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# Clinical experiences of intervention of neurodevelopmental disorders and difficulties in school learning from historical-cultural neuropsychology

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Cultural-historical (CH) neuropsychology proposes the qualitative analysis of neurodevelopmental disorders and learning difficulties through the identification of the neuropsychological factor (NF) that underlies the symptoms and difficulties that arise in cognition and academic performance. The objective of this study is to present clinical experiences of the neuropsychological intervention of unique cases of varying degrees of initial education. Qualitative assessment is a process that reveals the strengths and weaknesses in child development, as well as the possibilities of what children will be able to do for themselves. It assesses their zone of proximal development, not just the zone of current development. Neurodevelopmental and learning disorders present particular manifestations during life, so a qualitative analysis can account for their subtle changes during the course of life and schooling. The use of the principles of intervention constitutes the methodological axis for the elaboration of the programs; these programs will be shaped according to the needs of the children. The case study strengthens the expertise of clinical knowledge by contributing to the empirical field on the possibilities and proposals of neuropsychological intervention.

## KEYWORDS

neuropsychological intervention, neurodevelopmental disorders, learning disorders, clinical cases, cultural-historical neuropsychology

## Introduction

Neuropsychology as a branch of behavioral neuroscience studies the relationships between the brain and behavior in healthy subjects and in those who have suffered some type of brain damage. Specifically, it focuses on understanding higher mental functions (Portellano, 2008). In its beginnings, neuropsychology was aimed at studying the effect of brain lesions on behavior; however, in recent years, neuropsychology also studies the relationships between the brain and behavior in populations of various ages with typical neurological and neurocognitive development called the neuropsychology of the norm or individual differences (Akhutina, 2012). Therefore, the purposes and areas of application of neuropsychology can be diverse for both assessment and rehabilitation or intervention in children and adults. Thus, the purpose of neuropsychological evaluation would be to assess deficits in the face of injuries, to assess

the effects of the therapeutic treatment, or to know the state of cognitive functions for preventive purposes.

Child neuropsychology has a wide field of action, including the educational field, where the fundamental purpose is to evaluate the cognitive performance of children with neurodevelopmental disorders and school learning difficulties, attempting to identify how these possible difficulties in the brain are related to problems at school (Hale and Fiorello, 2004; Fletcher and Miciak, 2017). In turn, the results will be useful for determining the forms of treatment based on the identification of strengths and weaknesses in cognition, academic skills, and behavior inside and outside school (Portellano, 2018; Pennington et al., 2019).

## School neuropsychology

The classroom is where learning difficulties manifest themselves with greater expression, making clinical neuropsychology an essential discipline for the educational field (Miller and Maricle, 2019), giving rise to school neuropsychology as a potential source of scientific knowledge that has the methods and strategies necessary to overcome them (Murphy and Benton, 2010; Rhenals-Ramos, 2021).

The evaluation uses various clinical, psychometric, or neurological techniques to understand the characteristics of cognitive processing in both normal children and those who present some disorder, injury, or dysfunction of the nervous system (Portellano, 2008). However, the assessment of cognitive processes could be controversial because such assessments are not related to effective identification practices or forms of treatment (Burns et al., 2016). It has been pointed out that neuropsychological assessment has added value to psychometric assessments of academic skills since scores do not represent a child's ability to learn but reflect the same processes that lead to poor performance (Fletcher and Miciak, 2017); thus, such assessments would not be related to effective forms of treatment (Burns et al., 2016). In this regard, Vygotski (1996) had already pointed out that a different form of analysis is required for the difficulties that occur during child development and in school learning, where the task of the researcher is not only limited to verifying the difficulties but also to establishing their dynamic relationships and the mechanism that underlies them to intervene with the best strategies to help children.

On the other hand, the forms of intervention for developmental and learning difficulties are derived from central approaches in the history of psychology, such as behaviorist, cognitivist, and cognitive-behavioral theories. The first proposes the use of reinforcers, i.e., stimuli from the outside, to provoke changes in behavior. The second focuses its intervention based on the explanation of how the brain processes information. Finally, the third integrates behavioral techniques and cognitive strategies to achieve the expected changes (Trápaga Ortega, 2018). In general, intervention strategies are aimed at reducing errors in various school skills, but they are not aimed at correcting the cause that conditions them (Quintanar, 2009).

Therefore, does neuropsychology from the cultural-historical (CH) paradigm constitutes an alternative neuropsychological diagnosis to explain the positive and negative aspects of development? Based on the diagnosis, is it possible to develop methods and strategies to overcome the difficulties presented by children or adolescents, considering the complexity of the functional organization of the brain

in childhood? Do intervention strategies apply equally to all cases of children with developmental difficulties?

The objective of this brief review is to show the usefulness of historical-cultural (CH) neuropsychology in the assessment and intervention of neurodevelopmental disorders and school learning. I share some of my clinical experiences of unique cases of various degrees of initial education.

## Theoretical methodological foundation

The neuropsychological assessment of children should provide a functional diagnosis based on the principle of dynamic organization and systemic localization of mental functions (Luria, 1995) as a continuous process of corticalization of mental functions in the child, the functional brain organization of a particular mental process throughout life, and the presence of circular functional connections in the different brain structures (Akhutina, 2012). The hierarchical and dynamic organization between these levels is broad and complex; therefore, it is susceptible to manifesting symptoms due to functional deficits. For this reason, neuropsychological diagnosis, except in cases of obvious disorders that require a thorough medical assessment, is based on a functional analysis to identify strengths and weaknesses in child development. For these purposes, CH neuropsychology proposes a qualitative analysis of neuropsychological assessment (Eslava-Cobos et al., 2008).

Qualitative assessment is a dynamic structural process where the evaluator creates the necessary conditions to discover the strengths and weaknesses in development through systemic or syndromic analysis (Quintanar, 2009; Manga and Ramos, 2011); it refers to identifying the cause of present difficulties, which share a common neuropsychological factor (NF), while the best-developed strengths or skills do not require that factor. The psychophysiological mechanisms of the activity called neuropsychological factor (NF), resulting from the research on cortical and subcortical areas, are analyzed. Luria et al. have pointed out the need to identify the NF that suffers primarily and how this process leads to an insufficient development of both the determined psychological function and other higher psychological functions (HPF) (Korsakova et al., 1997). A factorial analysis establishes its particularities and integrations into complex functional systems (CFS) during child development (Glozman and Nemeth, 2020). An NF can participate in various CFS, such as attention, memory, and writing, so that a factor with insufficient functional development will lead to the presence of errors in the various CFS in which it participates, which is called the systemic effect of the primary factor (Luria, 1995).

The concepts of NF and CFS form the psychophysiological basis of HPF; at the same time, CFS are formed during the life of the individual; they are made up of various cortical and subcortical structures (Luria, 1970). Therefore, child neuropsychological diagnosis is directed to the precision of functional and non-anatomical elements in brain activity (Akhutina and Pylaeva, 2008; Glejzer et al., 2017) from the analysis of the functional status of weak and strong NFs. Table 1 shows the types of NF that are studied in CH neuropsychology, its function, and the brain area to which it corresponds.

TABLE 1 Neuropsychological factors (NFs) in cultural–historical neuropsychology.

Neuropsychological factor (NF)	Job/role in the writing process	Zone corresponding brain
Phonematic hearing	It enable the differentiation of verbal sounds of the language according to phonemic oppositions.	Left hemisphere temporals
Kinesthetic	Ensures fine tactile sensitivity, precise positions, and poses. In the articulation of language, it ensures the differentiation of verbal sounds according to where and how they are produced.	Parietals of the left hemisphere
Audio-verbal retention	It enables the stability of memory traces in the audio-verbal modality under interference conditions.	Left hemisphere; middle temporal zones
Visual retention	Guarantees the stability of memory traces in the visual modality under interference conditions.	Occipitals
Kinetic	It ensures a smooth transition from one movement to another.	Premotor of the left hemisphere
Regulation and control	Participates in the process of executing an activity by the objective set.	Prefrontals of the left hemisphere
Spatial global	Participates in the perception and appropriate production of the general shape, metric aspects, and proportions of objects.	Temporo-parieto-occipitals (right hemisphere)
Spatial analytical	Ensures adequate perception and production of essential features of the objects; spatial relationships at the graphic level and quasi-spatial relationships in language.	Parietal–temporal–occipital (left hemisphere)
Alertness or cortical tone	It guarantees maintenance and stability for the execution of the action.	Subcortical structures, reticular formation

Source: [Eslava-Cobos et al. \(2008\)](#).

## Principles of intervention in neuropsychology CH

Currently, the central objective of neuropsychological assessment is focused on not only the diagnosis of HPF alterations and their consequent cognitive deficiencies but also the investigation of intervention methods and strategies for various conditions during child development. Since the process of maturation of the infant brain, the course of formation of its morphological and functional particularities is determined by the genetic program and by the living conditions of the child during the child's activity under the influence of upbringing and teaching ([Venguer and Ibatullina, 2010](#)). In this regard, [Vygotski \(1995\)](#) pointed out that the choice of activities that lead to development is fundamental for the organization of child intervention; in turn, intervention procedures will guarantee the acquisition of dynamic and flexible brain systems ([Luria, 1995](#)). The methodology is based on the following five principles.

The identification of weak NF and strong NF constitutes the first principle of diagnosis, qualitative assessment allows one to appreciate the integrity and functionality of all NFs through flexible and dynamic procedures ([Solovieva et al., 2021](#)). The components of SFC are analyzed, which can present an uneven development, violating their conformation and functional stability. The causes of this problem could be related to unequal maturation cycles in the cortical and subcortical levels of the brain. The syndromic analysis aims to study the functional level of each of the NF since each child presents a particular development ([Bonilla-Sánchez, 2009](#); [Morais et al., 2023](#)); neuropsychological intervention is aimed at stimulating weak NF.

The second principle has to do with the possibility of offering students the appropriate means of work to form the actions that include the weak NF ([Talizina, 2009](#)). The therapist chooses the plane of action accessible to the child and, with his external language, constantly directs it until he reaches the plane of mental action, which constitutes the second principle of neuropsychological assessment and

intervention. With the theory of the formation of mental actions in stages, it is possible to study and form the HPF from any of its formative planes: (a) material or materialized action; (b) perceptual; (c) external or external verbal to himself; and (d) internal mental ([Galperin, 2000](#)). Thus, the formation of new mental actions takes place through a transition from social to individual experience; through a transition from the interpsychological plane to the intrapsychological plane; and through processes that naturally have different brain neurodynamics ([Quintino-Aires, 2021](#)).

During the assessment and intervention processes, the help provided to the child to achieve the proposed tasks constitutes the Zone of Proximal Development (ZPD). [Vygotski \(1996\)](#) defined ZPD as what the child is expected to be able to do in collaboration with the adult or a contemporary. The ZPD reveals the child's potential to perform the tasks that are asked of him/her. Help is provided to the child in three stages: in the orientation, which is the model of the action to be carried out, it is carried out through cards with diagrams ([Talizina, 2000](#)); in the execution, the therapist adapts the actions to the level of mental action that the child can perform (second principle) and provides operational help, for example, by performing the task jointly with the child. The relationship with “another veteran” is necessary for the presentation of the model for the execution of the action, mainly during the interpsychological phase ([Quintino-Aires, 2020](#)). The use of the ZPD constitutes the third principle.

In addition, the actions chosen to integrate the intervention program must meet the needs of the child's psychological age according to the guiding activity of the stage of psychological development in which he or she is. The guiding activity is that which promotes psychological development ([Vygotski, 1996](#)). Thus, at preschool age, the guiding activity is the play of social roles; and, at school age, it is the activity of study. Previous studies have pointed out the effectiveness of the application of neuropsychological intervention programs in preschool children using role-playing as a guiding activity for the formation of drawing and internal images in an urban

preschool (Bonilla-Sánchez M. R. et al., 2022; Bonilla-Sánchez M. D. R. et al., 2022), as well as for child psychological development because children learn games to repress their immediate impulses to achieve a specific goal; it also increases self-regulation—an important component of executive functions (Elkonin, 1980; Diamond, 2013; Nemeth and Glzman, 2020). The choice of a program of action according to the psychological age constitutes the fourth principle for clinical work. The use of the guiding activity of the corresponding psychological age promotes the appearance of neoformations and ensures the overall psychological development of children (Bodrova and Leong, 2008; Eslava-Cobos et al., 2008).

Finally, during the intervention, it should be considered that each action that is integrated into the program includes the motive, the aim, the action orientation, the execution, and the control, that is, relying on the psychological structure of the action—fifth principle in CH neuropsychology (Leontiev, 2000; Eslava-Cobos et al., 2008). The therapist will focus on orientation and control since execution is adequate only if there is adequate guidance, which is why it must contain the content of the object to be assimilated, the representation of the final product of the action, and the representation of the order of the actions that will be carried out (Nemeth and Glzman, 2020; Quintino-Aires, 2021). The use of the fifth principle makes it possible to compare the objective with the result obtained and, if necessary, correct possible errors in actions.

The qualitative neuropsychological evaluation allows the identification of the common NF of the difficulties presented by the child once the diagnosis has been determined; the use of the principles of the intervention will lead to the formation of the weak NF in their function and to their gradual integration into the SFC. Principles are the essential methods of intervention. Therefore, if the intervention program is aimed at strengthening the primarily deficient NF, it would be expected to also modify the systemic effect on other types of actions in learning and everyday life. It has been proposed that the methodology of CH neuropsychology is the most comprehensive and flexible one for investigating the factors underlying complex psychological functions (Glzman, 1999; Witsken et al., 2008).

Use of intervention principles is shown in the following therapeutic experiences with children and adolescents who presented various learning difficulties.

## Clinical experiences with children

The neuropsychological assessment based on syndromic analysis allowed the identification of positive and negative aspects of school learning; the intervention strategies were appropriate to the particular needs of each child (Glzman and Nemeth, 2020), given the fact that, from the point of view of the CH paradigm, the typical heterochronic maturation of brain structures defined by the genetic program is susceptible to change due to the influence of individual and social experience and the type of activity of the individual (Akhutina, 2000, 2012). The intervention was aimed to stimulate weak NF.

### Learning difficulties with severe errors in writing

A 9-year-old boy in the 2nd grade of primary school without a history of neurodevelopmental or psychiatric disorders received neuropsychological intervention for learning difficulties, mainly in

writing, where he presented rotation, omission, and inadequate location of letters in words.

The intervention program aimed to strengthen the weak factor of spatial analysis. In the first stage, the spatial relationships of objects and the body schema were strengthened; in the second stage, writing was improved through recognition and orientation in visual perception; the third stage strengthened the learning of basic mathematics, and this work was done on the material and visual perceptual planes (Avilés-Reyes and Bonilla-Sánchez, 2017). In the post-test, the minor managed to carry out the proper construction of complex spatial designs, basic mathematical operations, and sentence writing.

### Difficulties in understanding and expressing oral language

A 6-year-old child in 1st grade was treated because he had unintelligible language, restlessness, inattention, and school learning difficulties. A slight delay in language development was reported as a developmental history. The first stage of the intervention program was dedicated to strengthening the primary NF of regulation and control through planning and verification actions. The second stage was aimed at correcting and stimulating kinesthetic NF for phoneme pronunciation and phonemic ear for auditory discrimination. In the third stage, the acquisition of literacy was worked. Finally, in the fourth stage, basic mathematical skills were formed. It was concluded that the child achieved a greater understanding of complex words and instructions and a greater control of their verbal expressions and behavior (Juárez-Barrera and Bonilla-Sánchez, 2014). Intervention of language disorders at an early age can be effective if it is directed at the stimulation of primary NF (Sarmiento-Bolaños et al., 2016).

## Clinical experiences with adolescents

### Severe difficulties in school learning

A 13-year-old teenager was in the 1st year of secondary school; from the first year of initial education, he had difficulty learning, particularly in mathematics, geography, and history. The first stage of the program was aimed at stimulating the functional level of the kinetic organization of movements and inhibitory control at the visual perceptual level. In the second stage, the spatial organization in the corporal and visual perceptual planes was strengthened. The third stage was dedicated to strengthening the regulation and control of activity through strategy games and the analysis of narrative and scientific texts (Moreno and Bonilla, 2013). The intervention favored the automation of sequences of movements at the motor, graphic, and verbal levels and in the regulation and control of one's activity, as was observed in their writing, reading comprehension, and the retention of audio-verbal information.

### Learning difficulties and severe errors in writing and calculation

A 16-year-old male adolescent was in 1st grade of high school; he had low academic performance; his teachers referred to him as “distracted.” No psychopathological history or delay in the child's development milestones was reported. The primary NF was that of spatial analysis and synthesis and functional weakness in regulation and control (Pylaeva, 2004). The systemic effect was observed in the

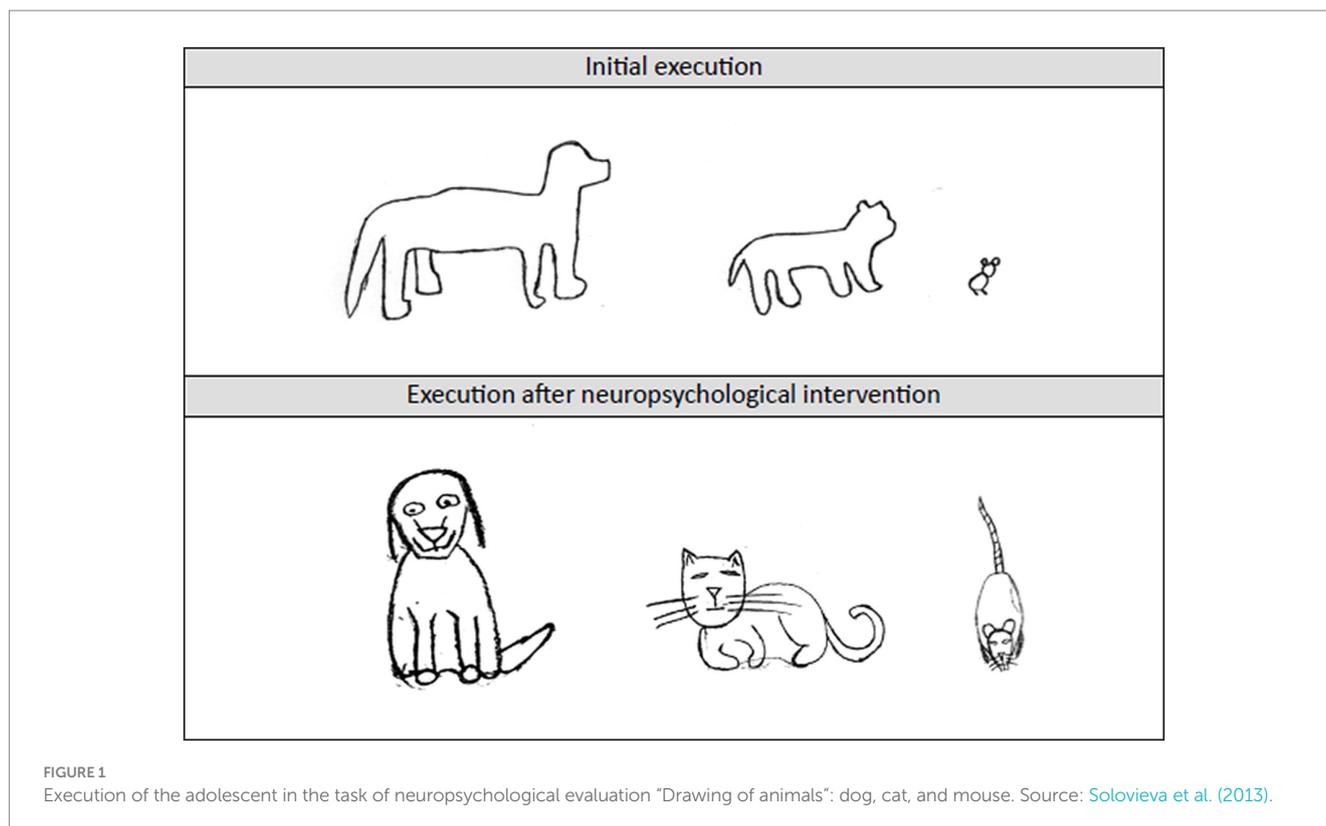


FIGURE 1 Execution of the adolescent in the task of neuropsychological evaluation "Drawing of animals": dog, cat, and mouse. Source: Solovieva et al. (2013).

execution of graphic and motor tasks, in writing, reading, problem solving (Akhutina, 2000). In the first stage of the intervention, the understanding of spatial relationships in the graphic perceptual plane was organized through the analysis and construction of word schemes; in the second stage, the visuospatial image of letters and words was formed (Akhutina, 2002); the third stage was oriented toward the analysis of words and reading of texts; in the fourth stage, the comprehension of literary and scientific texts was worked on; the fifth stage was devoted to forming the understanding of the deep sense of visual images and written composition (Tsvetkova, 1999); finally, the sixth stage was aimed at consolidating independent writing and solving calculation problems (Solovieva et al., 2013). The results of the intervention revealed a better execution of the adolescent in the post-test, mainly in written composition and graphic activity (Figure 1). The importance of the adolescent's motivation to carry out corrective tasks is highlighted, as well as the direction and levels of help that the therapist provided, especially in the most complex activities (Talizina, 2009).

## Discussion

The cases presented show the possibility of offering intervention alternatives to overcome difficulties in development and learning, considering the complexity of the functional organization of the brain in the course of individual development (Akhutina, 2012). Another aspect to highlight, in response to the second research question posed at the beginning of this manuscript, is that, by considering individual differences in development, the therapist will be able to provide the necessary strategies and aids for each particular case (Vyotski, 1996; Glozman and Nemeth, 2020).

Qualitative assessment feeds clinical analysis—an aspect that the quantitative-psychometric approach cannot explore because it only allows observing and typifying difficulties but not their causes (Reigosa, 2008; Quintino-Aires, 2020; Solovieva and Rojas, 2021); therefore, this approach directs the intervention toward the reduction of symptoms. It has been pointed out that psychometric batteries do not give the possibility to perform a complete systemic analysis of higher psychological functions in children and adults in normality and pathology (Glozman, 2002). Thus, it would not be possible to describe psychological functioning to determine the level and structure of the alterations (Burns et al., 2016).

The clinical experiences contribute to the empirical field on the possibilities of intervention of neurodevelopmental disorders and learning problems; the theoretical-methodological framework referred to was used with a didactic and illustrative purpose of qualitative analysis that condenses its key concepts. The case study strengthens the expertise of clinical knowledge in neuropsychology since the understanding of human behavior is not only explained using general rules but also by the deployment of this understanding in daily activity and life (Sánchez Vázquez et al., 2017). The results presented not only highlight the importance of applying qualitative assessment and diagnosis procedures—a process that shows what children will be able to do by themselves or with the help of an adult (Vyotski, 1996; Talizina, 2000; Quintino-Aires, 2020)—but also assess the current developmental zone.

The CH neuropsychologist will be able to evaluate the HPF to establish the topical diagnosis of lesions or insufficient development of brain structures; perform early differential diagnosis; describe the clinical picture and determine the level of HPF alterations; determine the causes and prevent different forms of abnormal

psychological functioning or learning disabilities; and develop methods of rehabilitation and intervention (Akhutina, 2012). Only based on a detailed analysis will it be possible to build the intervention program.

Finally, it should be considered that neurodevelopmental disorders and learning difficulties present manifestations during the different stages of life so that qualitative neuropsychological analysis can account for the subtle changes in their clinical manifestations during development and schooling (Quintanar and Solovieva, 2008). Reviewing the empirical evidence on the possibilities of intervention using the principles of CH neuropsychology and case studies should be a constant task for every clinical neuropsychologist in the children's area (Bonilla-Sánchez M. R. et al., 2022; Bonilla-Sánchez M. D. R. et al., 2022; Morais et al., 2023) and with adult patients with various brain affectations (Rodríguez et al., 2011; Mikadze et al., 2019; Bonilla-Sánchez and Martínez-Leija, 2020).

## Conclusion

The CH neuropsychology is an alternative for neuropsychological assessment and intervention in children. It offers the possibility of creating programs and strategies adapted to the particular needs of each case, so case analysis is a source of knowledge of the individuality of the subject and expertise in neuropsychology.

The recommendations for neuropsychological intervention can be synthesized in the multidisciplinary work of the specialists involved in the clinical case, and the participation of parents or caregivers from a holistic intervention approach, where the therapist provides them with continuous feedback. The recommendations for the field of clinical neuropsychology research are synthesized as follows: encourage further intercultural and international research; collect qualitative as well as quantitative data; consider behavioral observations as significant alongside numerical observations

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(Glozman, 2002; Nemeth and Glozman, 2020); and, in particular cases, integrate neuroimaging and/or metabolic studies.

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