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Translational research on ageing

Computer accessibility for individuals suffering from mild to moderate Alzheimer's disease

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ABSTRACT

New technology will allow the ageing population (including people with cognitive impairment) to keep in contact with their families, friends and professionals and to be stimulated by a range of different services and facilities. Since no data existed so far on the ability and feasibility of persons suffering from Alzheimer's disease (AD) in using a basic computer, this pilot study was carried out in order to compare the performances of these persons with older persons with no cognitive impairment (NI) when working with basic keyboard, mouse pad and a computer screen. We also asked participants of both groups their preferences and suggestions in order to draw a guideline that can be used to adapt a basic computer to their use. Although this pilot study only included a small amount of participants (18), the results showed that basic computers can be accessible to individuals suffering from mild to moderate Alzheimer's disease under certain conditions.

1. Introduction

Ageing of population is one of the highest achievements of humankind. However, the actual challenge consists in finding good strategies of a successful ageing as well as solutions to age-related diseases. The good strategies include implementing various self-management techniques and maintaining social network and activities [1].

Alzheimer's disease is a neurodegenerative illness that affects at first, the cognitive functions which have an impact on the patient's behaviour and on his social adaptation. In 2003, the PAQUID study [2] showed that in France there are approximately 769,000 demented people over 75 years old among which 611,500 are Alzheimer's.

In addition to the specific treatment, researchers also recognize the need to provide a better quality of care for people with Alzheimer's disease with interventions that enhance their daily living.

Information technology (IT) which will be part of everybody's life in the near future is already implemented to provide a great deal of social network and activities to the general population [3,4].

New technology might also provide useful tools of interaction and cognitive stimulation for individuals suffering from Alzheimer's disease [5–10].

In fact, they could be used to increase safety and care to people with AD, by allowing them to keep in contact with their families, friends and professionals and to be stimulated by a range of different services and facilities.

Old people may be scared thus reluctant by the use of IT. Most of them do not have a portable phone, an e-pod, a fax machine, a GPS or an e-phone and have never used a computer in their past. Thus their anxiety linked to the use of these new tools might jeopardize their potential benefit. Furthermore, since cognitive deficit associated with AD decreases the ability to adapt to new tools, the use of IT in this population might be even more hazardous.

Recently, different authors suggested that IT tools might be useful for old people when the technology is well tailored to them i.e. when (i) they take an active part in their conception, (ii) their opinions, needs and difficulties are taken into consideration.

However, usability which is central to the technology acceptance model has rarely been studied so far in this population. Gowans et al. (2007) carried out a study based on a user-centred approach which aimed to develop a computer-based tool that supported non-pharmacological intervention in dementia care environments [11]. These authors involved old-users suffering from dementia in the research and development process in order to

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evaluate their needs, preferences and aspirations and showed the usability of their system in this population.

To our knowledge, the usability of a basic computer in people suffering from cognitive impairment had not been evaluated before. Therefore, this exploratory study was designed to test this issue.

For this purpose, we compared the experimental group of persons suffering from mild to moderate Alzheimer's disease to a control group of older persons with no cognitive impairment (NI = no impairment).

Measuring both groups' performances and making a list of their particular needs, helped us in drawing a few guidelines to adapt basic computers to our population target.

2. Methodology

2.1. Subjects

Participants were consecutive older persons consulting in January 2009 in the Broca Geriatric Day Care Hospital in Paris. During four days we gave full explanation about the study and invited patients who came to the hospital for their regular follow-up to take part.

The evaluation procedure consisted of detailed recording of medical history, physical and neurological examinations, psychiatric and cognitive evaluations, laboratory tests and either brain computed tomography or magnetic resonance imagery. Cognitive status was evaluated by the Mini Mental State Examination (MMSE) [22] and a battery of neuropsychological screening tests, designed to assess immediate and delayed memory (with free and cued recall procedures), language, visuo-perceptual and visuo-spatial capacities and problem solving skills. All these tests comprise subtests and modified short forms of widely used neuropsychological measures (maximal score, 100) [23,24]. Laboratory tests included complete blood cell count and differential, serum electrolytes and glucose, liver and renal function tests, thyroid hormones, VDRL, vitamin B12 and folates levels and an EKG.

We included persons with either Alzheimer's disease or with no cognitive impairment.

AD patients who met the following inclusion criteria were enrolled:

- dementia of the Alzheimer's type of the Diagnostic and Statistical Manual of Mental Disorders Fourth Edition (DSM-IV) [12];
- receiving stable treatment with acetyl cholinesterase inhibitors (AchE-I) or/and N-methyl-D-aspartate receptor blockers (e.g., memantine) on a stable dose for at least three months;
- MMSE score between 21 and 28 (mildly and moderate impaired patients who retained the physical and functional ability to participate in a cognitive or motor stimulation program);
- absence of uncontrolled disruptive behaviours (agitation, violence, delusions and hallucination).

Both persons with Alzheimer's disease or with no cognitive impairment should have no severe auditory, visual or motor deficits; and were willing to participate.

Computer experience was not required.

Out of 35 persons interviewed, 18 met the inclusion criteria. They were 10 individuals with no cognitive impairment (NI) and eight individuals suffering from mild to moderate Alzheimer's disease.

The 17 others were excluded because: (i) two patients had Parkinson's disease, (ii) two individuals with no cognitive impairment did not want to take part in a protocol, (iii) four AD patients had a MMSE score inferior to 21, (iv) four AD patients had problems in coming to the hospital due to mobility disability and (v) five patients suffered from mild cognitive impairment.

An appointment was given to the 18 participants included and willing to participate. Written informed consent was obtained from all the participants enrolled in the study. All the patients wore glasses.

2.2. Procedure

Every participant came once for a one and a half hours individual session. They were coached by two professionals (one psychologist and one technician).

The usability was tested with two types of analyses:

- quantitative analyse: we used a performance measurement technique [13] that requires a pilot test first to make sure tools and techniques were understood before the actual experience starts. We prepared a standardised form to quote quantitative data, such as: the amount of time users took to complete a specific task and/or the number of specific tasks that can be completed within a given time limit;
- qualitative analyses: one of us (psychologist) wrote down participant's opinions and preferences while they were performing the tasks with the computer. She also observed participant's behaviour during the session in order to identify the degree of participation, the engagement and enjoyment of the experience.

First of all, participants were asked about their preferences in terms of 'Screen Presentation'. Then, they performed a few tasks regarding keyboard and mouse pad use.

Screen selection. Ten screens were shown, differing in terms of:

- screen colour: they could pick up the three best out of 10;
- character colour: they could choose one for the title, one for the text and one for the side information;
- character type and size: they could choose three (one for the title, one for the notes, one for the text);
- information organisation on the screen: they could pick up three out of 10.

Keyboard tests. Two exercises were specially made to measure participants' performances in using the basic keyboard, as follows:

- a moving letter appeared on the screen for a few seconds: patients had to type the very letter as quickly as possible. Letters (with and without accents) kept appearing one after the other until the end of the task;
- a number of three digits appeared on the screen: patients had to type it as quickly as possible. The following number would come as soon as the previous was typed correctly.

Mouse pad tests. Five tasks were given:

- double-click on a still target: rabbits appeared and stayed on for a few seconds. Patient had to track and 'double-click' on them as quickly as possible;
- double-click on a moving target: balloons would move for a few seconds on the screen. Patient had to 'double-click' on them before they disappear;
- drag & drop: pictures must be replaced in their right spots. Patient had to 'double-click' over a picture keeping his finger's pressure in order to grab and bring it to its correct spot. Progression was measured: three tasks with exactly the same degree of difficulty were given (only figures were different);
- cursor tracking system (CTS1): cover a doted way between point A and point B. Patient had to press left mouse button and keep