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COGNITIVE FUNCTION REHABILITATION AND THE ROLE OF NEW TECHNOLOGIES.

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A new world has opened up in front of Ana. She is 80 years old and has seen many things although nothing like this: a small arrow moving around the screen while following the direction of a mouse, controlled by an insecure hand. Ana suffers Alzheimer and is learning information technology.

(<http://www.hacercomunidad.org/Nota.aspx?IdNota=102>).

In the document 'Health for everyone in the 21st century', the World Health Organization establishes its aims of priority: to improve our way of life by using and having access to new technologies (ICT). An example of this is the increase of Internet networks and gateways. They aim to encourage interaction and leisure through services like thematic forum, chats etc. Today, our interest lies in demonstrating the impact ICT is having in the field of rehabilitation of cognitive functions in terms of people with deteriorating cognition due to brain injury, old age, Alzheimer disease or other related dementias.

The first application derives from the field of computer science. The development of this discipline has allowed a design of a wide variety of software and multimedia computer programmes, so-called Programmes of Rehabilitation by Computer. They are intended to stimulate and exercise the different cognitive capacities that the patient seems to have damaged or deteriorated: attention, memory, visuospatial functions, orientation, executive functions or calculation, among others. In this way, a potential instrument is acquired, which "goodness" is mainly: using very attractive systems of stimulation, like objects, panels, photographs, or moving elements, if necessary; introducing the instructions in audio through loudspeakers and visually through a written message on the screen. This should be applied in an easy and a manageable way, as it is adapted, as much as possible, to the deficit or limitations of the patient. This is the case of using a tactile screen instead of a mouse when responding to set tasks of stimulation, or to receive information about how well the training is being carried out, by such auditory messages as: "You are doing very well". "Try again". This motivates the patient and prevents any sense of frustration in his answers. The therapist can work with these programmes without necessarily having knowledge about computers. His task is to pre-establish: the desired cognitive modules to train the patient, the type of tasks that can be useful of the programmes, level of difficulty, number of necessary rehabilitation sessions and their duration. And finally, as the patient's performance is gathered together and stored in the programme, it is possible to observe the progress of the patient and adapt the therapy according to how it evolves.

Ever since this method of rehabilitation has been developed, many software programmes have been elaborated. Some of them, as in the case of the German programme RehaCom, require different qualities to carry out the tasks. Some of the most known and commonly used programmes, elaborated in Spain, used nationwide and already relying on digital screens, are *Gradior* and *Smartbrain*. The former one not only carries out

rehabilitation functions but also neuropsychological evaluation. Thus, it offers a clinical management that stores the patient's medical history and the results of his rehabilitation treatments. Moreover, it has generated proofs that allow for new tasks to be created and activities adapted to the type of cognitive deficit, needed to be rehabilitated. At the same time, *Smartbrain*, as *Gradior*, allows the specialist to make a follow-up of the patient and develop a personalised plan of stimulation and, if it is implemented in different populations with cognitive deficit, it is most frequently used in cases of dementias, specially the decease of Alzheimer. Finally, and in order to name some other incursions located within our national geography but no less interesting, Vizcaína Bizitzen Foundation has elaborated a software published in Euskera and in Spanish with exercises of psycho-stimulation directed to people who are in the initial stage of dementia. Additionally, through the programme ERES, the Andalusia Plan of Alzheimer makes use of computer programmes of stimulation for Alzheimer patients, both in day centres and in the patients' homes.

Another advancement of ICT in the field of cognitive rehabilitation is thanks to telemetry. The field of telemetry lies in combining telecommunication and computer science and has made possible the appearance of *tele-rehabilitation*, or *cognitive tele-stimulation*. This is the rehabilitation at a distance of cognitive deterioration. Tele-rehabilitation consists of applying a programme supervised by a cognitive intervention at-a-distance, usually by computer, without the therapist necessarily to be present. This method of rehabilitation becomes useful when, due to health reasons or territorial, the patient is unable to move to a rehabilitation centre. Doubtless to say, the principles and 'goodness', addressed above, of cognitive rehabilitation being by computer continue to be valid in the cognitive tele-stimulation, although with different types of additional advantages: reducing the cost of going to the hospital and maintaining the improvements achieved during the process of rehabilitation in the centre.

Today, there are various platforms on-line that offer diverse telemetric services - telemedicine, telealarm, etc. - and frequently include tele-rehabilitation. EuropaNet is, for instance, a European platform of tele-assistance for disabled patients with brain injury. Some platforms are directed specifically at the needs of elderly people with or without dementias, for example *Diretosalud*. It offers among its services, a professional cognitive stimulation to Alzheimer patients or with other dementias. The patient does exercises of cognitive stimulation in real time through a tactile screen and is constantly aided by a therapist through a videoconference. Similarly, a group of researchers in Gerontology at the University of Coruña has participated in diverse projects set to elaborate a platform where one can look for computer applications directed at elderly people who have problems of memory loss associated to their age or alterations in their mental abilities. This is the case of the projects *Discognitios* and *TelegerontologíaR*. This last one includes tele-rehabilitation among its services to its users and offers an interaction with a therapist through a videoconference.

Finally, over the last years, virtual reality is becoming one of the major and most complex technological applications linked to the use of ICT for rehabilitation of cognitive abilities. Virtual reality makes reference to situations created by a computer, which can generate sensations and emotions in real time. One example could be: a kitchen where a person has to carry out different tasks, like preparing food or to keep food ingredients in the fridge. With such everyday jobs, an individual who suffers any cognitive deterioration can work with abilities such as attention, memory and executive functions. Hence, the discipline Virtual Cognitive Rehabilitation has been created. The main advantage that the virtual rehabilitation offers is the possibility to create stimulating settings that are very

similar to real life. The patients develop activities, to a greater extent, which enable them to make a simplification, or transfer, to their own lives. This is important because one of the biggest limitations that the conventional cognitive rehabilitation has, whether by a computer or not, is its small degree of ecological weight. That is, the gap between the types of activities carried out during therapeutic sessions and the real difficulties the patients find in their own daily lives. In this sense, virtual cognitive rehabilitation not only trains and stimulates cognitive capacities but also those of functional type, closer linked to the activities of every day life. One needs only to mention the project PREVIRNEC. If up to present it has mostly been applied to groups with brain damage, it is now seen as a potential virtual platform with an active programme for people with dementia, with multiple sclerosis, and for children who suffer attention disorder or show problems with learning skills.

We have tried to reflect on how the use of technological instruments in therapeutic context is becoming a common phenomenon, due to the advantages described above. We, as professionals of rehabilitation, however, must ask ourselves some important questions when using them. Due to the lack of space, we are merely going to formulate two of them. Firstly, what is the theoretical base behind these technological instruments? We believe, besides the achievements and technical developments of software as in hardware, whatever the rehabilitation programme is, it must start from a precise *functional planning of the mind*. In fact, the precise affirmation that I make at this stage is independent from the type of instrument or format - cards of pencil and paper, computer or virtual reality - we can use. The rehabilitation programme must rely on a theoretical model that guides the design and the characteristics of the programme. Thus, it must be stressed that the majority of our programmes are guaranteed not only by a well-known team and/or companies specialised in the field of ICT. They also incorporate a close collaboration and a scientific assessment of prestigious professional teams and institutions in the field of rehabilitation. To name only a few, these are: the Foundation INTRAS in the case of the programme Grador, ACE Foundation in the case of Smartbrain, and the Team of investigation in Gerontology at the University of Coruña in the projects of Discognitios and Telegerontology, or the Institute Guttmann in the case of EruopaNet and PREVIRNEC. These scientific teams have published various studies providing information about the efficiency of these kinds of computerised programmes. In the particular case of dementias and the Alzheimer disease in a very especial way, programmes like Grador or Smartbrain have proved their efficiency for the first stages of the disease.

Secondly, can the computer and ICT substitute the therapist? We believe the connection established with the computer should not ease the relationship the person should have with the therapist. The neuropsychologist rehabilitation is a complex and a holistic process where technological instruments are only an added alternative and not the whole solution to the problem. Therefore, we celebrate the opportunities the new technologies offer us, but we do not forget the "goodness" of the human factor.

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