

## Introduction

For a generalist audience, it is worthwhile to define dementia and discuss the phenomenology of language changes associated with it before turning to the theoretical issues of interest. Thus I will start this presentation with a discussion of dementia broadly, then narrow in on the type of dementia of that is of greatest interest for those interested in language, Alzheimer's dementia. Then I will describe the language changes associated with its various stages. In the second part of the paper, I will focus on four areas of theoretical interest: **first** the interaction between language and cognition that is revealed by the language changes of dementia, particularly as these can be compared to the language changes associated with frank brain damage such as in aphasia resulting from stroke or brain trauma; **secondly**, the related question of whether, underlying the language changes of Alzheimer's dementia is an actual dissolution of the semantic store, or rather problems with access to it; and **thirdly**, what we learn from bilinguals who are demented about the pragmatic and underlying cognitive abilities associated with bilingualism.

## Definition of Dementia

Neurologists define dementia as being a disease state resulting from cellular changes in the brain whereby cognitive abilities are progressively impaired. Three out of the following four characteristics must occur in order for dementia to be recognized: **one**, changes in language; **two**, changes in memory; **three**, behavioral changes, such as markedly increased irritability or belligerence or, in one case I know of, a disconcerting increase in «niceness» in someone who had previously always been quite critical; and **four**, impairment of manipulation of acquired knowledge; the standard test for this is the ability to, say, recite the alphabet backwards, or spell a word such as «world» backwards.

There are a number of different sorts of dementia and they occur with relatively different frequency in the general population. Some of them are considered to be the result of primarily subcortical damage, that is, damage to the interior areas of the brain, while others are considered to be the result of damage primarily to the cortex, that is damage to the external surface, its convolutions and gyri, of the surface of the brain. I'm not going to talk about the primarily subcortical dementias, but for your information they include diseases like Parkinson's Disease and Progressive Supranuclear Palsy. The primarily cortical dementias include Pick's Disease which is associated with cellular damage primarily in the frontal lobes of the brain, and, my focus for today because the language changes are so interesting, Alzheimer's Disease which is associated with cellular changes both in frontal lobes and in temporal lobes of the brain.

For our purposes here, we don't need to discuss the specific cellular and, presumably neurochemical changes that are associated with the dementias; it is the behavioral phenomena that are of interest to us.

One of the forefathers of modern neurolinguistics, Carl Wernicke, in his famous 1874 article in which he described the fluent aphasia of Wernicke's aphasics, was the first to point us to a case of Alzheimer's Disease. It is worth reminding ourselves how Wernicke's Aphasia manifests because in certain stages towards the middle of the decline of Alzheimer's Disease, the language is quite similar to it. In the Wernicke's aphasic, whose lesion is associated with brain damage to the posterior part of the language area of the brain, the production of language is quite fluent — unlike that of the non-fluent Broca's aphasics who had been described a decade before by Paul Broca — but, again unlike the Broca's aphasics, comprehension is quite poor. When Wernicke talked about these cases, he gave two examples. The first is clearly the case of a patient who had suffered the sudden onset that is typical of the aphasias and Wernicke dealt with this patient at length; the second case he brings in to bolster his argument that the phenomenon is a more general one; this case is actually, upon careful reading (as in Mathews, Obler and Albert, 1994) more likely a case of Alzheimer's dementia, as the decline was progressive.

Alois Alzheimer himself published two important papers on the dementing disease that was to be named after him, one in 1907 and one in 1911. In addition to careful analysis of the cellular changes associated with the atrophy in the brains of patients he had seen before they died, Alzheimer includes superb descriptions of the language changes and other behavioral changes associated with what we have come to know as Alzheimer's dementia. It was his clinical observation that in the demented patient one sees impairment in the ability to name things, the ability to comprehend what is said to the patient, the ability to read and write. In the modern period we have understood that the ability to read aloud is markedly better spared than other language abilities, that repetition may be relatively spared, and that automatic speech shows some decline as well. Problems with discourse are seen in that while a substantial amount of language may be produced, it is quite empty and often impossible for the listener to make sense of.

In the modern period, also, we have come to have an understanding of the stages of dissolution. For the purposes of this presentation, I will speak about three stages: early, middle,

and late, although it is often of interest to focus on the stages between early stages and mid-stage and between mid-stage and late stage.

In the **early** stages naming is most likely to be impaired, comprehension in normal conversation appears to be relatively spared, in discourse the patient may wander from what he's said, or not respond fully to what he's been asked, but conversation can still go on. Reading aloud is quite spared, though reading for comprehension of any complex materials poses some problems.

The patient can still write and his speech will be as meaningful as his oral presentation. Automatic speech is relatively spared, although the patient may skip a month of the year in reciting the months of the year, for example, or need to be given the first month in order to start reciting the months of the year.

In addition to the language changes, clinically the patients' family will complain about their behavior in the real world: perhaps they are no longer able to appropriately use a checkbook, or will leave food cooking on the stove or leave crucial ingredients out of a recipe. Patients' memory problems will also become quite severe; they may become lost a few blocks from their house, forgetting where they standardly keep keys, etc.

By the peak of the **middle** stages of the disease, the patient looks like a classic Wernicke's aphasic. On naming tasks, the patient can name only the most common items, but he or she will come up with interesting substitutions for names; these may include examples of visual misperception e.g. **cucumber** for **escalator** or semantically related items (e.g. **elevator** for **escalator**). The patient's comprehension is as poor as that of a Wernicke's aphasic, so if patients respond to some association to a single word in a question, that is not surprising. While most reading aloud may be spared, for languages like English that have many irregularly spelled words, the patient may regularize these, for example pronouncing the word «yacht» as /yatcht/. In writing there are numbers of misspellings and omitted words, as well as nonsense words. Such nonsense occurs in discourse as well; indeed discourse is quite empty as you see in the transcription. The patient is unlikely to complete items of automatic speech as well and cannot perform on metalinguistic tasks.

### PATIENT 3

E: How old are you?

HJ: I Know I'm a 1937. Well... I tell you what. I have more than for that matter... Germany... eh like, for instance, I'm supposed to be in one and my, my wife is another one. She she's happened in another one. She, she —it takes her that way. See? Because she's in two places, you see, in other wo— she's she is a German, for one thing. And I'm Henry. I'm Josi, Josi, you know... that's what...

E: O.K. Let me ask you once more. How old are you?

HJ: At this moment, if you wanted if I should say... that I'm, I'm gonna do... Jesus! I could have...

E: Well let me ask you a different way.

HJ: When I'm fifty... I was gonna sixteen, no... well, I'm... Oh God.

E: Let me ask a different way. When were you born?

HJ: 19... A long time ago you wouldn't even know what it is that's a don't... that's an American cos (?) That's another thing. See? That's another one... in other words when I came, when I come s-and the time... and it goes —be it foreman and what have you, you know... and go to Germany. That'sd be something else. You see? That's my...

E: O.K. Let me ask you one more question. What year is it now?

Pragmatic abilities are often remarkably spared, however. The patients can be interrupted in their logorrheic outpouring and will respond to questions even if the response does not make sense in light of the question (or independently!). By this stage the patient requires substantial home care — a classic book on how the caregivers' feel is entitled «The 36-hour day»— and they are no longer able to undertake all but the simplest activities from their pre-morbid life.

In the late stages of the Alzheimer's dementia, language is virtually nonexistent. The patient initiates little speech, may respond pragmatically with a formula, or keep eye contact, but has no sophisticated pragmatic abilities left, and really cannot be tested by any standard language tests. Such patients are frequently institutionalized in the United States.

Now that you have a picture of how the language of a patient with Alzheimer's Disease is likely to look across the progression of the disease, let me turn to the theoretical questions that are raised by patients with the disease. Let us consider first the relation between language and cognition. Carl Wernicke himself had already called attention to the potential link between language and cognition in his classic 1874 article but his position was that the two can be separable. Indeed, he was right in that in aphasia, on which he intended to focus his discussion, they are. Alois Alzheimer, by contrast, saw «aphasia» —that is language problems associated with brain damage— as being one of the behavioral components of Alzheimer's disease.

Consider the problems posed by the phenomena of Alzheimer's Dementia for modern linguists or neurolinguists: We are interested in studying the brain bases of language, and many of us are committed to a belief that a certain subsection of the brain is associated primarily with language, although many other parts may be involved as well. We are committed, too, to a belief that language and cognition are independent. While in aphasia it is often possible to demonstrate that patients have understood, or can problem-solve, even if they cannot articulate an answer, in dementia the language and cognitive problems are clearly confounded with each other. Most overtly, if a patient has difficulty with remembering the name of an item, or calls it «thing» or substitutes another word for it altogether, can we say that the problem is strictly a language problem, or is it conceivable that it is another aspect of the many memory problems the patient has? When the patient presents empty discourse, is it because the patient isn't thinking of content to express, or is the thought in fact there, but the ability to articulate it is impaired?

When the patient has difficulty comprehending us, how can we know if this is strictly a linguistic problem, or a problem of memory, or manipulating acquired knowledge, or attending to the materials (one often finds attention problems in patients with Alzheimer's dementia or other dementias) or problems with working memory or short-term memory? In sum, it is when the language problems co-occur with the dementia that we cannot be sure if they are primary phenomena of language impairment or linguistic epiphenomena.

To resolve these questions from the data from Alzheimer's dementia, it is important to recall the aspects of language that are relatively spared. Thus it is clear that **syntax** remains quite unimpaired in production for patients with Alzheimer's disease as for those with Wernicke's aphasia. **Phonology**, too, and **morphophonological** rules are quite spared. Thus the patient will not show the problems that a non-fluent aphasic may show of distortion of phonemes. Although the patients do produce nonsense words —we call these **neologisms**— they would never create words that are **structurally** impermissible in a language, either in terms of the phonemes that are permitted to follow each other, or in terms of the morphemes that are permitted to follow each other. These sparings hold, I must point out, even in that florid middle stage when the patient may produce empty speech, even virtual nonsense. To the extent that these items are spared, of course, we must consider that the other language problems reflect a cognitive decline independent of linguistic abilities.

The second question I promised to treat, is whether the language problems are primarily problems of access to the linguistic store or dissolution of it. This question has been a focus of many researchers over the past decade. It is closely linked to the first question, as you will see. I mentioned earlier that one question we ask when patients are unable to name an item that they see or see a picture of, is whether this is a language or a memory problem. Many psychologists do not see a frank difference between them. They talk about the «**semantics store**» which includes, as far as I can tell, all language components, including words, as well as all the rest of

the knowledge we have learned in our life - e.g. the fact that New Year's Day is January 1st or how to get to this conference room. In Alzheimer's Disease, when patients are unable to read irregularly spelled words that we know they must have read relatively automatically before the Alzheimer's disease, or when they are no longer able to produce automatic speech in its entirety, we begin to suspect that the problem is frank dissolution of the semantic store. One important cue lies in the consistency of the response. If the patient is consistently unable to name a certain item, we may suspect that that item itself is impaired. Myrna Schwartz and her colleagues report a patient named WLP who was no longer able reliably to name common items, and was not even able to reliably sort pictures of dogs, cats, and birds into three piles. However, it is important to note that while the patient often sorted dogs and cats into the same piles, she never confused them with birds. Thus we may say there was **some** dissolution of her semantic categorization abilities, but not complete dissolution, obviously. The more superordinate category, bird vs. four-legged pet, was retained.

We recently conducted a study because patients with Alzheimer's dementia are observed to produce some neologisms - that is, nonexistent words, in their discourse, and also are observed to make semantically-related errors on naming tasks as well as in discourse (Nicholas et al., 1996). It was our hypothesis that patients with Alzheimer's disease, when they made semantically-related errors, would manifest errors that were semantically more distant from the target items than were such semantically-related errors that can also be made, albeit to a lesser extent, by normal elderly. First we had raters exclude patients' responses that represented visual misperceptions. In fact it is the case that patients with Alzheimer's dementia make markedly more of these than normal elderly individuals. Then when we had the remaining responses that could be deemed to be semantically-related responses, we had another set of raters rate the semantic distance of each error item from the target. We expected that, as I said, the semantic distance of the semantically-related errors of the Alzheimer's patients would be greater than that of the normals, and thus reflect the dissolution of the actual semantic store. For example, we expected more close errors like **elevator** for the target **escalator** from the normal elderly and more distant errors, such as **seal** for **beaver** or **hot dogs** for **pretzel** from the patients with mild-to-moderate Alzheimer's Dementia. To our surprise, there was no difference, nor even a tendency in the direction we anticipated. This then suggests that the semantic networks of the patients with Alzheimer's disease are as spared as those of normal elderly, and the problem on the naming task, markedly more severe for even these moderately demented patients, of course, is a problem of lexical access.

Another study that suggested that semantic organization is intact in Alzheimer's Dementia, while conscious access to it is impaired, by contrast, is a series of studies by Nebes and his colleagues (Nebes, Martin, and Horn, 1984; Nebes 1989; Nebes and Brady, 1988; 1990). Moreover the tasks they used were on-line tasks of semantic processing. Because these tests of semantic processing are on-line tasks, they eliminate the memory and other language production problems in the studies that are consistent with decline in the semantic organization

itself. In those studies, then, problems with the additional memory load may be falsely suggesting problems in semantic store.

However there is also data in the literature that suggests impairment in the actual semantic store. Studies of consistency in naming also speak to the question of whether the lexical store is impaired or simply hard to access in Alzheimer's Disease. Of course, virtually all neurobehavioral performance in patients with Alzheimer's disease is markedly more variable from day to day, even from minute to minute than in aphasics, who themselves perform somewhat more variably than normal elderly. Normal elderly themselves perform more variably than normal young subjects on many neurobehavioral measures. When consistency scores on naming batteries are studied, as in Henderson, et al., 1990, we see a certain consistency of naming errors that suggests that actual items have been erased or conflated with others in the lexicon, and thus that semantic memory itself is impaired.

In a recent study by Hodges and colleagues (1996), the authors ask patients with dementia and normal age-matched controls to give oral definitions of words that the patient has been able to name on a picture-naming task and also words that the patient was not able to name. Even for items they were able to name, the patients with Alzheimer's Disease gave worse definitions, and for the items they were not able to name, patients with Alzheimer's Dementia were unlikely to be able to provide even core concepts, although they were able to describe physical aspects of the object. This led the researchers to conclude that the problem in Alzheimer's Dementia is one of dissolution of the semantic store, although of course the problem is that they evaluated their subjects' oral definitions and thus compounded whatever definition problems the subjects might have with the problems of lexical access in discourse!

The question then, of whether it is access or dissolution that accounts for the language problems we see in patients with Alzheimer's dementia, remains unresolved. It certainly may be that there are both aspects of dissolution and of problematic access, but further work in many linguistic arenas remains to be done to determine the complex answer to this question.

The final point I want to cover here is the question of what happens in the bilingual demented patient and what it means. If language stores and the boundaries among items in them dissolve, one might expect bilingual patients with Alzheimer's disease to mix languages at every level, from phonological through morphological, syntactic, and at the discourse level. In fact, to one's surprise, there is relatively little intermixing. Some patients do show the sort of mixing that we can sometimes see in aphasic bilinguals, although there too, the normal bilingual's ability to keep two languages quite separate for production is remarkably spared. Instead of seeing such mixing on a large scale, except perhaps to borrow words in when the appropriate word cannot be found in discourse in the relatively early stages of dementia, the interesting phenomenon one sees in bilingual dementia is an inability to appropriately choose the language according to the interlocutor. A number of instances have been reported in the laboratory of Kenneth Hyldenstam and Christopher Stroud, my laboratory, and those of others, where bilingual demented patients will speak a language that the interlocutor does not understand. Usually this is an immigrant

grandparent, say, speaking the first language to a grandchild or to a health care practitioner who simply does not understand it.

Now this phenomenon is an interesting one because we do not see such «regression» to the first language in aphasic patients. The aphasic bilingual patient, while often able to speak —albeit aphasically— in impaired fashion in both languages proportional to how they were known before the aphasia-producing accident, will sometimes recover one or the other language disproportionately to how it was known before, as Michel Paradis discusses in this conference. In the latter cases, even when one language recovers disproportionately well, it is most frequently the language the patient has been using around the time of the accident, and thus, usually, the appropriate one in the environment the patients find themselves in. With the demented patient, as you will have understood, the opposite is the case. Here we often see the «regression» to the first language that Ribot posited would obtain (although it only obtains with chance frequency - Obler and Albert, 1977) in the bilingual aphasic, where the first-learned language should be better spared.

What is of theoretical import from this phenomenon is the bolstering of the notion with respect to bilingualism in normal individuals that from a very early age - I've seen it at two myself and it's usually reported from three - the child has developed a system for keeping the two languages separate for production and, moreover, the children are quite sensitive about figuring out with whom they speak. With bilinguals, the healthy bilingual child or adult may, in culturally appropriate instances, code-switch between the two languages; with monolingual speakers of either or any of their languages, they will appropriately restrict themselves to that language. It is this ability that appears to break down in dementia, and as is so often the case in neurolinguistics, it is precisely from the systematic breakdown that we learn about the modularity of abilities in normals. Clearly there is a component of normal bilingualism that consists in assessing the interlocutor's language abilities (and tolerance for code-switching) and determining which language to speak. It is this particular ability, then, that breaks down in discourse of bilingual patients with Alzheimer's Disease, on top of the other problems we have discussed earlier.

To conclude, then, we have evidence that certain aspects of language are remarkably spared in Alzheimer's Dementia as long as speech is produced. These are phonology, morphology, morphophonology, and even syntax. Thus language itself can be seen, even in dementia, to be relatively independent of other forms of cognition. The most problematic intersection of the two is in the lexicon or semantic memory. Here the question is unresolved as to the independence of the linguistic elements from the other data on both sides of the question at this point. Pragmatics too is a point of interesting interface. In the monolingual, as in the bilingual, we see certain aspects of pragmatics relatively spared into the late stages of the disease (Causino, et al., 1994). In the bilingual, one crucial aspect of pragmatic competence is impaired, namely the ability to appropriately assess what language or combination of languages the interlocutor expects to hear.



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