

**Title: Voice technologies have a power to eliminate physical disabilities**  
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### **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 paresis or plegia 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 with MyVoice, MyDictate and NEWTON Dictate, 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.

Software MyVoice serves as an interface between commands spoken to the microphone and standard applications running on a PC. It either complements or (in most cases) replaces keyboard and unlike interfaces embedded in some operation systems, the MyVoice offers a significantly higher degree of adaptability to the specific needs of people with disabilities. Its engine is capable of recognizing with up to 10,000 commands (single words or phrases). The commands can be split into domain-specific groups. This helps to keep the interaction with the computer under control and makes it more robust to recognition errors. The commands can be arbitrarily modified to fit the needs and limits of the users. For example, if the user's speech is affected by moderate dysarthria, the vocabulary can be tailored so that it consists of smaller groups of easily pronounceable (and distinguishable) commands.

The assignment of the actions to the commands is again very flexible so that the user can optimize his/her vocabulary and minimize the number of utterances needed to accomplish the most frequently performed tasks.

The Myvoice is mostly used as a tool that launches and controls applications, enables typing (of letters, frequent words and phrases), and provides access to internet services. It allows for virtually any activity that is normally performed via a keyboard and mouse.

The MyDictate is distributed with a lexicon containing about 550 thousand words. The employed technology allows the program to run even on recent low-cost PCs. The recognizer outputs the ordered list of 10 best candidates, taking into account the acoustic as well as the language model score. The word with the best score is automatically added to the dictated text while the next 9 candidates appear on the list shown in MyDictate's window.

The basic vocabulary assures about 99 % coverage rate for common Czech texts. If a dictated word is not in the lexicon, the user can add it there by voice even during the dictation.

As the program is aimed at people with physical disabilities, it must be able to cope with less standard pronunciation. If this is the case, the user can employ the embedded speaker adaptation module. For most users it helps to reduce the recognition error by 20 to 25 % relatively.

Our results show that the recognition accuracy further improves when the user gets accustomed to the program. After multiple adaptation steps, the score is usually improved by 5 to 7 per cent up to 90%. One of the users, a lawyer, uses the program for dictating highly professional texts where he achieves accuracy above 94 %, now. Trained person can type by voice quite fast, with maximum speed in range 30 to 60 words per minute.

The NEWTON Dictate uses continuous speech recognition, which means it can transcribe the whole speech at a time with accuracy up to 93%.

Similar software solution as the SW NEWTON Dictate for Czech language also exists, the SW NovaVoice. This software resulted from research performed by the chair in cybernetics, faculty of applied sciences ZČU in Pilsen.

The state of the art worldwide is SW called Dragon from Nuance, but it is used only for group of wide-spread and often used languages like English, French, German and similar. Because of high complexity of Slavic languages the SW used for speech recognition of them has to be more robust and precise. More technical details about used SW can be found in [1] and [2].

After the course our clients 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.

### **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](http://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.

In close cooperation with Mrs. Dita Horochovska and a scientific research group lead by professor Jan Nouza from the technical university of Liberec the company CZESHA - SERVIS, s.r.o. developed the first publication of a methodology on teaching the controlling of a PC via voice and additional teaching and learning materials for the participants of the training courses. Other lecturers suffering themselves from quadriplegia participated also on the development of the training materials and on lectures with their specific knowledge of the specific needs of course participants.

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 handwritten texts.

One participant after the course got a regular employment as legal counsel in a well-respected high school in Prague, two other participants work on a research project at the technical university of Liberec and the company Newton Technologies on voice technology. After two years running the project Rainbow Bridge we can state that we succeeded in helping 10 handicapped people who had already been categorized by the labor authorities as not being employable due to the nature of their disability. In the ensuing years we will prove that regular employment for such people can be found. Therefore we are at the process of establishing a social company, having a business plan which is based on getting orders where voice technology can economize the cost.

References:

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