



Normal and pathological cognitive aging Literary review; Alzheimer's as a model

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Abstract:

Aging is a normal process in human life, and it proceeds normally when the subject is not confronted with pathologies, including neurovegetative diseases such as Alzheimer's disease. This is what we attempted to explain in this presentation by focusing on memory and its types: working memory, episodic, semantic, and procedural memory. These impairments are the axis of Alzheimer's disease. We then presented palliative strategies to address cognitive decline in order to ensure normal aging and psychosocial balance.

Keywords: Alzheimer; Normal aging; pathological aging; palliative strategies.

Viellissement cognitif normal et pathologique Revue de littérature ; la maladie d'Alzheimer comme modèle

Résumé :

Le vieillissement est un processus normal de la vie humaine, qui se déroule normalement lorsque le sujet n'est pas confronté à des pathologies, notamment des maladies neurovégétatives comme la maladie d'Alzheimer. C'est ce que nous avons tenté d'expliquer dans cette présentation en nous concentrant sur la

mémoire et ses types : mémoire de travail, mémoire épisodique, sémantique et procédurale. Ces altérations constituent l'axe de la maladie d'Alzheimer. Nous avons ensuite présenté des stratégies palliatives pour traiter le déclin cognitif afin d'assurer un vieillissement normal et un équilibre psychosocial.

Mots-clés : *Alzheimer; vieillissement normal; vieillissement pathologique; stratégies palliatives.*



Introduction:

The human brain ages with the advance of the age of the human being, this means that braincells do not age in the same way but experience peaks of aging.

After a certain age, a reduction in brain function occurs, the size of certain regions of the brain decreases but without loss of function, however, changes in brain chemicals (neurotransmitters), changes in the blood supply to the brain of various aspects of brain functions can be affected at different times.

Short-term memory and the ability to learn new concepts tend to become promised relatively early. Oral and cognitive abilities begin to decline later, so intellectual performance (ability to process information) is usually retained in the absence of underlying neurological or vascular disorders. That said, this process does not follow the same path when aging is pathological and unfortunately generates significant diseases and disorders that thus alter the quality of life.

Pathological aging is an aging that is accompanied by the accumulation of several pathologies, both physical and psychological, in addition to neuro degenerative is eases affecting the brain, such as Alzheimer's disease, which is an example taken in this article. Elucidating the cognitive decline affecting the types of memories (working memory, episodic memory, semantic memory and procedural memory) that affect the well-being and sociability of the elderly subject, thus proposing palliative strategies to remedy cognitive decline and ensure the quality of life and better social adaptation of the elderly subject.

1. Definition of concepts

1.1. Alzheimer's disease

Alzheimer's disease is a progressive neurodegenerative disease of the central nervous system, characterized by progressive deterioration of memory, cognitive functions and, in advanced stages, motor and behavioral skills. It is the most common cause of dementia in the elderly. (Dubois, B., & al., 2021).

1.2. Memory:

Cognitive ability that allows us to capture, code, store and restore the stimuli and information we perceive.

1.3. Working memory:

It is designed as a short-term memory system that allows information to be stored momentarily. Working memory is composed of the central executive system (controls and coordinates processing operations), the articulatory loop (the slave system of the central executive system responsible for storing and refreshing verbal information) and the visual-spatial notebook (slave system involved in the maintenance of spatial and visual information) allowing the temporary holding and manipulation of information (e.g. dialing a phone number that we just read).

1.4. Episodic memory:

This memory system allows the encoding, storage and retrieval of acquired experiences in a precise spatio-temporal context. Episodic memory underlies the memory of episodes personally experienced. It is classically evaluated by tests of free recall (recalling previously learned material without any help from the experimenter), cueing recall



Soumission : 11/02/2025 Acceptation : 02/07/2025 Publication : 15/08/2025

(recalling previously learned material using a clue, often semantic, proposed by the experimenter) or recognition (recognizing in a list of stimuli those that have been learned previously and those that have not been processed), whether the material is verbal or non-verbal.

1.5. Procedural Memory:

It allows you to acquire skills gradually, with training, without reference to previous experiences. Inseparable from action, it is expressed in the course of the subject's activity. Procedural memory is involved in the acquisition and retention of skills, such as playing the piano or driving a car. Procedural learning skills are assessed using the Rotor test (chasing a rotating target with a stylus for as long as possible), mirroring (reading mirrored words as quickly as possible), the Tower of Hanoi (reconstructing a pyramid of pucks placed on a starting rod on a starting rod by moving only one puck at a time and never placing a larger puck on a smaller one).

1.6. Semantic memory:

It is the memory of concepts, ideas and facts independent of the spatio-temporal context of acquisition. This body of acquired conceptual knowledge allows the understanding of the surrounding world. Semantic memory abilities are assessed with tests of semantic verbal fluency or lexical evocation (evoking in 2 minutes the maximum number of exemplars belonging to a proposed category), naming (naming drawings of objects), or vocabulary (defining concepts).

2. Normal cognitive aging

Normal cognitive aging is characterized by a set of selective declines and preserved functions, in the area of memory in particular, age-related changes affect performance more in explicit tasks of episodic memory (recall and recognition) than in implicit tasks; other wise, it is generally accepted that normal cognitive aging spares structure. (Valentine Charlot and Pierre Feyereisen, 2005, p324). It is also linked to a reduction in executive capacity, cognitive slowing and a drop in various performances, it is Aging and Alzheimer's disease the result of a particularly pronounced neuronal deterioration in the frontal structures which presents the seat of executive functions. (Laurence Taconnat, D.Clarys, Vanneste et M.Isingrini, 2005, p17).

3. Memory and normal aging

3.1. Working memory

When they exist, the effects of age on span tasks maybe due to several factors, linked to the nature of the processes occurring in the specific task used. Indeed, it is above all a test of "passive" retention of a small amount of information, involving the phonological loop or the visuo-spatial notebook depending on the type of material, but the intervention of the central executive system and even long-term memory can occur, and in this case lead to a performance deficit in elderly subjects. A purer measurement of slave systems shows their preservation during normal aging (Belleville et al., 1996). On the other hand, the central executive system assessed using tasks requiring both the retention and manipulation of information, such as the reverse span, appears sensitive to the effects of age. This reduction in the capacities of the



Soumission : 11/02/2025 Acceptation : 02/07/2025 Publication : 15/08/2025

central executive system, also highlighted in the Brown-Peterson paradigm, partly explains the difficulties encountered by elderly subjects in complex cognitive activities and for some authors, it would even be the main responsible.

3.2. Episodic memory

Episodic memory*, which allows autobiographical information to be recorded in a temporal and spatial context, is the most elaborate system in Tulving's hierarchical model (1995). Functionally dependent on other systems, it is also the most fragile, the most vulnerable to different pathologies as well as the effects of age. Furthermore, normal aging affects controlled recovery processes, but not more automatic recovery processes, based on the feeling of familiarity (Clarys, 2001). Storage does not seem to be involved, as suggested by the absence of an effect of age on the forgetting rate or its weak influence on the performance of elderly subjects in a task of learning a list of words in several trials, the emphasis was placed on the sensitivity to age of certain aspects of episodic memory, such as source memory. For some authors, the effects of age on episodic memory could be explained by difficulties in encoding or retrieving the context of information whose content is preserved. However, amnesia of the source appears mainly in very old subjects. The memory of the distant past, on the contrary, is considered more resistant to the effects of age than that of recent events, particularly if the events have an emotional coloring. However, few studies have distinguished the episodic aspects from the semantic aspects of autobiographical memory (memory of knowledge and

personal memories). Piolino et al. (2000) showed that episodic aspects are more sensitive to aging than semantic aspects of autobiographical memory.

3.3. Semantic memory

Age effects have been shown on the ability to name objects or produce a word corresponding to a definition and the “word on the tip of the tongue” phenomenon increases with age. Even more clearly, verbal fluency decreases with age. However, this decline may be linked to non-specific cognitive changes (self-initiated activity, implementation of a strategy, sustained attention, speed of cognitive processing and oral production). The reduction in performance of elderly subjects in these different tests therefore does not allow us to conclude that there is an alteration of semantic memory 'per se', but rather indicates difficulties in accessing semantic representations which have long been intact National Foundation of Gerontology | Downloaded on 09/15/2025 from <https://shs.cairn.info> (IP: 154.252.23.13) Gerontology and Society - n° 97 - June 2001 page 36; Overall, the organization of semantic knowledge would be preserved during normal aging, but the exploitation of this knowledge could be less effective in elderly subjects, thus explaining the difficulties in carrying it out spontaneously. deep encoding of information in episodic memory.

3.4. Procedural memory

Procedural memory is evaluated by tests in which the subject is asked to acquire a procedure (which must therefore be new) through repetition of trials, and without necessary recourse to explicit memory. Despite the use of various methodologies explaining certain differences in



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results depending on the studies, the work generally converges towards a preservation of the capacities for acquisition of a new procedure, perceptual-motor (Rotor test), perceptual-verbal (mirror reading task) or cognitive (Tower of Hanoi test). The authors concluded that there are modifications, with age, of the strategies used to achieve the solution of the Tower of Hanoi, as well as a slowdown in the dynamics of learning. Indeed, older subjects reach the "procedural phase" later than young people, which marks the automation of the procedure and constitutes the last stage of learning. Taking into account the characteristics of memory tasks is crucial to understanding the results obtained, but other factors, specific to the subjects, must also be integrated. Indeed, the existence of a significant inter individual variation in performance, at the same age, has often been reported in the literature and this variability even seems to increase with age. (Syssau, 1998, pour revue).

4. Pathological cognitive aging

4.1. Memory and pathological aging

Memory problems constitute one of the criteria necessary to establish the diagnosis of Alzheimer's disease (McKhann et al., 1984) and are often described as being the most common symptoms National Foundation of Gerontology | Downloaded on 09/15/2025 from <https://shs.cairn.info> (IP: 154.252.23.13) Gerontology and Society - n° 97 - June 2001 page 38 early stages of the condition. Because of their insidious appearance, they are often blamed on age, following the stereotype that it is common place to lose memory as we age. The most evocative memory disorders are difficulty learning new information, for getting recently

experienced events and forgetting actions to perform. They are often associated, from the onset of the disease, with spatial and temporal disorientation. All memory difficulties have been the subject of numerous neuropsychological investigations, which have made it possible to describe the memory systems disrupted or preserved in the mild to moderate stages of Alzheimer's disease.

4.2. Working memory

Most studies show a disruption of working memory in Alzheimer's disease. Indeed, we observe poor performances in the span tests. As indicated by performance on divided attention tasks or the Brown-Peterson paradigm, the major disruption of working memory in Alzheimer's is dissociated at the level of the central executive system which controls and coordinates processing operations. However, the dysfunction of the central executive system would not be isolated: it could also be associated with a deficit in the phonological loop, or even with a disruption of the visuo-spatial notebook.

4.3. Episodic memory

This memory system is most frequently and early affected in Alzheimer's disease, which results in poor performance in tests of free recall, cued recall and recognition. The disruption would essentially relate to the encoding stage given the absence of significant improvement in performance in cued recall and recognition. This predominant encoding deficit led Grober & Buschke (1987) to qualify the memory disorders of Alzheimer's disease as 'authentic' as opposed to the 'apparent' disorders of subcortical pathologies characterized by a retrieval deficit.



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The encoding deficits noted in Alzheimer's disease are linked to a disorder of semantic organization. Episodic disorders could also be due to poor consolidation of new information during the storage phase. This dysfunction results in a more rapid forgetting of information correctly encoded, yet repeated during successive trials or by a significant rate of forgetting evaluated after delayed recall. The study of episodic memory is decisive for the early diagnosis of Alzheimer's disease because this condition is characterized, from the first stages of development, by numerous episodic disorders that do not exist in normal aging.

4.4. Semantic memory

Semantic memory disorders can occur early in Alzheimer's disease and result in vague spontaneous speech, composed of imprecise words and circumlocutions. Naming, fluency (lexical evocation) or vocabulary tests are the most frequently used to assess semantic disorders in Alzheimer's disease and make it possible to highlight certain errors characteristic of a disruption of semantic memory. Thus, object naming tests cause semantic paraphasias. Despite this consensus regarding the existence of semantic disorders during the assessment of Alzheimer's disease, the nature of these deficits remains imprecise and two contradictory theses are generally put forward to explain them. For some authors (Nebes et al., 1989), patients with Alzheimer's disease suffer from a deficit in access to knowledge within a relatively intact semantic stock. On the contrary, other authors (Chertkow et al., 1989) suggest a degradation of the organization and structure of semantic memory as well as a

specific and progressive loss of concepts and their attributes. Shallice (1987) proposed several criteria in favor of a central disruption of semantic memory : the consistency of errors from one test to another and during repeated examinations, the absence of facilitation by semantic cueing, the preferential reach of infrequent items, and the selective loss of specific attributes of concepts contrasting with a preservation of superordinate information. According to a hierarchical conception of semantic memory, Alzheimer's disease causes a partial and progressive degradation of semantic memory. It antidegradation of semantic memory which would lead to the production of semantic paraphasias, errors in definition tasks and a reduction in the number of exemplars cited in verbal fluency.(Eustache & Desgranges, 1997).

4.5. Procedural memory

Most studies evaluating procedural memory capacities in Alzheimer's disease have proposed the learning of perceptual-motor procedures and have shown a relative preservation of this learning in the Rotor test or maze learning tests. Studies concerning the learning of perceptual-verbal procedures such as mirror reading in Alzheimer's disease are rarer and less consensual, and this heterogeneity is partly explained by methodological differences between studies. The literature concerning cognitive procedural memory in patients with Alzheimer's disease is less dense. The results noted in Alzheimer's disease converge towards a relative preservation of this memory. However, tests that involve simple perceptual and/or motor processes are likely to perform better than tasks that involve complex cognitive processing. Memory problems are the most



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common and among the earliest symptoms of Alzheimer's disease. Recent euro psychological studies have, however, shown that memory deficits do not necessarily affect all memory systems in the same way. They also highlighted the significant heterogeneity of memory deficits following Alzheimer's disease. Furthermore, it appears that these difficulties are partly the consequence of various disturbances such as a dysfunction of executive functions (Desgranges et al., 2000). Normal aging and pathological aging (and more specifically Alzheimer's disease) appear to preferentially affect the same memory systems, namely episodic memory and working memory. However, these different systems are affected to much greater degrees in pathological aging, and the nature of these deficits is significantly different from that of normal aging.

5. Palliative strategies for managing cognitive decline

- Cognitive decline is a natural process associated with aging. However, it can sometimes progress to more serious problems such as Alzheimer's disease.
- Cognitive decline can affect memory, reasoning, decision-making, etc. So for this you should follow the following guidelines in order to remedy this;
- Maintain a regular sleep rhythm by limiting noise and light during the night.
- Secure the environment of the elderly subject and eliminate dangers by ensuring the presence of a family member.
- Use a calendar and a clock to help the elderly subject in time and space.

- Stimulate the brain and the senses by doing regular physical activity and introducing the elderly person to various activities such as reading, music, word games, gardening which keep the brain active.

6. Neurocognitive memory rehabilitation

Alzheimer's disease is a neurodegenerative pathology characterized by a progressive decline in cognitive functions. It affects several memory systems: semantic memory, episodic memory, procedural memory and working memory. Neurocognitive rehabilitation aims to support and stimulate these functions in order to improve the quality of life and autonomy of patients. (Clare & Woods, 2004).

6.1. Working memory

Working memory is an essential cognitive system for temporarily maintaining and manipulating information necessary for daily activities such as conversation or planning. In Alzheimer's disease, this system is significantly altered (Baddeley, 2012). Strategies include structured cognitive exercises (Clare & Woods, 2004), global cognitive stimulation (Huntley et al., 2015), and the use of digital technologies (García-Casal, Loizeau, Csipke, Franco-Martín, & Perea-Bartolomé, 2017). The association with compensatory strategies also improves the effectiveness of treatment. (Clare et al., 2010).

6.2. Episodic memory

Episodic memory, which concerns personal events located in time and space, is one of the first functions affected. The most used techniques are guided recall, reminiscence therapy (photos, music, videos) and implicit



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learning, promoting the consolidation of daily routines (Irish & Piguet, 2013). The use of compensatory strategies such as notebooks or digital applications is also encouraged (Hampstead, Sathian, Moore, Nalisnick, & Stringer, 2008). These approaches, although they cannot stop the decline, contribute to maintaining a certain degree of independence (Woods, Aguirre, Spector, & Orrell, 2012).

6.3. Semantic memory

Semantic memory, which stores concepts, words and their meanings, is particularly affected during Alzheimer's disease. Interventions includes mantic categorization, naming, and picture-word association. These methods help stimulate the recall of general knowledge and support communication (Belleville, 2008). Despite the inevitable progression of the disease, relative improvements were observed in language and social interaction (Grossman, 2018).

6.4. Procedural memory

Procedural memory, which allows the acquisition and maintenance of motor and cognitive skills, remains relatively preserved, particularly at early stages. Rehabilitation methods are based on repetition, implicit learning and above all error-free learning, which optimizes the consolidation of skills (de Werd, Boelen, OldeRikkert, & Kessels, 2013). The integration of multi-sensory stimulation (gestures, sounds, images) further strengthens the effectiveness of interventions (van Halteren-van Tilborg, Scherder, & Hulstijn, 2007).

Conclusion:

Aging is a long process, which begins at the conception of an individual and gradually evolves until the end of their life. Irreversible in its chronological aspect, aging is of ten associated with its deleterious effects, particularly in the cognitive domain. Indeed, during aging, the brain undergoes significant anatomical and physiological changes which govern the evolution of our intellectual abilities and lead to the deterioration of certain cognitive functions as we age. These declines can gradually lead to a decline in quality of life and independence, thereby preventing "successful aging." Cognitive aging is characterized by a decrease in cognitive performance in most areas of cognition. Alzheimer's disease is in fact the first neurodegenerative condition for which biological abnormalities can be measured in the Cerebrospinal fluid. (B. Dubois, B. (2013).). It is a progressive neurodegenerative pathology which is expressed by memory disorders and cognitive decline. And for this we have presented Neurocognitive memory reeducation in these patients which constitutes a promising approach. Although it cannot stop the progression of the disease, it helps maintain communication (semantic memory), autobiographical identity (episodic memory), functional autonomy (procedural memory) and executive abilities (working memory). These integrated approaches help improve the quality of life of patients and their families.



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