

Qualitative and Quantitative Neuropsychological Assessment: A False Dichotomy

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Качественная и количественная нейропсихологическая оценка: ложная дихотомия

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Abstract. Neuropsychological examination tries to define the state of the mental capacities of patients with brain injury. Traditionally, a dichotomy is established between qualitative and quantitative (psychometric) evaluations. Luria's qualitative evaluation is frequently opposed to "western" psychometric approaches. After reviewing a series of topics (symptoms due to brain lesions, assessment objectives, functional brain model, complex functional systems, and the metric characteristics of neuropsychological variables), it is concluded that a good neuropsychological assessment requires both quantitative and qualitative approaches.

Keywords: *neuropsychological assessment; qualitative neuropsychology; quantitative neuropsychology*

Аннотация. Нейропсихологическое обследование позволяет определить состояние психических функций при локальных нарушениях головного мозга. Традиционно проводится дихотомия между качественной и количественной (психометрической) оценкой. Качественная оценка А. Лурия часто рассматривается как противоположность «западной» психометрии. После изучения ряда тем (симптомы заболеваний головного мозга, цели оценки, функциональная модель мозга, сложные функциональные системы

и метрические характеристики нейропсихологических переменных) был сделан вывод о том, что для хорошей нейропсихологической оценки требуются как качественные, так и количественные методы.

Ключевые слова: нейропсихологическая оценка; качественная нейропсихология; количественная нейропсихология

Introduction

Neuropsychological examination tries to define the state of the mental capacities of patients with brain injury. Traditionally, a dichotomy is established between qualitative and quantitative (psychometric) neuropsychological evaluations. Luria's qualitative evaluation is frequently opposed to western psychometric approaches (Akhutina & Melikyan, 2012). The objective of this paper is to show that a good neuropsychological assessment requires both quantitative and qualitative approaches.

Materials and Methods

The following topics were reviewed: (1) Types of symptoms due to brain lesions. (2) Neuropsychological evaluation objectives. (3) Functional brain model. (4) The concept of complex functional system and the componential structure of mental capacities. (5) The variables of a test and their metric characteristics.

Development

Types of Symptoms due to Brain Lesions

Brain injuries are expressed in four main clinical fields: neurological disorders, cognitive disorders, neuropsychiatric disorders, and medical disorders (e. g. endocrinological). Symptoms depend on the etiology, as well as on the topography, the extent of the lesions and the time of evolution.

Neuropsychological Assessment Objectives

Neuropsychological evaluation attempts to identify the extent and nature of potential or demonstrated injury to the brain. In fact, neuropsychological assessment tries to define patterns of neuropsychological performance in terms of damage to one or more of the components of a model of normal cognitive functioning.

Functional Brain Model

The interpretation of test data can be carried out in a systematic, and objective way, if it is based on a comprehensive model of brain-behavior relationships. Recently, a brain

functional model beyond Luria's three functional units was proposed. This model includes elements that are missing from Luria's model. Five functional brain blocks were recognized: preferential, limbic, cortical, basal ganglia, and cerebellar (Peña-Casanova & Sigg-Alonso, 2020). The inclusion of new functional components allows differentiating clinical aspects such as the following: cognitive dysmetria (cerebellar block), learned routines *versus* executive functions (basal ganglia). In addition, the model reconsiders the anatomy of semantics as described by Luria.

The Concept of Complex Functional System and the Componential Structure of Mental Capacities

There is agreement that mental functions, as complex structures, are organized in functional systems of concertedly working zones, each of which performs its role. Luria accepted Goldstein's idea about determining "the basic disturbance (Grundstörung) that results directly from the lesion" (Luria, 1970, p. 99). The concept of *basic disturbance* or *neuropsychological factor* refers: (a) to the neurological impairment of a local brain area (a local processor), and (b) to the associated psychological phenomena. In fact, the concept of neuropsychological factor couples aspects of cognitive functioning with brain anatomy (Mikadze, 2011). Thus, qualitative symptom analysis is considered crucial in order to establish a correspondence between symptoms and lesion localization. Beyond these considerations, it is possible to integrate and combine qualitative and quantitative assessment approaches (Glozman, 1999).

The Variables of a Test and their Metrics and Qualitative Characteristics

There are two types of test variables metrics: dichotomous and distributed. *Dichotomous variables* are all those in which a maximum or complete performance is expected in all normal subjects, that is, a constant score. Many tests meet these characteristics (e. g. repetition of words). These tests are considered dichotomous (normal *versus* abnormal = qualitative variable), pathognomonic (errors are indicative of brain disorders). They have been described as "lurian," as they are the type of test used mainly by Luria's qualitative neuropsychology. *Distributed variables* show a normal or Gaussian distribution (e. g. scores of the Boston Naming Test). These scores are expressed as means, deviations, percentiles or scaled scores. In many cases, moreover, raw scores are adjusted for sociodemographic factors such as age or education.

Without a quantitative approach, it is impossible to make certain types of analysis. Without scores, it is impossible to determine the degree of deficit and its evolution over time. In the case of clinical trials, the quantitative approach is required. Some tests necessarily require a psychometric approach, especially when the scores, in normal subjects, depend on social and cultural factors such as age and schooling. In these cases, it is also imperative to carry out a qualitative analysis of the response process and the result (a lurian task, and characteristic of the Boston Process and Achievement Approach). In language assessment, for example, in addition to scores, symptoms must be described and classified. The same is true in any area of neuropsychological evaluation. On the other hand, the ipsative analysis of quantitative scores may lead to qualitative diagnostic clinical profiles.

Conclusions

Neuropsychological examination tries to define qualitative and quantitative dissociations between affected and preserved capacities. In many cases, trying to find a single basic (qualitative) disorder that explains a syndrome is illusory due the wide distribution of brain lesions. Neuropsychological assessment requires an updated comprehensive brain functional model. The proposed model is more realistic than the three blocks model. This model allows a better analysis of the neuropsychological symptoms and their anatomical relationships. This work shows that such a qualitative-quantitative contrast is, in fact, a false dichotomy. A correct neuropsychological evaluation must be both qualitative and quantitative. Quantitative dissociations represent in fact qualitative patterns.

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