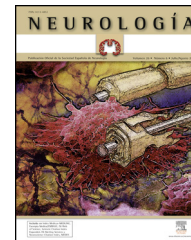




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## REVIEW ARTICLE

# Platforms for neuropsychological rehabilitation: current status and lines of work<sup>☆,☆☆</sup>

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### Abstract

**Introduction:** The incidence of neurological and psychiatric diseases and disorders has increased in recent years, and similarly, the number of technological tools facilitating neuropsychological rehabilitation for family members and therapists has also grown. The purpose of this article is to describe some of these tools and indicate the needs they cover.

**Development:** This article reviews some currently well-known neuropsychological rehabilitation platforms, compares them, and proposes future lines of work to be considered when developing tools that meet real needs. In this review, we list the main advantages and shortcomings of each of the tools and establish benchmarks for evaluating them. In comparing these platforms, we may observe their advantages on the one hand, and areas needing improvement on the other.

**Conclusions:** This review demonstrates that more of these tools are entering the market, but many aspects of neurorehabilitation remain uncovered. Additional studies evaluating these tools' effectiveness are also needed.

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<sup>☆☆</sup> 64th Annual Meeting of the Spanish Society of Neurology (SEN). Technologies applied in neuropsychological rehabilitation: ELENA (ELEctronic Neurocognitive stimuLation). November 2012.

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**PALABRAS CLAVE**

Rehabilitación neuropsicológica; Estimulación cognitiva; Plataformas online; Neurotecnologías; Neurorrehabilitación; Software rehabilitación

**Plataformas de rehabilitación neuropsicológica: estado actual y líneas de trabajo****Resumen**

**Introducción:** En los últimos años se ha incrementado la incidencia de las enfermedades y trastornos neurológicos y psiquiátricos y con ello la aparición de herramientas tecnológicas que facilitan a los terapeutas y familiares la rehabilitación neuropsicológica. De aquí que sea necesario establecer cuáles son algunas de estas herramientas y qué necesidades cubren.

**Desarrollo:** El presente artículo revisa algunas de las plataformas de rehabilitación neuropsicológica más conocidas hoy día, comparándolas y proponiendo líneas futuras de trabajo para tener en cuenta en la construcción de herramientas que se adapten a necesidades reales. En esta revisión se han visto las principales ventajas y carencias de cada una de las herramientas y se han establecido unos criterios comparativos para evaluar las mismas. En la comparación de estas plataformas, podemos observar, por una parte, las ventajas que nos ofrece su uso, pero también las carencias que aún tienen.

**Conclusiones:** Se demuestra el crecimiento de estas herramientas en el mercado, pero aún quedan muchos aspectos que cubrir de la neurorrehabilitación y estudios que muestren la eficacia del uso de las mismas.

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**Introduction**

The technological advances of the past few years have contributed to the increase in new tools intended to facilitate neuropsychological rehabilitation in many types of patients. Cognitive deficit may arise from such diverse causes as head trauma, cerebrovascular disease, or disorders secondary to neurological diseases (Parkinson's disease, multiple sclerosis, Alzheimer disease, etc.). Creating a list of rehabilitation tools and the needs they cover is therefore necessary.

Neuropsychological rehabilitation developed from early models in which management was centred on cognitive, behavioural and emotional alterations caused by brain damage. Basic strategies for neuropsychological rehabilitation were first described by Butfield and Zangwill<sup>1,2</sup> in the twentieth century. Some of the principles of neuropsychological rehabilitation are as follows:

- Restitution or restoration: based on stimulation and repeated practice of exercises and tasks, the aim is to restore the mechanisms affected by the lesion and optimise performance.
- Compensation: refers to the use or support of other preserved cognitive functions to complete the task that had mainly been done by the altered function. The aim is for patients to learn or re-learn how to perform functional activities which are important in daily life.
- Substitution: refers to using supporting devices or external mechanisms in order to effectively perform the task.

The current and growing trend is to use a comprehensive rehabilitation strategy in which different cognitive functions will work simultaneously; attention, executive functions, and memory are rehabilitated as a whole as processes used in activities of daily living.<sup>3</sup> Focusing on one isolated process without mentioning the others is not easy; processes

are interdependent at both the neuroanatomical and functional levels since these functions share several structures and neural circuits. The intervention used will depend on the aetiology of the patient's neurological lesion, the stage of recovery, the general cognitive status, and responses to interventions.

If doctors are to design this type of tools and tasks correctly, they must know how the brain captures information and combines it to elicit cognition, movement, perception, and emotion. Doctors must also be familiar with computerised resources focusing on specific aims that will help patients overcome environmental barriers, and they should understand the reasons for cognitive rehabilitation's profound impact on cognitive performance: plasticity, neurogenesis, and neural models of learning and memory.<sup>4,5</sup>

**Requirements for a cognitive rehabilitation tool**

A technological tool should fulfil a series of requirements to improve patients' performance and increase the efficacy of rehabilitation. The materials used should be related to actual activities of daily living and therefore demonstrate ecological validity. This way, therapy results can be extrapolated to other situations which the patient might have to face. Likewise, the material should motivate the patient and be meaningful (familiar pictures and music). It is essential that these materials not resemble laboratory equipment, which is typically complex and not comparable to that found in other contexts. Materials must be adapted to the type of user and level of development (children, adults, and elderly patients), and to the user's cognitive capacities. Any potential motor disabilities or attention deficits should also be considered. These tasks should be presented in an order that will also be followed by the training tools when introducing this working method into other areas of the patient's routine.

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