MEMORY STIMULATION. WHICH SCIENTIFIC BENEFITS? WHICH EXERCISES?

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From « Revue de Gériatrie 2006;31 : 421-433 » (French Geriatrics Journal)

Keywords : Memory – Stimulation – Training – Computer – Internet

Summary:

Aging is responsible for a progressive decline of cognitive functions. A number of scientific works found that cognitive stimulation had a significant positive impact as well for maintaining a high-quality cognitive competence as for delaying the onset of Alzheimer's disease. Beside more classical leisure pursuits, cognitive stimulation can help seniors to understand their memory decline and to improve their abilities. Cognitive training can be done through paper exercises or e-training sessions. We report our experience of a personalized interactive cognitive e-service which proposes various games to train cognitive functions. The objective of cognitive training is threefold: improve cognitive performance, transferring these abilities to everyday activities and improve self-esteem. Its biological effect is mediated through cerebral reserve and cognitive reserve.

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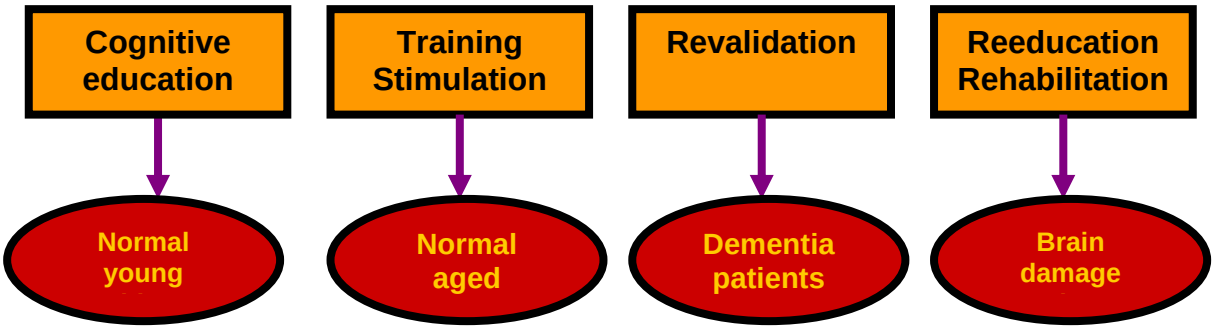
Man has always felt the need to strengthen their memory with mnemotechnical methods [(1)]. Just to quote a couple of examples, the method of loci invented by Simonide of Ceos (c. 556-468 B.C.) enabled orators to easily remember their speeches, whilst Giulio Camillo (1480-1544) tried to logically gather all the knowledge of the world into one memory theater. On top of the school and professional requirement to learn effectively, mature individualss also wish to preserve their memory in order to maintain "good health". And indeed, aging is responsible for a progressive but unequal cognitive decline of the individual components. The weaknesses of the memory component are most obvious for seniors who wish to prevent these deficiencies. Memory stimulation (which may be distinguished from cognitive stimulation) is one of the main possible measures but is still underestimated and even demonized.

The term "cognitive stimulation" has largely been used by Jocelyne de Romu in a global cognitive, psychological and social solicitation approach and refers to framed theoretical concepts [(2)]. We should quickly specify this sometimes rather confusing terminology *(figure 1)*. Stimulation differs from reeducation and rehabilitation which applies to patients with an objective cognitive deficiency, usually due to vascular or traumatic brain damage. In these cases the applied techniques aim at restoring, correcting or adapting damaged cognitive processes following a pathological process. It is, thus, a therapeutical structure which therefore has to occur under the effective control of a speech therapist (for language) or neuropsychologist (for memory and all other cognitive functions). Even though the term is also used for patient care with degenerative cognitive pathologies, the current tendency is to favor the term revalidation in this very context. The intention of revalidation is to regain, restore, strengthen or develop cognitive strategies by intervening on altered or maintained cognitive components, depending on the case. For a complete definition, the concept of cognitive education brings all educational approaches for imparting intellectual tools together.



For their part, stimulation or training is designed for elderly but healthy subjects, who suffer from functional deficiencies due to physiological aging. The term "cognitive optimization" can also be used. Stimulation techniques are designed for individual patients or for groups, on their own or supervised by activity organizers. The aim, or at least the rationale of memory stimulation (and of cognitive stimulation in the broadest sense) is to challenge certain cognitive components of normal elderly patients, so as to help them be more effective in daily life and to enable a psychological and social well-being, without which we cannot consider any relevant cognitive improvement [(2)]. Elderly people's desire and even need is often more acute: improving their psychometric performance, which cannot be an objective in itself since all cognitive stimulation has to have a psycho-social dimension.

This paper does not narrow memory stimulation down to a technique but to all means, whether they are natural or specifically structured (exercises) to achieve a stimulation of all cognitive functions.

Many epidemiological works have shown that education and cognitively stimulating activities maintain the cognitive potential of the brain, regardless of age, and reduce the risk of dementia. The term currently used in scientific literature for all cognitively and physically stimulating activities is “lifestyle”. How do you define memory stimulation? How relevant is cognitive training and what is its real impact? Which kind of exercises should be provided? All these answers are to be found around notions of neuroplasticity and cognitive reserve, which describes the brain’s life-long ability to change its structures and functioning after a damage or by means of adapted stimulations. It is now acknowledged that cognitive neuroplasticity can be developed at any age [3, 4].

WHY STIMULATE YOUR MEMORY?

What happens to cognitive abilities when you age?

From a physiological point of view, aging is responsible for a slower processing of cognitive information, lower attention spans and poorer performance of the working memory. Elderly people also suffer negative stereotypes, are less adventurous and more isolated on the social and functional level. On the other hand, they are also more curious, just as creative, and even more, and prove to be wiser and to have more opinions and experience. Good examples include: Verdi composed “Falstaff” when he was 80 and Winston Churchill became Prime Minister at the age of 65!

Despite great individual differences based on socio-educational level and personal fields of knowledge, all studies on memory aging in elderly individuals show a decline of explicit memorization abilities, mainly when the matter is complex and requires greater focus. Since seniors are more affected by interruptions, it is more difficult for them to apply thorough and parallel processing of the content to be memorized. Finally, elderly people achieve worse performances at spontaneously recovering information, whilst being more efficient with a cued recall.

Aging is also detrimental for prospective memory and meta-memory. The prospective memory allows a person to remember the intention of doing something and becomes less efficient, which is why seniors need to have a diary, for example. The meta-memory is used to control memorization activities, to assess the extent of knowledge, judgment and recollection ability: seniors progressively belittle the image of their memory as they underestimate their real mnesic skills and automatically exaggerate their failures.

However, aging does not so much affect knowledge organization abilities, automatic mnesic processes and the personal fields of expertness. If they are explicitly challenged and given advice on adapted and personalized cognitive strategies, seniors maintain efficient encoding and information recovery abilities.

Why stimulate your memory and your cognitive functions?

Education, having a professional activity and hobbies prove that it is possible to acquire knowledge and master know-how throughout life. There seems to be a double biological relevance in cognitive stimulation: maintaining a certain level of personal cognitive function during aging and delaying the onset of Alzheimer’s disease.

For a better personal cognitive function: “Use it or lose it!”

Longitudinal studies have proved the cognitive relevance of regular intellectually stimulating hobbies. This was revealed by the Victoria study in Canada: over a six year period, an active lifestyle as well as taking up new intellectually stimulating activities were linked to a reduced cognitive decline by means of a positive impact on the working memory, which facilitates the global maintenance of cognitive performances [4]. In return, according to the rules of the virtuous circle, this cognitive maintenance is likely to ease personal involvement in more effective life activities. The impact of the educational school level on cognitive aging for centenarians has been positively modulated by keeping up

cognitively stimulating activities throughout their life [5]. Finally, transversal studies have shown that practicing intellectually stimulating activities when aging may contribute to maintaining a good performance level in certain cognitive areas such as verbal memory and cognitive-perceptive speed, independently from school level or the type of occupation [6]. However, it is not completely clear whether these activities prevent cognitive decline or whether those who develop a cognitive decline are less likely to have cognitively stimulating activities.

As for stimulation via cognitive training exercises, Verhaeghen, Marcoen and Goossens [7] reported in a meta-analysis of about thirty experimentations that elderly adults' memory could be improved when trained. Nevertheless, the kind of training needed for improvement and the characteristics of people who most benefit from such training remains little understood. Training programs involving several memory related functions such as attention, organization, imaging, relaxation, as well as the education of participants (memory mechanism, age impact...) and discussion groups, favor better cognitive performance. Furthermore, several studies quoted by Lemaire and Bherer [8] have shown that elderly people's performance significantly benefited from a memory stimulation with organizational strategies or mental imaging techniques.

Karen Ball's team demonstrated the efficiency of a cognitive training on certain abilities of everyday life (ACTIVE study) [9]. For two years, this team followed 2,832 normal subjects, aged 65 to 94, with an average MMS ("Mini Mental Status") of 27.3 (from 23 to 30). The subjects were divided into four groups: a control group and three other groups, each one following training sessions in one of the three cognitive areas memory, reasoning and attention speed. The sessions used purely theoretical material, just as well as exercises applied to everyday life. Over a period of 5 to 6 weeks, each group had 10 sessions of 60 to 75 minutes each. These training sessions very significantly improved the trained areas, without having a general effect however, neither to other areas nor to everyday life, and significantly reversed cognitive decline which is usually detected within 7 years of aging. Eleven months later 60% of all participants benefited from a further series of stimulations with 4 new sessions of 75 minutes each over a period of 2 to 3 weeks. As it was observed, the reasoning and attention groups experienced an additional improvement of psychometric performance. This time the reasoning group realized a translation into daily environmental standards. Thus, this study shows the persistence of a cognitive learning potential in elderly patients, which merely needs to be exploited.

Delaying onset of Alzheimer's disease

During prospective and retrospective studies several teams showed that education and cognitive maintenance by way of social activities and hobbies were significantly linked to a reduced risk of developing Alzheimer's disease [10-15]. The incidental dementia declined in seniors who realized tasks that required initiative or planning (gardening, travelling, repairing, reading, going out for meals or to the cinema, making music, doing puzzles or practicing sports). Passive activities such as watching TV or attending meetings did not reduce the risk. These activities should be developed or maintained right from the age of 20 to 39 [11], as it has also been proved by a study on 576 seniors with an average age of 80 and past cognitive activities which significantly contributed to their intellectual functioning and were related to their cognitive retirement activities [16]. Quite logically, intellectual hobbies are more effective to reduce the risk than social or physical hobbies [12].

The next logical question is about the exact meaning of few hobbies for elderly people: are they really responsible for this lack of cognitive protection or does this already reflect the presence of an existing dementia? Taking part in certain cognitively stimulating hobby activities may indeed be the result, rather than the cause, of preserving cognitive activities. As an attempt to answer this question, Wilson's (2002) team carried out a prospective study on a group of 801 American priests and churchmen on whom a very complete neuropsychological assessment had established the lack of cognitive anomalies beforehand [17]. The hours spent on various hobby activities were systematically counted: newspapers, magazines, books, TV, radio, visiting museums, going to the theater, games (cards, crosswords, chess, puzzles). At the beginning of the study, the mixed score of cognitive activities varied between 1,57 and 4,71, a high score which reflects the realization of frequent, varied and intense cognitive activities. After four and a half years of monitoring, it appeared that an increase

of the score by one point reduced the psychometric cognitive decline by 47%, the decrease of decline varying from 60% for the working memory to 30% for the information processing speed. At the same time, when the score increased by one point, the risk of Alzheimer's disease was reduced by 33%.

Cerebral reserve and cognitive reserve: Brain plasticity

The general synthesis by Fratiglioni, Paillard-Borg and Winblad [18] of all longitudinal studies on the effects of social networks, physical activities and cognitive hobbies has shown that they suggested a beneficial impact on cognition as well as a protective effect on the risk of dementia and Alzheimer's disease. On the whole, whilst 14 studies did not report any associations at all, 43 publications noted a positive association. These authors mention three intervention mechanisms which are cognitive reserve, stress and vascular damages. The concepts of cerebral reserve and cognitive reserve are at the heart of the brain plasticity concept [13]. Over the next years these rather seductive concepts, which doctors still know little about, will evolve greatly. Indeed, they allow us to understand the preventive role of cognitive stimulation, as much for the normal aging of the cognitive functions, as for the risk of the occurrence of Alzheimer's disease. Brain plasticity is the ability of the brain to change within its structures (synaptic development, neurogenesis) or within its functional adaptation (developing new strategies) throughout life, as much after brain damages as under the effect of cognitive stimulation.

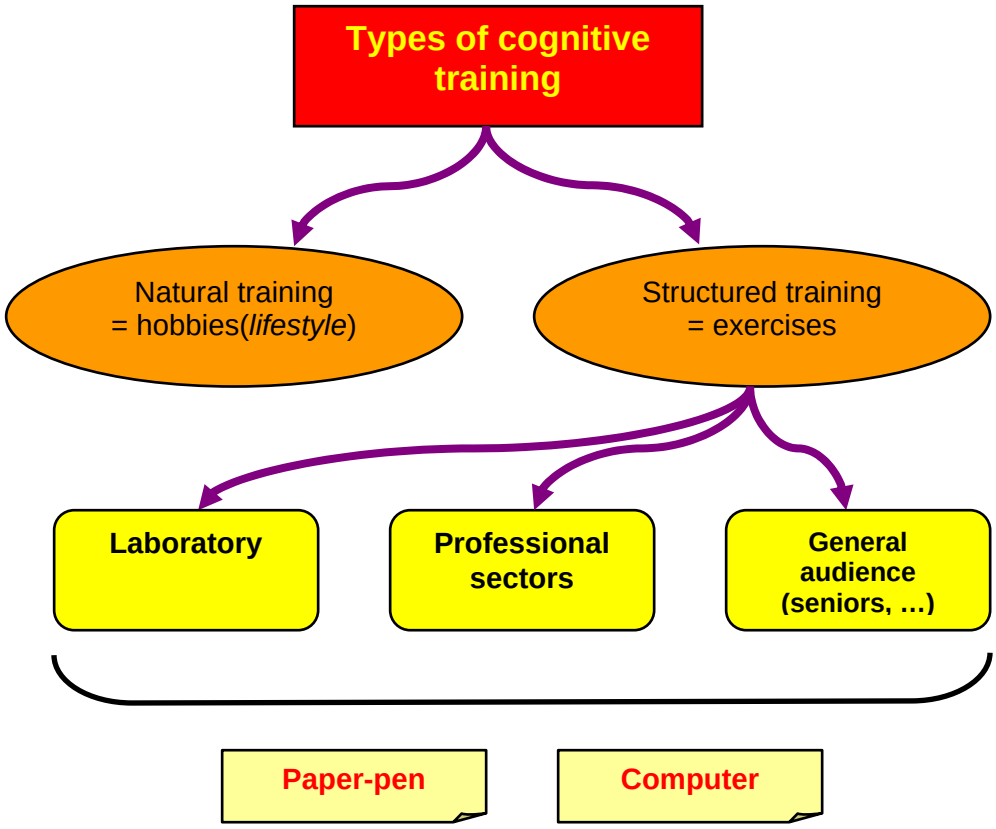
Cerebral reserve is related to structural brain elements, such as its size, its weight, the amount of neurons and of synaptic connections. In spite of the progressively lesser amount of nerve cells, normal aging comes with an increase in synaptic connections, which suggests a structural neuronal plasticity and thus possibilities of regeneration or adaptation, even as aging occurs [19].

Cognitive reserve is an active process of adaptive neuroplasticity which eases the optimization of cognitive performance, either by recruiting other brain regions, or by using new or alternative cognitive strategies. This is what Pr. Christian Derouesné calls the "cognitive whiplash", an additional impulse developed from the generally used cognitive resources. The structural consequence of this learning potential is the increase of dendritical and synaptic network density of the neuronal systems involved in cognitive functions that are stimulated by new experiences. Hobbies and activities developed throughout life thus strengthen certain cognitive abilities (working memory, speed, ...) and, in return, stimulate planning and initiatives. Biological evidence for neuroplasticity has been brought by works of functional brain imaging and shows that older subjects with a similar mnesic effectiveness activate a wider neuronal network than was observed in younger subjects, especially on the frontal level, and even more when they are given specific strategic instructions [20-22]. Under these conditions the onset of Alzheimer's disease cannot be avoided but merely delayed, since the rich synaptic connections increase the tolerance for degenerative damage by delaying the threshold of clinically perceptible cognitive deficiency. Since the reserves of lower level subjects are weaker than those of subjects with a higher socio-educational level, they will cross the threshold to clinical dementia faster. Paradoxically, if a higher socio-educational level delays the onset of Alzheimer (since these patients tolerate degenerative damage for longer), subjects develop faster (faster memory decline and earlier death after being diagnosed), as the clinical appearance of the disease results in a greater amount of damage, which then accelerates its development [13-15].

WHICH KIND OF EXERCISES SHOULD BE GIVEN?

As we have seen, cognitive training can be done naturally with cognitively stimulating hobbies, but it can also happen in a structured way by doing specific exercises *(figure 2)*. Lifestyle is linked to a lesser risk of incidental dementia for seniors, and structured training has a beneficial and sometimes lasting psychometric effect in the trained areas. Even though the ACTIVE study [9] has shown that training with reasoning exercises achieved a transfer to the adequate daily situations in their environment, so far most studies do not show such transfer. However, the psycho-social consequences of structured stimulation are essential in terms of educational methods, regaining self-confidence and strengthening social links.

Figure 2. Different situations of cognitive training



Goals and disadvantages of memory stimulation

There is no such thing as miraculous cognitive bodybuilding that would allow a global memory improvement! It is dangerous for seniors to believe that it is possible, necessary and desirable to increase their ability of learning things by heart. It would doom them to failure since memory is not a muscle that can be over-trained in a mechanical manner. Furthermore, it is impossible to transfer what has been learned from one field to another: learning poems by heart does not help you find your car or remember a name. Finally, the improvement of a psychometric sector does not automatically lead to a greater effectiveness in everyday life: improving your number memory does not mean that it will be easier for you to remember phone numbers. Transfer is only possible and effective if, on top of training, the person actively applies the strategies that they have learned during the training.

Paying a lot of attention and being very motivated are two fundamental requirements for all training. Memory stimulation should be associated with a fun game and patients should find the exercises interesting. Being at the root of stimulation and fun, a friendly atmosphere leads to positive reinforcement. Finally, the aim of training is always educational: the importance is not to succeed but to understand why and how we succeed, as well as why and how we fail. Paradoxically, being successful on the first go is not an ideal objective since we only pay little attention to what is easily achieved! However, challenges need to be reasonable so as to not discourage participants [(2)].

Which strategies should be privileged?

Whilst mentally repeating a list of words to yourself considerably helps memorization, the effectiveness of this process decreases with age. Literature has greatly proved the spontaneous or trained efficiency of other techniques for mature individuals based on categorization, semantic organization into a hierarchy or mental visualization [(8)]. In 2001 a study by Dunlosky and Hertzog [(23)] involved 70 year old and 20 year old subjects who had to specify the encoding process for memorizing word pairs: seniors

found it easier to build sentences based on two target words (38% against 29% for the young) whilst young subjects preferred self-repetition (20% against 15% for seniors) or mental visualization (38% against 34% for seniors).

It should be noted that seniors use sentence building strategy almost as often as mental visualization (38% and 34% respectively) whilst self-repetition is only used by 15% of seniors. In this personal study which was carried out this year and has not yet been published, we asked 290 volunteering seniors (average age = 64.2 ± 9.9; 76% of women; 58% of subjects with a socio-educational level less then high school diploma) to specify their techniques for memorizing simultaneously the words cherry and car. The results were as follows: self-repetition (14.4%), mental visualization (34.9%), building a sentence (8.6%), combined use of previous techniques (19.4%), other techniques (22.7%). Mental visualization is a clearly predominant memorization technique. Answers were influenced neither by age, nor gender or socio-educational level. In our study we obtain similar figures to those of Dunlosky and Hertzog for self-repetition (14.4% against 15% respectively) and mental imaging (34.9% against 34%), whilst our subjects adopted the sentence building technique far less (8.6% against 38%).

The lesson to be learned is that seniors should avoid learning things by heart, using mechanical self-repetition. Memory stimulation exercises should, on the one hand, strengthen existing natural cognitive strategies, and on the other hand improve learning, development and maintaining of new strategies based on logic and reasoning. These new strategies should make it easier to acquire and recall information since, if you do learn by heart, it's better to memorize processes rather than word lists!. To that end, the information to be memorized needs to be analyzed in order to: (1) establish connections with the prior knowledge, (2) better organize the information using categorization or networking techniques, (3) create mental images, and (4) possibly develop tricks with mnemotechnical methods. All these processes make it easier to appropriately encode material which needs to be memorized and to establish valuable hints for recalling it later. Finally, repeating the tasks allows the subject to progressively acquire a cognitive process, it is up to him to apply it explicitly to everyday life.

THE VARIOUS TYPES OF COGNITIVE TRAINING

Paper-pen exercises

Logically, the first exercises were paper-pen exercises for individual use. There are countless books which are soon discredited by their promising titles ("Dope your intelligence", "Develop your memory") and their conceptual naivety. There are a number of inconveniences about these paper-pen exercises: mechanical approach, levels of difficulty cannot be adjusted, focus on success, no explanatory feedback when failing... or succeeding, impossible to do the smallest transfer to everyday situations.

"Memory Activities" and "Memory Workshops"

When developed by professionals with an adequate training, however, these paper-pen exercises turn out to be highly relevant. Nevertheless, they are more efficient in a group and supervised by a psychologist who can adjust the difficulty of the exercise, oversee group dynamics and make it easier for participants to acquire the strategies [(2)]. The psycho-social impact of these groups cannot be denied. Nonetheless, there is a risk that gifted participants might discourage less active subjects and might thus be the only ones to benefit from these sessions.

Computer exercises

Don't demonize your computer!

Personally, we very clearly prefer the computer as an innovative approach. Despite popular belief, elderly people are not scared of computers. Seniors use a lot of computing equipment. Computer specialists get older as well and in a few years many residents will obviously be former computer users, taking their computers with them, just like their television. Elderly people are also curious to

discover this new world, of which they can only catch a glimpse on TV (advertisements, news flashs, cinema, etc.). We thus met nuns from a residence who were delighted to finally meet the famous "mouse" and almost became "addicts" after a few sessions.

Finally, it is always possible to adapt the materials to elderly people's impairments by using touch screens or trackballs.

In 1996 a work on computerized training [24] was already published by Rebok's team. Twelve normal seniors (average age = 76.3 years) trained on a computerized battery of memory tasks (Colorado Neuropsychology Tests). The participants were supervised by a psychologist and worked 90 minutes a week over a period of 9 weeks. Half of them practiced explicit memory tasks and the other half implicit memory tasks. Both groups significantly improved their test performances, the one group doing implicit memory exercises showing the most progress. As an essential emphasis, seniors did not express any disapproval of this computerized technology and showed – ten years ago – their ability to efficiently use a computer.

Cognitive training via a website

In 2001 we helped develop the website www.happyneuron.com (company Scientific Brain Training) to offer seniors computerized and supervised cognitive training. The aim was to help them understand their cognitive mechanism and to allow them to reinforce their declining cognitive resources, whilst hoping to make it easier to maintain psycho-social skills. The website exercises (also available on CD-Roms) were developed by a team comprising a Doctor in Neuropsychology, two Doctors in Cognitive Psychology, a Doctor in Education Sciences and a Doctor in Computer Sciences specialized in Man-Machine Interaction. The stimulation and training programs are regularly tested, confirmed, assessed and enriched by two student research groups from the UTA Université Tous Ages ("University for Third Age Learning", Lumière Lyon 2 University). The website currently offers about 50 exercises, split into 5 cognitive sectors: memory, attention, language, executive functions and visio-spatial. As opposed to laboratory exercises used to train an extremely specific cognitive sub-system [25], our exercises are fun and educational, and several cognitive sectors are trained simultaneously, despite the fact that each one is characterized by a cognitive dominant characteristic.

All exercises are organized in the same way: a home screen with general information about the exercise, a "Know more" part to explain the cognitive mechanism and the aim of the exercise, an "Example" part to educationally explain the course of the exercise. Before starting the exercise, a screen offers you to choose from different difficulty and sometimes topic variants. Computing allows to set up a rich database for each exercise. This data is randomly presented, according to the chosen degree of difficulty: one exercise, for example, is based on roughly 800 sentences, another on a database with almost a thousand photographs. The exercises can thus be done again with a different design or an inferior, similar or superior degree of difficulty, so as to make it easier to acquire and master strategic proceedings. However, in order to guarantee the scientific efficiency of the method, the website also offers control exercises which comply with the scientific constraints of an experimental protocol and allow the supervisor to work on normalized data, unbiased regarding the senior and his or her preferences.

Accuracy and time for answering are taken into account for the results. The computer allows interaction on three levels: (1) a calibration in percentiles considers three classical demographical variables, being age, gender and socio-educational level, (2) the subject's results are compared with the appropriate calibration, they also include commentaries, and (3), a computer supervisor (coach) adapts the program to each user.

The supervisor coach is designed by applying adaptive techniques based on a user model that combines four types of information: demographical data, thematic interests, cognitive indicators of the exercises, behavioral use data [26]. When tests are efficiently supervised by a specialist in cognitive psychology or neuropsychology, the person also considers the subject's fatigability as well as stress and possible interferences between tests. Seniors doing computerized exercises can organize their

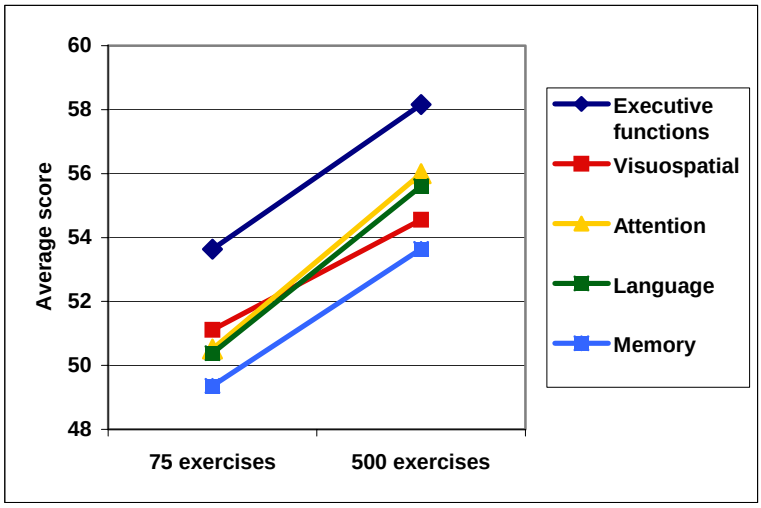
training themselves and it is therefore impossible to wisely divide his attention component, to appreciate interruptions between exercises, or assess his fatigue level. It is therefore up to the supervisor to not let him carry out several difficult exercises in a row, which might alter results: indeed, it is obvious that training on several memory exercises during one session not only leads to an interference amongst the used materials, but also to an attention overload that will provoke an anxiety due to the obtained results. The supervisor also detects failures and repetitive behavior of participants to whom he will either suggest exercises from the areas the person usually avoids, or to try and choose an easier variant, if he has failed. The four exercises suggested by the supervisor do not take longer than 20 to 30 minutes, as the point is to limit training related stress and tiredness. The French laboratory Beaufour-IPSEN-Pharma developed a CD-Rom version of the interactive supervised training under the name of "GYM-CO: Memory training course", which was awarded a special prize at the renowned French scientific symposium "Entretiens de Bichat" in 2004.

Study on website subscribers

The website exercises are designed for healthy seniors at home without any cognitive pathologies. The analysis of 628 subscribers reveals women are the main users (64%) and a predominant academic level (56%). There are more men at academic level (63% against 52% for women). Whilst the average age is 41.8, we can observe 3 age peaks around 22, 44 and 57, regardless of the gender, even though these peaks are more emphasized for women. 9% of subscribers are older than 70, which shows that these exercises really are suitable for people aged 70 and older. On the average, 6 exercises are carried out each time someone logs on.

We also analyzed the progress of performances of 39 subscribers who were particularly assiduous and carried out an average of 1099 exercises and an average of 3 to 4 exercises each daily login session. There were 27 women and 12 men, 29 of them being at academic level (74%). The training behavior of these 39 subscribers showed three profiles: 16 people carried out exercises from each cognitive sector, 14 people did essentially memory exercises and 9 people mainly focused on executive functions. The threshold for significant progress was crossed at 376 exercises. On the average these subscribers realized a progress of 12% within 18 weeks. Between the 75th and 500th, a significant progress occurred for the global cognitive score (p = 0,014), the memory score (p = 0,04), the languages score (p = 0,05), the attention score (p = 0,011), the reasoning score (p = 0,024) but not for the visuo-spatial score (p = 0,12) *(figure 3)*.

Figure 3. Results of the cognitive training on the five trained cognitive domains in 39 subscribers of the site www.happyneuron.com . The improvement is significant on four domains (memory, language, attention, reasoning), the improvement is not significant on the visuo-spatial domain.



The impact of new technologies on nursing homes for the aged

A multi-functional software package: training, creativity, communication

After an invitation by the Ministry Delegate for Research and New Technologies to participate in the "Uses of new technologies for society" program, we have been developing the MNESIS research project since 2004. This project on the "Uses of Internet tools as a means of social integration and cognitive stimulation in a nursing home" brought together the company Scientific Brain Training, the Collaborative Interaction Laboratory, Distance Training, Distance Occupation (Ecole centrale of Lyon and INSA of Lyon), the Study Lab for Cognitive Mechanisms (Lumière Lyon 2 University), the residence group of the Médica-France company, and finally our Neuropsychology Laboratory (Civil Hospices of Lyon).

Stimulating the residents' cognitive performance is not the only aim of the ActiVital™ software package, but also to challenge their creativity and facilitate social linking within the residence, as well as outside. To that aim, the software has been divided into three parts, specifically applicable to elderly residents: (1) 10 simplified exercises for cognitive training, (2) an editing tool for a residence journal, and (3) a simplified messaging tool for seniors to send and receive emails. The software package can be used with a touch screen. At the beginning the psychologist nursing staff have to check the appropriate utilization of the computer and software package by the user.

First results

A preliminary analysis of the sociological aspect allows todistinguish between advantages and disadvantages of introducing ActiVital™ to some nursing homes [(27)]. The average age of seniors (85% women) was 84, their MMS lying between 25 and 30, and they did not suffer from depression. As one negative aspect, we noticed that residents who did not know how to use a computer were even more aware of their sensory-motor deficiency. It also appeared that some residents rejected those who easily and fully mastered this new technology. However, some initially reluctant residents wanted to use the computer as soon as they saw their neighbors working on it. Some patients suffering from Alzheimer's disease who originally refused to take part in classic residence activities even requested to participate in training sessions. As a further positive aspect, it turned out that residents' self-esteem increased with their ability to use the computer and on accomplishing exercises. They bonded with other residents (mutual assistance to explain the process to each other) and their families (exchanging emails, grandson coming to help his grandmother, etc.). Many residents, who particularly liked this group writing activity, met and collaborated whilst editing the residence journal. Owing to this, ActiVital™ meets the educational and psycho-social requirements for cognitive stimulation [(2)]. Indeed, this software allowed these seniors in nursing homes to re-acquire a certain intellectual curiosity and to regain self-confidence and self-esteem.

CONCLUSION

Numerous works proved the beneficial impact of having natural cognitively stimulating activities (under the aspect of lifestyle) as much on the cognitive comfort of mature individuals as on the delayed onset of Alzheimer's. The ACTIVE study results would even prove that "intense" cognitive training might delay age related psychometric cognitive decline by several years for the trained areas [(9)]. The cognitive reserve concept presents a neurobiological explanation for all these aspects, as neuronal plasticity can function despite the aging process. Whilst the applied strategies optimize the effectiveness of mnesic processes, the impact on cognitive performances is not the sole issue, in fact it is also the significant beneficial effect on daily life activities as well as the personal social, psychological, cognitive and behavioral attitude.

Computer exercises will probably experience a strong and rapid development, for new nursing home residents will arrive who will have used computers in their jobs. Due to our experience of a website for

all and of a simplified software package for nursing home residents, we not only recommend the use of computerized exercises to stimulate the residents' cognitive performances, but also the use of software aiming at challenging their creativity and helping to establish or maintain social linking amongst residents or with their families. On top of the biological aspects which seniors may not perceive, there is a triple objective in cognitive stimulation: showing them that they are able to improve their performance, helping them to translate positive training effects to daily life situations, and finally, strengthening their self-esteem, at a time in life when they experience all kinds of rebuffs. It is our responsibility to find the best cognitive stimulation techniques and to adjust modern technologies to elderly people. Even though we do not know the entire potential impact of memory stimulation, there is one thing we can be certain about: not training your memory is the safest way to let it decline!

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