REACTION TIMES IN NORMAL AGING AND ALZHEIMER'S DISEASE.

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INTRODUCTION

This study was designed to investigate the relationship between normal aging and dementia of Alzheimer type (DAT) on reaction time tasks.

There is general agreement in the psychological literature that speed of performance declines with age; there is less agreement on the meaning of this decline and on its magnitude.

Methodological considerations have suggested that observed age differences could be overestimated or inappropriately interpreted. This fact prevents the real comprehension of the nature of the decline of cognitive functions, particularly when pathology, like dementia, is involved.



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There are two models that could explain the slowing of RT with age (Cerella, 1985).

The first model depicts age as having an additive effect on latencies. The difference between young and old subjects should be constant across tasks. The second model states that age has a multiplicative effect on latencies. More complex tasks could show greater differences between young and elderly.

How could these models contribute to understand the nature of differences in normal and abnormal aging ?

METHOD

Subjects

Three groups of subjects participated to the experiment: young adults (11M+9F); normal elderly (10M+24F) and demented patients (9M+6F). The characteristics of each group are presented on Table 1.

TABLE 1: DEMOGRAPHIC CHARACTERISTICS OF EACH GROUP.

| Group | Ν | Age | Educat | IQ+ | Cognitive |
|---------|----|------|--------|-----|-----------|
| | | | ion | | score* |
| YOUNG | 20 | 22 | 14.5 | 121 | 28 |
| ELDERLY | 34 | 65 | 6.6 | 103 | 23 |
| DAT | 15 | 67.6 | 5.4 | | 22.9 |

+ Raven's Standard Progressive Matrices

* CCSE, Jacobs et al., 1977

DAT = Dementia of Alzheimer Type

Elderly and demented were matched for age and education . DAT patients were classified as mildly to moderately demented. Clinical severity was assessed following the "Clinical Dementia Rating Scale"(CDR). DAT subjects were submitted to a standard follow-up neuropsychological study and after six months dementia was confirmed, according to DSM III and NINCOS-ADRDA criteria.

Old normal subjects were attending a public recreational center in Rome. They were without any apparent neurological and psychological problem. Only subjects with an IQ=>90 were considered.

Young adults were undergraduates, paid for their participation.

PROCEDURE

All subjects were submitted to the following tests:

A) Cognitive Capacity Screening Examination (Jacobs et al., 1977), (see Table 2);

TABLE 2 : Characteristics of Cognitive Capacity Screening Examination (CCSE) of Jacobs et al. (1977).

| No. of items | Types of items |
|---------------------|------------------------|
| 30 | : Orientation, memory, |
| (one point for each | : recall, calculation, |
| correct answer, | : and use of language |
| maximum score = 30 | D) : |

B) A Simple Reaction Time task (SRT), with asterisk as a target appearing in the center of a video screen;

C) A Choice Reaction Time task (CRT): two stimuli were presented and subjects were required to press two different keys according to the stimulus.

In both reaction time tasks stimuli appeared for 140 msec. Each task consisted of 96 presentations; the first 24 were practice trials. Both tasks were controlled by an Apple II computer.

D) Young and normal elderly were evaluated also for intellectual quotient (PM-38, Raven's Progressive Matrices).

RESULTS AND DISCUSSION

Statistical analysis on correct reaction times (Anova for a split-plot design) showed significant differences among groups (F=44, DF=2,66, P<.001) and a significant group by task interaction (F=9.8, DF=2,66, P<.001) (besides the task effect).

This means that group effect in Choice Reaction Time is larger than group effect in Simple Reaction Time.

TABLE3 : MEAN CORRECT REACTION TIMES (in msec.) AND PERCENTAGE OF ERRORS AS A FUNCTION OF THE TASKS

| GROUP | Simple RT | Choice RT | MEAN | |
|-------|----------------------|----------------------|------|--|
| | 221 (1%) 286 (2%) | 323 (3%) 432 (6%) | 272 | |
| DAT | 446 (7%) | 726 (23%) | 586 | |
| | | | | |

GROUP x TASK Interactions p<.001



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These results are in agreement with previous data obtained in other studies (Cerella, 1985; Salthouse, 1985) showing addictive and multiplicative effects at work.

Since differences among groups are present even in simple reaction time tasks, we suppose that two distinct factors affect the performance: one presumably linked with age and the second with the cognitive level of the subjects (cfr. Rabbitt & Goward, 1986), particularly affected in case of brain pathology.

The extensions of the previous models to pathological aging supports the view of a single underlying mechanism and of a continuum in the distribution of performance.

This hypothesis was partially confirmed splitting the normal elderly group according to the IQ. There were no age differences between these two elderly groups.

A new analysis of variance considering four groups showed again a significant group by task interaction (F=5.45, df=3,65, p<.005). The group with a lower IQ results to have a performance inferior to the other elderly group, mainly in the choice RT. Studying other groups it should be possible to gain other evidence for the continuum hypothesis.

TABLE4: MEAN CORRECT REACTION TIMES (in msec.)AS A FUNCTION OF THE INTELLECTUAL LEVEL

| GROUP I | NIC |) Sim | ple RT | Choice RT | MEAN |
|-----------|------|-------|--------|-----------|------|
| YOUNG 2 | 0 12 | 1 2 | 221 | 323 | 272 |
| ELDERLY 8 | 3 12 | 3 2 | 256 | 362 | 309 |
| ELDERLY 2 | 6 9 | 7 2 | 296 | 453 | 374 |
| DAT 15 | 5 - | Z | 146 | 726 | 586 |
| | | | | | |

(Group by task, F=5.45, df=3,65, p<.005)



GROUP x TASK Interaction

CONCLUSIONS

A. Simple and complex reaction time tasks allow us to discriminate groups with different cognitive levels.

B. This finding could be relevant in the identification of variables influencing normal aging and even more in early and differential diagnosis of senile dementia.

The slowing of reaction times seems to be better C. explained by the cognitive level of the subjects rather than by their chronological age.

D. The transposition of the "normal models" to the pathological condition, suggest possible and similar underlying mechanisms. This means that the study of one condition may contribute to the understanding of the other brain condition.

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Abstracts

The Second International Conference on Alzheimer's Disease and Related Disorders

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NEUROBIOLOGY OF AGING, VOLUME 11, 1990 ABSTRACTS OF SECOND INTERNATIONAL CONFERENCE ON ALZHEIMER'S DISEASE CLINICAL COURSE.

Alzheimer's disease. Yet, focal atrophies may not be uniform in their presentation. Fifteen patients who presented with progressive aphasia were studied longitudinally. Eight had a first degree relative with a similar condition. Neuropsychological examination identified three sub-groups based upon distinct patterns of language disorder and different accompanying psychological deficits. These neuropsychological differences were mirrored by different distributions of reduced tracer uptake on functional imaging by single photon emission tomography (SPET). Abnormalities involved the left hemisphere selectively, frontotemporal regions symmetrically or fronto-temporal regions with left hemisphere predominance. Two brothers fell into different sub-groups. Autopsy studies have revealed similar histological findings in each clinical group with large neuronal cell loss, spongiform change and astrocytic glosis. Neurofibrillary tangles, senile plaques, Pick cells and Lewy bodies were absent. The distribution of atrophy has reflected that shown by SPET Imaging.

Distinct clinical presentations of progressive aphasia appear to have a common pathology and the particular distribution of lobar atrophy determines the neuropsychological syndrome. Clinical and pathological similarities with dementia of frontal-lobe type suggest that both are forms of lobar atrophy, genetically determined and representing a non-Alzheimer primary cerebral degeneration.

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REACTION TIME IN NORMAL AGING AND ALZHEIMER'S DISEASE

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There are two models that can explain the slowing of reaction time (RT) during aging. The first one depicts age as having addictive effect, the second states that age has a multiplicative effect on RT. General cognitive abilities, simple and choice RT were compared in young adults, normal elderly and Alzheimer's disease patients (DAT). Statistical analysis showed significant group effect (F = 47, DF = 2.63, p<.001) and a significant group x task interaction (F = 9.5, DF = 2.63, p.<001). Further analysis of two groups of elderly subjects with different IQ also showed group x task interaction (p<.005). (p<.005).

Our results suggest that simple and choice RT may help to differentiate groups with different cognitive levels and normals from demented subjects.

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ORIENTING OF VISUAL ATTENTION IN ALZHEIMER'S AND PARKINSON'S DISEASE. *M. Freedman, P. Caffarra, A. Scaglioni, C. Abbati, C. Warner, J. Pogue, M. Liotti. Instituto di Neurologia, Universita di Parma, Italy; Behavioural Neurology, Baycrest Hospital, Toronto, Canada.

Posner et al., have recently shown that the reaction time to detect a visw 1 stimulus is decreased in normals when the location of the visual target is indicated in advance by a cue. Few studies have shown that covert attention, i.e., ability to shift attention from one place to another in the visual field without eye movements, may be differentially affected in cortical vs subcortical lesions.

The aim of the present study was to investigate orienting of visual attention in Alzheimer's the the orienting of Visual attention in Alzheimer's disease compared to Parkinson's disease. Preliminary data have been obtained from 4 Alzheimer's patients and 9 Parkinson's patients. The Alzheimer's patients met NINCDS-ADRDA criteria for probable Alzheimer's disease. The Mattis Dementia Rating Scale and the Beck Depression Inventory were administered to each subject. subject.

subject. Subjects were presented with neutral and cue conditions with valid and invalid trials (trials in which the target appeared on the side opposite to that indicated by the cue). The results showed that in the neutral and cue conditions, the Alzheimer's patients had significantly slower reaction times as compared

to the Parkinson's patients. The Alzheimer's subjects comprised the only group that was significantly impaired on the invalid condition as compared to the valid condition. We conclude that parietal lobe dysfunction associated with Alzheimer's disease is critical for disengaging attention from a salient inaccurate cue.

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VIOLENCE AND PSYCHOSIS IN DEMENTIA OF THE ALZHEIMER'S TYPE. * L.H. Deutsch, F. Bylsma, B. Rovner, C. Steele, M.F. Folstein. Department of Psychiatry, The Johns Hopkins University School of Medicine, Baltimore, Maryland, 21205 USA.

The frequency and type of psychotic symptoms The frequency and type of psychotic symptoms and the relationship to violence is examined in 209 research patients with probable or possible Alzheimer's disease enrolled in the Johns Hopkins Alzheimer's Disease Research Center. Data were gathered from caregivers at six month intervals over several years (80% had six visits). Information regarding delusions, hallucinations, and misidentifications was available for 197 subjects. subjects.

Delusions were the most frequent psychotic symptom (N=91,46%) with persecutory delusions the most common type (N=68,75%). The presence of delusions was significantly associated with

delusions was significantly associated with hallucinations and misidentifications at some time during the period of study. Misidentification syndromes were reported in 30% (N=56) of the cohort. Hallucinations were reported at a frequency of '27% (N=53); the majority being visual (N=43,81%). Delusions, misidentifications, and hallucinations frequently preceded and were significantly associated with a violent episode. Delusions and misidentifications were significant predictors of violence but together accounted for only 6.5% of the variance. However, treatment of these symptoms with medication and education of family and staff may reduce the potential for episodes and staff may reduce the potential for episodes of violence.

Further research is needed to identify other variables such as level of cognitive impairment, functional ability, and premorbid behavioral problems which may predict violent episodes in patients with Dementia of the Alzheimer's type.

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GAIT CHANGES CHARACTERISTIC OF INDIVIDUALS DIAGNOSED AS HAVING SENILE DEMENTIA OF THE ALZHEIMER TYPE. *M.J. McKinnon, S. Pfeiffer, C. Taves, School of Human Biology, University of Guelph, Guelph, Ontario, NIG 2W1; D.W. Molloy, Henderson Hospital, Hamilton, Ontario, Canada.

The health care professional needs to know if changes in the nearth care professional needs to know if changes in the pattern of gait of an individual diagnosed Senile Dementia of the Alzheimer Type (SDAT) are indicative of the progression of the disease. To identify gait characteristics of individuals diagnosed SDAT, temporal patterns of gait were compared in 12 SDAT individuals (8M,4F, \bar{x} age 67.1 yr) and 12 age-matched controls (6M,6F, \bar{x} age - 67.3 yr). The SDAT cubicate ware disensed by a grainstriction and classified into age-matched controls (6M,6F, \bar{x} age = 67.3 yr). The SDAT subjects were diagnosed by a geriatrician, and classified into Reisbarg scale categories 3(N=3), 4(N=5) and 5(N=4). A portable conductive walkway, 7m x 1m, provided measures of velocity (m/s), & double braking support time (DBST), & total support time (TST), & swing time (SW.T.), stride time (ST.T.) and support/swing ratio. The temporal components of gait were quantified using reflector timers and software developed for the Annue II computer. Fach subject completed ten trials on the Apple II computer. Each subject completed ten trials on the Apple 11 computer. Each subject completed ten thirs on one occasion. There were statistically significant differences (p<0,05) for all temporal components. The SDAT group showed a decreased velocity, increased & DBST, increased & TST, decreased & SW.T., increased ST.T. and increased support/swing decreased 4 SW.T., increased ST.T. and increased support/swing ratio. The SDAT group showed significantly greater between-trial variability in velocity in $\langle \mathbf{\hat{x}} \ CV \rightarrow 12.1$, compared to 3.5 for the control group). Stepwise discriminant function analysis identified velocity as the strongest discriminating variable between groups. The Spearman rank correlation coefficient, r_{g}^{o} , was computed to test for relationships