Digital technologies to help visually impaired persons

The TEDxUTCompiegne programme is a sequence of local events that aim to “boost creativity, enable change and encourage innovation to make Compiegne prosper”. The latest invitation to the event organized at the Technology Transfer Centre was Anke Brock, a research scientist with Inria-Bordeaux, on the theme ‘Horizon 2050 – Innovation and Society’ and a member of the Bordeaux Laboratory for Computer Science and Applications, a specialist in Man-Machine Relationships. Her interests for the moment are focused on “geolocalization tools” to help partially blind persons.

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To what extent are information and communication technologies (ICTs) to be seen as challenges for partially blind persons (and handicapped persons in general)?

By the age of 75, one person out of five in France develops a visual impairment, which represents some 200 000 handicapped persons. It is therefore important to learn more about relevant ICT research that potentially could help disabled, impaired persons. What I personally want to show is that computer science research is not an exclusive, reserved area for technology ‘geeks’ but also means that we must have a degree of compassion and sensitivity to better understand users with special needs.

Today, persons with visual impairments use digital technologies to access information they could not get otherwise. All current smartphones and i-Pads propose an audio read-out of text displayed on the screen. Overall, the digital world appliances offer tremendous possibilities to improve the standard of life-style for handicapped persons.

How does a visually impaired person cope with a spatial reference?

This question of how a visually impaired person perceives a spatial environment was first raised in the 1930s by experimental psychology scientists. At the time, the answer proposed was to assert that a partially blind person was incapable of 'building up' a mental representation of space, other than simple or familiar shapes and forms, such as the lay-out of a home, apartment and its furniture. Today, our research has shown that visually impaired persons can create efficient spatial representations. Nevertheless, different zones of the brain are involved in memorizing and representing spatial information. We have found that certain zones of the visually impaired persons are underdeveloped. Beyond the question of brain development, cognition sciences have also revealed that the capacity to cope with spatial data still differs a lot depending on whether the impairments goes back to birth or not. Globally speaking, the development of cognition capacity to cope with spatial data is slower for visually impaired persons.

There are three levels of spatial knowledge. The first level relates to identified points of interest and the second to the 'trajectories' between these points. The third level, known as "configurational knowledge", implies the spatial representation of the data taking the form of a plot map which integrates orientation, distances and all the information needed to move around confidentially in, the surrounding environment. It is this last-mentioned level that enables a flexible approach to the environment by adapting decisions in terms of spatial representations. Studies in cognition science show that those with visual impairments find it more difficult to reach and use the third level. Our research nonetheless also shows that these parsons can acquire this level of knowledge notably by using accessible interactive maps.

What technologies are currently available or under study that could help visually impaired persons to cope with their

environment?

Well, various technologies do exist or are being explored. Ocular prosthetics are now being envisioned, but only for special forms of impairment. Geo-location tools are also under development, transmitting information by audio or tactile channels. Originally these tools were intended for pedestrians or cyclists but they could also prove very useful for partly blind persons. Having a map is often necessary for a geo-location process. Braille maps have been available for a long time now, which of course implies that you have to able to ‘read’ braille, which is not the vase for all visually impaired persons, especially those who develop and suffer from their impairment in later life. Consequently, scientists a have been working on interactive maps for the past 3 decades. The screens are fitted with pistons (or screen bumps) that dynamically represent braille words or signs and landscape features. There are systems such as Tactus that propose keyboards with screen keys that liquid channels make emerge. There is also research on screens that generate local vibrations or electrical pulses that induce a sensation of texture. There are indeed numerous development areas but all of them are more or less easy to, implement and costly.

My work focuses on classic screens over which 3D maps can be superimposed. The map can therefore be followed by finger, with the tactile screen picking up the position and translating into sound data, things like street names, distances, opening hours for shops … Not only do the experiments show that interactive maps are every bit as efficient as classic 3D maps enabling impaired persons to represent spatial information, but also provide for a swifter access to the geographic information. 3D maps offer a more global representation of the environment because the user can rapidly explore the entire environment to gain a general view; this is not the case for tools that propose a tactile (vibration or texture simulation) return that offer better local data. To proceed this way (based on local knowledge only) calls for effort in memorization and spatial reconstruction, whether you are impaired or not! Further development and popularization of 3D printers should change the deal overall and thereby enable anyone to make his/her own 3D maps as needed.