NORMALITY AND PATHOLOGY IN REACTION TIME TASKS AND THE RELATIONSHIP WITH COGNITIVE SCORES

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INTRODUCTION

This study was designed to investigate the relationship between reaction times and age and between normal aging and dementia.

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 or how great it is.

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.

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.

In the previous IAG meeting some data had been presented supporting the second model (Salmaso et al., 1985).

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

METHOD

Subjects

Three groups of subjects were considered: one group of young adults (11M+9F), a second group of normal elderly (10M+24F) and a third group of demented patients (8M+4F). The characteristics of each group are presented in Table 1.

TABLE 1: DEMOGRAPHIC CHARACTERISTICS OF INVESTIGATED GROUPS.

Group	N	Age	Education	IQ+	Cognitive score*
YOUNG	20	22	14.5	121	28
ELDERLY	34	65	6.6	103	23
DAT	12	68	5.4	---	22.5

+ Raven's Standard Progressive Matrices
* CCSE, Jacobs et al., 1977
DAT = Dementia of Alzheimer Type

Elderly and demented were matched for age and education . Demented were classified as mildly to moderately demented. Clinical severity was assessed following the "Clinical Dementia Rating"(CDR). The demented were submitted to a standard follow-up neuropsychological study and after six months dementia was confirmed.

Old normal subjects were attendig 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 (one point for each correct answer, maximum score = 30)	Orientation, memory, recall, calculation, anduse of language

B) A Simple Reaction Time task, where the target is an asterisk appearing in the center of a video screen;

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

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 ($F=47$, $DF=2,63$, $P<.001$) and a significant group by task interaction ($F=9.5$, $DF=2,63$, $P<.001$).

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

TABLE 3 : MEAN CORRECT REACTION TIMES (in msec.) AND PERCENTAGE OF ERRORS AS A FUNCTION OF THE TASKS

GROUP	Simple RT		Choice RT		MEAN
YOUNG	221	(1%)	323	(3%)	272
ELDERLY	286	(2%)	432	(6%)	359
DAT	465	(8%)	754	(28%)	609
(RT- Groupx Task, F=9.5; DF=2,63; P<.001)					

This result confirms previous data, for example Ferris et al. (1976) or Benton (1977), which showed both an age effect and a brain dysfunction effect.

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

This hypothesis was assessed by considering of normal elderly two groups: one having an IQ mean of 123 and the second an IQ mean of 97. There were no age differences between these two elderly groups and no IQ differences between young and elderly with a high IQ.

A new analysis of variance considering four groups showed again a significant group by task interaction ($F=5.46$, $df=3,62$, $p<.005$). A post hoc analysis indicated that between young and elderly with high IQ there was only the significant group effect ($F=11.07$, $DF=1,26$, $P<.01$).

TABLE 4 : MEAN CORRECT REACTION TIMES (in msec.) AS A FUNCTION OF THE INTELLECTUAL QUOTIENT

GROUP		IQ	Simple RT	Choice RT	MEAN
YOUNG	20	121	221	323	272
			N.S.		
ELDERLY	8	123	256	362	309
ELDERLY	26	97	296	453	374
DAT	12	--	465	754	609

(Group by task, $F=5.46$, $df=3,62$, $p<.005$)

Observing differences among groups on Simple Reaction Time and Choice Reaction Time it is evident that the most significant role is played by cognitive factors.

A similar result was obtained in a recent work on immediate memory (Salmaso et al, 1987).

With reference to the problem of dementia, we can observe that the difference between our normal elderly and demented patients is both quantitative and qualitative.

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.

C. Our results on demented patients do not support the hipothesis of a sheer exaggeration in the decline of cognitive functions that appears in normal aging.

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

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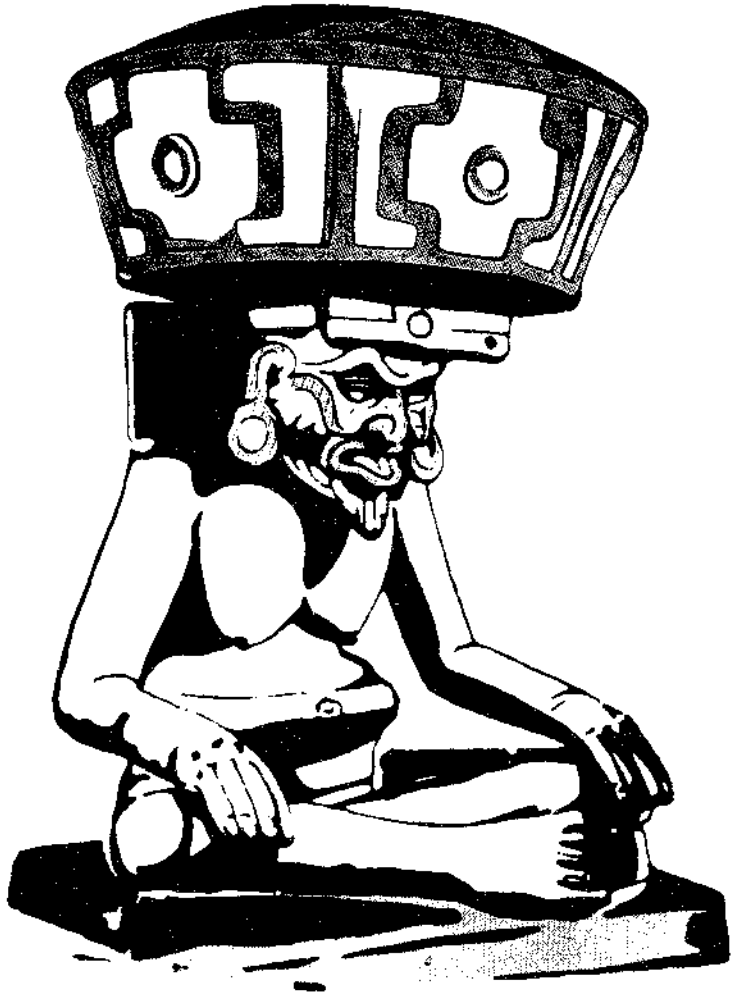

Book of Abstracts

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NORMALITY AND PATHOLOGY IN REACTION TIMB TASKS AND TBB RBLATIONSHIP WITH COBNITIVB SCORBS Dario Salmaso, P. Caffarra, A. Scaglioni and P. Viola, CNR-Psychology Institute, Viale Marx, 15, 00137 Rome, ITALY.

In the previous IAG meeting we presented the findings obtained from reaction time taske on young and old subjects. The main result was the absence of difference for a siaple reaction time task and a slowing down of the elderly in more complex ones. We proposed that seneory and aotor factors are less important of cognitive factors in age group discrimination. We wonder if a similar conclusion could be applied to normal/pathological discriiination. One group of normal elderly (n=20, 66 yr.) and one group of patients (n=10, 66 yr.) with aild semile dementia of the Alzheimer type (SDAT) were tested on a simple (SRT) and a choice reaction time (CRT) task. Both groups were also subiitted to a cognitive screening exaaination. Results indicate that patients are slower than normal only with CRT, while they have the same performance in SRT and cognitive scores. We conclude that the factors involved in CRT may be of the primary irportance both for age group discrirination and for early and differential diagnosis of senile dementia.