Narrative analysis in Alzheimer's disease

Philippe Thomas[a] [*], Remy Billon[b], Cyril Hazif-Thomas[c]

[a] *Semiotics Research Center, University of Limoges, Limoges, France*

[b] *Hospital St Louis, La Rochelle, France*

[c] *Department of Psychiatry for the Elderly, CHRU de Brest, Bohars, France.*

[*] Corresponding author. E-mail: philippe.thomas.2008@orange.fr

Background. Alzheimer's Disease (AD) is a neurodegenerative illness, which occurs with increasing frequency as people age. While progressive memory impairment is the upfront element associated with the disease, other neurocognitive troubles are also associated with it, such as language impairment which can degenerate into aphasia. Language disorders interfere and worsen the functioning of memory.

Aim of the study. To evaluate semantic and textual impairment in AD patients.

Methods. The current study involved 151 AD patients undergong consultation at Brest University Hospital. Certain sociodemographic data (sex, age, cultural levels) were collected, as well as results from the following neuropsychological tests: Folstein (MMSE); Dubois's 5-word test; Dubois's frontal assessment test battery (fluencies); Cornell's scale for depression; and Barbizet's test ("The Lion's tale"). All were subject to textual analysis. Our sample of demented patients included 102 females and 49 males of average age 80.3 ± 6.91.

Results. All the tests, including the number of items recalled much later in the Barbizet's test, showed impairment, all the more by Folstein's test being altered. The demented patients' formal fluency was less impaired than their semantical lexical fluency (scored respectively 5.74 ± 1.09 versus 4.41 ± 2.19; $t = 5.60$, $p < 0.01$). The demented cohort exhibited more intrusions ($n = 36$) than inversions in the delayed recollection of the Lion's Tale, both for items and the episodes in which they occurred ($n = 19$). The regressive PLS analysis showed that, to explain the overall scores relating to "The Lion's Tale", calculated later, only attainment of lexical fluency had any notable influence (Regression coefficient $CR = 0.224$) or, more accessorily, the cultural level ($CR = 0.12$).

Conclusion. AD patients' proficiency in tests of category fluency and their cultural levels have effects on narrativity.

Key words: Alzheimer's Disease, semiotics, semantics, textuality

Introduction

Alzheimer's Disease (AD) is a neurodegenerative illness which occurs with increasing frequency along with advancing age (P. Thomas, Clement, Hazif-Thomas, & Leger, 2001). While progressive memory loss is the upfront element associated with AD, other neuro-psycho-cognitive troubles are also associated with it, such as language impairment which can degenerate into aphasia (Gewirth, Shindler, & Hier, 1984).

Language dysfunction is one of the most significant symptoms affecting AD patients' ability to narrate a story (Hassenstab et al., 2015). In the earliest stages, the influence is slight, but it increases over time through foreseeable phases. Memory dysfunction also interferes with the patient's abilities to use language (Reilly, Rodriguez, Lamy, & Neils-Strunjas, 2010). The patient's judgment and ability to conduct his/her own life also have a broad impact on their language difficulties. Put another way, disorganized phasic patterns and verbal abilities often limited by aphasia, reflect a deconstruction of a patient's personal meaning, which is itself essential for recall, as well for social interactions with others, and maintaining memories. An inconsistent story of one's life weakens one's self-esteem and ability to monitor daily life, a condition that leads to behavior disorders (P. Thomas & Hazif-Thomas, 2016). Knowing the importance of both these components could help the individual prepare as well as possible for the consequences on his/her social life. We have tried, in this monocentric prospective observation and study, to evaluate the semantic and narrative dysfunction in AD.

Methods

The cohort we studied were elderly demented patients living at home with AD, who had been followed for at least three months by gerontopsychiatrists for cognitive, behavioral, and memory dysfunction. During a gerontopsychiatric interview, the patients and accompanying family were informed completely and loyally and in understandable language about how the study would be carried out. With the agreement of the patient and his/her assistants, the results of the neuropsychological tests were computer-recorded anonymously. The study protocol was ethically reviewed and approved by the Hospital of Brest ethics committee. Computing procedures for data capture and processing followed the recommendations of the French National Commission on Computer Technology and Freedom.

Criteria were determined for inclusion based on the AD patients (MMSE >10) (Folstein, Folstein, & McHugh, 1975) having given written consent, together with their family assistants, to take part in this study validated by the Hospital of Brest ethics committee. Only those patients still capable of understanding the instructions for the Barbizet's test, showing symptoms of Alzheimer dementia–i.e. without massive memory impairment and capable of asserting their consent and assent during the test and fit and able in the eyes of the Law–were included. A patient's inability to understand information relating to the study, his/her inability to choose whether or not to take part, and the possible opposition of the family member accompanying him/her were decisive criteria for exclusion. The size of the population studied reflects the number of demented persons followed over the period of this one-year study.

Semantic memory is the memory necessary for language manipulation, and is not very vulnerable to amnesia (Tulving, 1995). To evaluate semantic and textual disorders in the cohort of AD patients, we routinely recorded the results of tests measuring memory, as well as noting some sociodemographic data. These were sex; age; and cultural level as estimated by the patient's number of years of schooling: 1 = illiterate ; 2 = can read and write ; 3 = six years schooling ; 4 = 11 years schooling ; and 5 = more than 11 years of schooling. The following are the tests customarily carried out on patients under consultation for AD: Folstein Test (MMSE) (Folstein et al., 1975); Dubois's 5-word test (D5WT) (B. Dubois, 2001); formal fluency (number of animals mentioned in one minute) semantic lexical fluency (number of words beginning with L named in one minute); (B. Dubois, 2001); DFB (Dubois's Frontal Battery) (B. Dubois, Slachevsky, Litvan, & Pillon, 2000); Cornell's scale (depression) (Alexopoulos, Abrams, Young, & Shamoian, 1988); and Barbizet's test (Barbizet & Truscelli, 1965) aka "The Lion's Tale". The formal fluency test uses mechanisms of analogy between memorized objects, while semantic lexical fluency refers to the use of vocabulary stored in memory, which is vulnerable in Alzheimer's disease.

"The Lion's Tale" (presented in *Table 1*) must be read by the examiner slowly. The subject must be informed that it is a long story, the point of which is to evaluate his memory capacity. He must be told it is not a matter of repeating the story word for word, but just recalling its main thrust and as many details as possible. Barbizet recommended an immediate application, an immediate recall, and then a delayed recall. In practice, in the present framework, the text was read out at the beginning of the consultation, followed by an immediate recall, and then a delayed recall towards the end of the consultation--that is, about one hour later.

Table 1

"The Lion's Tale" (Barbizet & Truscelli, 1965). Text and sequential organization

Episode	Text
Escape	A lion named Sultan escapes from its cage, due to the door having been left open by a careless guard
Crowd movement	The crowd of visitors, which is numerous on Sunday, runs away towards the nearby buildings
Woman and child	A woman, dressed in blue, who was holding her one-year-old child in her arms, drops him. The lion seizes him.
Deal	The woman, in tears, retraces her steps, and begs the lion to return her young
Resolution	The animal looks at her for a long time, fixedly, and finally releases the child without having done him the slightest bit of harm.

So this short text, with 22 sub-items learned sequentially, is to be recalled immediately, and repeated later. The elements can be organized, according to the author of the test, into five episodes: escape, crowd movement, woman and child, deal, resolution. Barbizet's test reveals what things from the tale are forgotten, and notes

intrusions and inversions. These data are then compared with that of the neurosychological tests. Statistics were established with a SAS program by a bio-statistician, Dr. R. Billon. The tests selected were Chi2, Student (un-paired), Pearson's correlations, and Partial Least Squares regression, chosen to reduce risks of collinearity (Tenenhaus, Esposito Vinzi, Chatelinc, & Lauro, 2005). If a classic linear model is used, collinearity between explanatory variables makes the model unstable, and the results uncertain.

Results

One hundred and fifty-one patients, living at home on their own or with their families, were included in the study. There were no cases recorded of refusal to participate in the study, or to having the results observed and computerized anonymously. The cohort of demented patients was made up of 102 females and 49 males of an average age of 80.3 years ± 6.91. *Table 2* reprises the main results. The average characteristics did not differ statistically between the males and the females. The tests showed that the formal fluency of the demented patients was less impaired than their semantical lexical fluency (scored respectively 5.74 ± 1. 09 versus 4.41 ± 2. 19; t = 5.60, p < 0.01).

Table 2

Sociodemographic data and results in the diverse tests (N = 151). DFB = Dubois's Frontal Battery; D5WT = Dubois's 5 words test.

Age	Cultural level	MMSE	DFB
80.3 ± 6.9	2.82 ± 0.50	16.5 ± 5.1	11.3 ± 4.5
Cornell	D5WT	Semantic lexical Fluency	Formal Fluency
10.6 ± 4.2	4.58 ± 1.1	4.41 ± 2.2	5.7 ± 1.1

The studied population showed more cases of intrusion (n = 36) than inversion in the later narration, whether items or episodes combining the two (n = 19). Nearly all the inversions were by patients whose MMSE was below 19, and the intrusions were by patients whose MMSE was below 15 (*Table 3*). Admittedly, intrusions are specific to AD pathology, where we find their greatest occurrence. However, these results could suggest that intrusions are essentially linked to executive problems concerning response control. In respect to patients' dysexecutive syndrome (DFT < 13; n = 77), it is to be noted that, overall, inversions occur in the more deficient group (*Table 4*). It is also to be noted that inversions are observed to be more precocious when the disease has caused a deterioration of textuality, and hindered the pragmatics of communication. MMSE for the executive syndrome sub-group (n = 77) was 11.9 ± 2.9 against 20.9 ± 2.6 for the less seriously affected group (n = 74).

The correlation matrix for the various parameters showed many correlations, leading to our choice of PLS for regression analysis. The factor studied is the overall score for Barbizet's test, with the model including the variables of the previous

figure. Formal fluency, with a coefficient of 0.224, remains the characteristic that most influences the overall score. The higher it is, the greater the success in the test; this influence is almost three times that of the lexical memory. Then, we will retain cultural level (coefficient = 0.12) and, more accessorily, age (coefficient = 0.11); all the others are less interesting.

Table 3

Percentage of Inversions (n = 19) and intrusions (n = 36) according to the MMSE. Chi2 with Yates's correction (p < 0.05) comparing the number of intrusions and of inversions; and for each items, the level of MMSE (cut-off MMSE >14)

	MMSE>19 N = 50	MMSE : 19-15 N = 42	MMSE 14-11 N = 39	MMSE = 10 N = 21
Intrusions	2	24	28	61
Inversions	0	20	20	25

Discussion

We are presenting here the results of a preliminary study on textuality in AD, based on consultation with patients in an old-age psychiatric department. The very nature of the department explains the age of those recruited. The patients' worsening MMSE made it hard for them to understand the text, and even the value of their consent. The aid given by their family or accompanying person was then precious, and all the tests were carried out under the specialized consultation of our establishment.

The executive disorders studied by the DFB test and cognitive disorders estimated by the MMSE are strongly correlated. Also it is difficult to know which verbal problems resulted specifically from which factors. We chose a threshold of 13 for two reasons: one, so that the sub-populations were balanced, and two, for a clear cut-off point showing whether or not there was a dysexecutive syndrome connected to frontal disorders. The presence of such a dysexecutive syndrome, in case of late depression (with or without dementia), impacts on the patient's cognitive status (Hazif-Thomas, Reber, Bonvalot, & Thomas, 2005). The depressive elderly person frequently presents changes in verbal fluencies and deficits of planning connected to frontal disorders (Elliott, Sahakian, Herrod, Robbins, & Paykel, 1997). The scores on the Cornell scale were weak in the population we studied. Depression is common when dementia progresses, especially when the elderly person lives in a nursing home (Alexopoulos et al., 1988). The elderly included in this study lived at home. The scores on the scale of Cornell presented here are low (*Table 2*: 11.3 ± 4,5, while the depression threshold value is >8).

We shall note in this study the important progression of the narrative disorders observed in the scores on the delayed recall in "The Lion's Tale", all the more degraded that the cognitive disorders are installed. Intrusions and inversions can result from cognitive disorders as well as from related executive disorders. Formal fluencies weigh in in a significant but modest way on the model of regression (CR = 0.224), so that with a lower score on the cultural level (CR = 0.117), the cog-

nitive disorders of the dementia, as well as the linguistic disorders, are being classically modulated (Arroyo-Anllo, Beauchamps, Ingrand, Neau, & Gil, 2013; Folstein et al., 1975).

Although the PLS model is more influenced by formal fluency, the lexical semantic fluencies are more altered than the formal fluency (*Table 2*). Finding a word beginning with a letter ("L" in French, "S" in English, for reasons of frequency of use of this letter in the beginning of a word) requires a strategy of recovery based on the abstract lexical representation (Lee, 2012). The degradation of formal fluency triggers a more important disorganization of the functions of language. Moreover, the analog mechanisms mobilized by demented patients seem to be more concerned and better conserved in Alzheimer's disease, judging from the results observed with formal fluency. Memory, together with judgment, build a meaning of life conductive to a coherent self-narrative account (Ricœur, 1990).

Disorders of judgment and memory seem to be allied in Alzheimer's disease. Wording and the building of sentences are altered in this disease, but the analog operation seems to be preserved longer. The figures evoked for an analog mechanism mobilize old emotions, and from these emerge ancient memories buried deep in the patient's mind (Brainerd & Reyna, 2015; P. Thomas, Chandès, & Hazif-Thomas, 2017). The concrete items with strong emotional connotation in "The Lion's Tale" (A woman, a child, a lion …) are better recalled than the more secondary features of the story (For a long time, fixedly …); even there, emotion appears clearly as the "power steering" of the reason and the memory.

Conclusion

Lexical semantic fluency is more altered than formal fluency in the Alzheimer's disease. The degradation of formal fluency testifies to a more important disorganization of the functions of the language. Formal fluencies are less impaired (Imaging or Gist memory process) than Semantic lexical Fluency (Verbatim process) (Brainerd & Reyna, 2001). The impairments of fluencies have an impact on the memorization of a text, in parallel with the development of cognitive disorders. The patients' cultural level also influences his/her narrative skills, which remain sensitive to the emotional aspect of a story when assessed in memory testing. This emotional mobilization is probably an interesting way to motivate patients in speech therapy, for the prevention of damage to, or maintenance of, lexical and textual capacities in patients with Alzheimer's disease.

References

Alexopoulos, G. S., Abrams, R. C., Young, R. C., & Shamoian, C. A. (1988). Cornell Scale for Depression in Dementia. *Biol Psychiatry, 23*(3), 271-284. https://doi.org/10.1016/0006-3223(88)90038-8

Arroyo-Anllo, E. M., Beauchamps, M., Ingrand, P., Neau, J. P., & Gil, R. (2013). Lexical priming in Alzheimer's disease and aphasia. *European Neurology, 69*(6), 360-365. https://doi.org/10.1159/000347223

Barbizet, J. & Truscelli, D. (1965). L'histoire du lion (considérations sur la fabulation). *Semaine des Hôpitaux, 28*, 1688-1694.

Brainerd, C. J. & Reyna, V. F. (2001). Fuzzy-trace theory : Dual account in memory, reasoning, and cognitive neuroscience. *Advances in Child Development and Behavior, 28*, 41-100.

Brainerd, C. J. & Reyna, V. F. (2015). Fuzzy-Trace theory and lifespan Cognitive Development. *Developmental Review, 38*, 89-121. https://doi.org/10.1016/S0065-2407(02)80062-3

Dubois, B. (2001). L'épreuve des cinq mots. Fiche technique. *Neurologie-Psychiatrie-Gériatrie*, 40-42.

Dubois, B., Slachevsky, A., Litvan, I., & Pillon, B. (2000). The FAB: a Frontal Assessment Battery at bedside. *Neurology, 55*(11), 1621-1626. https://doi.org/10.1212/WNL.55.11.1621

Elliott, R., Sahakian, B. J., Herrod, J. J., Robbins, T. W., & Paykel, E. S. (1997). Abnormal response to negative feedback in unipolar depression: evidence for a diagnosis specific impairment. *Journal of Neurology, Neurosurgery, & Psychiatry, 63*(1), 74-82. https://doi.org/10.1136/jnnp.63.1.74

Folstein, M. F., Folstein, S. E., & McHugh, P. R. (1975). "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. *Journal of Psychiatric Research, 12*(3), 189-198. https://doi.org/10.1016/0022-3956(75)90026-6

Gewirth, L. R., Shindler, A. G., & Hier, D. B. (1984). Altered patterns of word associations in dementia and aphasia. *Brain Lang, 21*(2), 307-317. https://doi.org/10.1016/0093-934X(84)90054-3

Hassenstab, J., Monsell, S. E., Mock, C., Roe, C. M., Cairns, N. J., Morris, J. C., & Kukull, W. (2015). Neuropsychological markers of cognitive decline in persons with Alzheimer disease neuropathology. *Journal of Neuropathology & Experimental Neurology, 74*(11), 1086-1092. https://doi.org/10.1097/NEN.0000000000000254

Hazif-Thomas, C., Reber, G., Bonvalot , T., & Thomas, P. (2005). Syndrome dysexécutif et dépression tardive. *Annales Medico-Psychologiques, 163*, 569–576. https://doi.org/10.1016/j.amp.2005.07.005

Lee, H. (2012). Langage et Maladie d'Alzheimer : Analyse Multidimensionnelle d'un Discours Pathologique. Thèse de doctorat. *Université Paul-Valéry, Montpellier 3,* 198-199. Retrived from *https://tel.archives-ouvertes.fr/tel-00812618v1/document*

Reilly, J., Rodriguez, A. D., Lamy, M., & Neils-Strunjas, J. (2010). Cognition, language, and clinical pathological features of non-Alzheimer's dementias: an overview. *Journal of Communication Disorders, 43*(5), 438-452. https://doi.org/10.1016/j.jcomdis.2010.04.011

Ricœur, P. (1990). Soi-même comme un autre. *Editions du Seuil, Paris.*

Tenenhaus, M., Esposito Vinzi, V., Chatelinc, Y.-M., & Lauro, C. (2005). PLS path modeling. *Computational Statistics & Data Analysis, 48*(1), 159-205. https://doi.org/10.1016/j.csda.2004.03.005

Thomas, P., Chandès, G., & Hazif-Thomas, C. (2017). La reconstruction de la signification dans la démence. *Soins Gerontol, 22*(127), 40-43. https://doi.org/10.1016/j.sger.2017.06.012

Thomas, P., Clement, J. P., Hazif-Thomas, C., & Leger, J. M. (2001). Family, Alzheimer's disease and negative symptoms. *International journal of geriatric psychiatry, 16*(2), 192-202. https://doi.org/10.1002/1099-1166(200102)16:2<192::AID-GPS301>3.0.CO;2-Y

Thomas, P. & Hazif-Thomas, C. (2016). Language Disorders in Alzheimer's Disease and Phatic Function. *Open Journal of Psychiatry, 6*(4), 213-216. https://doi.org/10.4236/ojpsych.2016.63026

Tulving, E. (1995). Organisation of memory: quo vadis? *The cognitive neurosciences. Mass: MIT Press. M.S. Gazzaniga (Ed), Cambridge*, 839-847.