NEUROPSYCHOLOGICAL ASSESSMENT USING LURIA NEBRASKA NEUROPSYCHOLOGICAL BATTERY – ITS INTRODUCTION IN PORTUGAL

RESULTS FROM AN INTRODUCTORY FIRST EMPIRICAL PORTUGUESE STUDY – 3 SHORT CASE STUDIES

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Abstract

Alexander Luria (1902-1977) was probably the greatest contributor to the development of contemporary Clinical Neuropsychology, which is based in the precise knowledge of functional neuroanatomy, as well as cerebral affection/dysfunction/lesions semiology. The possibility of using an accurate assessment model to assess cerebral malfunction related with a set of potentially localized cerebral areas has been developed in the last decades. One of the most utilized neuropsychological battery is the Luria Nebraska Neuropsychological Battery (LNNB) presented by Golden, Hammeke and Purisch in 1978. It is a comprehensive battery developed to assess neuropsychological functioning with a method that integrate qualitative information generated originally by Luria techniques with the quantitative methods of psychometric American School, resulting in a hybrid approach in which relevant elements of both traditions were considered. Results of three subjects are presented in order to elucidate different aspects of neuropsychological evaluation, in different clinical or normative population: one "Normal" subject, one patient referred by a general practitioner doctor and other patient referred by a neurologist doctor. The preliminary results suggest that the Portuguese adaptation of LNNB has a strong accuracy in differentiating normative and clinical population, and also that it can be used as a strong neurological screening test when utilized by a trained psychometrician. Finally is also suggested that, to elaborate a deep and integrative neuropsychological evaluation the neuropsychologist must have a strong background in neuropsychology, being aware of the patient's premorbid characteristics and not only

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the current behaviour repertoire, in order to evaluate the global affection after a given traumatic, incisive, pathogenic, or other relevant process.

***Key-words**: Neuropsychology; Luria Nebraska Neuropsychological Battery; Neurological Assessment.*

INTRODUCTION

A long time ago the ancient Hypocrates already pointed out the relevance of the brain in the human nature determination.

> *Men ought to know that from the brain, and from the brain only, arise our pleasures, joys, laughter and jests, as well as our sorrows, pains, grieves and tears. Through it, in particular, we think, see, hear, and distinguish the ugly from the beautiful, the bad from the good, the pleasant from the unpleasant… It is the same thing which makes us mad or delirious, inspires us with dread and fear, whether by night or by day, brings sleepleness, inopportune mistakes, aimless anxieties, absent-mindedness, and acts that are contrary to habit. These things that we suffer all come from the brain, when it is not healthy, but become abnormally hot, cold, moist, or dry, or suffers any other unnatural affection to which it was not accustumated. Madness comes from its moistness. When the brain is abnormally moist, of necessity it moves, and when it moves neither sight nor hearing are still, but we see or hear now one thing and now another, and the tongue speaks in accordance with the things seen and heard on any occasion. But all the time the brain is still a man is intelligent.*
>
> Hypocrites, Vth Century, BC
>
> (cit. in Kandel & Schwartz, 1981, p.3)

This subject strongly developed since then and the Brain had become a major study object, allowing the development of what is known as the Neurosciences. One branch of the neuroscience is the discipline denominated Neuropsychology, concerned, in a certain way, with the assessment and understanding of human mental processes (Luria, 1973).

Alexander Romanovich Luria (1902-1977) was probably the greater contributor to the development of what is the contemporary Clinical Neuropsychology, based essentially in the precise knowledge of functional neuroanatomy, as well as cerebral affection/dysfunction/lesions semiology. The interest of the possibility of using an accurate assessment model, to classify (assess) a given cerebral function (or dysfunction) related with a set of potentially localized cerebral areas has been developed in the last decades, and is part of the Psychology History, namely on the field of Neuropsychology development (see Luria, 1980a, 1976b, 1973).

Luria based his evaluation model in a strong knowledge about functional neuroanatomy and deficits provoked by cerebral cortical areas lesions. Based on that knowledge Luria presented a set of simple tasks that were believed to elicit superior and basic cortical mechanisms of neuropsychological functions. In his most known book "Higher Cortical Functions" (England, 1966; In Hebben & Milberg, 2002) Luria developed his approach describing hundreds of tasks that could be used with the objective to characterize the details of cerebral affection effects in each particular case (Hebben & Milberg, 2002; see also Golden, Freshwater & Vayalakkara, 2000).

According to Hebben & Milberg (2002) this work is not confined to scientific history greatly because of the efforts from A. Lise Christensen, a Norwegian researcher. Christensen was herself a Luria apprentice that introduced the Luria method in the United States of America. This assessment method gave rise to the so-called "Luria's Neuropsychological Investigation" (Christensen, 1985, 1975), which included a set of materials (suggestions on objects utilization, like pens, sound-instruments, etc., stimulus cards, photographs, etc.) used by Luria in its investigations and clinical applications. The next important step on the Neuropsychological Assessment History was the development of the Luria-Nebraska Neuropsychological Test Battery (LNNB), by Golden, Hammeke & Purisch (1978) (Golden et al., 2000; Hebben & Milberg, 2002). Charles Golden, a Neuropsychologist with a strong specialization in the utilization of the Halstead – Reitan Battery, jointly with Thomas Hammeke and Arnold Purisch, utilized the model presented by A. Lise Christensen in order to develop a battery of tests. Golden intended to develop a test with strong fidelity to the Luria Model in which a simple and structured set of tasks could assess the functioning of a particular area, simultaneously considering the empiricist and rigorous tradition of the American psychometric models (Hebben & Milberg, 2002). Several authors like Hebben & Milberg (2002) states that the publication of LNNB in 1978 represented a milestone on the neuropsychological assessment methods.

LNNB is a comprehensive battery developed to assess neuropsychological functioning (Golden, Purisch, & Hammeke, 1985). According to Golden et al. (2000) LNNB is a method that integrates the qualitative information generated by techniques of A.R. Luria with the quantitative methods of the psychometric American School, resulting in a hybrid approach in which relevant elements of both traditions were considered.

The test allows a global measure of cerebral dysfunction and at the same time a measure of lateralisation, localization and focal cerebral affection (Hebben & Milberg, 2002).

OBJECTIVES

Luria Nebraska First Portuguese Adaptation

The translated and adaptated Luria Nebraska Neuropsychologic Battery had not been introduced in Portugal, till the present moment. Recently we presented a large description of the battery as well as some specific results of assessment and rehabilitation cases (see Maia, Loureiro, Silva, Vaz Patto, Loureiro & Marques, 2003; Maia, Loureiro, Silva, Vaz Patto, Loureiro, Correia, Carvalho, Gaspar, Oliveira, Viegas, Amaral, Azevedo, Marques, Pombo, Branco & Pita, 2003a; 2003b; 2003c).

This paper presents some particular Portuguese results from the LNNB (from the several subjects evaluated till this moment we have chosen three different cases, in order to elucidate different aspects of neuropsychological evaluation, in both clinical and normative population).

METHOD

In the first phase of the project, after the phase of bibliography review, tests acquisition, requesting utilization permission, translation and adaptation, we began to evaluate normal subjects, free of any known neuropsychological deficit. In this phase we evaluated 20 voluntary college students. With that procedure we were aware of some limitations, namely related with translation oddity, cultural expressions that needed to be changed, administration time ascertainment, material adaptation. It also served as a practicum period for the evaluators themselves.

In the second phase we initiated the clinical neuropsychological evaluation with the Experimental Portuguese Translation and Adaptation of Luria Nebraska Neuropsychological Battery (Golden et al. 1985, Portuguese experimental translation and adaptation by Maia, Loureiro & Silva, 2002).

In this paper we present the results form three subjects: one "Normal" subject ("Normal Subject"), one patient referred by a general practitioner doctor ("General Subject") and other patient referred by a neurologist doctor ("Neurological Subject"). These subjects will be reexamined in a single-case methodology (Franklin, Allison & Gorman, 1997), on the final of 2003.

TESTS

Luria Nebraska Neuropsychological Battery (Golden et al., 1985; Portuguese experimental translation and adaptation by Maia et al., 2002).

MMSE (Folstein, 1973; Portugese adaptation by Guerreiro, 1993).

Some individual neuropsychological tasks (Clock Draw, Luria Series, Coping drawing, etc.).

RESULTS

In order to facilitate the uniformed presentation of the results we grouped the subjects in charts where the several major aspects of Sample Characterization and Neuropsychological Evaluation were presented.

Table I presents the subjects data. The Normal Subject is a 33 old college student, with a normal result on MMSE, highly collaborative with the neuropsychological evaluation process, and with no history of clinical events, especially neurological like events. The General Subject (Cf. case brief description previously presented in Maia, 2003b) is a 44 old sales man, collaborative with the neuropsychological evaluation process, with complete High School. The major clinical events to be related are a Right Frontal--Temporal-Parietal craniotomy for extraction of a benign neoplasic process on the Right Occipital Lobe in the year of 1999; a major convulsive seizure (with loss of consciousness), unique episode, in the summer of 2002, and marked personality alterations on the last three years: social inadequacy, pessimistic thinking, lack of initiative, professional instability, irritability, anxiety and dysthymia. The Neurological Subject is an 86 old retired taxi driver and merchant, highly collaborative and with complete Basic School. The major clinical events to be related are diffi-

TABLE I - **SUMMARY IDENTIFICATION, MENTAL STATE, ATTITUDE DURING THE EVALUATION AND CLINICAL CHARACTERISTICS**

	Normal subject	*General subject*	*Neurological subject*
Identification	Male, age 34, Student Attending College	Male, age 44, Sales Man, High School	Male, age 86 Retired (Taxi Driver, Merchant) Basic School
Mental State	MMSE Normal: 28	MMSE Normal: 28	MMSE Normal: 25
Collaborative attitude	High Collaboration	Good Collaboration	High Collaboration
Major clinical events and complains	Not applicable	1999 - Right Frontal-Temporal -Parietal craniotomy for extraction of benign neoplasic process on the Right Occipital Lobe	Difficulties on memory in everyday events Some disorientation when have to walk alone on the street
		2002 (summer) – Major convulsive seizure (with loss of consciousness) unique episode	Heart disease (Cardiac Pace Maker) Lack of "habitual" corporal force
		Alterations of personality: Social inadequacy Pessimistic thinking Lack of initiative Professional Instability Irritability, Anxiety Dysthymia	Lack of "habitual" initiative

culties on memory in every day events: some disorientation when walking alone on the street; heart disease (Cardiac Pace Maker) and lack of "habitual" corporal force and initiative.

Regarding to data of our major assessment instrument (LNNB) Table II shows the results of the subjects, namely on the clinical and summary scales.

The analysis of Table II shows that the Normal Subject, present only a clinical scale above the specific critical level: C9 (Arithmetic). The Pathognomonic Scale is well below the critical level; Left and Right Hemisphere scales are well below the critical level and present a difference of 2 points in terms of T score: Left Hemisphere, T = 38 and Right Hemisphere, T = 36 (no signs of lateralization); and finally the Profile Elevation and Impairment Scales are both well below the critical level.

Regarding to the General Subject, all clinical scales are below the critical level,

TABLE II – **MAJOR RESULTS FROM CLINICAL AND SUMMARY SCALES LURIA NEBRASKA NEUROPSYCHOLOGICAL BATTERY**

LNNB – scales	*Normal subject*	*General subject*	*Neurological subject*
Clinical	Only a clinical scale above the specific critical level: C9 (Arithmetic).	Below the critical level	Rhythm, Visual, - slightly above critical level Writing, Memory and Intellectual Processes – well above critical level
Pathognomonic	The Pathognomonic Scale is well below the critical level.	Below the critical level	Bellow critical level
Left and Right Hemisphere	Left and Right Hemisphere scales are well below the critical level and present a difference of 2 points in terms of T score: Left Hemisphere, T = 38 Right Hemisphere, T = 36	Left and Right Hemisphere scales are well below the critical level and present a difference of 2 points in terms of T score: Left Hemisphere, T = 39 Right Hemisphere, T = 41	Left and Right Hemisphere scales are slightly below the critical level and present a difference of 8 points in terms of T score: Left Hemisphere, T = 65 Right Hemisphere, T = 57
Profile Elevation	Below critical level	Below the critical level	Well above critical level
Impairment	Below critical level	Below the critical level	Well above critical level

as well as the Pathognomonic, Profile Elevation and Impairment Scales. Also the Left and Right Hemisphere scales are below the critical level, presenting a difference of 2 points in terms of T score: Left Hemisphere, T = 39 and Right Hemisphere, T = 41 (no signs of lateralization).

Finally, regarding the Neurological Subject, five clinical scales are above critical level (Rhythm, Visual – slightly above critical level; Writing, Memory and Intellectual Processes – well above critical level). The Pathognomonic Scale is below the critical level. Also the Left and Right Hemisphere scales are below the critical level, presenting however a difference of 8 points in terms of T score: Left Hemisphere, T = 65 and Right Hemisphere, T = 57 (suggesting a slight tendency – not significant – for left hemisphere affection more than right hemisphere affection). The Profile Elevation and Impairment Scales are well above critical level.

In the figure I we present the synopsis of Clinical and Summary Scales in a sample profile sheet (adapted from Golden et al., 1985).

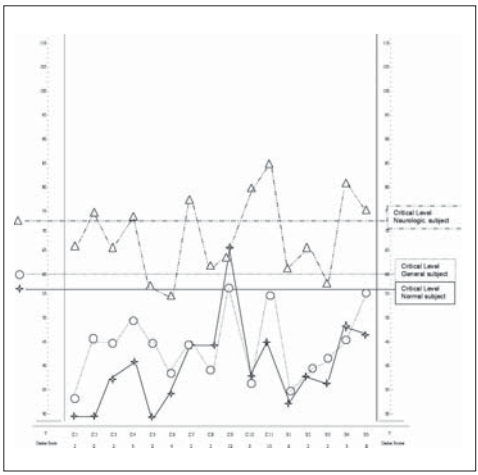

Figure 1 – Clinical and Summary Scales. Adapted from Golden et al., 1985.

PARTICULAR ASPECTS OF EVALUATION

In order to present more details about data collected with LNNB we utilised some particular tests to clarify some aspects of neuropsychological evaluation. In this section we will present some relevant results from the Neurological subject in the Clock Draw test (also used in the LNNB, although with some particular differences in the application form: in the Traditional Clock Draw test the subject has to put the numbers and the pointers of a clock in order to be a particular time evoked by the evaluator. In the LNNB version the subject only has to put the pointers in a clock with the marks of the hours but with no numbers), and Luria Series. We also used a copy of MMSE object.

PARTICULAR RESULTS OF NEUROLOGICAL SUBJECT

Figure II shows the Clock Draw test of the Neurological Subject. Despite the subject being able to point the approximate places of the numbers required for a given time, he is incapable of draw the pointers of the clock. At the same time, the places signed are the very site numbers evoked by the evaluator and not the places were the pointers should be in a particular given time (for example, in the first clock on figure 2, the places signed are 11 and 12, that is, literally but not correctly, 12:50hs). Phenomenologically we could say that the subject rather points to the numbers evoked by the examiner, more than he represents the numbers heard in a more complex time frame. In the examples shown the subject points literally to the sites of the evoked numbers, 12 and 10 – 12:50 on the first clock, numbers 4 and 7 – 4:35 on the second clock and the numbers 11 and 2 – 11:10 on the third clock (the subject was supposed to place the clock hands somewhere between the sites of the hour that was heard and the following hour). For example, on the first clock (12:50) the clock hand should be between the number 12 and the number 1.

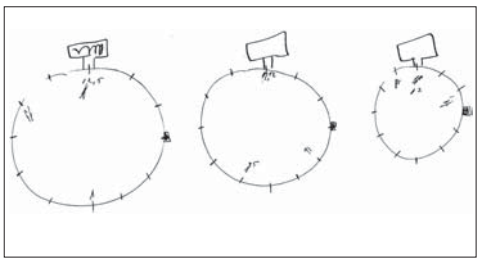

Figure 2 – Clock draw – neurological subject.

Another evident result from the Neurological Subject is the result on the "Luria Series" (Figure 3 and 4). The subject is incapable to reproduce a completely perfect Luria Series. In its difficult version (Figure 3), the subject does not maintain the alternate item presentation and present a slight tendency to micrographic writing. In the easiest version (Figure IV) the patient is able to alternate the item presentation, though a micrographic writing tendency is clear as well as the inaccurate reproduction of one of the items (a X instead a +).

Finally, Figure 5 shows the copy reproduction in the MMSE object of the Neurological Subject. The subject presents a clear difficulty in organizing the free space in order to reproduce a slightly simple sample. The patient is unable to anticipate the coping process and reproduce a specific draw.

PARTICULAR ASPECTS OF GENERAL SUBJECT

Figure VI shows the evidence of Right Frontal-Temporal-Parietal craniotomy for extraction of benign neoplasic process on the Right Occipital Lobe in 1999, of the General Subject.

Figures VII and VIII presents signs of Anterior-Temporal right cerebral atrophy.

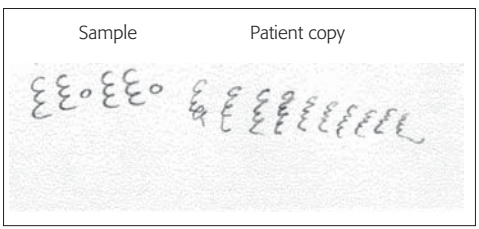

Figure 3 – Luris series. Neurological subject.

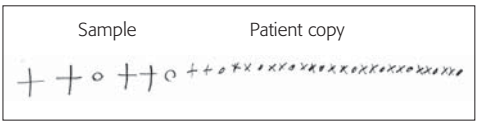

Figure 4 – Luris series. Neurological subject.

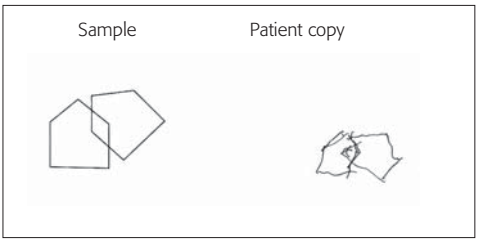

Figure 5 – Copy object/MMSE – Neurological subject.

Figure 6 – Lateral view of an axial computorized tomography.

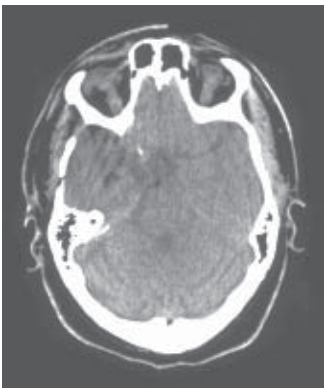

Figure 7 – Axial view of an axial computorized tomography.

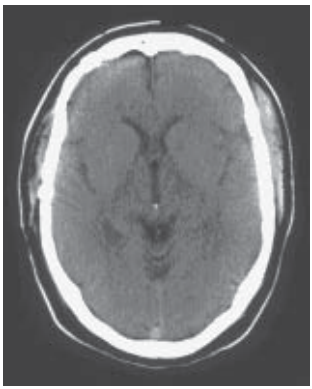

Figure 8 – Axial view of an axial computorized tomography.

DISCUSSION

The three cases presented are in some way very different, but at the same time very similar in the evidence of data collected. The major objective of the study was to test the diagnostic viability of the Luria Nebraska Neuropsychological Battery (Golden *et al.*, 1985), in its first Portuguese Experimental Translation and Adaptation (by Maia e*t al.,* 2002).

In a first analysis, the subjects profile on the Clinical and Summary scales of the battery are consentaneous with the particular condition of the subject: the Normal Subject presents lower elevations of the scales when compared with the General Subject, and this subject presents lower elevation of the same scales when compared with the Neurological Subject. The only exceptions of this pattern is the verification that the Normal Subject presents an irrelevant slight higher elevation of the Reading Scale and the Profile Elevation Scale, when compared with the General Subject, though clearly below the respective critical levels (at a normal range). The Normal Subject's only scale clearly above the classification of the General Subject is the Arithmetic Scale. This scale deserves a special consideration. According to Golden *et al.* (1985) this scale is the most sensitive of the LNNB scales to educational deficits. According to the authors of LNNB, even in normally educated individuals "this is the scale most likely to appear in a severely pathological range when there is, in fact, no problem" (p. 148). In the studies carried out to LNNB standardization, individuals with normal academic backgrounds, with no signs or history of neurological deficits, have obtained scores as high as 90T (Golden *et al.*, 1985). The results of the Normal subject on this scale (T = 66) are likely to represent his reaction and affinity to mathematical items. Not only his academic history as well as the performance during the LNNB suggests that this subject feels uncomfortable with this area and easily gave up, and is not able to keep on trying beyond the first errors. In fact, the analysis of the entire profile suggests no cerebral affection in any given particular area.

These first analyses are in accordance with the idea that the LNNB can be used as a strong neurological screening test when utilized by a minimally familiarized and trained psychometrician (Golden *et al.*, 1985).

The second level of analyses is related with the idea that in order to bring up all the potentialities in the LNNB one has to be truly familiarized with advanced training and experience in clinical neuropsychology (Golden *et al.*, 1985). At this point we will have to present some separated

considerations regarding every subject evaluated.

The Normal Subject presents a normal profile, with just one elevated clinical scale, already referred before.

When we look particularly to the General Subject we find a very interesting profile. As stated earlier, this subject doesn't show any scale above the critical level. However if we focus our attention on the particular task performance of some Scales, as Rhythm, Tactile Functions, Visual Functions, Arithmetic and Intellectual Processes, it is obvious that several items are quoted as incorrect partly due to a pattern of impulsivity, lack of persistence on tasks, particularly in those with a higher level of complexity and challenge. Curiously this patient stated to have suffered a clear alteration on personality characteristics after the neurosurgery in 1999. The analysis of imagiology in this patient suggests Frontal-Temporal atrophy and slight enlargement of the right lateral wing of the right lateral ventricle. This pattern could be consentaneous with the pattern of personality alterations (maybe it would be more accurate to say the alterations in the behavioural repertoire) found in this patient in the last three years.

Although with different contours, namely on the nature of the traumatic event, this case reminds us of the case of the unfortunate Phineas Gage. In 1848 his tragic event became itself perhaps in one of the most known work accident approached by the scientific world, and gave a major contribute to what is known today as the Neuropsychology field.

The General Subject does not present a so marked semiologic picture like in Phineas Gage fatidic history, but there is a clear pattern of personality changes after a given traumatic incident (craniotomy in this study), some structural affection (tough in a much less level of affection) and the absence of marked alterations on cognitive functions. After the post--operatory recovery period, the General Subject didn't show any evidences of marked neurological deficits. His personality, however, have markedly changed (see Mesulam, 2000; Mesulam, 1986; Miller, 1985, Damásio, 1979, for some approaches about behavioural alterations after cerebral frontal and temporal affections). These results suggest that the clinical neuropsychologist must be aware of the patient's premorbid characteristics and not only of the current behaviour repertoire in order to evaluate the global affection after a given traumatic, incisive, pathogenic, or other relevant process.

The Neurological Subject also presents a very interesting pattern of tasks resolution on LNNB.

His performance in tasks involving the frontal and temporal lobes regulation presents a clear deficit (although not severe). The subject is unable to maintain a pattern of conflictive stimuli to be reproduced (Luria Series), presenting also a marked tendency to micrography (Christensen, 1985). The copy reproduction of a moderately simple object is not completely achieved, apparently not because of some peripheral semiologic features like tremors or other aspects.

On the "clock draw" the subject is unable to predict the real sites where the pointers were to be putted. In fact he is

only able to sign the places of the numbers heard on the query. For example, when the evaluator ask "Where should be the pointers in this clock so that in this moment could be exactly 12:50 hs?", the subject point literally to numbers 12 and 10 (he counts the minutes parting from 12, till reach 50 minutes, that is to say, the number 10).

Regarding the dynamic organization of hand motor functions when the subject is invited to copy some hand patterns, he knocks randomly on the table with none or poor relation between his movements and the problems presented. This happens even when he is able to verbally reproduce the instruction (see Christensen, 1985, for a descriptive analyses of such syndromes).

The learning process is clearly stereotyped (according to Christensen, 1985). When the subject is invited to learn a series of unrelated number and words, he can't precisely predict his performance (he is not able to say how many items of the next series he will be able to remember). The item repetition doesn't follow any order and the subject doesn't pay any particular attention to the items missed on the previous series. In general, the patient repeats the initially learned series and maintains the same errors. In conformity to these results we could postulate a clear affection of attention skills. According to Luria (1979a, 1979b) the frontal lobes play an important role in attention voluntary control. Luria suggests that during the ontogeny and phylogeny maturation process of Central Nervous System a progressive corticalization of attention takes place, ending in a complete activation of frontal lobes (Junqué, 1995). During this process of cerebral maturation, attention (as a process) would evolve from an involuntary and reactive stage to a controlled and intentional one. On this perspective the child initially would be dependent of environment stimulation and the stimulus characteristics (novelty, intensity, contrast, etc.) (Junqué, 1995). Progressively the subject would acquire the voluntary control of attention process, in such a way that in adult age, the adult attention process represents the full ability to select or inhibit relevant or irrelevant stimulus. When the Frontal Lobes are affected the involuntary and stimulus dependent attention comes back, and the attraction by several stimulus (relevant or irrelevant) takes supremacy (must of the times) over attention to a single task (Junqué, 1995), particularly if the actual task requires maintained levels of attention. This seems to be the case of this patient. His major deficits are not related with cognitive and memory like events but with his ability to organize the environment stimulation in a comprehensive frame and in cerebral frontal operations.

The elevation of "Visual Scale" could also be in conformity with atentional deficits, rather than a direct affection of "visual cerebral areas" or parietal-occipital related areas. In fact the patient didn't show any marked difficulty on reading, object discrimination, visual identification of the majority of objects, etc. The relative elevation of this scale (immediately above the critical level) seems to be due randomly by errors on items that demand elevated levels of visual analysis (focusing attention on a target, perceiving every part of the visual stimulus, and integrating them in a meaningful representation). Obviously, these results could also suggest

impairment of the so-called "Top-Down Modulation of Attention connections" (Mesulam, 2000). In a recent and relevant book, "Principles of Behavioral and Cognitive Neurology", Mesulam (2000) states that the "parietal, limbic and specially prefrontal cortices mediate the top down modulation of attentional responses in ways that are sensitive to contexts, motivation, acquired significance, and conscious volition" (p. 190). This author quoted a set of studies[1] (Johansen, Jakobsen, Bruhn, Hansen, Gee, Støkilde-Jørgensen & Gjedge, 1997; Pardo, Fox, Raichle, 1991; Roland, 1982) which strongly suggest that the "prefrontal and parietal superior cortices exert a top-down influence upon all types of domain specific attentional modulations in a manner that may mediate the volitional regulation of the attentional focus" (p.190). Despite the several postulations of cerebral areas implicated in attentional tasks, the prefrontal cortices seem to be always associated with this syndrome (Mesulam, 2000). This could even support the evidences that in everyday life events the Neurological Subject shows more than a pattern of static memory difficulties. In fact, the subject present fluctuations on his attentional states more than a static pattern of memory afection. Sometimes he is completely able to pursuit in a given task (walking alone on the street, good spatial-temporal orientation, a good memory for faces of relatives or friends, etc.), although sometimes he seems confused and disorientated, but never "completely lost".

The elevation of "Rhythm Scale" suggests difficulty on groups of tones analysis, perception of tonal qualities and expression of tonal relationships. These results would be in conformity with the postulation of a Frontal-Temporal affection on this patient.

Finally, considering his old age (86 old) and according to the empiric clinical knowledge that depression enters as a differential diagnosis of dementia in several settings (see for example Mesulam, 2000), our first analysis was evaluating the humour of the patient. In each of the two moments of evaluation the patient presented himself in a very good mood, expressive facies, reactive to environment and a normal cognitive state. This picture crossed with the analysis of several tasks suggests bilateral frontal-temporal lobe affection, possibly a dementia process, free of depressive symptomatology.

Generally we could postulate a diagnosis of Possible Mild Frontal-Temporal Dementia, possibly with a vascular ethyopathogeny.

CONCLUSIONS

Neuropsychology has suffered a dramatic development since the last century

[1] Original references:

a) Johansen, P., Jakobsen, J., Bruhn, P., Hansen, S.B., Gee, A., St_kilde-J_rgensen, H. & Gjedge, A. (1997) Cortical sites of sustained and divided attention in normal elderly humans. *Neuroimage*, 6: 145-155.

b) Pardo, J.V., Fox, P.T. & Raichle, M.E. (1991) Localization of a human system for sustained attention by positron emission tomography. *Nature*, 249: 61-64.

c) Roland, P.E. (1982) Cortical Regulation of selective attention in man. *Journal of Neurophysiology*, 48: 1059-1078.

(Johnstone & Stonnington, 2001). Particularly on the 1970-1980 period, and namely on analyses and assessment of several semiologic neuropsychological patterns like sensation and perception (Luria, 1975), cognitive development (Luria, 1976a), reading problems (Cf. Coltheart, 1985; Coltheart, Patterson & Marshal, 1980), neurolinguistics (Luria, 1980), spoken language (Cf. Coltheart, Sartori & Job, 1987), cortical visual systems (Ungerleider & Mishkin, 1980; cit in Stilles, 2001), face visual recognition (Johnson & Morton, 1991, cit. in Haan, 2001), object visual recognition (Humphreys & Riddoch, 1987), memory (Parkin, 1987; Mayes, 1998), working memory (Baddeley, 1987; cit. in Bachevalier, 2001), attention (Jeannerod, 1987), experimental lesions on the field of Neurobiology and Neuropsychology interconnection (Damásio, 1989), language and conscience (Luria, 1995 – Spanish reprint from 1975 edition).

This development, and the subsequent application of the emergent knowledge to the clinical field required that, as repeatedly suggested, the utilization of neuropsychological tests demands a very strong background in neuropsychology (Golden *et al.*, 1985).

According to Lezak (1995) Neuropsychology "is an applied science concerned with the behavioural expression of brain function and dysfunction" (cit. by Mitrushina *et al.*, 1999, p.3). Such statement provides us with the concept of the Neuropsychologist as a neurobehavioral specialist who administer tests and test batteries that are typically designed to answer specific referred questions (Mitrushina, Boone & D'Elia, 1999). Mitrushina et al. (1999, p.3) states, "After the administration of the test battery, the neuropsychologist is faced with making sense of a plethora of numerical and qualitative data. In order to make optimal use of the test data, the neuropsychologist must have an understanding of what constitutes 'normal' performance on the tests before an opinion regarding the strengths and/or weaknesses of various neurobehavioral capacities can be offered". Finally Lezak (1995, in Mitrushina *et al.* 1999, p.3) stresses that the interpretation of data collected in a neuropsychological evaluation must take in consideration "qualitative observations and the patient's history, background, present circumstances, motivations, attitudes, and expectations regarding self and examination".

Our article suggests that the utilization of a battery as LNNB could be very useful, as already stated by Golden, Hammeke, Purisch, Berg, Moses, Newlin, Wilkening & Puente (1982, p.3) "in planning rehabilitation and making prognostic decisions (along with such information as neurological course, age, education, family support, premorbid personality, financial strengths, timing of insurance settlements, and motivation)".

In this article we tried to present an integrative comprehensive evaluation of data collected from three subjects. More than presenting diagnostic labels our attention was focused on the neuropsychological description and possible interpretation of data collected. The simple analyses of the neuropsychological profile of every subject could not allow a complete understanding of the meaning of their particular performance in every task of neuropsychological evaluation, neither a

comprehension of phenomenological aspects of the subject's life. By these reasons we believe that the neuropsychologist must be able to look at the patient in an integrative perspective trying to bring up some characteristics or features that help to consolidate the meaning of every data collected in the extensive and complex process of neuropsychological evaluation.

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