Technology for the Benefit of Individuals with Special Needs

Ofra Razel

The huge technological development of our time has the potential to widen the gap between the ‘regular’ population and individuals with special needs. At the same time it also offers a wonderful opportunity for these individuals to bypass difficulties and improve their ability to function – relative to the past. The Internet has become an integral part of our life – from checking train schedules and receiving medical information to an update about the marriage of the neighbor’s daughter to her sweetheart in New Zealand. Yet it is supposedly inaccessible to many people with special needs, including the blind and the visually impaired, the physically handicapped that cannot use a mouse, dyslexics and many more. There are however wonderful technological solutions for these population groups which I will discuss, along with representative examples from various fields.

Reading Assistance

There is no need to describe the importance of reading. However the ability to read, that is taken for granted by most of us, is missing from the life of individuals who are a part of our society, people that make an effort to become integrated and function in society like others. It is obvious why

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it is difficult or impossible for the blind and the visually impaired to read from a printed page. Yet for those with learning disabilities in general and for dyslexics in particular the difficulty is deceptive. Individuals who do not look as if they have a disability nevertheless cannot read: for neurological reasons they have difficulty identifying letters, following one word and one sentence after the other; everything ‘jumps’ and ‘seems a mess’. New technology brings help in a variety of ways to all those individuals that have difficulty reading or who for various reasons cannot read at all.

**Automatic Narration**

TTS – Text to Speech software: this software can translate written text into automatic speech. It is a very big challenge to develop such software in Hebrew because it requires two unique components: first, the ability to decipher unvowelized Hebrew text (consider the difficulty deciding how to pronounce the word יְם – (in Hebrew the word can be pronounced shemen, shamen, shemin, shuman and shimen, just to mention a few options – each with a different meaning). The second component has to do with difficulty producing sounds that will not sound mechanical, will be narrated with the correct intonation and will maintain the sense of separate sentences, just to mention a few issues. By overcoming these challenges, and developing TTS, the blind and dyslexic can now ‘read’ text, inaccessible to them before the software was developed.

The blind require another component known as a ‘screen reader’ – software that enables users to move around the screen and read ‘actively’, for example: operate various functions, skip something that does not interest them and use links to surf the Internet. The screen reader activates the TTS software which in turn reads the text.
Conversion to Braille

Another option available to the blind is conversion to braille. Until technology supplied solutions, Braille texts were produced manually. Now there are technologies that can convert printed text to braille automatically: (a) using a software program that activates a braille printer which automatically embosses braille letters on paper; or (b) using a special display on which the blind person puts his fingers, feeling pins that move up or down creating braille letters and translating the computerized text into braille display: The picture below shows a braille display that is an add-on to the regular keyboard, where blind users place their fingers in order to read.

Audio Books

When discussing reading assistance it is also important to mention the current availability of audio books on MP3 players or mobile phones. Individuals can listen to an audio book anywhere without the need for heavy equipment.
Narrated text is utilized in various learning contexts, for example by websites and software packages for students with learning disabilities - the text is narrated as it is highlighted on the screen. This enables students to follow the narrated text with their eyes while listening. Examples can be found on the ‘Shetef Kriya’ website (http://shtef.cet.ac.il) or the ‘Kol Basefer – Tanach LeBagrut’ (Bible for matriculation exams) website (http://kol-basefer.cet.ac.il).

**Display Adjustment**

Many visually impaired individuals and those with learning disabilities have difficulty reading because, among other things, letters are too small, lines too close to each other or the color contrast between foreground and background is insufficient. The computer provides users with the ability to change and customize size, color, background color and font type.

**Reading with Picture Symbols**

There are individuals who cannot read or write but can be taught to read picture symbols. There are several accepted symbol languages in the world (which of course enable users to use symbols unique to them – for example to insert a picture of their mother for the word ‘mother). Symbol language is usually taught to children with autism, with mental retardation or with a combination of physical and developmental disabilities. Software that translates written text into symbols is available: the teacher or parent writes the text or ‘imports’ it from any source with ‘copy and paste’ and the software immediately places the appropriate symbol above every word. The user who knows the symbols can use them to ‘read’ the text.
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Writing Assistance

Writing, just like reading, is a significant part of our life. People have difficulty writing for a variety of reasons: physical disabilities that do not enable them to hold a writing device; blind individuals who do not see what they are writing; individuals with learning disabilities in general and those with dysgraphia in particular (dysgraphia is a serious writing disability). The fact that the computer has become the most common writing instrument has made it easier for many of them.

Word Processor

Use of a word processor and writing by means of a keyboard has certainly solved the writing problem for the blind and the visually impaired. There
are also physically disabled individuals who cannot hold a pen but are able to type using a keyboard. Among those with learning disabilities the use of a word processor solves many problems such as illegible handwriting, deleting text and organizing and formatting text on a page.

**Spell Checker**

Most of us are familiar with and use the spell checker in WORD. For people suffering from dysgraphia that make many spelling mistakes the spell checker may provide at least a partial solution. Individuals who make spelling mistakes are embarrassed and often avoid writing. Others fear that they will not be understood because of their many mistakes and were it not for the spell checker would avoid written communication. The spell checker enables them to write and to communicate in writing (provided the mistakes are not too serious and that they select the correct word from the various options suggested by the spell checker).

**Translation of Speech into Written Text**

Speech recognition software that translates speech into writing is available now in many languages including Hebrew. Individuals with writing difficulties due to physical disabilities that prevent them from using a keyboard or those who suffer from severe dysgraphia, can speak to the computer or to a mobile phone and their message is immediately translated into written text that can be saved or sent. The problem with these tools is lack of accuracy, but these things advance over time.
Communicate, Respond and Influence

Imagine a disabled individual that cannot control his body movements, cannot willingly move his hands and legs, cannot speak, is fed by others and only has control over moving his head to the left. Whether born with a severe disability or the result of a car accident or a disease these individuals are imprisoned in their body. They cannot respond to the world as ‘regular’ people do and cannot impact what is happening around them, or are very limited in doing so. Steven Hawkins, the famous scientist, is an example of just such a person, but there are many like him. However if these individual can willingly move even only one muscle – blink an eyelid, move the ‘pinky’ finger or their eyes – their life can change dramatically with a computer operated by one or more switches.

The active muscle activates the switch which in turn operates the computer. How does this work? a special software scans the computer screen, using a color frame that moves from one element on the screen to another, at a speed set in advance by the user. The user waits until the frame reaches the element he wants to choose, and than he activates the switch which in turn operates that element.(for example: turn on the speaker, exit the program or write a character). The more switches an individual can activate, the greater the scanning efficiency and the faster the ability to operate the desired element (for example one can use switches that function as arrow keys, thus can get to the desired element more quickly).

Here is how an individual that activates a single switch can write or even speak using the computer: a virtual keyboard with a number of rows is displayed on the screen: the software begins scanning the rows. It scans the keyboard one row after another. When the scan reaches the desired row, the user activates the switch to select that row. Now the scanning process begins within the row, moving from one character to the next in
the specific row. When it reaches the desired character the user activates the switch and the character is written. Tiresome? Definitely. However if this is the only way individuals can express themselves then we have changed their life.

Here is a picture of a virtual keyboard with the scanning frame on the second row.

After the message is written the user can also activate Text to Speech software of the type described above, and the computer will read it out loud. This is one alternative form of communication which the computer affords. Other possibilities are the use of symbols: instead of writing words, one letter at a time, users select picture symbols by using ‘communication boards’ that contain the symbols organized specifically for their needs.

**Internet Accessibility**

At the beginning of this paper I indicated that technology may widen the gap between ‘regular’ people and those with special needs, and as an example mentioned Internet use. Extensive efforts are invested daily to persuade website designers to design their websites enabling access to individuals with disabilities. The definition of an ‘accessible website’
was set by an international organization that defined various levels of accessibility and provided guidelines regarding their technological implementation. This issue is in various stages of legislation in Israel and when passed will require website design to address the needs of individuals with disabilities.

What is an accessible website? Here are some examples:

- The color contrast between the characters and the background is heightened to facilitate reading by the visually impaired.

- There must be a verbal explanation ‘behind’ every picture so that a blind person using a screen reader will know what is displayed on the screen.

- Text is not displayed as a graphic element (for example names and logos), because automatic narration software programs used by the blind do not ‘understand’ these graphic elements and therefore cannot ‘read’ them out loud.

- The screen structure is organized such that the ‘screen reader’ can follow the logical arrangement of the elements (a screen reader cannot operate when screens are overcrowded with advertisements, articles, news, etc. displayed alongside each other).

Since implementation of laws for accessibility take time, CET, with the support of the National Insurance Institute, recently developed the ‘Resisim’ website, an accessible RSS reader. What is RSS? It is a standard and widespread technology commonly used on the Internet, that enables websites to provide content and information updates conveniently and quickly. It works like this: many websites prepare summaries of their content in a format called RSS. Users can choose websites from which
they wish to receive these summaries, according to their areas of interest, and these are then collected for them in a private account in a website that is an ‘RSS Reader’. When information is uploaded in the selected website, a summary of this content is then available in the user’s personal account. The content also contains a direct link to the source.

The uniqueness of the ‘Resisim’ RSS reader is that it is fully accessible to individuals with disabilities. Users can access the reader through different and varied access modes such as screen readers, braille, touch screens, switches, varied scanning formats, customized mouse and more. The website fully supports Hebrew and the display can be adapted to the user’s needs.

Through the ‘Resisim’ website users can read information summaries from a wide variety of websites, without unnecessary information load on the screen. After reading the summary users can use a link to go to the original information source. Thus users can browse the Internet relatively quickly and access diverse information previously inaccessible to them.

The website has a database of about 2,000 channels in Hebrew that provide information summaries (RSS updates) on a variety of topics divided into categories. Users can create a personal channel list from a channel library and organize it according to personally selected categories. They can also add their own channels in any language and organize the information in a format convenient to them. Furthermore, information can be tagged and cataloged and users can prepare a list of favorite websites to access.

There is a significant gap in computer and Internet use between individuals with disabilities and the general population. The ‘Resisim’ website cannot eliminate the digital gap but can contribute to its narrowing, particularly among individuals with disabilities that use a
computer but find it difficult to use the Internet on a regular basis. In this case technology that created the digital gap also helps narrow the divide.

**Summary**

This article presented a small sample of technological solutions for different types of special needs. Thankfully the majority of the population does not need these solutions, however, for those that do need it, it means everything. The problem is that Israel is a small country, the number of Hebrew-speakers in the world is limited and commercial entities are wary and reticent when it comes to technological developments with limited economic benefits. For this reason the involvement of entities such as the National Insurance Institute and relevant government ministries is so vital for developing solutions. Activity by philanthropic organizations (such as the CET – the Center for Educational Technology) is significant but insufficient. On this backdrop, the recently announced initiative of the Israel Ministry of Finance in collaboration with the Ministry of Industry, Trade and Labor to allocate an earmarked budget to fund the development of technological solutions for special needs individuals in Israel is particularly uplifting.