): allowing a blind student to fully participate. The adaption of the images shall:

1. Allow the student to fully understand a subject
2. Help the teacher to provide a proper explanation, taking into account that there may be gaps in the knowledge of the student
3. Allow cooperation with (partially) sighted students

The teachers were asked to select images from the book they thought they would need and they were invited to ask for additional or alternative images if they would think that necessary or better. They were asked to motivate their choices and to indicate the purpose of each image. The purpose might lay in explaining (or testing the knowledge of) the main subject (e.g. electricity, the working of the senses and so on) or in explaining a particular object or concept further that might not be known or clear to a blind student (e.g. a belly speaking doll that was given as an example for how the senses may be tricked).

In the first round the teachers did not ask for alternative tactile pictures; they only selected images from the book. They motivated their choices with quotes from the text in the book; the image would serve to make that fragment clear. Sometimes they added sketches and/or Braille labels they wanted to have added in the tactile images.

The images were used in ordinary lessons (that otherwise would have taken place without images). From observation it was immediately clear how inclusion improved since the blind students now could more actively participate. The hypothesis from the first tests is that having a tactile image – or a model – enhances the inclusion of the blind student and the pleasure in learning as we observed from the response and mimic of the students. The multimodal experience probably also enhances the quality of learning. This is subject for further study.

For the teacher it seemed that the extra effort including the blind student paid back. However in the first round we observed that the teacher had to do quite some extra effort in the plenary lessons, since the students worked with different materials. Moreover the images were not always sufficient for the blind student since the (partially) sighted students worked with a lot more images and the teachers had not indicated that the subjects and terms explained there had to be incorporated in the image(s) that were produced for the blind student.

In the second round teachers will be asked to rethink the lesson; what are the learning purposes of the class and what needs to be explained in images? We then will provide a set of images that can be used for the whole class. The (partially sighted) students can find and study the corresponding images in the text. The images will be designed for use by blind, partially sighted and color blind students and students with dyslexia or other reading and/or concentration problems. Working with tactile images forces to make clear choices, sometimes to simplify and (re)structure. It also forces to be exact.
We expect that all the children in the class will benefit from the well structured explanation.

At the ULD conference we will present our findings. They will give food for thought and further research and development of both an Evidence Based and cost effective way to produce tactile images and descriptions for nature and science (like disciplines).

Vision Interaction Software for the Blind

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1 Introduction

The role of human sight becomes increasingly important as information technology progresses. Presentations based on multimedia help to explain many kinds of situations. However, this form of communication, so convenient for persons gifted with sight, is inaccessible to the visually impaired. Thus, persons lacking eyesight are eager for a method that can provide them with access to progress in technology.

There has been a significant amount of research conducted over the years to devise alternative forms of communication for the visually impaired [1, 2]. For instance, several types of software that allow selected visual information to be converted into a text form and transmitted as synthesized speech or Braille already exists on the market. Efforts are also underway to improve the accessibility of GUI's by combining auditory response with tactile display. The main issue here is that it is difficult to provide vision information that cannot be represented in word. In addition, most of tactile images do not provide vision information as well as sighted persons understand visual information from images.

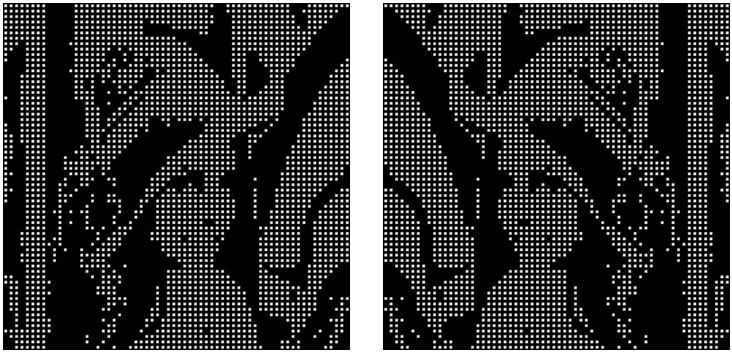
On the other hand, Social linguistics has shown the importance of language register when answering a demanded task. A blind person may not understand fully what is being requested for he may not be sharing the same vocabularies, though he may know what that word means in the dictionary. The main issue here is that it is difficult to provide vision information to blind persons. Touch is known to be slower than vision for acquiring some information due to the fact that it obtains information sequentially [3]. However, some of the raised-line patterns used in haptic recognition tasks are made in rather large-scale drawings, which may cause a burden on memory. In fact, it is not known which size picture is better for tactile recognition, nor is it known what details should be included or excluded for better haptic recognition. These questions illustrate the need for a more complete study to learn whether blind people can really make sense of a two-dimensional picture. Focusing on the Braille system, it is a method that is widely used by people who are visually impaired to read and write, and was the first digital form of writing. The average braille reading speed is about 125 words per minute, but grater speeds of up to 200 words per minute are possible [4]. Thus, those who has enough braille literacy can easily detect braille patterns. We focus on between these features and character based image technique called ascii art for vision interaction with blind persons.

The aim of the present study is to develop a vision interaction software whereby a nature gray scale image is converted into braille based pattern based on several image processing methods so that blind persons can detect sevral localized segmentations where they have interests in the image.

2 Software design and discussion

There are many difficulties in converting vision information into braille pattern, because a digital image holds a substantial amount of information. Converting a digital image to braille pattern directly requires several ways to transform a digital image to binary image. In addition, this binary image is required to have vision information to share between the blind persons and sighted persons. To avoid these issues, our present study takes advantage of recent image processing algorithms. The main point is that the braille image should present visual information which is difficult to represent in word. Thus, we choose image segmentation algorithm based on recent image processing technologies. Fig. 1 shows the interface of our developed software which enables to convert the multi-grayscale image into the braille image. Fig. 2 shows braille pattern pictures. These braille patterns enable the blind persons to recognize correctly which points are different in the case of reversed image by touch. Our short paper will disclose both the detail image converting algorithm and vision interaction efforts with subjects of our proposed method.

[Fig. 1] The interface of vision interaction software.



[Fig. 2] Braille pattern picture without margin guide.

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Tactile Applications in Development of the Multimodal Learning Environment for the Blind Students with and without Learning Disabilities

2

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The development of the framework strategies in making of the multimodal learning environment for visually impaired (mostly, blind) students over the years has been the subject of many doubts and concerns worldwide. The researchers have discussed and developed different strategic, methodological and practical approaches to the possible solution of this problem. Some linked such development to the simultaneous formation of visual and non visual interactivity, the others, in contrary, stated that non visual multimodality have to be built according to different methodology and general principles then visual one. However, the definite, complex solution of the problem is yet to come.

Also the long discussion have taken place regarding the issues of the "balance of modalities" within the development and improvement of the multimodal learning environment for both students with hard visual impairment and those without them. The notion of multimodal learning environment – the integral part of the concept of universal learning design, is frequently considered being universal indeed. Not only in the conceptual and methodological, but also in fairly practical, even technical and technological sense. It means – some scholars presuppose that multimodal learning environment might serve as the methodological, technological and educational *lingua franca* connecting students except for their physical abilities/ disabilities and stimulate them to use the multimodally received information in productive, beneficial and sustain way.

The author of the current paper offers the reconsideration of framework applications/applicability in making of the multimodal learning environment for the blind as seen from the positions of a complexity discourse, where all the constructive elements (theoretical, methodological, technical, medical and educational) merge together in order to form an "ideal formula" for such emerging framework strategies. Finding this formula is one of the crucial aspects in successful and meaningful transition from *the book* to *the digital tradition* in education for the blind, too, where bookish, static perception of multi channel (modalities) information flow is gradually transforming in order to meet the requirements of the emerging digital learning tradition or multimodal learning environment.

Creating the multimodal learning environment for the blind is a very complicated process with various challenges of theoretical and practical background.

During this process, it is impossible to use the very 'backbone' of the traditional multimodal learning agenda – visual information, which refers to more than 80 % of all the amount of information available in the surrounding world. Only less than 20 % of information refers to other senses or modalities (modality channels) like audial and haptic perception. Therefore, the multimodal learning environment, where all kinds of visual interactivity are excluded, is formed according to other principles and is based on other kinds of modalities than the multimodal learning environment for students without visual impairment.

The definition of the role of the tactile applications (such as Braille print, 2D tactile graphics and 3D models presented in all possible technical ways) in creating the multimodal learning environment for the blind is still under discussion. However, its clear that tactile applications here are playing and will play rather crucial role, even in comparition with use of the auditory information – but still the level of its overall informative improtance and applicability is controversial. At this moment, it is only possible to assert implicitly that the they will gain more significant importance in the formation of a specific non-visual multimodal learning environment. They will constitute a few of the most important theoretical and methodological building blocks of this environment that will manifest the unity and integrity of inter-semiotic translation from the visual to the haptic modality as well.

In the context of the rhetoric of the cross modal (for example, inter-semiotic, intra – semiotic etc.) translation process itself, the tactile applications will embody the holistic methodological nature of the haptic modality, with the same level of integrity as it is characteristic of the visual modality. The visual modality consists of enormous variations of visible objects and their characteristics, but it comes from one modality source – vision. It is similar with the tactually perceptible information and the haptic modality – the sources of all information in this case are tactual senses.

In the practical aspect, however, the the tactile applications will ensure the possibility for blind students to gain a maximal informative outcome from the haptical modality oriented sources of the non-visual multimodal learning environment. At the same time, the practical level of these applications in the field of PC usage will show new paths and possibilities for the improvement of the human computer interaction (HCI), where the communicating human has lack of vision and should be talked to by means of diverse haptic stimulus and informative sources.

It is necessary to point out that development of the multimodal learning environment for the blind students and the role of the tactile application in this process – both in terms of theoretical and methodological and practical discourses, lead to another form of understanding of the multimodal learning environment

as universal category, as the truly comprehensive element of the universal learning designs framework. Here the crucial points of convergence between visual and non – visual interactivities as the very base of the multimodal learning environment creation should be found and explored in order to determine whether they can or cannot serve also as the pathways – the cross modal bridges, in valuable communication (informative exchange via cross modal translation) between modalities. And not only between modalities as the sums of the single or small group phenomena, but also as the holistic multidimensional concepts, too.

The multimodal learning environment for the blind (based on non-visual multimodality) generally could be characterized as follows:

- it is an audially and haptically based multimodality where visual information can be included only in remodalized (cross modally translated) forms;
- building of this environment should be focused on the maximal informational output of included modalities;
- the transfer of visual information to the non-visual multimodal environment should be performed via cross modality (inter-semiotic) translation;
- the cross modality translation is an action where "the human factor" still plays a significant role, and the integration of the translation results into multimodal electronic platforms is frequently problematic;
- the audial element of the non-visual multimodality is more developed than the haptic one due to its long-time (historical) technological achievements;
- generally, the non-visual multimodality consists of two dimensions: the non technology based (educative toys, part of sensory room equipment and other applications leading to understanding of the multimodal principle, but not being technical themselves) and the technological ones (all technical and electronic applications/devices);
- the non-visual multimodality is more case changeable than the visual one – it is not so unified and PC centered yet;
- it is another form of HCI (human – computer interactions) where all innovative haptic devices/technologies could be incorporated and tested.

But, from the end users' (students') viewpoint this complicated structure could be reduced to following aspects of representation:

- auditory, haptically, kinesthetically and olfactory based,
- auditory and haptic interactivity fills whole informative field

- it explores only auditory or haptically perceivable logical or cognitive structures
- auditory information is the primary source of information.

Needless to say that for the blind students using the multimodal platforms and being involved very deeply into the learning agenda based on multimodal non-visual interactions might be rather challenging and problematic not only because of their major sensory impairment, but also because of the possible additional disabilities – whether they are of sensory or other nature.

Physically determinate incapability to use tactual or auditory senses for widening of the informative field might be named as two most threatening problems. But there are more. For instance, those of the learning disability spectrum, which have rather specific and complicated manifestations in connection with major visual impairments, and, primarily, blindness. For blind students who are having some kind of learning disabilities or complex disabilities to perceive the non-visual manifestations of the visual phenomena, the usage of the multimodal learning applications – particularly, tactile ones, is even more challenging task.

Current paper deals with the theoretical and methodological determinations of the role of tactual application in the making of the multimodal learning environment for the bind students with and without learning disabilities: it outlines the major conjunctive and disjunctive aspects of these determination as well as brings forward the issues of necessity to widen and specify the inner content of the HCI concept in this context.

In more general terms, the paper also deals with interconnections and interactions of the multimodal learning environment and universal learning design agenda, trying to determine their logical and conceptual relations on the base of the one narrow and specific problem – role of the tactual application in the making of the multimodal learning environment for the bind students with and without learning disabilities.

Haptic geometric experiences for blind children

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2

This paper wants to add the point of view of a professional mathematician (focused in geometry) in the field of education of blind people.

Indeed, several studies point out some specific difficulties of blind students, and in particular of those blind from the birth, in mastering geometric facts: they have problems in translating and transferring three-dimensional objects into two-dimensional iconic form, so that they cannot understand perspective drawings; also, they have problems in enlarging and minimizing even two-dimensional forms, so that they are not able to recognize different-sized shapes as being the same.

From several anecdotes and teaching experiences I collected, I arrived to state the following conjecture: lacking of (early?) geometric experiences in sections and projections is strictly related to problems of blind students (and persons) about the perception of geometric (mostly, but not only, 3-dimensional) facts.

To the best of my knowledge there are no manipulatives focused on offering this kind of experiences. Sometimes blind children are asked to cut some soft material, but nothing else.

Consequently, I realized several manipulatives purposely planned to offer blind students those geometric experiences they usually miss.

Indeed, manipulatives are commonly recommended and used in the field of education for blind children, for several teaching purposes. In particular, several authors stress the importance of this kind of tools for giving blind children the possibility of acquiring mathematical concepts though concrete activities (e.g., Del Campos, Russo, Tindell), and there is a large offer of concrete materials for blind students, but just a few are specifically planned for teaching mathematics.

And my feeling is that, despite the efforts, the manipulatives offered to blind children are often planned by sighted people, who didn't recognize enough that it is not sufficient that a object "contains" an information. For that information to be received by a blind student, it has to be grounded on the experiences the student already knows,

The manipulatives already realized (by a brilliant student of mine) allow an haptic exploration of the meaning of "perspective", showing (haptically) the simplest geometric facts about drawing (for example, drawing the same segment gives different-sized images depending of the distance of the segment from the point of view). A more complex manipulative shows how and why a circle is drawn as an ellipse.

The objects have been tested at the ICCHP-SU 2011, and the reactions and

comments of blind people were very encouraging. The comment I like more: an university student saying "Ah, if I had this object during my high school years!".

Bearing my conjecture in mind, I believe that a deeper reflection can help in designing better concrete tools, specifically planned to offer a concrete ground of experience as a surrogate for the visual experiences; so I am starting to re-read Euclid, from the very beginning, to realize an haptic collection of manipulatives to explore his journey through geometry.

Is this work worth trying? I suppose yes, and like to remind the story of Mademoiselle Melanie de Malignancy, blind from the birth, able to master geometric facts, as told by Diderot in his "Letter sour les aveugles":

"Je lui disais un jour: «Mademoiselle, figurez-vous un cube. – Je le vois. – Imaginez au centre du cube un point. – C'est fait. – De ce point tirez des lignes droites aux angles; eh bien, vous aurez divisé le cube. – En six pyramides égales, ajouta-t-elle d'elle-même, ayant chacune les mêmes faces, la base du cube et la moitié de sa hauteur. – Cela est vrai; mais où voyez-vous cela? – Dans ma tête, comme vous.»"

Development of a Tactile Star Chart Automated Creation System

2

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1 Introduction

Tactile star charts are educational aids to help the visually impaired students learn about astronomy. They are useful for learning about constellation lines and the arrangement of constellations. The Multi-modal Book "An Introduction to Astronomy" is an astronomical textbook that includes tactile star charts. Because this is a printed book, however, users cannot change the settings of the tactile star charts. Whenever tactile star charts with different settings are required, the teachers have no option but to create them by hand. These take a tremendous amount of time and effort to complete. Therefore the authors decided to develop an automated system for creating tactile star charts based on settings specified by the user.

2 Tactile star charts

Tactile star charts created by this system allow stars, constellation lines and constellation boundaries in a given starfield to be observed by touch. Stars are expressed as points, constellation lines as solid lines and constellation boundaries as dotted lines.

2.1 Starfields

A starfield is an arbitrarily fixed area of the night sky.

2.2 Constellation lines

Constellation lines are lines drawn to link up stars, often forming human or animal shapes after which the constellations are named. Many of these originate in Greek myth.

2.3 Constellation boundaries

Constellation boundaries are lines showing the boundaries between constellations. The entire night sky is divided into 88 constellations enclosed by constellation boundaries in polygonal shapes, each with its own name.

3 Tactile star chart automatic creation system

This system is built as a Web application. Users input the constellation name and star chart settings to get the original star chart. The star chart is printed on microcapsule paper and passed through a developer. The tactile star chart is completed in this way.

3.1 How the system works

1. User inputs star chart settings – The settings of the targeted tactile star chart are designated on the Web page.
2. Decide the central coordinates of the chart – When using constellation names to designate starfields, the central coordinates of the targeted constellation are extracted from the constellation database. When designated by rectascension and declination, these values are used as they are.
3. Write into text file – The settings obtained are written into a text file, which is saved in PP3 format.
4. Execute using PP3 – The text file created in step 4 is read, data are captured from three sources (the star database, the constellation line database and the constellation boundary database), and a star chart image is created in PDF format using the star chart creation program PP3.
5. Return the PDF file – The PDF file is returned to the users.

3.2 Tactile star chart settings

To create a tactile star chart which is easy to observe by touch, the following three points must be taken into account.

1. If the lines are too wide they will overlap with nearby stars; if too narrow, they will be difficult to observe by touch. Therefore, the width of the lines has to be set appropriately.
2. Stars and lines are hard to distinguish if they are too close to each other. Therefore, the space between them must be made sufficiently wide.
3. A surfeit of objects makes observation difficult. Therefore, objects have to be selected.

Based on the above, this system allows the user to set the following five parameters on Web page.

The brackets show which of the above requirements is satisfied in each case.

- Width of constellation lines and constellation boundaries (1)
- Space between stars and constellation lines (2)
- Constellation boundaries on / off (3)

- Magnitude of displayed stars (3)
- Scale (3)

3.3 How to designate starfields

In this system, constellation names can be used to designate starfields. The starfield may also be designated by specifying rectascension and declination.

3.4 Star chart creation program PP3

The star chart creation program uses the PP3 (Parvum Planetarium, version 3) developed by Torsten Bronger. This is operated by loading the text file with star chart specifications into PP3. Once the text file is loaded, PP3 creates and automatically compiles a TeX file and generates EPS, DVI and PDF files.

3.5 Databases

This system uses four databases.

- Star database – Uses BSC (Bright Star Catalog), a catalog of stars compiled at Yale University. The coordinates and magnitude of stars is extracted from this database.
- Constellation line database – PP3 includes a original database created by Bronger himself. However, this database has too few constellation lines. Therefore, a separate constellation line database was created for this system.
- Constellation boundary database – Uses the Constellation Boundary Data created by A.C. Davenhall, based on constellation boundaries determined by the International Astronomical Union in 1928.
- Constellation database – Holds constellation names and the central coordinates of those constellations.

3.6 Printing and development

The star chart is printed on microcapsule paper and passed through a developer. The parts coated black absorb the heat and swell, causing the stars, constellation lines and constellation boundaries to lift up in relief. The tactile star chart is completed in this way.

4 Conclusion

The authors set out to develop a tactile star chart automatic creation system enabling users to create tactile star charts with various settings quickly and simply. In the future, experiments will be conducted to find the settings most suited to tactile observation.

An interdisciplinary approach to alternative representations for images

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1 The R & D or application idea

A key principle of accessible design is the use of appropriate text alternatives to non-text content in web pages and digital documents. A text alternative allows the images in a web site to be readable by screen readers or other assistive technologies, making them accessible by blind users or users with other disabilities. Although the need of text alternatives is recommended by the number 1 guideline of WCAG version 1.0 and 2.0, currently the implementation of alternative text to images on the web is far from being totally correct and lots of images have missing, incorrect, or poor alternative text (Petrie et al. 2005). The reason could be that the normative only offers general recommendations regarding "how" to create the alternative text description for images and currently there are not commonly agreed guidelines on how to describe the image content nor standards defining the process of the image description. As an answer to this limitation, several attempts have been made to formalise the description of images by different institutions, being the most relevant the set of guidelines for describing images proposed by the NCAM (NCAM 2009) and the DIAGRAM Center (DIAGRAM Center 2012). In order to go beyond these two cases, our proposal consists of the cross-fertilization of Information Visualization (InfoVis), Library and Information Science (LIS) and Semantic Web disciplines in the definition of alternative representations to images.

2 State of the art

The theoretical principles that regulate the creation of alternative representation of images could be defined by the combination of models for the analysis of images offered by the discipline of InfoVis and LIS. This analysis can integrate the models of *layers of image* proposed by LIS (Panofsky 1993) with the rules of composition proposed by InfoVis (Engelhardt 2006). This could be a significant step towards *the definition of the image* in relation to: the syntactic and semantic visual features; the function in the context in which is presented; the interpreta-

tion of its content by the user and the process in which the visual information is created and managed. The visual representation could be considered into the standard process of creation of knowledge and the alternatives viewed as parallel, previous or posterior steps to it (Card et al. 1999).

The methods and techniques supplied by LIS and Semantic Web could improve the standardisation and even the automation of the creation and management of alternative representations of images (Kawanaka et al. 2009) (Fredj & Duce 2007). They could facilitate its integration into the publishing workflow improving, at the same time, the retrieval and the adaptation of the images to different contexts of access. A formal description would also benefit the reuse of the information included in the visual representation, for example in the process of cataloguing and retrieval of images.

The methodology used in this work is the result of a thorough literature review of the principal theories, models, guidelines and best practices about the description of images in the four disciplines cited, focusing the attention on the need to improve the accessibility, the generation of alternative representations and the retrieval of images.

3 R & D work and results / Impact or contributions to the field

The current results of the investigation consist of the identification and synthesis of strengths and opportunities of improvements in the accessibility discipline and in the synthesis of the major contributions supplied by the disciplines of InfoVis, LIS and Semantic Web. The strengths and opportunities detected in the accessibility discipline, when analyzed in conjunction with the other disciplines, are presented in Table 1.

Strengths	Opportunities of improvement
• Praxis and Guidelines • Normative/legal framework • Multimodal approach to the description of images • Techniques for the inclution of alternative reprentations • Special attention to the profile of the user, the equipment used to access the content and the general context of access.	• Theory to back the process of description • Sell lateral benefits, made clear by other disciplines (retrieval, understanding, reuse…). • True inclusion of the alternatives into the publishing workflow.

[Table 1] Strengths and opportunities detected in the accessibility discipline

The expected impact to include the other disciplines methods will be:

- A theory to attain the process of description
- Standards for the different areas covered in the description
- Richer techniques to include the description within the image
- Reuse of the descriptions
- Increased use of descriptions due to a perceived benefit of retrieval
- Richer descriptions
- Automation of part of the process

4 Conclusion and planned activities

As we have seen InfoVis, LIS and Semantic Web can enhance image description and convert it into a truly implemented activity within the authoring process of a digital document. Starting from this hypothesis we should validate it making specific proposals of integration, analyzing the workflow in the publishing processes, talking to stakeholders, prototyping and evaluating a first model of implementation of the uncovered ideas. As a final result we expect to be able to propose guidelines, models and the implementation of methods and techniques for the description of images and their integration into the publishing workflow, with the aim to standardize and even automate the task of creating and managing alternative representations of images.

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Communicative Images – New Approach to Accessibility of Graphics

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2

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1 Introduction

Although the image recognition techniques are still far from being able to fully describe an analyzed picture, current technologies enable us to associate many useful pieces of information to images. For example, the date and time of a snapshot, GPS information, and in some cases recorded sound are often directly associated with photographs by the camera. Typically, this information is saved in the format of the image and can be exploited for image classification and semantics retrieval, see e.g. [1–3].

Most of the relevant information, however, is not directly feasible. Let us imagine a photo from a holiday ten years ago: the woman in the middle is my wife, but who is the guy standing behind her? It is apparently somewhere in the Alps, but what place? What is that peak in the background? Such pieces of information are virtually inaccessible. However, some relevant pieces of information can be retrieved using current information technologies. GPS coordinates allow us to determine where the photo has been taken. Face recognition [4–6] may help reveal the identities of persons. The orientation may help to determine some objects in the picture (e.g. the peak in the background).

The idea of communicative images presented in this paper lies in enabling the people to communicate with the images, i.e. enabling the users to get easily relevant pieces of information from the images and enabling simultaneously the images to gather relevant information about themselves from the users. Communicative images learn from the communication, enlarge they knowledge base and use it in further communication. They also provide intelligent and efficient natural language dialogue with the user.

The concept of communicative images is very general and allows many applications, e.g. in image searching, e-learning, image recognition, etc. However, probably the most important and direct impact is in making the images accessible for blind and visually impaired people.

Because of space limitation, this extended abstract presents just some basic ideas and examples to introduce the communicative images concept. More detailed description and implementation details will be presented in the full paper.

2 Building up Communicative Images and Communicating with Them

To make a standard image communicative, it is necessary to transform it into a format suitable to support structured annotation data. In our approach, the ability of the SVG format [7] to wrap the original raster image and to integrate annotation data is exploited. The general knowledge base is described by the OWL ontologies [8] that are linked from the SVG pictures via the *owl:imports* statement. In this way, the knowledge base can be shared by many pictures. On the other hand, concrete annotation data, i.e. concrete values of the properties prescribed by the ontologies, are stored directly in the SVG format in the form of XML elements. Technical details related to coupling OWL ontologies with the SVG formatare discussed in [9].

Once an image is transformed into the SVG format, the system tries to acquire as much information about the image as possible, using auto-detection and image recognition techniques, e.g. face detection and recognition algorithms [4–6], similarity search algorithms searching in large collections of tagged pictures [10–12], EXIF data extraction from photos, etc. After this initial stage, the user is informed about the estimated content and invited to confirm or refute the information and to continue with questioning. New pieces of the acquired information are stored in the image ontology and reused by subsequent interactions.

2.1 Graphical Ontologies

The OWL ontologies present formal specification of shared conceptualization. They describe the semantics of data with modeling domain concepts, their relationships and attributes. In [13], we have presented a basic graphical ontology which restricts abstraction to the aspects that are suitable and utilizable for dialogue-based investigation of a graphical content. Using this ontology, the annotator can express, for instance, that some object is "mostly red, oval and unusually big", etc.

Although the graphical ontologies cover basic visual characteristics that are useful for generic dialogue interactions, verbal descriptions of domain-specific pictures require to employ specialized ontology extensions helping to generate domain-specific dialogues. For example, a domain model, *People*, provides vocabulary and background knowledge to classify people by their relationships, similarly to the popular "circles" known from social networks. People in a photo are identified and assigned into "circles" (e.g. my family, friends, colleagues, etc.). Similar models can be found in [14, 15].

2.2 Dialogues with Communicative Images

Instead of more detailed discussion, which will be included in the full version

of the paper, we present two examples in this section showing typical dialogues between the user and communicative images (*U* stands for User, *I* for Image).

Example 1.
U: [activates the dialogue with the image]
I: This photo has been taken at January 16, 2012. There is a group of people in the picture, among them your friends Peter and Eve.
/In the corresponding ontology, GROUP_OF_PEOPLE is a predefined ontology relation.
FRIEND is an ontology relation related to the user (modal ontology relation).
PETR and EVE are objects of the ontology. The photo is of the type PEOPLE, therefore in the description of the environment is omitted in the brief summary./
U: What are the other people?
I: The other people are John, Mary and Michal. John is brother of Mary and Michal is a friend of John and Mary. Do you know John, Mary or Michal?
U: Yes, they are my schoolmates.
/This information is encoded into the ontology format, compared with relevant ontology information, and, if it does lead to conflicts or if it does not need other explanation, this piece of information is added to the graphical ontology./

In this example, the user is assumed to be sighted. Important feature of the communicative images concept is that the annotation made by sighted people can be in further communication exploited by blind and visually impaired users. Internet and especially social networks form a suitable environment for this concept. Moreover, because communicative images gather also the information about the user, the image is able to apply special dialogue strategies when communicating with blind users.

Example 2.
U: [activates the dialogue with the image]
I: This photo has been taken at January 16, 2012. This is a view of the Brno city with the castle Spilberk and the cathedral Petrov.
U: Where is Brno located?
I: Brno is located in the eastern part of Czech Republic.
U: What is the population of Brno?
I: The population is about 400 000 people.
U: Is there a friend of mine that lives in Brno?
I: Yes, your friend Michal Novak lives there.
U: Tell me some interesting facts about Brno.
/The requests activate the search engine, which searches at the internal pieces if information encoded in the image graphical ontology, and, if this search fails, it activates real time searching Internet. If this search is successful, the relevant pieces of information are exploited to answer the request./

In this example, the user could be both sighted or blind. In both cases, the dialogue shows its functionality.

3 Ontologies and Logics – Formal Framework for Information Exchange

The core of the management of the dialogue strategies for the communication between the user and the image is based on graphical ontologies, as a basic source of information, and a suitable logic standardizing syntax and semantics for information interchange. The interface between natural language and formalized ontology framework provides an engine transforming natural language into corresponding formal schemes. Typically, we can restrict ourselves to a small fragment of natural language, so that the engine can be based on relatively simple grammars in combination with the frames technology and standard techniques for misunderstanding solving.

The complexity and the strength of the chosen logic is determining the complexity and the strength of the dialogue strategies. Predicate logic, the logics that are developed within the Semantic web (e.g. Common Logic [16]), modal logics, temporal logics, Transparent Intensional Logic [17], etc., can be used for this purpose. This approach enables to develop a single general scheme, into which standardized formalizations of different logics can be easily implemented.

4 Communicative Images and the People with Special Needs

The concept of communicative images seems to be a promissing approach in accessibility of graphics for people with special needs, especially for blind and visually impaired people. Moreover, the communicative images paradigm makes it possible to build other useful applications. In [18], Chai et al. proposed an intelligent photo album enabling to organize and search collection of family photos by means of ontologies and SWRL questioning [19]. If communicative images are implemented into this scheme, we see straightforward way to enhance its functionality. Because the photos in the album are organized by means of OWL ontology, it might be possible to employ the mechanism of generating dialogues from domain ontologies. In this way, the user could organize photos via dialogue as well.

E-learning is another field, which could benefit from communicative images. A very important feature of the presented communicative images concept is, that because of the concept is based on formal ontologies, it is fully compatible with the Semantic web paradigm and simultaneously fully supporting multilinguality.

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Section 3

General Web and E-learning Accessibility, Effectivity of Teaching Within the Framework of Universal Learning Design

The section focuses on:

- *WCAG and comparable documents, their enforceability, advantages and imperfections in relation to persons with various types of special needs; web accessibility and usability.*
- *Transferability of WCAG and comparable documents to E-learning environments and digital documents; accessibility, readability and content comprehensibility of official and specialized documents.*
- *Universal design of video and audio formats.*

Guidelines for Developing e-Learning System for Visually Impaired

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According to the last "People with Disabilities Report" (cro. *Izvješće o osobama s invaliditetom*) in Republic of Croatia lives 529 103 persons with disability which is more than 10 % of total population. There is 18 317 persons with impaired vision (blind and visually impaired). Compared to previous years this number has increased by 2044 people. According to estimates 10 %, with a tendency to increase, of blind people is using the Internet. Estimates are based on documents and reports that are currently derived from the project "Communication Rod to Independence" (cro. *Komunikacijskom štapom do neovisnosti*).

Using of Internet and new technologies geared towards enhancing the quality of life for visually impaired has led to the development of accessibility of everything that surrounds visually impaired person. Development of accessibility has been analyzed in terms of website development, i.e. development of e-Learning system for visually impaired according to existing standards and with newly developed standards.

When planning, designing and developing e-Learning system for visually impaired these criteria must be met:

- Planned according to existing standards, i.e. WCAG 2.0 and BS 8878: 2010
- Usability criteria have to be met
- Universal design
- Support for assistive technologies (screen readers, specially designed keyboards, scanning applications and others)

Accessible and usable web is part of e-accessibility concept, one of key elements of e-inclusion. E-inclusion seeks to ensure inclusion of all people in the Information Society. In that context, e-accessibility defines removal of technical barriers and difficulties that visually impaired person could come across.

W3C standards define the provision of access and use of website content for visually impaired. Understanding of information, movement an interaction between website and user defines website usable for all users which are currently using the website. Accessible website strives to ensure all users, regardless of disability or experience, equal access to the information.

Usability criteria include basic requirements in the website design such as:

- Exact element positions on the website
- Simple design

- Ability to change font size
- Ability to change background color
- Accurate image description
- Appropriate language support
- Video recordings need to have voice and text
- Website frames need to have assigned names
- Forms have to be standard
- Text should not be in form of an image
- If visual verification is used (CAPTCHA) there should be audible verification available

Universal design term represent that a product or service must be accessible to all people regardless of whether they have some degree of disability. Principles of universal design is defined in seven points:

1. Impartial use
2. Usage flexibility
3. Simple and intuitive use
4. Perceptible information
5. Error tolerant
6. Low physical effort
7. Size and space for approach and use

System needs to have support for assistive technologies such as screen readers and specially designed keyboards and so on. Assistive technologies enable visually impaired person efficient usage of the system.

This paper will discuss described definitions and standards that will be implemented in learning management system (LMS) as a module for visually impaired. LMS developed at the Faculty of Transport and Traffic Sciences has been in use since 2004. System is composed of five modules: Document Management System (DMS), The Authorization and Supervision System (cro. Sustav Autorizacije i Nadzora; SAN), students module e-Student, SMS module SMSCentar and mobile learning module FPZMobile.

This paper will define guidelines, according to WCAG 2.0 standards, for development of the LMS module for visually impaired. These guidelines will be recommended for their implementation of the Strategy for e-Learning at the University of Zagreb (cro. *Strategija e-Učenja Sveučilišta u Zagrebu*).

Voice technologies have a power to eliminate physical disabilities

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Polovina nebe, Czech Republik

Physical disability may not mean fatal handicap anymore

Computer voice control programs have been used in many countries and languages for some time. However, the idea of using them for systematic teaching of severely disabled people, who have to rely on others to help them almost in all aspects of their lives, is absolutely unprecedented in the Czech Republic and neighboring countries.

It was a member of our civic association Jan Nouza, professor at the Technical University of Liberec, who came up with the idea to prepare a proposal and implement this unique project called Duhový most (Rainbow Bridge). This is no coincidence. Professor Nouza and his research team have been dealing with speech recognition and developed, among other applications, three computer voice control programs named MyVoice, MyDictate and NEWTON Dictate.

Even the best ideas and intentions do not guarantee success and way from idea to its realization is not easy. In case of unique projects, which Rainbow Bridge undoubtedly is, the realization is tough. However, we are pleased to say even before the end of the project targeted on clients in Prague that the Rainbow Bridge project is successful in all respects. In fact, the project is so successful, that the lectures on controlling PC using voice commands spread to four other regions in the Czech Republic.

Rainbow Bridge – Hope for the disabled

The three-year project focuses mainly (but not exclusively) on people suffering with quadriplegia, paraplegia of upper limbs or other severe disability that prevents them from performing even the minimum fine motor tasks. Using new technologies based on voice recognition we try to eliminate the health disadvantages and enable these people work with PC.

In the Rainbow Bridge project we teach our clients, who are unable or have difficulty controlling mouse and keyboard. They learn the basics of essential computer skills. Each lesson of three month courses comprises of the lecture and the subsequent group or individual training, during which the clients practice working with PC using voice commands. Although the excellent computer voice control demonstrated by our lecturer Dita Horochovská, also suffering with

quadriplegia, can be achieved only through a long and constant practice, our clients can cope with all common tasks on PC.

They can write and work with MS Word, Excel, surf the Internet, use e-mail, chat, read books, watch movies, all without the otherwise necessary assistance. They acquire skills that enable them to apply for suitable positions in the labor market according to their intellect, which is also extremely important.

3

There's a First Time for Everything

Our decision to prepare the project was a step into the unknown. We knew how the voice-control technology worked and we had an idea of how prepare the lectures but until the start of a pilot lecture in October 2010 we were not able to answer the question of how to offer the courses to the target group and how our clients would react and participate.

We were fortunate that at the very beginning of the project we contacted the right people who helped us significantly with the recruitment of participants of the pilot course, which was crucial for the whole project. It was Mr. Vojtech Sedlacek, founder of IT teaching in a well-known institution for persons with disabilities, Mr. Jaroslav Winter, who gave us advice and a lot of space on his web portal that is focused on helping people with disabilities (www.Helpnet.cz) or Mr. Milan Boehm, who introduced our current lecturer Dita Horochovská to us. A major role in success of our project was the personal contact of project manager, Daniela Rázková, with Mrs. Jana Hrdá of the National Council for Persons with Disabilities, who herself was one of the participants of the pilot course. Many clients found us through the company NEWTON Technologies, dealing with speech recognition, which we closely cooperate with.

Along with preparations we addressed hundreds of organizations and civic associations and asked them to spread the information about our free courses among their clients. Given the exceptional nature of the project, we appeared in most of Czech significant media, including public television and radio stations that repeatedly informed about the project. It also turned out that perhaps the most effective means of promotion of our courses were and still are the participants themselves. They recommended our courses to their friends with disabilities.

Teachers and pupils

There is no sense hiding the fact that the project team itself has learned a huge lesson when alongside with teaching and technical support had to ensure smooth running of courses in terms of logistics (transport of participants including the donations of their fare), but also necessary services (lunch delivery from a nearby

cafeteria). But more significant was the creation of friendly and trusting atmosphere, which overcame the usual initial skepticism of most of our clients.

This was successful. And it wasn't only a matter of individual attitude to the course participants and their specific needs and habits. More important was to break through the barrier which was their disbelief and distrust in their own abilities. Important role in this was undoubtedly played by lecturer Horochovská, who is quadriplegic herself.

It is our great satisfaction, therefore, that all course endings were not simply an end of course, but there always was a bit of nostalgia as there is at the separation of good friends. That is why we try to keep these contacts for the future. Before Christmas 2011 we organized a meeting for all participants of our courses. Almost all arrived and we were lucky enough to see on our own how in a very positive atmosphere a new community of people randomly joined by the Rainbow Bridge project was emerging. When we talk about the community, let us add that our participants used this opportunity to exchange their email addresses and telephone numbers with a determination to remain in contact with participants of different courses.

Rainbow Bridge is a project to use

We also put an effort to provide the necessary technical consultation after the end of our courses. Many of our participants received a financial support for buying quality laptops (essential for voice technology) from municipal authorities after our intervention. We also try to help them during the search and negotiations for a suitable job. We employed one of the participants of the pilot course as an additional lecturer of voice control of PCs, another participant found a new job in the archives of the municipal office and as soon as the National Gallery in Prague provides a barrier-free access, she will start working there. Some participants have already earned their own money by rewriting hand-written texts.

A Guide System for the People with Handicap at Public Facilities in Normal and Emergent Situation: a Case Study at Kagoshima City Aquarium

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1 Introduction

The exhibitions at an aquarium or a museum are to be "shown". However, many blind or deaf-blind people are tend to come there recently. They say they can enjoy them without seeing unless there should be some guides, touchable exhibitions and explanations in precise. Their comments have made us notice their needs which we have been unaware of. There is a recent idea named "Universal Museum" in which they provide touchable exhibitions.

An aquarium, being different from a museum, has a certain limit to offer touchable exhibitions. It should be better to ask those people directly how they can enjoy them.

We must consider, on the other side of welcoming those people, of a guide system for evacuation at an emergency as much as regular guide maps or exhibitions. The present system of broadcasting announcement and the guides by the staffs would not be proper for them.

We should offer information through terminals as mobiles , rental PDA and others, tactile maps, braille pamphlets for the blind, and for the deaf, signing and texting. Another problem is how to deal with the evacuation of the wheel chairs at an emergency when all the elevators and escalators stopped.

It is a big problem that those customers are coming everyday without any measure and it is common to all the aquariums and museums in Japan. This paper is a proposal of resolution system using electronic communication tools from a human- interface viewpoint. We take Kagoshima City Aquarium as a model case and we hope it will contribute to decrease the rate of victims of those people who need help at an emergency.

2 Background

As for the measures of evacuation for those who need help such as the handicapped or aged people in Japan, almost all of them are for a natural disaster like an earthquake, a tsunami, or a typhoon. The measures of evacuation from a

house or from a building are for those without handicaps, and there are only a few researches for a nursing home for the aged.

Emergency Evacuation Planning Guide for People with Disabilities by National Fire Protection Association [1], USA is opened to public, which is further advanced in this field than that of Japan where we have no law like ADA. However it is not directly applicable to Japanese society because the notions and definitions of disability and cultural background are different from them.

3 Research

3.1 Making an evacuation manual for those who need help

These are the steps to make an proposal of the manual in the closed situation like inside of a building.

1. Experiments: Asking them to participate the experiments in the real situation of the exhibitions and also a fire drill in order to point out the problems. To prepare for the unforeseen accident in the experiment, we would provide helpers and supporters and should take some advices in advance from the organizations of those people. Repeated experiments by a few people must be necessary considering a danger of a mass at the same time.
2. Making: Specializing for KCA, checking the evacuation manual in the USA above and some evacuation manuals in Japan as a base.

3.2 Designing an Evacuation Guide System

1. Customer's Location Estimating System: It is important to know where the customer is at an emergency. Our system estimates the present location of the customers using the customer's mobile with the Bluetooth devices in many places. The GPS system in the mobile, Skyhook Wireless [2] or Place Engine [3] is not sufficient for the closed area in a building, and a new system is needed.
2. Self-Guide System for the people with handicap: Even if we offer a customer a free mobile internalizing the location estimation system, they would not appreciate unless there is some additional value. We would offer them some applications to explain the exhibitions by voice or sign language automatically, using the location estimation system. The customer can enjoy it in an ordinary situation. Moreover for the hearing disabled people, they wear a head-mounting display and see the sign language guide through watching an exhibition or a dolphin show.

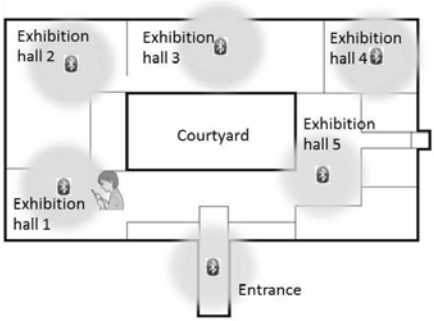
3. Emergency Announcement: At an emergency, pushed announcement would be inserted in the guide system, using sound and vibration altogether for the blind and the deaf customer. Their present locations are informed to the administration office and they would indicate them the evacuation route immediately.

3

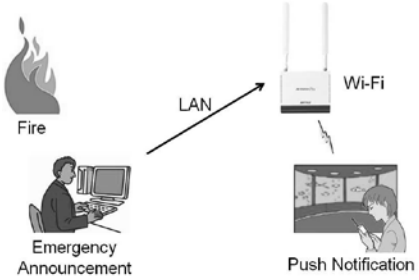
4 In the Future

Some demonstrative experiments have been done, although the results are under analysis. This report is specialized to an aquarium but we hope it will be generalized to the museums and other facilities. We regard the evacuation manual for the people who need help or support as a universal matter.

We hope we will be able to advise an aquarium, a museum or a gallery throughout our country or the world. We supposed people with handicap and the aged who need help in this paper but the foreigners must be included in a real situation since they have the same communicational problems as the handicapped people do. We excluded the foreign language here because we anticipated the problems which language to take besides English, and that of an accuracy of translation. We notice our system is applicable to it in the future to adopt the global interest of sightseeing.



[Fig. 1] Location estimation system using Bluetooth.



[Fig. 2] Emergency Announcement System.

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e-Learning Services for Persons with Disabilities on a Web-Accessibility E-learning Platform in Taiwan

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Digital participation is a basic human right for modern citizens; however, the digital division still bars people with disabilities from participating in the digital society and e-learning environment. The government in Taiwan has made many efforts to construct the Web accessibilities and focus on developing accessibilities for e-learning environment. To improve the digital participation and enhance their computer skills for persons with disabilities, it is necessary to develop multiple solutions for their e-learning needs. We have provided e-learning services for persons with disabilities in Taiwan. Our e-learning platform provides web accessibility functions according to the web accessibility guidelines. This study is to discuss the needs for persons with disabilities and to explore whether they can apply information technology to participate in digital learning.

1 Introduction

Information technology plays a significant role in our daily life. It can also assist people with disabilities to participate in educational, vocational and other daily activities in a variety of ways [1, 2, 3]. In recent years, several developed countries in Europe and the United States of America have devoted to constructing the Web accessibility with the purpose of promoting the e-learning environment for persons with disabilities. For example, there has been the push by the U.S. Department of Education and technology leaders to integrate technology with teaching and learning in schools. The plan noted the persons with disabilities also enjoy the equal chance to use IT or digital learning [4].

Additionally, the "Section 508" in the U.S. with Disabilities Act mandated that all students have accommodations or access to use online resources. In Europe, the eEurope action plan developed by European Union pondered as well the de-

mand of digital participation for the persons with disabilities in order that they can access information and take full advantage of the information society.

Taiwanese government proposed "Taiwan Digital Archives Expansion Project" in 2002 and the reactive plan of digital learning included "e-learning for all" and "narrowing the digital divide" and other projects. The projects expected to set up a highquality digital learning environment. In order to minimizing the domestic digital divide, RDEC (Research Development and Evaluation Commission Executive Yuan) referenced from international standard WCAG 1.0 (Web Content Accessibility Guideline) to make the Accessible Web Development Guidelines (AWDG) in 2003. RDEC also drew up the policy and schedule to advance the Web accessibility. Taken as a whole, the government in Taiwan has obvious attention these issues on the policy. However, the improvement of Web accessibility and the accessibility for persons with disabilities is only providing the basis of accessing information; it is still not enough for persons with disabilities to participate the digital learning.

Digital participation is a basic human right for modern citizens. In order to improve the digital participation for persons with disabilities, it is necessary to develop multiple solutions. Yao-Ming Yeh et al. had developed the initial Web-Accessibility elearning platform for person with disabilities [6]. It was an integral solution program which allowed people with disabilities to take part in e-learning more easily. It included Web-Accessibility e-learning platform, Web-Accessibility e-learning courses and Web-Accessibility e-learning services. In Web-Accessibility e-learning platform, it should be able to offer universal keyboard operations and conform to the web accessibility standard. In Web-Accessibility e-learning courses, it needs to consider demands of each disability learner in operation and cognitive learning. In Web-Accessibility e-learning services, it should be able to assist each disability student to exclude learning disorder and guide them to adaptive learning [5, 6].

The purpose of this study was to promote the information access for persons with disabilities and to explore whether they can apply information technology to participate in digital learning.

2 Methods

The methods of this research are as following:

2.1 Participants

There were 402 participants with a variety of disabilities, ranging from physical disability, visually impaired, hearing impaired, psychiatric disability, etc. accessed in Web-Accessibility elearning platform.

2.2 Instrument

The Web-Accessibility e-learning platform was adopted to conduct the experiment. In this research, the Web Accessibility Service established by RDEC in Taiwan was used to identify e-learning platform accessibility. Machine identify results showed that the platform conformed level "double-A" to Accessible Web Development Guidelines (AWDG).

In terms of Web-Accessibility e-learning courses, there were 6 subjects (basic computer, basic office, advanced office, webpage design, pre-career introduction, proficiency check skill) set up in the Web-Accessibility e-learning program. Each virtual class includes 2–7 subjects and each subject had more than lhr courseware. And the development of e-learning courses was based on ADDIE model [5].

For Web-Accessibility e-learning services, the project provided e-tutor services for asynchronous e-learning. In addition, the services also held 1 synchronous discussion seminar for each class; each seminar lasted more than 90 minutes (see Figure 1).

[Fig. 1] Synchronous discussion seminar.

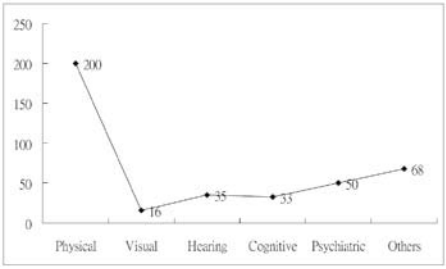
Besides research instrument described above, in order to realize the effect of e-learning for the participated learners, the researchers designed the 5-point Likert-type scale questionnaire, the survey namely "The Web-accessibility e-learning for digital participation". The content of questionnaire included understanding the satisfaction of members with e-learning materials, user interfaces design, learning services and learning performance. IF members filled out questionnaire with high score, it reflected better satisfaction.

3 Results and Discussion

The data analysis of digital participation for persons with disabilities on a Web-Accessibility e-learning platform is as following:

3.1 Data analysis of participants

The e-learning platform served 402 participants with a variety of disabilities in this study. As shown in Figure 2, approximately 50 % of the participants were physically disabled, and the remaining ones were visually impaired (4 %), hearing impaired (9 %), cognitive disability (8 %), psychiatric disability (12 %) and others (17 %).



[Fig. 2] Participants enrolled in Web-Accessibility e-learning.

There were 6 classes set up in the Web-Accessibility e-learning platform. The participants of novice would enroll the basic classes and the advanced learner would enroll in any classes. Table 1 shows the participants enrolled in each individual e-learning class. The number of participants enrolled in webpage design class was the largest. The number of participants enrolled in Skill Test class was the least. Notably, Skill Test class for certificate required mastery learning and proficient skill, so only a minority of the participants enrolled.

[Table 1] Participants enrolled in each e-learning class

Disability/ Course	A	B	C	D	E	F	Total
Physical	82	52	71	115	44	8	372
Visual	5	3	5	6	7	2	28
Hearing	15	13	12	20	4	3	67
Cognitive	10	4	9	8	10	2	43
Psychiatric	19	12	17	24	13	0	85
Others	29	18	30	31	19	1	128
Members (n)	160	102	144	204	97	16	723

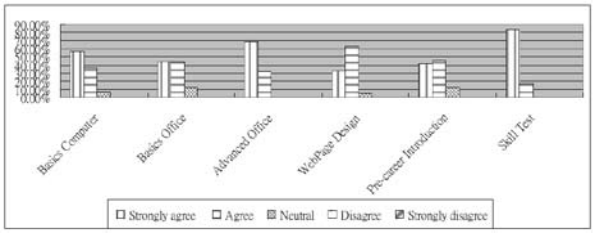
Note: Classes: A (Basic Computer), B (Basic Office), C (Advanced Office), D (WebPage Design), E (Pre-career Introduction), F (Skill Test)

3.2 Data analysis of questionnaire

'The Web-accessibility e-learning for digital participation' questionnaire enabled us to verify that the effect that participants carried on e-learning. Data analysis of participants responded to the questionnaire is as following:

3.2.1 Satisfaction of participants in content materials

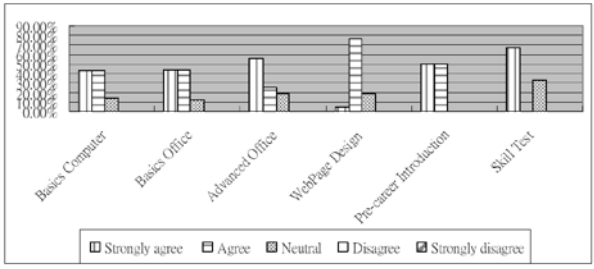
As shown in Figure 3, Over 85 % (strongly agree and agree) of the participants satisfied with the teaching materials of courses and teaching or response from the professional instructors by the Web-Accessibility e-learning platform. The results reflected the majority of participants were satisfied with learning materials.



[Fig. 3] Satisfaction of participants in content materials.

3.2.2 Satisfaction of participants in user interface

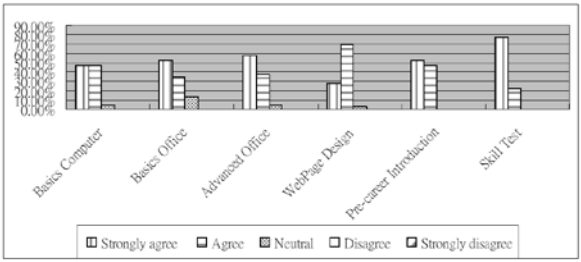
Each class had over 80 % (strongly agree and agree) of the participants satisfied with the user interface design and the stability of the Web-Accessibility e-learning platform except Skill Test class. Only 66.67 % of all respondents in Skill Test class strongly agreed that they were satisfied with user interface, but 33.33 % of them remained neutral (see Figure 4). One explanation of this was that only a few of the participants enrolled in Skill Test class and it affected the questionnaire results.



[Fig. 4] Satisfaction of participants in user interface.

3.2.3 Satisfaction of participants in learning services

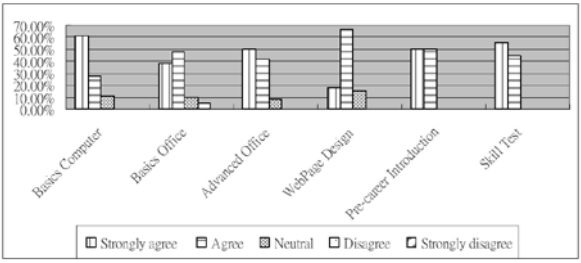
Almost 87.5 % stated that they were satisfied with the service of the Web-Accessibility e-learning platform, the quality of service of the e-tutor in each class and the service of the toll free customer service line. The results had been very positive and it was also had implications for those conducting researches on participation of persons with disabilities in digital learning. Probably the key drive for persons with disabilities to participate digital learning is the fact that we provided well e-learning services.



[Fig. 5] Satisfaction of participants in learning services.

3.2.4 Learning performance of participants

After participating in the Web-Accessibility e-learning, it was also largely agreed (85 %) that they were satisfied with their own learning results and knew more characteristics and advantages of digital learning. Otherwise, most of them agreed that e-learning was far more effective than traditional teaching in improving the learning results.



[Fig. 6] Learning performance of participants.

4 Conclusions and Recommendations

E-learning has become the major trend of the development with regard to education reform. With the construction of the digital environment, availability of

multimedia materials and the quality of good services, the chance for persons with disabilities to participate in e-learning is being offered. Over the past years, the focus of assisting persons with disabilities in digital environment was related to computer access and the apparatus they needed. But more recently, the focus issue has shifted to reflecting the "digital participation "for them.

This research was based on Web-Accessibility e-learning platform to explore the digital participation for persons with disabilities. The present findings contribute to the field's understanding of the various forces acting on digital participation for persons with disabilities. Part of the results will depend on the quality of the instruction and materials delivered in the e-learning platform. Furthermore, the quality of e-learning services is another possible reason to support digital participation for persons with disabilities. This study should provide a descriptive basis for additional research.

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Measuring Real Accessibility

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3

How to determine the **real accessibility** of websites? Is a web page with ten headings more accessible than another page with only four headings?

Accessibility is nowadays often a part of laws. Risk of ligitation, moral and political pressure force site owners, designers and developers to ensure that their sites are accessible. Very often they need "a proof" of accessibility and they face the tasks of deciding what is the most efficient and reliable way of evaluating accessibility.

Accessibility is strongly influenced by a lot of factors and it is very shortsighted to narrow accessibity down only to technical factors – quality of HTML code and CSS, its validity, etc. Other factors are for example

- user disability (both health and technical),
- user knowledge of using web itself,
- used browser,
- used assistive technology,
- user knowledge of assistive technology,
- user preferences and habitual practices.

Let's see typical internetbanking. It is not fully compliant with any guidelines (eg. WCAG 2.0), but people with disabilites commonly use it – because they need it and they have power tools (browsers and assistive technologies) and enough knowledge to do it. Other typical examples are social networks such as Facebook or Google+.

All aspects mentioned above **has to be taken in mind** if you want to speak about accessibility. User-centered view and focus on user instead on technology and rules is much better and chime in with real aspects of accessibility. Users aren't interested in compliance with guidelines. Their demand is simple – use the web and accomplish the task that they need.

Each webpage has its own main objective and this objective should be the key – if a person with disability is able to complete his or her task with tools which he or she has available, in way which he or she prefers, the website is accessible for him or her.

On the other hand, giving a definition and setting some rules and guidelines help webdevelopers to know what is best practice and learn the way leading to the true aim.

Accessibility metrics provide a valuable role in establishing the extent to which a web resource can be effectively used by people with specific access needs. Measuring accessibility should not be restricted to web pages; but rather the extent to which goals can be completed by disabled people relative to other members of the target audience. This can cover alternative equivalent routes, using alternative online resources if necessary or alternative access means (eg. screenreaders or screen magnifiers). This definition of course contains more subjective, experiential issues, that may modify the apparent impact of a specific accessibility barrier – but real life isn't only black or white.

There are typically two approaches how to measure the web accessibility. "Conformance review" approach that rely on some checklist and "user testing" approach – some form of user testing by people who have different disabilities and/or who rely on different assistive technologies.

Conformance review is a typical way of evaluation of web sites accessibility. In general, this involves someone with expert knowledge checking whether the site as a whole, or more commonly a selection of pages, comply with a some guidelines (predetermined checklist of criteria) such as WCAG 2.0. This process is sometimes called "accessibility audit".

User testing is usually carry out by a group of users with different disabilities, and different levels of skill in using the internet and their required assistive technology. These users undertake a series of typical website tasks. Their actions are observed (and sometimes recorded) by the evaluator with the aim of identifying the accessibility barriers that maybe encountered.

Both approaches have their strength and limitations, and neither can provide a reliable declaration about the accessibility of a site on its own.

At the very beginning of Blind Friendly Web project, we had relied only on guidelined approach to the accessibility. After some years, when we often had met limitations of this approach, we started to combine "guidelined" with "user-centered" approach. Now our typical web accessibility test contains results of both approaches. Accessibility expert evaluates web for conformance with some methodology/guidelines and group of 6 users with various visual impairment undertakes some (3 or 4) typical website tasks.

This combination brings more realistic view on web accessibility. Users evaluate the possibility to fullfil their needs and accessibility expert can find barriers, that users aren't able to find – for example blind tester isn't able to assesses sufficient contrast of text and background color.

Our testing model unfortunately has one weekness, that we would like to "fix" – ideal user group should cover all (or let's say all major) group of users with disabilities – not only user with visual impairment. But on the other hand – it's better to have one group of testers than none.

Our solution for now is following. Now accessibility expert in specific way "stands in for" disabilities, that aren't cover in user testing, because guidelines are usually more general and cover needs of more than one group of disability users.

Based on our experience and despite the weekness mentioned above, the **combination of "guidelined" and "user-centered" view is now the best solution how to measure real web accessibility**.

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Teaching languages accessibly using an open source web-based tool

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The primary theme of this paper is on giving disabled students direct control over the technologies they use. It also includes developing employment prospects for disabled students and open educational resources for accessible practice.

Application Idea

Xerte Online Toolkits (XOT) is an Open Source, award-winning application that is used to build and publish web-based e-learning objects. A learning object comprises interactive pages that are created from a variety of Xerte templates. XOT puts the disabled students in charge because it allows students to make their own adjustments on a variety of settings. These settings include font, letter size and contrast. Its templates include narrations and related audio clips.

Development idea

The e-TALIA project is a Leonardo Transfer of innovation project and has seven partners from six different European countries. The objectives of the project include building upon the innovative blended e-learning used in the coordinating institution and working collaboratively with European partners. It included developing a set of online learning objects that could be used for language learning in small to medium enterprises (SMEs) within the leisure and hospitality sectors. A criterion for the learning objects was that they were required to be developed using free or Open Source applications.

State of the Art

An early part of the e-TALIA project comprised a literature review of the current situation of language and intercultural needs and the modes of course delivery for SMEs in leisure and hospitality. These findings from the survey showed that many SMEs miss out on business because of insufficient foreign language skills.

In addition, several of the partners carried out a customer survey to determine the needs of SMEs in the hospitality and leisure sectors concerning training in the areas of language skills and intercultural awareness. From the results, it was confirmed that there was a need for language learning within the sectors and the two languages that were most indicated were English and German.

Methodology

The stages of the project started with the literature search and needs analysis for language training and intercultural awareness in the Hospitality and Leisure sectors, to establish the state of the art mentioned above.

The next stage was to transfer from the promoter partner to the other partner members experiences in developing blended e-learning training. The partners' best practice would then be integrated into the existing e-learning template in order to provide a training solution.

The e-learning objects would make training more accessible to people within the SMEs.

The e-TALIA e-learning objects would then be piloted by SMEs employees.

This paper concentrates on the transfer of knowledge using Xerte Online Toolkits as place for creating learning objects and feedback from those constructing the learning objects.

Work and results

Having concluded that there was a training need for language and intercultural awareness, the author used XOT to build a language learning objects based on ones that had been previously constructed using an alternative e-learning tool. These were used as examples to present some of the templates in a language learning context to the Polish partners who were to be authors of the e-TALIA language learning objects.

XOT was used because it was free, unlike the alternatives that had previously been used. It was a stipulation of the project that free applications be used. XOT also had templates that could use audio and multimedia which would be useful for language learning. Finally, XOT had inbuilt tools to enable students to change settings according to their browsing preferences.

Learning objects have been created by the Polish partners using XOT and are to date being checked and modified where necessary and are being sent out for piloting.

Results so far show that the Polish partners were able to create learning objects that incorporated a variety of XOT templates and they have reported that XOT is a good solution to creating language learning objects, due to its accessible ethos.

Impact

XOT will have been introduced to people in five other European countries. The use of XOT's accessibility features has been successfully expanded for use within language learning.

Conclusion

Innovation has been transferred successfully and language and culture learning objects have been created using XOT. These can be developed further according to the feedback that would be received after the piloting stage of the project. It is envisaged that the learning objects could be incorporated within a Moodle course.

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The Use of Personas in the Design of an Arabic Auditory Training System for Children

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Introduction

Children with Specific Learning Difficulties (SpLDs) and auditory discrimination problems provide much greater challenges to user-centered design than more traditional user groups [1, 2]. It is essential to encourage designers, who are often young and more technology-oriented, to develop a relationship with and empathy for, children with SpLDs to account for their needs in the design of interactive systems [2]. It is recommended that children with SpLDs be fully integrated into the design process. Researchers, however, need to take care to be sensitive to the different manifestations of the learning difficulties, user characteristics, sensory capabilities, and the attitudes of children with SpLDs to computers and to being included in the design and development of interactive systems [2]. This paper emphasizes the impact of using personas in the context of a persona-driven testing and evaluation of an auditory training system designed for Arabic-speaking children with hearing impairments or SpLDs.

Personas in the Design of Assistive Technology

Cooper has defined personas as "fictional characterization of users" [1]. Personas have been used to guide the creation of user profiles in interaction design [1, 3]. Personas have been shown to be effective in providing interaction designers with realistic ideas and grounded understanding of users throughout the design process [1, 6, 7, 8, 9]. However, there has been less discussion on the impact of personas on the evaluation phases in User-Centered Design (UCD) cycles.

Sada

Sada is an Arabic auditory training system which consists of games that aim to improve auditory discrimination skills for children with auditory related problems. The system is comprised of games designed in local dialects and in Modern Standard Arabic (MSA). Target user populations include children with cochlear implants, Attention Deficit/Hyperactivity Disorder (ADHD), dyslexia, Auditory Processing Disorder (APD) and autism. The UCD approach was adopted in this project; domain experts, children, caregivers were included in the requirements'

discovery, design, and evaluation phases. Based on the design team's understanding of the characteristics and needs of each type of target users, a persona was created for each user type in the design phase of the system in a data-driven approach [6]. Involving children as design partners was not feasible due to the constraints of the project. To account for individual differences in testing, personas were used as aids for designers in the design phase. Moreover, these personas were again used in the planning for usability evaluations phase of the system and in the analysis of usability testing results to inform the revisions related to the system's design.

Personas in the design phase

Creating personas for each class of target users, has helped in designing the system with a clear image of the child-user in the minds of the design team by focusing on the limiting characteristics and accessibility needs as noted by Henry [4]. This in turn, led to produce a user-specific design involving the profile characteristics of each child users and their adaptive strategies in using technologies in different aspects of the design (e.g. visual design of the interface, modality, and difficulty levels of games). For example, the interface and pace of the games were designed to allow configuration and customization by end users with default settings adapted to each user category's needs.

Personas in the testing phase

In the testing phase, our personas were mapped to real users with similar profiles. Evaluations were conducted with a sample of children with SpLDs in local public schools. Using persons has proven to be a very effective approach in planning the evaluation for the design team, facilitating the testing and evaluation processes in terms of accommodating user needs in the session and analyzing the findings from these usability sessions in post-session analysis. That was apparent throughout the process in which testers were matching intuitively each of the personas with the children participating in usability testing sessions.

Conclusion

Using data-driven personas in both the design and testing phases of Sada was effective in supporting the design team's understanding of target populations with considerable individual differences. Validating the personas with domain experts facilitated the utilization of personas in usability evaluations with real users. This project adds to the limited research available on utilizing personas in the evaluation of assistive technology for children.

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Can Audio-Haptic Games form a playful and effective learning gateway for students with Visual Impairment?

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There has been a debate as to whether educational games should be integrated into the school curriculum. Some educators hold stereotypical and sceptical attitudes as to what are the immediate positive changes of student's learning cycle and competitive advantages games may offer in comparison to the traditional teaching and learning process. They overplay the negative social impact games might have on students' behaviour (Provenzo E. F., 1992) and attitude towards learning. Some others with more conservative outlook strongly support that teaching and learning should continue to be carried out in the traditional way. So mainly when educators have discussed use of games, they have focused on the social consequences of game play, ignoring important educational potentials of gaming (Squire K., 2007). On the other hand, there are the more liberal educators who see lots of promising outcomes of integrating game technology into teaching. But there is one thing that both parties conclude on; computer-assisted instruction (CAI) and multimedia in education have significantly changed children's learning and cognitive processes (Tsung-Yen C. et al., 2007) and can make learning a more enjoyable experience. Furthermore, research indicates that educational computer software can be motivating (Millen 2010) for children with learning difficulties and/or students with a cognitive handicap. The emergence of haptic technology and the opportunity of creating interfaces for non-visual audio-haptic interaction have opened the door to 3D interfaces by blind users (Petridou M. et al., 2011).

There are lots of parameters that an instructional technologist and a game designer should study in order to understand why games are such a popular and influential medium. For example, they should think about how game designs create emotions in players such as joy, happiness, anger and anxiety. One way in which this may be achieved is by balancing a number of game components, such as character traits, game rewards, obstacles, level of difficulty, competition with other peers and very importantly how they can achieve collaboration with other players.

Teamwork and collaboration with sighted peers and teachers is very difficult to be included in blind user interactions with graphic interfaces and in the long term may isolate students with visual handicap. Therefore, the acquisition of a

shared understanding and collaboration with sighted students cannot easily be formed and the communication channel can fail to be established. It is necessary to find a way to create a channel for exchanging information between visually impaired students and their sighted peers and teachers. Visually impaired students need so share a common ground of understanding with the people around them as this will form a foundation for collaboration and interaction. Educational stakeholders should form ways of making the learning process of blind students less complicated and more enjoyable. This research deals with one way of designing and developing a playful educational game by involving users in the design process and by doing so in an arena where the cost for audio-haptics may be easily justified. Special consideration has been given to supporting collaboration between blind students and their sighted class mates. It looks into ways haptic and audio technology can help students with severe visual impairment learn and practise basic geometrical concepts by interacting with a Virtual Learning Environments (VLE).

Focusing on geometry, the main theory of space, it is very crucial for visually impaired students to develop accurate clues of spatial sense and reasoning. Geometry is a major subject in the school-curriculum and is considered to be the main theory of space. To understand the basis of its concepts, students require a good sense of spatial awareness and the ability to use optimally systematic thinking and reasoning. Among the visually impaired student population it is considered to be the most challenging and difficult subject to learn. Its contents are very rich in visual representations and pictures, adding an additional barrier to students with visual handicap to learn.

The current paper presents the research team's efforts to identify what are the characteristics that educational games for blind students should have to be fun and effective in supporting their learning. Moreover, the team is looking into different ways of using haptics effectively to provide new computer interaction techniques for visually impaired students and how can these findings form a well-designed VLE for practising geometry using the Novint's Falcon console. It discusses the findings and presents the way that the game was built based on the input of end-users.

Approaches to Creating E-learning Educational Tools Reflecting the Students with Special Needs

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In spite of support and a series of measures concerning the integration and inclusion of people with special needs, there are still many people who, due to their specific needs, are socially excluded and suffer from a lack of opportunities to participate fully in the life of the majority society. People with special needs represent almost 10 % of the population of the European Union. It is clear that even a group of university students will contain a significant minority of students with specific needs to be met. The question is whether this really happens and whether universities provide the students with special needs with suitably adapted forms of education. One of the modern forms of education is definitely e-learning, which has been gradually integrated into the everyday school life. It is thus important that even this form of education reflect existence of a group of students with special needs. The present paperanalyses the field of educational tools used in e-learning from the perspective of evaluation of their characteristics and quality, especially in terms of their ability to evaluate specific tools suitable for students with special needs.

Introduction

In Europe, a consensus was reached upon the use of a unified term of e-learning, which, according to the information at the e-learning portal for Europe Elearningeuropa.info, is understood as the *application of new multimedia technologies and the Internet in education, in order to improve its quality by enhancing access to resources, services, the exchange of information and cooperation* (Simonova, 2010).

According to this definition, e-learning covers not only a wide range of tools that are used for the presentation or the transfer of the educational content and for the management of studies, but also an entire spectrum of communication channels. The tools are used via LMS (Learning Management System), which is a prerequisite for the implementation of a truly effective learning process through e-learning. LMS thus represents a virtual 'classroom' environment comprised of tutorials, quizzes, study instructions, exercise plans or discussionforums (Mauthe, Thomas, 2004).

Apart from LMS, properly structured and didactically adapted educational texts, *referred to as e-learning supports* (Paulsen, 2003) contribute significantly to the implementation of e-learning. To get a clear and permanent definition of the term, it is therefore necessary to focus on the structure and the arrangement of

individual elements that such a teaching material is composed of. Study materials for distance learning, in both classical form and the form of e-learning, have gradually evolved from textbooks. In terms of the text structure, a classicaltextbook (Möhlenbrock, 1982) iscomposed of two basic components, i.e. text components ('written text') and extra textual components (graphical components). It should nevertheless be noted that e-learning supports have their own unique characteristics as they are intended for a particular form study, characterized above all by a higher level of independence and individuality (Bates and Poole, 2003). A characteristic feature of thus structured electronic study supports designed for e-learning is the fact that their nuclear structure is enhanced by various interactive and multimedia elements, i.e. animation, multimedia records, dynamic simulation, sound recordings, etc.

Modern information and communication technology should therefore able to offer students with special needs educational tools that can help them in overcoming the difficulties arising from the latter. The interest of teachers and students is more frequently focused on the educational content, which is not just the text and static image information, but also the dynamic image information, animations, simulations, or even the virtual reality. (Marešová, 2009) According to the changing form of educational content and its structure, it is also necessary to change used tools and evaluation strategies by which the educational content and its structure is evaluated. If there is a possibility or an intention that the educational tool will be used in the education of students with special needs, it is necessary to extend the valuation of this area, too. The following text will describe currently the most commonly used approaches to evaluating e-learning training courses, namely from the perspective of readiness to evaluate specific tools suitable for students with special needs.

Current attitudes to evaluating e-learning courses

The conventional approaches to the evaluation of training courses (at the time also known as "training programs") are based on Kirkpatrick the 4th level model. The four level model of educational evaluation were later reworked and in the year 1993 updated in the book called Evaluating Training Programs: The Four Levels (Kirkpatrick, 1998). The current system of evaluating the effectiveness of e-learning courses is based on the basic postulate of distance education, that education is the education of adults and can therefore be applied not only in the corporate sector, but also in the tertiary sector and in lifelong learning (Bednaříková, 2008).

Other systems are based on a qualitative concept of evaluation, for example in the European quality promotion policy, which the European Commission launched in 1994. The concept of total quality management – Total Quality Man-

agement – (Blecharz, Zindulková, 2005) is based on the business field, but is also applicable to the university education. Thanks to projects such as e.g. SEEQUEL, there already exist Conceptions of quality in e-learning (Seequel, 2004) or the General framework for quality in e-learning (Anderson, McCormic, 2005). The quality management system has gradually been constituted.

There are also questionnaires for assessing e-learning from this perspective (e.g., Quality on the line: benchmarks for success in Internet-based distance education, project SEEQUEL) and some are even of Czech origin, e.g. Evaluation Standards of Faculty of Economics of West Bohemia in Pilsen (Eger, 2005). This attitude to the evaluation of e-learning is based on the overall results of comparing the effectiveness of education and identifying, regardless of the qualitative aspect. It looks at the whole process of education as a single entity and does not differentiate the educational process itself, i.e. its phases, the arrangement and structure of learning content or its form. Neither of these evaluation systems reflectsthe demands of the group of students with special needs nor contains adequate tools for assessing the quality from this point of view.

Current attitudes to the evaluation of the learning materials for e-learning

Another attitude to the evaluation of e-learning (with which the authors of this article identify) is based on the fact that it is also possible to assess and evaluate the individual building blocks of e-learning. One of these basic pillars is that there are e-learning study texts with a high rate of use of multimedia and simulations, which are nowadays beginning to use cyberspace and virtual reality. Even in this attitude to the assessment e-learning there (both at home and abroad), a number of studiesand research investigations focused on the quality of standards of e-learning components have been carried out. There is a very interesting work by M. Simonson, S. Smaldin, M. Allbright and J. Frydengerg (Frydengerg, 2002). As regards Czech production, the publication of Květoň K., Koníček L., Bauerová D. (Bauerová, 2007), E. Mechlová, J. Šarmanová and M. Malčík, can be mentioned.

Even though these concepts of evaluation of e-learning study texts are very relevant and balanced, we must say again, that neither of these evaluation systems reflects the target group of students with special needs. According to this article authors' opinions, it is necessary to create an appropriate assessment tool that would eliminate this deficiency.

Proposal for an evaluation system of e-learning study texts reflecting the students with special needs

We can say that during the analysis of existing systems for evaluating electronic learning texts, we did not find a totally adequate system that would be effective for the quality assessment in practice. Because of this, we have defined theoretically and on the basis of realized education research verified, a new system for evaluating electronic learning texts, which allows a wide application of all necessary aspects of evaluating. There are also some links to support management systems or control systems during the study, which under the conditions of distance learning, are implemented by LMS systems. A research investigation was carried out at the Faculty of Education of Palacký University in Olomouc and was attended by 734 respondents. The results were processed using multidimensional statistical methods of cluster and factor analysis. On the basis of the research we have shown that there are 6 main fields of evaluation, each containing three to five most important evaluation criteria (a total of 43 observed characteristics) necessary for the relevant assessing of the properties of e-learning study texts:

- The criteria focused on the student's personality (psychological aspects).
- The criteria focused on student learning (educational aspects).
- The criteria focused on educational content and its form (multimedia, visualization, abstraction).
- The criteria focused on the specifics of e-learning tools (the element character of e-learning).
- The criteria focused on the technical aspects of e-learning.
- The criteria focused on the ergonomic aspects of e-learning.

Even though we have to prove a proposed system for evaluating electronic study texts using the statistical methods, we have to say again that the methods of this system do not currently reflect the target group of students with special needs. In another research work, we want to fill this gap and extend the evaluation system to include tools for assessing the quality of e-learning study texts, even if it is intended for this group of students. The system structure will therefore be enriched with another field of criteria:

- The criteria focused on consideration groups of students with special needs.

It is already clear that this field of evaluation criteria will continue to be divided in more detail on the criteria of the target group reflecting hearing, visual and physical disability (psychical illnesses and mental disability are not resolved at this stage). The definition of the observed characteristics and their verification on the basis of statistical methods is the main focus of further research work of

the authors of this article. In connection with this there is an intention to create a national (Czech) or international team of experts who would be involved in this research, both in the theoretical and application parts. This article is thus also a challenge to all those interested in cooperation.

Outline of a way to test the proposed system for evaluating of e-learning study texts reflecting the students with special needs

The extended evaluation system described above will be subjected to a statistical analysis aimed at verifying the research premise: "the system of evaluation of educational materials for e-learning can be divided into 7 basic groups of evaluation criteria." This premise will be proved by using the multivariate (multidimensional) statistical methods, cluster and factor analysis. The evaluation will be performed with quantitative methods, and as the default research method, the factor analysis (McDonald, 1991) will be used. Another research method to be used in verifying the evaluation systems is the cluster analysis (Pecáková, 2008).

There is a presumption that the research sample of this survey will consist of a group of students with special needs from Palacký University in Olomouc, who graduated the full-time and combined forms of study using LMS Unifor through using the educational materials intended for e-learning. We think, however, that to ensure really valid results, it is necessary to verify our assumption within a wider research sample, so we are fully prepared to accept any offers from colleagues from Czech and foreign schools. Collecting the research data will be realized via an interview – qualitative methods.

Conclusion

The area of supporting students with special needs manifests itself through all levels of education. As regards of Czech elementary education,focus is currently put on the issue of developing inclusive education, which brings along the need for restructuring the educational content for the students' with special needs seek. These students can also take advantage of the possibilities of managed self-study, which in the case of elementary schools is not common yet. Here, therefore, e-learning could help to solve these difficulties. To this area, an evaluation system could be introduced, supposing it will be applied on this sample of respondents, as a good guide for teachers for developing learning support materials.

As for tertiary or secondary education, it is essential to providethe students with special needs with a wider range of forms of education, which may contribute to increasing comfort and level of education of the latter. E-learning seems very promising in this area. It is necessary that there be adequate tools for the evaluation of educational instruments intended for this form of study.

The facts mentioned above are perceived as a stimulus for a further discussion and as well as an incentive for a responsible and balanced attitude to the specific demands of students with special needs by implementing e-learning, even if only as a small part of their study. There is an intention of the authors of this article to build up a national (Czech) or international team of experts who would participate in further research, both in theoretical and application parts. This article is thus also a challenge to all those interested in cooperation.

3

Multiuser Virtual Environments and People with Special Needs

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Objective

This paper evaluates multiuser virtual learning environments that were designed or used specifically for the education of people with special needs. The good practice examples are analyzed and also our own experiences with the multiuser virtual environment Second Life in the seminars at Faculty of Education, Palacky University in Olomouc.

Background

A multi-user virtual environment (MUVE) is defined as a virtual 2D or 3D simulation environment representing the real space (Brdicka, 1999). It represents the integration of existing forms used by online communication and becomes a medium through which it is possible to create social interaction very close communication in real space. The popularity of 3D virtual worlds in recent years has grown rapidly. For example in one of the most famous virtual worlds, Second Life, grew from 230,000 residents in 2006 to the present more than 13 million (BeVirtual, 2008), of which the Czech Republic has tried SL about 30 thousand users. According to Gartner Research (Gartner, 2007), in 2011 more than 80 % of active Internet users will be a member of any part of the virtual worlds. Some authors argue that these virtual worlds redefine the Internet as we know it today (Kluge, Riley, 2008). Indeed, the signals can be recorded in terms of more use of video and share 3D virtual environment and computer games, which today represent real-world simulation.

Effectiveness of communication is increased if the characteristics of the media are in accordance with the processes of communication – the immediacy of feedback, variability of symbols, the number of possible ways of communication, testability, replicability and others (Riha, 1999). Collaborative hypermedia environment that represents MUVE, meets most of the above aspects – they are the object-oriented systems, where communication takes place in real time, for example, through audio or video conference or in the immediate interaction through its 3D graphical representations (avatars). Unlike previous types of communication (e-mail, text or video) that are mostly used for communication isolation, communication in all these types of MUVE integrates and enhances the effect of online communication. User moving in MUVE can monitor the

communication of individual participants, he can move to a specific participant, all of which can communicate very much like the real environment.

This aspect of communication options similar to the real environment without the necessity of personal presence in the communication situation provides a strong motivational moment for the use of these technologies by people with special needs. Interactive software also encourages active involvement in learning and gives the user the experience of control over the learning process. This is especially important for people with learning difficulties. Learners can work at their own pace. They can make as many mistakes as they like without irritating others and the computer will not tire of the leader attempting the same task over and over again, or get impatient because they are slow or engrossed in particular details. It also showed some studies – Standen et al (1998) describe a study which involved taking 19 pupils aged 14–19 years with severe learning difficulties to a supermarket to find four items on the shelves and take them to the checkout. Nine pupils spent twice-weekly sessions carving out a similar task in a virtual supermarket. The remaining pupils had the same number of sessions using other virtual environments. There was no difference between the two groups on their first visit to the real supermarket. Yet, on their return visit, those who had practised shopping in the virtual supermarket were significantly faster and more accurate than those who had not.

According to statistics suffer from some type of disability approximately every tenth citizen of the Czech Republic (Chvátalová, 2010). Numbers of research projects focused on the use of ICT by person with special needs were provided in the Czech Republic in the last decade. These include communication with eg Project Database Systems for Handicapped-based natural language (P. Slavik et al, project GACR), Blind User Adaptive Navigation in a virtual environment (V. Nemec et al., project Ministry of Education), presentation of virtual acoustic scenes for navigation in real environments using augmented reality for the visually impaired users (A. Sporka, Ministry of Education project), Interactions of Visually Impaired Users in Virtual Environment with surround sound (V. Nemec et al., CTU project) and other.

Multi-user virtual environment Second Life (SL) can be one of the suitable options for the education of persons with various forms of disability – such as persons with reduced levels of visual perception, which can use voice chat, while deaf people can enjoy classical chatting, people with disabilities can be in SL through their avatars move (walk, run, fly) equally with other colleagues, and not at the level of the social groups experiencing feelings of otherness. Creating of social communities in these environments can help these people feel free from traditional prejudices encountered in real life. In addition to their own education it is possible to use SL as a space for an information platform for communities of people with special needs, for conferences and lectures.

The SL has appeared first projects focused on a group of people with special needs – for example IBM has launched a project called Aira (Accessible Rich Internet Application), which is based on the possibility of complementing objects in SL labels and information relevant reader can then interpret the blind users or the Virtual Ability Island (Island of virtual capacity), focused on people with the different types of disabilities etc.

Methods

We used the method of analysis of available literature, Internet resources and selected multi-user virtual environments in order to gain an overview and evaluate the effectiveness of some virtual environments for people with special needs. Based on these findings, we implemented a multi-user virtual learning environment Second Life in teaching of the seminar New Media and Cyberculture at Faculty of Education, Palacky University in Olomouc. Following the completion of training, we investigated the attitudes of respondents to the teaching in the environment by a questionnaire method.

Results

Our results suggest that work in multi-user virtual environment is a particularly strong first motivational stimulus for learning, but a very important role play also the user skills, because a lower level of ICT skills also led to more negative attitude to learning in multi-user virtual environment. Based on the analysis of examples of good practice and self-assessment of questionnaire surveys, we set some of the aspects that must be respected especially for students with special educational needs with regard to learning in MUVE. Our intention for the future research is to provide the teaching in MUVE with a group of students with special educational needs.

Conclusion

Virtual education is beneficial for students with disabilities, because they form a more level playing field than teaching face-to-face. Virtual worlds allow users with special needs to have an access to teaching and learning materials from their home. It can help them keep abreast of relevant information and also give them the sense of belonging to common study groups, where it would be more difficult to implement in a real environment. Possibility to participate in the presentation through a virtual world from home or workplace offers these users a comfortable environment. The flexibility of virtual worlds significantly improves their opportunities for learning and work cooperation.

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Dealing with Changes in Supporting Students with Disabilities in Higher Education

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3

Idea

Following a study on the "Social situation of People with Disabilities in Austria" carried out by the Austrian government (Federal Ministry of Labour, Social Affairs and Consumer Protection) within the framework of the annual "European Union Statistics on Income and Living Conditions" (EUSILC) 1 survey, 18 % of all Austrian citizens without a formal recognized disability finish their education after compulsory education (9 years of school). Within the group of people with disabilities, a significantly higher amount of persons (46 %) finish their educational path after compulsory school. The "Matura", the formal certificate that entitles people in Austria to enter Higher Education (e.g. university or university of applied science) is reached by 30 % of all Austrians without a formally stated disability and by 11 % out of the group of people with disabilities. As information on disability is subject to special data security regulations, this information is not asked when people enrol for Higher Education. There are of course numbers given by disability support structures (installed at most Austrian Higher Education institutions) but it is up to the individual with a disability or chronic illness to get in touch with these structures and "re-appear on the screen". Therefore, there are no formal surveyed numbers on people with disabilities studying and/or finishing their studies and reaching a career different from "traditional" jobs but numbers given by disability support services throughout Austria that are, again, far smaller than the number within the group of people without a disability. Out of own experiences, this group is further diminishing during their time in Higher Education until successfully entering the first labour market at a position corresponding to personal abilities, knowledge, skills and competences. Many issues are to be sorted out before, during and after Higher Education – issues resulting from specific needs that might arise from a disability or chronic illness, issues connected to a specific study scheme, connected to Assistive Technologies (AT) and Information and Communication Technologies (ICT) in use… but first and foremost issues that should be part of a most flexible, interactive and reliable support framework in order to create possibilities and facilitate pathways.

State of the Art and Necessary Steps Beyond seen from Austrian perspective

In 1991, the institute Integriert Studieren at Linz University was founded as "Endeavour Informatics for the Blind" and first formal Austrian offer for students with disabilities, following experiences and expertise of a similar scheme at Karlsruhe Institute of Technology[1]. The 2 students supported worked already with Braille Displays and PCs (MS DOS™) and were supplied with study literature in accessible formats.

In these first years, blind and partially sighted people from all over Austria came (or, more precise, 'had to come') to Linz and wanted to study computer science – even if this field of study was not the best one for them. Today, the institute works as function unit in supporting the university board in various issues connected to "disability" at Linz University.

To get an overview, the following table shows the distribution of disability forms on the institute's student population. There are 3 people out of these 60 individuals characterizing their constraints as "multiple disability / combination of different disabilities" where only the most influencing has been counted:

[Tabel 1] Distribution of disability forms amongst the institute's students population (N=60, where 3 people characterized themselves as affected by a multiple / combined disability where only the most influencing has been counted)

Form of Disability	Numbers
Blind / Partially sighted	24
Motor / Manipulation	14
SPLD	4
Psychologic constraints	2
Deaf / Hard of Hearing	3
Chronic Illness	2
Speech / Language	1
„Not to be published"	10
Total	**60**

Since 1991, as described above, a continuous and ongoing change has taken place, caused by:

- The rapid progress in ICT / AT facilitating more and more ways of trans-

1 http://epp.eurostat.ec.europa.eu/portal/page/portal/microdata/eu_silc (Panel size 15.000 persons in 6000 households – last lookup in January 2012)

port and representation of knowledge and information, facilitating the inclusion of more and more people with most diverse forms and combinations of disabilities into secondary education that led to

- "New" forms of disabilities entering University. Connected to this,
- The numbers of people with disabilities entering University rose and of course that led to
- Additional fields of Study and universities our students with disabilities are interested in, resulting in
- Changes in:
  - Work and workflows
  - Services provided
  - Tasks fulfilled and
  - Funding needed

This paper will discuss the changes faced in supporting students with disabilities at Linz University and the methodology used compared to other support schemes around Europe presented within the EU wide "Higher Education Accessibility Guide" (HEAG) installed by the European Agency for Development in Special Needs Education[2]. As the (online) survey amongst 100 support structures from Austria, Belgium, Croatia, Czech Republic, Denmark, Estland, Finland, France, Germany, Greece, Iceland, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Romania, Sweden and UK that we designed to collect further information is running in the moment, first results will be available for the final paper and stable results for a possible presentation in July. First feedback from 20 institutions (from Austria, Czech Republic, Sweden and Germany) shows that the institute's working group "social inclusion" and its service offer follows a quite different approach, therefore it will be described on the following pages in more depth.

Methodologies Used to Comply with the Changes Faced in Daily Work

As described above, the most influencing changes resulted in necessary adaptations in the following areas:

- Work and workflows
- Services provided
- Tasks fulfilled and

2 http://www.european-agency.org/agency-projects/heag (last lookup in January 2012)

- Funding needed (primarily for personal assistance, e.g. sign language interpretation)

New technical / technological developments helped in solving some of the issues, other requirements had to be tackled by changes and adaptations in the basic organisational structure of the support scheme or adjustments in the provision with accessible study materials / study literature had to be evolved from 1:1 or face to face personal assistant settings to a user-centred, self administrating and transferable (i.e. independent from University, field of study, disability form and number of students supported), highly available web based toolset, an experience also reported by some of the answering institutions from our survey.

The core idea in short words is to provide a web based tool / literature database where the students enter the study materials they need. If available, the students may download the adapted materials directly, otherwise a standardized workflow is triggered. This workflow reaches from putting a query to publishers in order to get the texts needed in digital formats over the adaptation process until the provision of the ready materials – based on "open document" files – easily convertible to diverse formats: "simple .doc / .html" over .xhtml to .mp3 and finally also Daisy versions.

R&D Work and Results

Within the first years of supporting blind and partially sighted students at Linz University, the provision with study materials / study literature and accessible working environments were at focus. With the rising number of (prospective) students there was a need to expand and transfer the service scheme to other supportive structures, universities, forms of disabilities and fields of study. Simultaneously, the administrative effort and the support expenses (in terms of time) for this process had to be reduced but in the same time tailored to the individual needs and nevertheless made efficient, manageable and affordable.

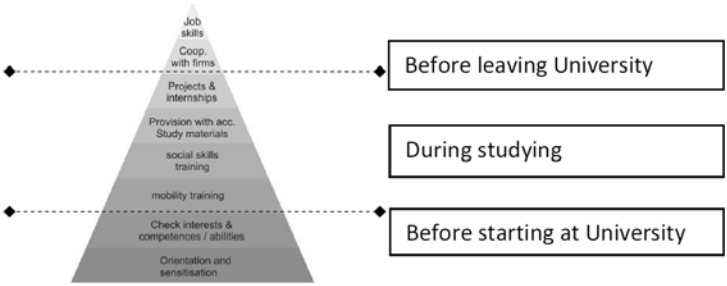
Another issue was the experience that the dropout rate of students with disabilities was – even with the best adapted study materials and technical / technological framework – reasonably higher than in the "mainstream population". Evaluations showed that – in most cases – there was a lack of:

- **Social skills**
  - Necessary to build up personal relationships and communicate own needs resulting from the disability and getting part of / build up supportive peer groups that are crucial in order to succeed at University, as "lone fighters" are always at the risk of failure caused by the far higher effort in studying and getting further

- **Communicative skills**
  - Strongly connected to the social skills needed for studying effectively – but in most cases not learned during (even integrative) first / secondary education
- **Sound knowledge of studying at university level, planned fields of study and necessary ICT / AT skills**
  - It is necessary to get in touch with prospective students as early as possible in order to counsel them in using ICT / AT efficiently and work with them on finding and choosing a study field corresponding to their skills, competences and interests. that finally, amongst other issues (health related, related to financial issues or other influencing factors), led to the observed reasonably higher dropout rate.

Therefore, an additional service, the working group "social inclusion" was installed, responsible for supporting the students in this additional issues as well as doing research on the topic.

The following scheme was developed in order to complement the already implemented institute's technical / technological support:



[Fig. 1] Support pyramid for students with disabilities at Linz University showing that most support is needed when starting

This model acts already before the formal start at university by contributing to activities like the "International Camp on Communication and Computers"[3] and provides interested people with information and strategies on the efficient use of ICT / AT as well as informing them on studying and possible support structures available. Before starting at university, there is also an orientation phase where the prospective students get to know the university, the campus, the people involved in supporting them and the support offers in terms of what the institute does and what is left to the individual.

3 *ICC, International Camp on Communication and Computers*: http://www.icc-camp.info (looked up in January 2012)

During their studies, a variety of offers (besides the "traditional" provision of accessible study materials) is provided, ranging from incoming/outgoing evaluation, monthly team / students meetings, development dialogues, (inclusive) social events like cooking together, over organised excursions and events to specific trainings like "Body language, mimics and gestures / communicating disability", "assessment centre training", "presentation skills" and individualised mobility training. Another important part of our activities concentrates on the provision of possibilities to test oneself within scientific / professional settings (projects and internships in connection to projects carried out at the institute or with partnering institutions like employment services), that often already opens important doors to a later professional entry. Before leaving University, the activities concentrate on the successful career entry and a smooth transition into the labour market. Co-operation with firms, partners and employment services gives the necessary basis. This two activities seem – following first feedback from our survey amongst study support structures in Europe – to be the most promising approach and will be at scope in the final version of this paper and the presentation in July.

Following this scheme, informal experience shows that the risk of dropping out can be reduced to personal factors (health related issues, financial issues,...), what has to be evaluated and monitored formally during the next years as the first students that entered this new scheme is now preparing to finish their studies.

Impact on or Contributions to the Field

In designing the support structure as flexible, expandable and transferable as possible, the impact on the quality of support provided at university level can be estimated as high. Together with keeping the administrative scheme as efficient, user centred and accessible as possible, more time and resources can be put in necessary activities in the field of social inclusion what leads to a smaller dropout rate and a complete package of support provided.

Conclusion and Planned Activities

The scheme of service provision for students with disabilities and chronic illness at Linz university is rather open, flexible and expandable to different needs, disabilities, AT and ICT used and fields of study. This leads to a higher number of students that can be served and therefore get the possibility to study and choose an educational path and a career corresponding to their personal skills, competences and interests.

During the next year(s), new activities like preparatory language courses for deaf students in order to enable them to write essays, mentoring or peer group

counselling / learning support groups ("Tandem Learning") have to be implemented and the scheme has to be evaluated and benchmarked with other support structures (partially concentrating on a single form of disability or just dealing with the provision of accessible study literature / accessible study materials) in terms of resources needed, "output" of students, contentment of students and university partners involved.

3

Workshops

Developing effective teaching strategies and course websites for the diverse needs of postsecondary students through the use of Universal Instructional Design

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W

This presentation will report on a project that produced a set of learner-centred teaching guidelines using Universal Instructional Design (UID) and accessibility standards for application to post secondary course websites. The principles of UID are found in the Universal Design (UD) perspective that views people as individuals with varying abilities and preferences. Based on the perspective of Universal Design, Universal Design in Higher Education (UDHE) identifies physical spaces, information technologies, services, and instruction which allow instructors to adopt inclusive choices.In this presentation, we are concerned with the instructional aspect of UDHE, Universal Instruction Design, and how the principles of UID are applied to web-based course sites. Instructors who employ UID principles consider the potential needs of all learners, identifying and removing unnecessary barriers to teaching and learning, while preserving academic rigor (Coomber, 2007).Teaching strategies based on the principles of Universal Instructional Design help to fill a gap in teaching by providing insight into developing specific teaching strategies to provide effective instruction for a diverse audience of students.

The presenters partnered with a group of faculty through a university-wide learning community seeking to improve instructional strategies for course websites. The literature review, about accessible course web sites, was produced in consultation with the Centre for Teaching and Learning, Student Disability Services, University of Windsor Accessibility Committee, and the School of Social Work, University of Windsor, Accessibility Planning Committee. The main issues for exploration, developed from the literature review, include clarity of materials, efficacy of organization, timeliness of posting, and other concerns, such as, legible font and size, color contrasts, audio to assist navigation through the web site, links to other websites and self-help tools. Data acquired from students in eight undergraduate courses in social work and disability studies by developing and adding twelve additional questions to the course student evaluations will be discussed. The results will assist instructors to examine and adjust their course websites to reflect the principlesof UID and compliance with consumer accessibility standards.

By targeting varying learning needs, this project will help faculty to adopt instructional practices for course websites that strengthen a learning-centred ap-

proach. As a result, faculty will focus on learning obstacles that face students with varying needs rather than viewing student needs through their impairments.This approach will maximize inclusion for students with disabilities and address the diverse learning needs of all students.

This presentation seeks, through audience participation, effective teaching strategies and applications for the instructor's course website. The following objectives will enable the participant:

To review current literature about learning centred approaches and the principles of Universal Instructional Design (UID).

To engage in an interactive group exercise that involves selecting applications for a course in disability studies, reflecting good teaching strategies and principles of UID.

To consider how application choices for course websites comply with and foster accessibility.

To reflect on the applicability of a set of guidelines for course websites and to what degree they are consistent with good teaching strategies and principles of UID.

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Brno 2012

Please note that the texts have not been proofread or edited by a native speaker.