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A screening proposal in ADHD diagnosis

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Abstract

My doctorate thesis focuses on screening proposals in diagnosis of *Attention-Deficit/Hyperactivity Disorder*. Summarizing existing literature, I analize the disorder characteristics, causes, neurocognitive models and frequent associations with other disorders. Starting from literature evidences, I investigate possible associations between ADHD and language impairments.

To diagnose ADHD disorder I propose some computerized tools (DAWBA interview and ADM software for ASEBA questionnaires) based on the main manuals of disorder classification (DSM-IV-TR and ICD-10). On the linguistic side, I suggest to use a battery of tests (BVL_4-12) evaluating linguistic skills in children aged 4 to 12. Since 2009, I have been contributing to its standardization and application in clinical settings.

Being interested in association between language impairments and behavioural-emotional problems, in a 2012 study I find that the presence of one linguistic impairment in children aged 4 to 12 is enough to show some internalizing problems, especially withdrawal/depression ones.

In a longitudinal study aimed to explore neuropsychological, genetic and morphofunctional features in children and adolescents referred to Child Psychiatry centres for behavioural-emotional problems, I focus on data about children with at least one ADHD diagnosis at referral. As result of my investigation, I note that they might maintain attentive and total problems on CBCL scales at a distance of time (about five years after the first evaluation). A following and possible confirmation of ADHD diagnosis through DAWBA interview will be necessary to identify disorder evolution and association with other disturbances. At the moment, only parents' reports on children behavioural-emotional profiles and other cognitive tests are available.

I cannot find any correlation between scores on CBCL scales and scores on linguistic tests proposed, probably because most adolescents are over linguistic battery threshold age and some linguistic competencies are acquired. Nevertheless, I believe in longitudinal studies which allow clinicians to observe disorders evolution and direct their interventions, and researchers to check and test their hypotheses.

To my grandmother, the “real” researcher

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Toward a definition of *Attention-Deficit/Hyperactivity Disorder*

1.1 Introduction

Children with Attention-Deficit/Hyperactivity Disorder (ADHD) cannot self-monitor their behaviours without others' help or instructions. This aspect causes problems at home, school and in other settings where actions have to be started or stopped.

Affected children show attention deficits, concentration problems and difficulties in moderating their impulses and activity levels. They always seem inattentive, avoid to perform activities involving attention for particulars or organizing skills, frequently lose objects necessary for tasks (toys, pencils…), and forget important activities. Their impulsivity appears as a difficulty in organizing complex actions, with a shift from an activity to another, and in respecting their turn in play or group situations. Children with ADHD do not respect rules and other children's times and spaces. At school they cannot seat long and miss important information during teacher's explanations.

The disorder may be observed with different clinical manifestations from preschool to adult age, and may compromise large development and social functioning areas. Moreover, ADHD predisposes children to other psychiatric disorders and/or social problems during their lives.

ADHD has a strong impact at different levels (individual, familiar and relational levels) and impedes children to achieve their personal aims and maintain relationships with peers. This disorder causes discouragement and stress in parents and teachers who are not prepared to manage children's behaviours. However, this pathology may be treated with success if professionists (clinicians, educators…) adopt a multimodal approach combining psychosocial interventions with medical treatments.

1.2 Diagnostic criteria

ADHD has been reconceptualised many times. Several terms such as minimal brain dysfunction, hyperkinetic, hyperactive, and attention deficit disorders (ADD) have been used to describe children presenting attention and concentration problems with additional difficulty in moderating activity and impulsivity.

With the publication of DSM-III in 1980 a new conceptualization of the disorder was given (ADD-Attention Deficit Disorder) and two categories were identified: 1) ADD with hyperactivity and 2) ADD without hyperactivity.

In 1987 the DSM-III-R reconceptualised again ADD as one-dimensional category and gave it the term, currently known as Attention-Deficit/Hyperactivity Disorder. Other changes were applied to nomenclature and diagnostic criteria with the publication of DSM-IV in 1994 and the updating in 2000 (American Psychiatric Association - Task Force on DSM-IV, 2000).

According to DSM-IV-TR, ADHD is subdivided in three categories: 1) ADHD combined type; 2) ADHD predominantly inattentive type and 3) ADHD predominantly hyperactive-impulsive type. The first type is diagnosed when at least six symptoms of inattention and six symptoms of hyperactivity-impulsivity have persisted for at least six months. The ADHD predominantly inattentive type occurs when at least six symptoms from the inattentive category (but less than six symptoms from the hyperactivity-impulsivity category) have persisted for at least six months. On the contrary, the ADHD predominantly hyperactive-impulsive type is diagnosed when at least six symptoms from the respective category (but less than six symptoms from the inattentive category) have persisted for at least six months. The DSM identifies an onset of the disorder when the child is about seven, but some symptoms usually appear at about three. The difficulties linked with ADHD

would be evident once the child is inserted in a structured school context. ADHD is not diagnosed if symptoms become manifest when children reach middle or high school age.

ADHD symptoms have to be present in two or more environments such as home, school and other social contexts, with evident damages on social, academic or occupational functioning.

In general, a preschool child with ADHD shows an excessive motor restlessness, has difficulties in playing with peers and presents some associated problems such a delay in the development, oppositional behaviour and poor social skills (Harpin, 2005). Growing up, a primary school child with such a disorder is unpopular or experiences few relationships among peers, has severe difficulties at school (inattention, distractibility, difficulties in organizing activities and finishing tasks) and is not able to do a work without any interruptions. In the transition from childhood to adolescence, some hyperactive symptoms may decrease in intensity, but other existing symptoms such as inattentiveness, poor tolerance to frustration and restlessness may be still observed or worsen (Litner, 2003; Harpin, 2005). In adult age inattention and impulsivity are more likely to persist than hyperactivity (Newton-Howes, 2004): adults with ADHD may have concentration problems at work, daydream and forget daily activities, loose temper, and be impatient. Moreover, these difficulties may lead to poor relationships and unsatisfactory life perspectives.

ADHD is not the result of any mental disorder, anxiety, depression, pervasive developmental disorder or learning disability. Nevertheless, ADHD is often associated with conduct and oppositional defiant disorders, learning disabilities and social relation problems.

According to APA estimates, ADHD is present in preschool age population between 3% and 7%. The disorder is more common in males than in females with a ratio from 2:1 to 9:1 depending on type (i.e., the ratio is less marked with regard to the predominantly inattentive type) and environment (i.e., more males arrive at clinical services).

Milich *et al.* (2001) suggested that ADHD Combined Type (ADHD/C) and ADHD Predominantly Inattentive Type (ADHD/I) are different disorders characterized by different features, gender ratios, population prevalence and

associated disorders. Authors reviewed the literature on the ADHD subtypes taking into account different DSM versions and linked studies. ADHD/C and ADHD/I can be differentiated from each other considering the main features used to describe the two groups (hyperactive/impulsive symptoms) and the features supposed to be in common (inattentive symptoms). Symptoms as "distractible, hyperactive and disinhibited" characterize ADHD/C whilst symptoms as "daydreaming, sluggish and underactive" describe the inattentive type (Carlson & Mann, 2002). According to the authors' review, externalizing disorders are frequently associated with the combined group, whilst the inattentive type is more likely to show internalizing problems. Comorbid type children, compared with inattentive type children, are more frequently male, are characterized by an earlier age of onset and referral, and result unpopular among peers because of their inadequate behaviours.

The ICD-10 (International Classification of Deseases, 10th edition; World Health Organization, 1993) describes the same items accepted by DSM-IV-TR; the only difference is represented by item 'f' ('often talks excessively') included in hyperactivity-impulsivity category. According to WHO, this item is a manifestation of impulsivity and not hyperactivity.

The ICD-10 uses another term to identify the syndrome, i.e. "Disturbance of Activity and Attention", differently from DSM-IV-TR. For this manual the ADHD onset has to appear before 7 years whilst for ICD-10 it is necessary to find the first symptoms at 3 years.

According to ICD-10, a clinician can make a diagnosis if patient presents at least six symptoms of inattention, three of hyperactivity and one of impulsivity. The diagnosis changes if the clinician observes comorbid aggressive behaviours which refer to conduct or oppositional defiant disorders. In this case the ICD-10 uses another term to identify the syndrome (i.e. hyperkinetic conduct syndrome) because differently from DSM-IV-TR it does not allow associated diagnoses. In the DSM-IV-TR there are fewer restrictions than those described by ICD-10 and it is possible to diagnose ADHD even if patient shows only six symptoms of inattentive or hyperactivity-impulsivity category. The manual allows multiple and associated diagnoses in comorbidity (i.e. ADHD associated with conduct disorder). Depending on the manual of classification chosen, different diagnoses and data are noticeable about the disorder diffusion. According to DSM, patients with ADHD

are about 5% whilst ICD-10 estimates an ADHD presence below 2%. The North of America uses prevalently the DSM while Europe (and especially Italy) tends to adopt also ICD-10; for this reason, in Europe ADHD is less frequently recognised and diagnosed than in the North of America (Marzocchi *et al.*, 2007).

1.3 Causes and neurocognitive models

Data from twins, family and adoption studies revealed that genetic factors contribute to explain the complex etiology and high heritability of ADHD (Faraone *et al.*, 2005; Khan & Faraone, 2006; Gizer *et al.*, 2009; Sharp *et al.*, 2009). The genes coding for DRD4, DRD5, SLC6A3, SNAP-25 and HTR1B play an important role in the etiology of the disorder (Faraone & Mick, 2010). Moreover, there are environmental factors that act together with the genetic ones in the pathogenesis of ADHD (Curatolo *et al.*, 2010). For example, prenatal exposure to nicotine and alcohol-use is associated with ADHD, ADHD symptoms and externalizing problems during childhood (Linnet *et al.*, 2003; D'Onofrio *et al.*, 2007; Sen & Swaminathan, 2007).

Neuroimaging studies showed that subcortical–thalamocortical neural circuits, along with cerebellar-frontal networks, are involved in explaining neuropsychologic difficulties in ADHD (Giedd *et al.*, 2001; Nigg, 2005). Dopamine is considered as an important neuromodulator in these circuits, especially at the level of prefrontal cortex and striatum (Casey *et al.*, 2001; Casey *et al.*, 2002). Abnormalities have been frequently found in these structures with focus on size, asymmetry, and glucose metabolism and blood flow (Castellanos *et al.*, 1994; Castellanos *et al.*, 1996; Krain & Castellanos, 2006).

Several neuropsychological models have been proposed in order to explore ADHD deficits in executive functions (Barkley, 1997), state regulation (Sergeant, 2000, 2005), and delay aversion (Sonuga-Barke *et al.*, 1992; Sonuga-Barke, 2003, 2005).

Barkley (1997) suggested that the core problem in children with ADHD is a deficit in behavioral inhibition and executive functions. Executive functions (EFs) represent high-order cognitive functions that coordinate basic cognitive processes such as perception, motor skills, memory or attention. Their presumed neuroanatomical location is at the frontal lobe in connection with basal ganglia and

cerebellum. From a neurobiological point of view, this neural loop is fed by some neurotransmitters, especially dopamine and norepinephrine. According to Barkley, the inhibition deficit in ADHD causes dysfunctions at levels of executive functions: working memory, self-regulation of affect–motivation–arousal, internalization of speech, and analysis/synthesis of events (reconstitution).

Sergeant (Sergeant, 2000, 2005) proposed a cognitive-energetic model subdivided in three levels of information processing: 1) a level characterized by cognitive processes such as encoding, central processing and response organization; 2) an energetic level characterized by effort (useful to make available to the child energy required for performance on a task), arousal (energy required to answer quickly) and activation (energy required to maintain vigilance), and 3) a high-order cognitive level represented by executive control system. ADHD causes deficits at the three levels: cognitive processes, such as response output, energetic pools, such as effort and activation, and EFs dysfunctions.

The dual pathway model (Sonuga-Barke *et al.*, 1992; Sonuga-Barke, 2003, 2005) conceptualizes ADHD as the point of arrival of two distinct pathways: a cognitive pathway, mediated by EFs (inhibitory) deficits, and a motivational pathway mediated by delay aversion. The first pathway involves alterations in the fronto-dorsal striatal circuit and associated dopaminergic branches (e.g. meso-cortical). The second pathway implicates the involvement of fronto-ventral striatal reward circuits and meso-limbic branches ending in the ventral striatum, especially the nucleus accumbens. According to the delay aversion hypothesis, children with ADHD prefer a small and immediate reward than a larger and delayed reward. They result delay averse especially with the passage of time spent waiting. Marzocchi *et al.* (2007) underline that settings characterized by long delays acquire negative tones whenever they are associated with unpleasant emotions experienced after continuous failures.

Wahlstedt *et al.* (2009) highlighted the importance of viewing ADHD as a heterogeneous disorder with multiple neuropsychological pathways in relation to different ADHD symptoms groups (inattentive, hyperactive/impulsive and combined symptom groups).

Seidman (2006) reviewed the literature about neuropsychological functioning in people with ADHD from early childhood to adulthood. The collected data show

that 'executive dysfunctions' can be considered as correlates of ADHD regardless of gender and age. These deficits may worsen if ADHD is associated with learning disabilities, i.e. dyslexia. The presence of neuropsychological deficits was confirmed by a recent study on a medication *naive* sample of adults with ADHD (Biederman *et al.*, 2011).

1.4 Association between ADHD and language impairments[1]

Although not included in ADHD diagnosis, language deficits underlie the symptom clusters described in the DSM-IV-TR (American Psychiatric Association - Task Force on DSM-IV, 2000). Inattentive symptoms may be linked with language comprehension abilities whenever we consider the ADHD children's difficulties in listening to direct speech, following through teacher's instructions and remembering daily activities. Moreover, hyperactive/impulsive symptoms may reflect deficits in pragmatic aspects of communication: children talk excessively, blurt out their answers in academic settings without respecting conversational rules or turn, interrupt others' speech and activities.

Language impairments (LI) are often associated with psychiatric disorders and behavioural/emotional problems (Baker & Cantwell, 1987; Beitchman *et al.*, 1990; Beitchman *et al.*, 1996; Noterdaeme & Amorosa, 1999). The most frequent psychiatric diagnosis among children with LI is Attention Deficit Hyperactivity Disorder (Cohen *et al.*, 1998) and, conversely, language impairments are comorbid disorders frequently associated with ADHD (Baker & Cantwell, 1992).

In a recent article (Bellani *et al.*, 2011) our group reviewed the studies exploring the association between language impairments and ADHD. We focused on particular language abilities (oral speech discrimination, listening comprehension, pragmatic aspects and discourse analysis) and linked cognitive processes (verbal and spatial working memory).

Four studies reported different results about working memory abilities in children with ADHD. Cohen *et al.* (2000) tried to identify deficits belonging to

[1] Part of this section is based on the paper published by Bellani M., Moretti A., Perlini C. & Brambilla P. (2011), Language disturbances in ADHD, *Epidemiology and Psychiatric Sciences*, *20*(04), 311-315.

ADHD, others characterizing LI and those in common between the two disorders. They found that working memory abilities (verbal, visuospatial and combined verbal-visuospatial) are more impaired in children with LI (group with ADHD and comorbid language impairments and group with other psychiatric disorders and language impairments) than those measured in children without LI (ADHD only and OPD only). On the contrary, McInnes *et al.* (2003) found that children with ADHD (n=21) showed impairments in listening comprehension and working memory abilities irrespective of comorbid language impairment. Children with ADHD, compared with normal children, had more difficulties in making inferences and monitoring their comprehension of instructions after listening to spoken expository passages. Moreover, they showed poorer verbal working memory, spatial span, and spatial working memory than the Normal group. However, their verbal memory span measures were comparable to those of the Normal children.

Differently from McInnes *et al.*, Jonsdottir *et al.* (2005) did not find working memory deficits in children with ADHD-only. They showed impairments on verbal working memory measures in ADHD+SLI group.

Martinussen & Tannock (2006) confirmed McInnes *et al.*'s results by evidencing impairments in some components of working memory. They subdivided their sample aged 7 to 13 in four groups of children: children with ADHD-only (n=62), children with ADHD and comorbid reading disorders/language impairments (RD/LI; n=32), children with RD/LI (n=15) and a comparison group (n=34). The authors noted that the ADHD-only group performed worse than the comparison group on the verbal and spatial central executive (C.E.) domains of working memory. These components are useful to check and manipulate actively information in working memory in order to perform complex activities/tasks (Baddeley, 1986, 1996). Differently from the ADHD-only group, children with RD/LI (with or without ADHD) showed additional poorer performances on the verbal storage component, useful to maintain information in working memory for subsequent manipulation. Martinussen & Tannock revealed that the ADHD-only group's difficulties were associated with the inattention symptoms but not with the hyperactive-impulsive symptoms dimension. This study is relevant to identify C.E. deficits as common neuropsychological features showed by children with ADHD and/or language learning problems.

Other authors (Camarata & Gibson, 1999; Oram *et al.*, 1999; Kim & Kaiser, 2000) agree on the presence of pragmatic language deficits in ADHD, somewhat similar to those reported for explaining pervasive developmental disorders (Bishop & Baird, 2001; Geurts & Embrechts, 2008) and schizophrenia (Tavano *et al.*, 2008; Bellani *et al.*, 2009; Bellani *et al.*, 2010).

Kim & Kaiser (2000), for example, tried to evidence strengths and weaknesses in the linguistic skills of children with ADHD (n=11) aged 6 to 8, compared with typically developing peers (n=11). They found that on the seven TOLD-2 Primary subtests, measuring different receptive and expressive linguistic skills, children with ADHD showed worse performances than the typically developing group only on the *Sentence Imitation* and *Word Articulation* subtests. There was no difference between groups in the pragmatic knowledge assessed by TOPL (Test of Pragmatic Language), but ADHD children showed more inadequate pragmatic behaviours than typically developing children during conversations with an adult partner. Their speech was characterized by no response to speaker's requests or questions, frequent overlaps/interruptions and unspecific vocabulary use.

Mathers (2006) analysed the written and spoken texts of 11 children with ADHD, aged 8 to 12, comparing their performances with those of 11 control children matched for age, gender and other socio-demographic characteristics. Children were instructed to manage an interactive software useful to generate an animated cartoon. Each child was asked to provide a story retell text orally, describing the story of the cartoon generated. Then each participant was required to recount the involved skills before creating the cartoon and to list the procedures necessary to use the computer. Finally, children were asked to write three texts corresponding to the three language-sampling tasks presented. Mathers found that, compared with the control group, children with ADHD showed more abandoned utterances in spoken texts and higher percentages of spelling and punctuation errors in written texts. These children tended to be avoidant or to use more tangential and unconnected information. The author hypothesized that these results might be due to ADHD children's difficulties to maintain their attention in effortful and prolonged tasks. Children probably failed to comply with conventions of written language because of their limited monitoring skills.

In conclusion, verbal working memory, pragmatic language and aspects linked with discourse analysis seem to be impaired in children with ADHD, being related to linguistic skills but, partially, also to general executive functions (Cohen *et al.*, 2000). Clinicians should enquire into the potential comorbidity between ADHD and language disorders in order to plan specific interventions for ADHD children with or without LI.

1.5 Association between language impairments and behavioural-emotional problems

Specific Language Impairments (SLI) are characterized by altered language acquisition. Afflicted children may start talking later than their peers and show different production and comprehension deficits according to their specific linguistic disturbance (i.e. phonetic, phonological, morphological, syntactic, semantic or pragmatic disturbance) (Bishop, 1997; Leonard, 1998; Marini *et al.*, 2008).

Even though the classification of language impairment types varies according to different diagnostic procedures (International Classification of Deseases, 10th edition - World Health Organization, 1993; Diagnostic and Statistical Manual of Mental Disorders, 4th edition, Text Revision - American Psychiatric Association - Task Force on DSM-IV, 2000), the affected children's intellectual development has to result in normal range with a non-verbal intelligence quotient higher than 70. Furthermore, the observed language difficulties must not be explained by neurological or sensorial deficits, psychiatric disorders or environmental deprivation. Nevertheless, several studies have shown that children with SLI take an increased risk of developing psychiatric disorders (Baker & Cantwell, 1987; Beitchman *et al.*, 1990; Beitchman *et al.*, 1996; Cohen *et al.*, 1998; Noterdaeme & Amorosa, 1999). Cohen *et al.* (1998) studied a large cohort of 380 children - aged 7 to 14 – referred to different Child Psychiatry centres and divided in three groups: children with normal language development, others with previously certified language impairments, and others with unsuspected language disorders revealed only by formal testing. The authors noted that children with previously certified language disorders had higher probability to get an ADHD (Attention-Deficit/Hyperactivity Disorder) additional diagnosis than other groups.

1.5 Association between language impairments and behavioural-emotional problems

Noterdaeme & Amorosa (1999) highlighted the need of using standardized questionnaires enquiring into potential comorbidity between language impairments and behavioural-emotional problems. In this context, many authors have focused on the association between language impairments and behavioural-emotional problems in children population, mostly composed by boys. Mattison *et al.* (1980) investigated the behavioural symptoms of children (about 6 as mean age) with speech and language disorders, administering some behavioural questionnaires to their parents and teachers. A series of factor analyses revealed that factors as "Hyperactivity/Conduct" and "Affect" were in line with "Aggression" and "Withdrawal" factors reported in other studies (Kohn, 1977; O'Donnell & Van Tuinan, 1979). Menting *et al.* (2011) found that over the period from kindergarten to fourth grade elementary school children with lower language skills had more externalizing problems and were more frequently rejected by peers than children with better language skills.

Other researchers used the Child Behaviour Checklist (CBCL; Achenbach, 1991; Achenbach & Rescorla, 2001), which is a widely-used standardized screening instrument for detecting emotional and behavioural problems in children. Given its well-established predictive effectiveness (Ivanova *et al.*, 2007), studies that used different CBCL forms are presented below.

Coster *et al.* (1999) evidenced that teachers and parents reported more internalizing and total problems in children with SLI (N = 56; aged 8, 10 and 12) than in the normative group. The authors also hypothesized that there might be no aggressive behaviours in these children: according to their age it seems that aggressive behaviours tend to disappear when children with language impairments grow older.

Many authors have focused their studies on 4 to 6 aged children samples. Willinger *et al.* (2003), for example, explored the different behavioural problems of children with language developmental disorders (n = 94) and children with unimpaired language development (n = 94). They found that, as mothers reported, 34% of children with language developmental disorders presented behavioural problems within the clinical range (i.e. attention problems, withdrawal, thought problems and aggressive behaviour). In a sample of 71 five-years-old children with language impairment, van Daal *et al.* (2007) found more behavioural problems than

within normative data on the *Withdrawn*, *Somatic Complaints*, *Thought Problems* and *Aggressive Behaviour* scales. Stanton-Chapman *et al.* (2007) noted that children with SLI (mean age = 55 months) differed significantly from their typical peers only on the *Internalizing scale* results, especially on the *Withdrawn scale*.

Other studies investigated the linguistic development and behavioural-emotional profile of 18-35 months aged children, finding a strong association with the type of language disorder (Tervo, 2007). Toddlers with receptive-expressive language delay presented more significant problems on the *Pervasive Developmental Problems scale* (a CBCL scale available only in the preschool version) and differed significantly from their peers without language delay on the *Withdrawn scale*. On the contrary, Rescorla *et al.* (2007) have shown that the association between language delay and behavioural-emotional problems is not significant in children of the same age as those studied by Tervo (2007). Excluding children with suspected pervasive developmental disorders and those with neurodevelopmental delay, the only significant difference between children with language delay and children with normal language development was detected in the *Withdrawn scale*, with higher scores for the first group (Rescorla *et al.*, 2007).

The available literature reports conflicting results depending on the age range chosen. Externalizing problems, such as aggressive behaviours, might be associated with language impairments during preschool life (Qi & Kaiser, 2004; Carpenter & Drabick, 2011). Then, as children with SLI grow older, internalizing problems (i.e. withdrawn and somatic complaints) might substitute for the externalizing ones.

Other studies investigated the language skills and prevalence of language disorders in students with emotional and/or behavioural disorders (EBD; Nelson *et al.*, 2003; Rogers-Adkinson, 2003; Benner, 2005; Nelson *et al.*, 2006; Benner *et al.*, 2009). Children with emotional disturbances frequently experienced co-occurring language delays with an impact on their academic skills (Nelson *et al.*, 2006; Benner *et al.*, 2009). Rogers-Adkinson (2003) suggested the presence of neurological deficits to explain this comorbidity in children with emotional disturbances.

Rogers-Adkinson & Hooper (2003) proposed an interdisciplinary approach to study the relationship between language and behaviour. All the specialists involved (i.e., educators, psychiatrists or psychologists) should interact and collaborate with

speech and language pathologists to identify the characteristics of language impairments and how to direct their interventions. Considering language as a means of emotion expression, it is important to underline that the two elements are frequently linked – a poor language often agrees with the difficulty of verbalizing oneself emotions and emotional difficulties often agree with language impairments.

2

Assessment tools to diagnose ADHD

2.1 Introduction

This chapter refers to some personal suggestions about diagnosing ADHD disorder using computerized tools based on the main classification systems of mental disorders.

As ADHD disorder is frequently associated with language impairments, I suggest evaluating specific linguistic skills (morphosyntactic and pragmatic ones) using a particular linguistic battery for children aged 4 to 12.

At last, I take into consideration ethical aspects linked with the usage of Information and Communication Technologies (ICTs) and Internet technologies in psychology and psychopathology.

2.2 A computerized proposal in ADHD diagnosis

According to the main diagnostic manuals of mental disorders (World Health Organization, 1993; American Psychiatric Association - Task Force on DSM-IV, 2000), the formulation of an ADHD diagnosis is a complex process that requires a behavioural assessment, i.e. a detection of symptom presence in at least two contexts of a child's life. No medical instrument (magnetic resonance, blood

sample, electroencephalogram) or neuropsychological test can ascertain the ADHD presence.

Clinicians usually administer specific interviews or questionnaires useful to explore the child's clinical situation. Diagnostic procedure requires that the most important sources of information (i.e., parents and teachers) are involved because of their relevant presence in the main contexts of a child's life (i.e., family and school). Diagnostic procedure typically consists of the following steps (Marzocchi *et al.*, 2007):

- collecting information from multiple sources (parents, teachers…) by administrating semi-structured interviews (K-SADS-PL; Kaufman *et al.*, 1996; Kaufman *et al.*, 2004) or standardized questionnaires such as *Child Behaviour Checklist* (Achenbach, 1991; Achenbach & Rescorla, 2001) or *Conners Scales* (Conners, 1989; Nobile *et al.*, 2007);
- interviewing the child about his/her awareness of encountered difficulties and their impact on emotions and relationships;
- assessing neuropsychological features and learning levels in order to obtain confirmation of the diagnosis, delineate the child's functional profile, make a differential diagnosis and plan future interventions over time. Neuropsychological assessment usually requires a study of the following areas: cognitive level (IQ), sustained attention, impulsivity, planning and use of strategies, and inhibition (Marzocchi *et al.*, 2010);
- observing clinically the child within a familiar context (home or school), by using structured or semi-structured techniques.

The research project, titled GENESIS/CABALA and described in Chapter 4, takes into account the steps mentioned above. In this study, parents were considered as the main source of information and a series of interviews and questionnaires were administered to them. These tools were also administered to children/adolescents in order to deepen the state of psychological well-being achieved over time. Moreover, a neuropsychological assessment resulted necessary to identify the points of strength and weakness of children's cognitive skills.

The use of the following computer tools helped the data collection and maintenance:

- the ADM software (Assessment Data Manager): a computerized system for the administration, correction and maintenance of data on ASEBA questionnaires (Achenbach & Rescorla, 2001, 2003);
- the DAWBA interview (Development and Well-Being Assessment; Goodman *et al.*, 2000a): characterized by a computerized form, it presents a system that facilitates administration, processes data, and guides the clinical evaluation directly online (www.dawba.com; www.dawba.net).

2.2.1 The ADM software for ASEBA questionnaires

The ADM modules provide information useful to make a scoring, display data in relation to multicultural norms and obtain different profiles on ASEBA questionnaires (Achenbach System of Empirically Based Assessment; Achenbach & Rescorla, 2001, 2003), an assessment tools collection to detect behavioural, emotional, and social problems from age 1 ½ to over 90. ASEBA instruments (www.aseba.org) are widely used in schools, medical settings, mental health services, child and family services, legal environments and research contexts.

The *Child Behaviour Checklists* for ages 1 ½-5 and 6-18 (CBCL/1 ½-5 and CBCL/6-18) are administered to parents to obtain their reports of children's problems and competencies. Similar forms are available for collecting information from teachers (*Teacher's Report Form*-TRF), caregivers (*Caregiver-Teacher Report Form*-C-TRF/1½-5), adolescents (*Youth Self-Report*-YSR), adults (*Adult Self-Report*-ASR and *Adult Behavior Checklist*-ABCL), older adults (*Older Adult Self-Report*-OASR and *Older Adult Behaviour Checklist*-OABCL), direct observers (*Direct Observation Form*-DOF), clinical interviewers (*Semistructured Clinical Interview for Children & Adolescents*-SCICA), and psychological examiners (*Test Observation Form*-TOF).

The CBCL 6-18, used in my research project, consists of 118 items grouped to form eight empirically based syndromic scales and three broad-band scales (i.e. *Internalizing*, *Externalizing* and *Total Problems* scales). The *Internalizing scale* is obtained by the *Anxious/Depressed*, *Withdrawn/Depressed*, and *Somatic Complaints* scales; the *Externalizing scale* is formed by the *Rule-Breaking Behaviour* (*Delinquent Behaviour* in the CBCL/4-18) and *Aggressive Behaviour*

scales. The questionnaire also investigates social, thought, and attention problems, corresponding to the relative scales. Finally, the *Total Problems scale* takes into account all responses to the questionnaire. The questionnaire comprises also six DSM-oriented scales whose items were recognized by experts from different cultures as consistent with DSM-IV categories. The DSM-oriented scales are: *Affective*, *Anxiety*, *Somatic*, *Attention Deficit Hyperactivity*, *Oppositional Defiant* and *Conduct Problems* scales.

Figure 2.1 shows a typical profile on syndromic scales: the ADM system calculates Total and T-scores for these and other scales. The dotted lines at T = 65 and T = 70 represent a *borderline* clinical band within which scores do not clearly fall in the *clinical* range as those that are above T = 70. Scores below the cut-off T = 65 are considered in the normal range. For the *Internalizing*, *Externalizing* and *Total Problems* scales the *borderline* clinical band indicates T-scores between 60 and 63. Scores above T = 63 fall in the *clinical* range whilst those below the cut-off T = 60 are considered in the normal range.

The CBCL/6-18 provides a description of many problematic behaviours in children/adolescents aged 6 to 18 and allows to identify *syndromes*, i.e. problems that tend to occur associated, without assuming any specific model explaining the nature or causes of disturbances.

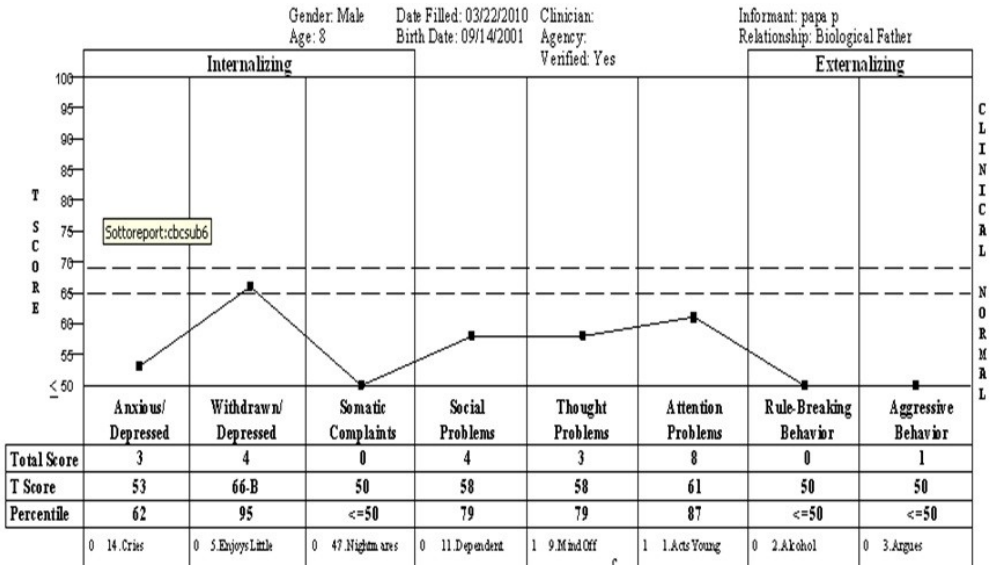

Figure 2.1 An example of behavioural-emotional profile on CBCL syndromic scales.

2.2.2 The DAWBA interview

The DAWBA (Development and Well-Being Assessment; Goodman *et al.*, 2000a) consists of interviews, questionnaires and rating techniques designed to facilitate diagnostic procedure based on ICD-10 and DSM-IV. This tool covers different psychiatric diagnoses in children aged 5 to 17. Interviews are usually administered online thanks to the website of **youthinmind** system, allowing to process data and presenting information useful to evaluate possible psychological disorders.

Information is collected from three sources:

- an interview with parents of children/adolescents aged 5 to 17;
- an interview with children/adolescents aged 11 to 17;
- a questionnaire filled in by teachers of children/adolescents aged 5 to 17.

The DAWBA interviews can be administered by computers or humans. In the first case, an interviewer is not necessary, so costs are reduced, and the respondent can complete the interview directly from home or work: only a connection to Internet is needed. In the second case, the interviewer transcribes the respondent's answers and contributes with personal comments or annotations also in a second time.

The parents' interviews and teachers' questionnaires include closed questions such as "Does he ever worry?" and open-ended questions such as "Please describe in your own words what it is that he worries about".

Respondents complete the *Strength and Difficulties Questionnaire* (SDQ) before moving on to the following DAWBA sections. SDQ is a short behavioural screening questionnaire about children/adolescents aged 3 to 16 years. It includes 25 items on psychological attributes divided in 5 scales:

1. emotional symptoms;
2. conduct problems;
3. hyperactivity/inattention;
4. peer relationship problems;
5. prosocial behaviour.

SDQ is used as part of a clinical assessment or as a tool research useful to predict the presence of child psychiatric disorders with good specificity (Goodman *et al.*, 2000b; Goodman *et al.*, 2000c).

The different sections forming the DAWBA interviews investigate different types of psychological problems and present a similar structure:

- an introduction to section contents;
- some screening questions assessing whether it is necessary to continue the interview;
- a detailed investigation of symptom presence and severity in the area concerned;
- a deepening of symptom duration and onset;
- a request for evaluation of symptom impact on the child/adolescent, family and other contexts.

Sections investigate psychological problems such as separation anxiety, specific phobias, social phobia, panic disorders and agoraphobia, post-traumatic stress disorder, compulsions and obsessions, generalized anxiety, major depression, the presence of self-injurious behaviours, the level of attention and activity, the presence of difficult and problematic behaviours and less common disorders such as autism and anorexia.

The DAWBA interview applies skip rules, which allow to move quickly among different sections of questionnaire. In this way, such a computer tool guides diagnostic procedure directly online and does not take into account certain sections if specific symptoms do not appear or diagnostic criteria are not met.

The answers to the structured questions are fed into a computerized diagnostic algorithm, useful to predict the probability of a diagnosis on the basis of symptoms and impact on multiple settings. The collected data are subjected to a clinical evaluation by an expert rater in this procedure: the rater examines the parents' and child's transcripts, checks whether questions have actually been understood, interprets the dissonance emerged from different transcripts and finally makes a definitive diagnosis. So, the final diagnosis is made by a DAWBA clinical rater, not by the computer.

Aebi *et al.* (2012) found that the choice of DAWBA interviews as part of clinical assessment influenced the diagnostic decision-making about emotional disorders in a clinical sample of children and adolescents aged 5 to 18.

2.3 A proposal of linguistic assessment

In conjunction with the doctorate, from 2009 to 2011 I worked as a researcher within the standardization project of the "*Battery for Linguistic Assessment in children from 4 to 12 years*" (Batteria per la Valutazione del Linguaggio in Bambini dai 4 ai 12 anni; Marini & coll., in fieri). This battery, adopted in part in the second phase of GENESIS/CABALA project (see Chapter 4), might allow to identify linguistic strengths and weaknesses of the children and adolescents recruited. A careful language analysis about children with ADHD may identify the linguistic resources used in a daily context and indicate areas where interventions may be more effective (Mathers, 2006). Marini & coll. are working to transpose some linguistic tests from BVL_4-12 into a computerized form, more accessible in different clinical settings.

The standardization project has recently evolved into another in order to define the linguistic phenotype in Autism. During 2012 the linguistic battery has been used to assess the linguistic skills of children with Specific Language Impairments (N = 63). In 2013 this assessment tool will be used to compare the linguistic performances of children with SLI with those of children with Autism Spectrum Disorders.

Four tests from BVL_4-12 were administered in the second phase of GENESIS/CABALA project:

- *Narrative Task* (Eloquio Narrativo): children were asked to describe the stories represented in 2 single images, i.e. the "Cookie Theft" (Goodglass & Kaplan, 1972) and the "Picnic" (Western Aphasia Battery, WAB; Kertesz, 1982), and 2 images made up of six scenes each, i.e. the "Flower Pot" (Huber & Gleber, 1982) and the "Quarrel" (Nicholas & Brookshire, 1993). At the end of the story, children were encouraged to provide a title for each image. Every storytelling was audio-recorded and then transcribed including pauses, false starts, phonological fillers and tangential utterances. Marini *et al*. (2008) highlighted the importance of

assessing narrative skills in children with SLI, whose linguistic performances are usually evaluated by traditional neuropsychological tests;

- *Test of Syntactic Structures Comprehension* (Test di Comprensione di Strutture Sintattiche): children had to choose pictures corresponding to target sentences (40) uttered by the examiner, discriminating them among the morphological-morphosyntactical distracters. The test consists of 33 active and 7 passive declarative sentences. The active sentences are divided into: adversative (2), negative (4), reflexive (2), relative (5) and reversible (5) sentences, others with double negation (2) and clitic pronouns (4), and sentences applying the principle of grammatical agreement among words (9). The passive sentences are divided into: affirmative reversible (4), negative (2), and negative reversible (1) sentences;
- *Test of Sayings and Proverbs Comprehension* (Test di Comprensione di Modi di Dire e Proverbi): the examiner read 10 sentences in sequence and asked the child to choose the correct meaning among the three presented for each sentence;
- *Test of Linguistic and Emotional Prosody Comprehension* (Test di Comprensione della Prosodia Linguistica ed Emotiva), based on the administration of 30 sentences (six examples) recorded and uttered by an adult female. Within the Linguistic Prosody test, the child's task was to listen to sentences and identify whether each sentence was an Order, a Question or an Affirmation. Within the Emotional Prosody test, sentences were read and interpreted using three different intonations (Sad, Happy and Angry) and children were asked to recognize the emotion conveyed in each sentence.

Preliminary results from standardization project (see Table 2.1) indicate that Emotional Prosody test would be simpler than Linguistic Prosody test for preschool children whose proper performances might depend on knowledge of terms such as Order, Question or Affirmation. This acquisition should take place during the years of primary school.

Table 2.1 Preliminary results on four tests from BVL_4-12 according to age range of children examined.

Number of children	**Age range** (years and months)	**CSS** (M ± SD)	**CSP** (M ± SD)	**CLP** (M ± SD)	**CEP** (M ± SD)
118	4.00-4.11	24.0 ± 7.59	2.1 ± 1.51	3.6 ± 2.54	9.4 ± 3.28
193	5.00-5.11	30.0 ± 5.71	2.7 ± 1.50	3.8 ± 2.70	10.3 ± 2.61
137	6.00-6.11	32.8 ± 5.06	2.7 ± 1.64	6.0 ± 3.20	10.8 ± 2.26
133	7.00-7.11	35.0 ± 2.75	4.8 ± 2.15	7.8 ± 2.92	11.3 ± 1.47
138	8.00-8.11	36.4 ± 2.84	6.7 ± 2.37	9.8 ± 2.39	11.3 ± 1.46
177	9.00-9.11	37.4 ± 2.03	8.0 ± 2.00	10.3 ± 2.13	11.4 ± 1.49
118	10.00-10.11	37.8 ± 2.06	8.6 ± 1.50	10.3 ± 1.75	11.5 ± 0.84
88	11.00-11.11	38.2 ± 1.40	9.1 ± 1.19	11.1 ± 0.83	11.8 ± 0.58

Note: CEP = *Test of Emotional Prosody Comprehension*; CLP = *Test of Linguistic Prosody Comprehension*; CSP = *Test of Sayings and Proverbs Comprehension*; CSS = *Test of Syntactic Structures Comprehension*; M = Mean; SD = Standard Deviation.

The comprehension of sayings and proverbs involves the ability of interpreting and using figurative language. Children acquire this ability slowly and gradually during language development, involving a series of phases characterized by transition from literal to figurative language (Levorato & Cacciari, 1997; Cacciari, 2001). Up to 6-7 years, children use literal strategies of language interpretation; then, they begin to use contextual information in order to assign a meaning to figurative expressions. Around 9-10 years, children are aware that sometimes the sentence meaning does not lie in its linguistic form; in this way, they begin to master the comprehension of figurative language. At the end of primary school, children are able to produce simple metaphors, proverbs or idioms, showing a good metalinguistic awareness. Preliminary results from standardization project seem to confirm such a slow and gradual acquisition (see Table 2.1).

The Syntactic Comprehension test requires that the examiner utters a series of sentences of increasing difficulty (relative, reflexive, negative, passive sentences) and the child indicates the pictures corresponding to the uttered sentences. The child's task is to select the right picture among different morphological-morphosyntactical distracters. Even in this case, preliminary results (see Table 2.1) show a gradual acquisition of this skill. The active reversible sentences and those applying the principle of grammatical agreement among words are already simple

for children aged 4 (see Table 2.2). Children aged 9, 10 and 11 are characterized by similar scores on all categories of sentences. However, the number of sentences is not balanced for each category and the test consists of more active than passive sentences. The statistical analyses that will be included in the published manual will be useful to detect differences among age groups.

I cannot show the results on Narrative Task because the transcripts of stories, requiring a lot of time and training, have not been completed yet.

Table 2.2 Preliminary results on different categories of sentences (*Test of Syntactic Structures Comprehension*) according to age range of children examined.

Children (N)	**Age range** (years and months)	**AD-ADV** (M ± SD)	**AD-AGR** (M ± SD)	**AD-CL** (M ± SD)	**AD-NEG** (M ± SD)	**AD-NEGNEG** (M ± SD)	**AD-REF** (M ± SD)	**AD-REL** (M ± SD)	**AD-REV** (M ± SD)	**PD-AFREV** (M ± SD)	**PD-NEG** (M ± SD)	**PD-NEGREV** (M ± SD)
118	4.00-4.11	0.8 ± 0.77	7.0 ± 1.87	2.2 ± 1.02	2.2 ± 1.43	1.0 ± 0.87	0.9 ± 0.73	2.6 ± 1.61	3.4 ± 1.59	2.6 ± 1.21	0.7 ± 0.68	0.3 ± 0.46
193	5.00-5.11	1.2 ± 0.82	7.7 ± 1.73	2.5 ± 0.99	2.7 ± 1.06	1.4 ± 0.74	1.3 ± 0.74	3.6 ± 1.25	4.3 ± 1.16	3.1 ± 1.06	1.0 ± 0.74	0.4 ± 0.49
137	6.00-6.11	1.3 ± 0.86	8.2 ± 1.42	2.8 ± 0.85	3.0 ± 0.96	1.6 ± 0.66	1.5 ± 0.67	4.1 ± 1.15	4.6 ± 0.96	3.4 ± 0.96	1.2 ± 0.70	0.6 ± 0.50
133	7.00-7.11	1.4 ± 0.80	8.7 ± 0.68	3.2 ± 0.71	3.3 ± 0.64	1.8 ± 0.41	1.6 ± 0.61	4.4 ± 0.79	4.9 ± 0.26	3.7 ± 0.62	1.4 ± 0.64	0.6 ± 0.50
138	8.00-8.11	1.7 ± 0.59	8.8 ± 0.50	3.4 ± 0.60	3.4 ± 0.66	1.8 ± 0.43	1.7 ± 0.54	4.5 ± 0.68	4.9 ± 0.53	3.8 ± 0.44	1.5 ± 0.61	0.7 ± 0.45
177	9.00-9.11	1.7 ± 0.57	8.9 ± 0.24	3.5 ± 0.62	3.6 ± 0.97	1.9 ± 0.35	1.8 ± 0.44	4.7 ± 0.54	5.0 ± 0.20	3.9 ± 0.37	1.6 ± 0.56	0.8 ± 0.42
118	10.00-10.11	1.9 ± 0.43	8.9 ± 0.29	3.7 ± 0.55	3.7 ± 0.52	2.0 ± 0.20	1.8 ± 0.40	4.7 ± 0.54	5.0 ± 0.23	3.9 ± 0.23	1.6 ± 0.51	0.8 ± 0.41
88	11.00-11.11	1.9 ± 0.34	8.9 ± 0.25	3.7 ± 0.47	3.8 ± 0.43	2.0 ± 0.21	1.8 ± 0.48	4.7 ± 0.52	5.0 ± 0.21	3.9 ± 0.34	1.7 ± 0.47	0.8 ± 0.41

Note: AD = Active Declarative; ADV = Adversative; AFREV = Affirmative Reversible; AGR = Agreement; CL = Clitic; M = Mean; N = Number; NEG = Negative; NEGNEG = double Negation; NEGREV = Negative Reversible; PD = Passive Declarative; REF = Reflexive; REL= Relative; REV = Reversible; SD = Standard Deviation.

During 2012, I was involved in *test-retest* phase contributing to administer the linguistic battery to 94 children aged 4 to 12 (Girls = 46; M = 7.31; SD = 2.58). The *test-retest* phase is useful to check the tool reliability in assessing the enquired skills at a distance of time. Measures are reliable when results remain constant even after *retest*, i.e. at a subsequent tool presentation in the same conditions observed during the first administration. In our case the BVL_4-12 was administered again one week after the first presentation (M = 7.4 days; SD = 4.21). According to preliminary results, positive correlations emerged between *test-retest* scores on the following tests: *Test of Syntactic Structures Comprehension* ($r = 0.898$, $p < .01$), *Test of Sayings and Proverbs Comprehension* ($r = 0.902$, $p < .01$), *Test of Linguistic Prosody Comprehension* ($r = 0.829$, $p < .01$) and *Test of Emotional Prosody Comprehension* ($r = 0.482$, $p < .01$). Figures 2.2, 2.3, 2.4 and 2.5 show the

straight-line equation and *r-squared* value, relative to every linear regression performed. Results seem to indicate a good reliability of the instructions provided for each test.

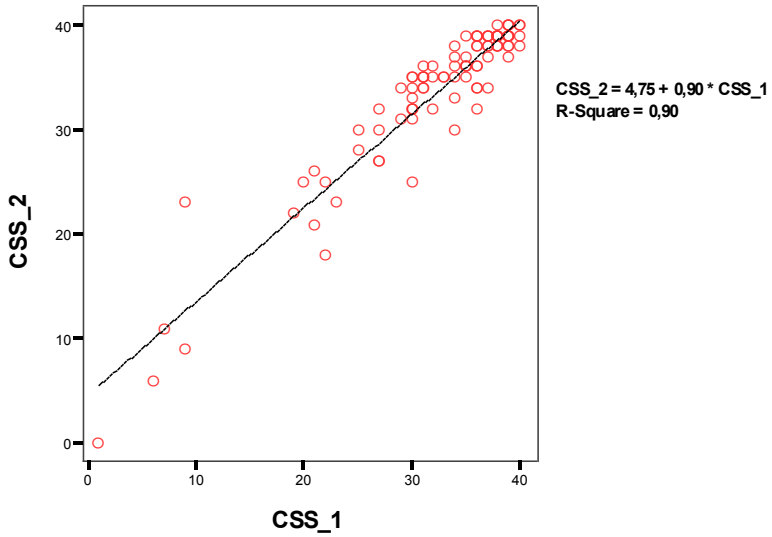

Figure 2.2 Relation between *test-retest* scores on the *Test of Syntactic Structures Comprehension*. Linear regression is reported in the plot.
Note. CSS = *Test of Syntactic Structures Comprehension*; _1 = test; _2 = retest.

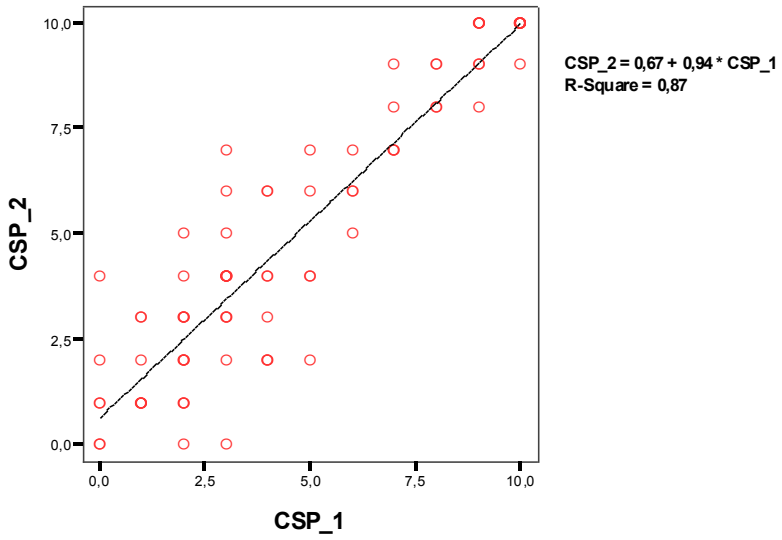

Figure 2.3 Relation between *test-retest* scores on the *Test of Sayings and Proverbs Comprehension.* Linear regression is reported in the plot.
Note. CSP = *Test of Sayings and Proverbs Comprehension*; _1 = test; _2 = retest.

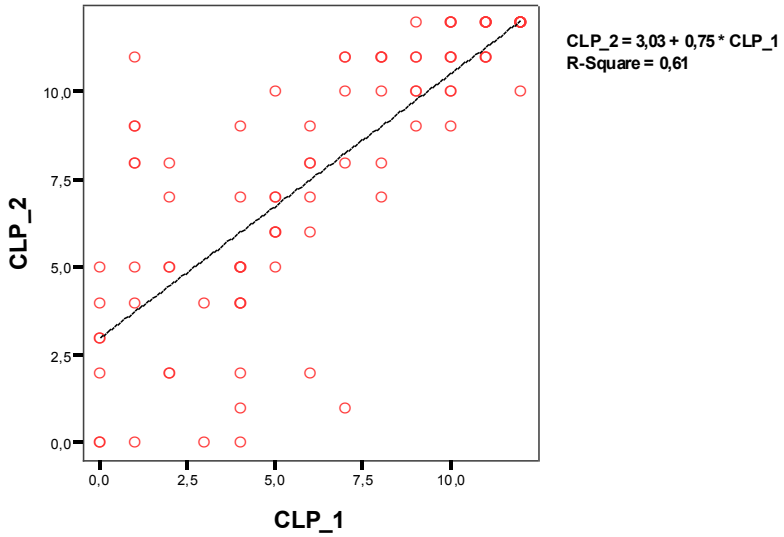

Figure 2.4 Relation between *test-retest* scores on the *Test of Linguistic Prosody Comprehension.* Linear regression is reported in the plot.
Note. CLP = *Test of Linguistic Prosody Comprehension*; _1 = test; _2 = retest.

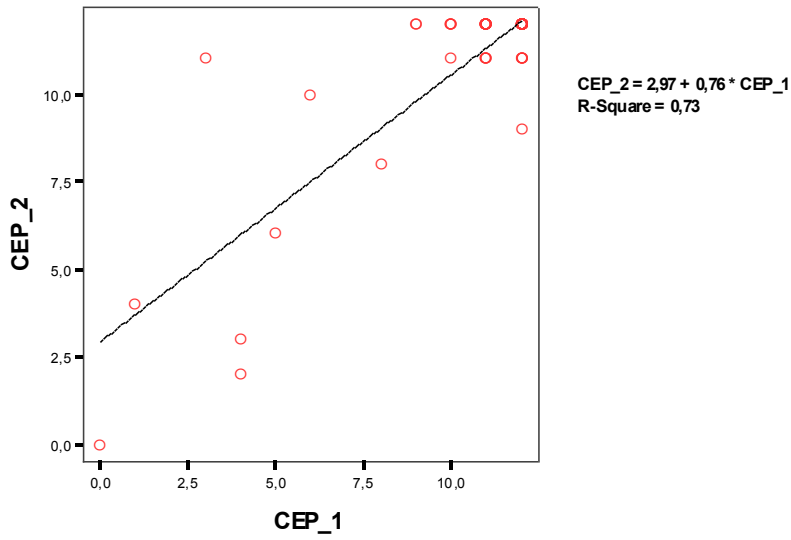

Figure 2.5 Relation between *test-retest* scores on the *Test of Emotional Prosody Comprehension.* Linear regression is reported in the plot.
Note. CEP = *Test of Emotional Prosody Comprehension*; _1 = test; _2 = retest.

2.4 Information and Communication Technology in Psychology: some ethical aspects.

The integration of Information and Communication Technologies (ICTs) and Internet technologies within the traditional psychology results in what is commonly defined as *e-psychology* (Drigas *et al.*, 2011). The authors propose an interesting e-psychology platform to support individuals referred to clinical departments. This model provides operations of *e-diagnosis* and *e-therapy* and is based on four levels:

1. the administrator, whose role is to manage the platform using the available tools of the system;
2. the psychologist/therapist, whose role is to generate and organize the electronic contents of the platform. These contents must be accessible to patients who can communicate online with their therapists;
3. the patient/supported individual, whose role is to regulate the e-psychology platform by its use. The patient communicates online with his/her therapist, has free access to the electronic contents proposed by psychologists and can judge their usefulness. In a broad sense, the patient "uses" actively the psychological support;
4. the visitor, whose unique opportunity is to have access to consulting materials, discussion forums or general sessions.

The authors designed this integrated platform as an user-friendly and user-centered system, able to meet individual needs. Its future implementation will allow people with visual and hearing impairments to satisfy their communicative needs. From this perspective the ICT tools could guarantee respect for disabled people rights to education, knowledge, support and employment.

I think that *e-psychology* facilitates the inclusion of technologies into psychological sessions to such a point that ICT users can be distinguished in: a) patient or participant in a research, who uses electronic tools for pleasure/searching information or assessing/rehabilitating his/her cognitive functions, and b) clinician/researcher who uses electronic tools in order to assess patient/participant's cognitive functions or collect/maintain data about these functions.

The Professional Order of Friuli Venezia Giulia Psychologists puts some limits on using electronic technologies for professional activities at distance

(www.psicologi.fvg.it). At this time, the psychodiagnostic and psychotherapic practices, carried out via Internet or at distance, may be punishable in extreme and uncontrolled cases. For this reason, psychologists must respect their deontological code and protect patient/participant's privacy (personal identity has to remain unknown). They require an informed consent, that usually results necessary for giving a psychological support or asking somebody to voluntarily participate in a research. Moreover, original data are given a code when technology is used to facilitate diagnostic procedure or collect and maintain patient's data.

On a web site it's forbidden to make diagnoses, comments or evaluations and suggest any therapy. Activities of psychological support or rehabilitation through electronic technologies are allowed for short and agreed periods of time. Psychologists must ensure the security of transactions, including financial transactions, and the confidentiality of psychological and personal information.

If relationship with patient cannot be previously established in person, web users should be informed about their rights and data stored. A direct visual or oral communication is, however, preferred, but, if this is not possible, clarity and transparency must be guaranteed with respect for privacy. On a web site, psychologists must specify their identity and membership of Professional Order, update security devices in order to avoid any intrusion, and check web user's identity (child, adolescent or adult).

Professionists must take into account that electronic means interaction may involve the recording and storage of information by the user, too. This does not happen in a standard therapeutic setting, where technology acts as a filter to the relationship between psychologist and patient only in few and controlled situations (i.e., use of computerized interviews or specific programs).

Psychologists who offer professional activities at distance must take into consideration that the service can be used also outside of national borders. Web users can be characterized by different nationalities, ethnicities, religions, customs or normative references, compared to those of professionists. These features can lead users to inadequate or incongruous expectations.

Any new or innovative means of communication implies an identification of its specific characteristics. In a broad sense, it represents a professional challenge that

requires psychologists to update their knowledge and evaluate the epistemological, theoretical, technical and deontological appropriateness of means.

3

Study 1: Association between language impairments and internalizing problems

3.1 Introduction

This chapter refers to a 2012 study about the association between language impairments and internalizing problems in children aged 4 to 12.[2]

As this comorbidity is frequently reported in literature depending on the age range chosen, I suggest using regularly screening instruments for behavioural-emotional problems during linguistic evaluation. Psychiatric symptoms and

[2] Based on this study, a paper ("Increased Internalizing Problems in Children Aged 4 to 12 With Language Impairments" by Moretti A., Nobile M., Garzitto M., Marini A., Fornasari L., Negri G. A. L., Bonivento C., Piccin S., Isola M., Gregoraci G., Mattiussi E., Balestrieri M., Molteni M., Fabbro F. & Brambilla P.) has been prepared and is currently "in press" (*Journal of Psychological Abnormalities in Children*). Its content has been presented as a poster ("Association between language impairments and internalizing problems in children aged 4 to 12" by Moretti A., Nobile M., Garzitto M., Marini A., Fornasari L., Negri G. A. L., Bonivento C., Piccin S., Isola M., Gregoraci G., Mattiussi E., Balestrieri M., Molteni M., Fabbro F. & Brambilla P.) on the 14-15 September 2012 at Pisa, *VI Convegno Internazionale AISMI "Fare Diagnosi per prevenire, predire e curare"*.

cognitive levels should not be underestimated in order to plan specific interventions on linguistic skills, behaviours and emotions.

The study refers to a linguistic assessment tool different from the one previously described in Chapter 2, and used in the mentioned clinical services between 2003 and 2010. The previous chapter took into account some tests from a recent battery for linguistic assessment, that will be soon published and implemented in a computerized form.

3.2 Method

Relying on the objectives of other studies conducted to date (Keegstra *et al.*, 2010), we aimed to investigate whether:

- there were more behavioural-emotional problems in children with language impairments than in their referred peers with unimpaired language development;
- language impairments were associated with more internalizing than externalizing problems and what kind of problems there were;
- the association between language and behavioural-emotional problems were influenced by the children's cognitive levels, gender or age at evaluation time.

3.2.1 Participants

A sample of 186 children (Girls = 43), aged 4 to 12, was selected for the present research. They came under observation to three Child Psychiatry centres of the "E. Medea" Scientific Institute in the North of Italy (Pasian di Prato and San Vito al Tagliamento in Friuli Venezia Giulia region and Conegliano in Veneto region) between 2003 and 2010. All children spoke Italian as first language and did not have hearing loss, intellectual delay, post-traumatic neuropsychological deficit or neurological diseases.

After the assessment of their linguistic skills, the participants were subdivided in two groups: an experimental group and a control one. The experimental group consisted of 84 children (Girls = 18; median age = 7.95 years, age range = 5.02-11.88 years) whose performance on standardized linguistic testing was below the cut-off (2 Standard Deviations, SD) on at least one of the linguistic tests, whilst the

control group was made of 102 children without language impairments (Girls = 25; median age = 8.05 years, age range = 4.45-12.95 years).

3.2.2 Procedure

The cognitive level was assessed with the Italian versions of Wechsler's intelligence scales (WPPSI, WISC-R, WISC-III; Rubini & Padovani, 1986; Orsini & Picone, 1996, 2006), depending on age: verbal and performance IQ were taken into consideration. Children with a full-scale or a performance IQ ≤ 70 were excluded from sample.

The children's linguistic skills were assessed by administering some of the tests that form the *Linguistic assessment in children from 4 to 12 years* (Esame del linguaggio in bambini dai 4 ai 12 anni; Fabbro, 1999), the Italian adaptation of the *Batterie d'évaluation du langage oral de l'enfant aphasique* (De Agostini *et al.*, 1998). This assessment tool evaluates several aspects of oral language production, comprehension and repetition in children aged 4 to 12.

The linguistic skills assessed were:

- Semantic Comprehension evaluated by the Italian version of the *British Picture Vocabulary Scale* (BPVS). Children had to choose pictures corresponding to target words (32) uttered by the examiner, discriminating them among the distracters (semantic, phonological and non-related meaning);
- Morphosyntactic/Syntactic Comprehension assessed by the *Test of Grammatical Comprehension for Children* (Test di Comprensione Grammaticale per Bambini, TCGB; Chilosi & Cipriani, 1995). Children had to choose pictures corresponding to target sentences (76) uttered by the examiner, discriminating them among the morphological-morphosyntactical distracters. In this test each item has been designed to tap a specific kind of sentence (declarative, relative, negative, passive, etc.);[3]

[3] The *Test of Syntactic Structures Comprehension*, described in Chapter 2, is similar to the *Test of Grammatical Comprehension for Children.*

- Production skills assessed by the *Naming Task* (De Agostini *et al.*, 1998), which required children to name 36 pictures representing different objects (animals, common tools, body-parts, etc.);
- Repetition skills assessed by the *Word Repetition* and *Non-Word Repetition* tests (De Agostini *et al.*, 1998), useful to tap children's abilities in reproducing words and sequences of phonemes not forming real words. The latter is thought to tap working memory skills.

In order to obtain the children's behaviour profile, parents or tutors were asked to fill in one of the CBCL questionnaires (Achenbach, 1991; Achenbach & Rescorla, 2001). The CBCL/4-18 (Achenbach, 1991) was administered to 14 parents (n = 7 in the experimental group and n = 7 in the control group), whilst the CBCL/6-18 (Achenbach & Rescorla, 2001) was given to the others 172. The two groups (old versus new version) did not differ in their distribution for the presence of language impairments, χ^2 (1, N = 186) = 0.14, p = .705. No difference between groups emerged for age, t (184) = -1.59, p = .114, Full Scale-IQ, t (184) < 0.01, p = .994, Verbal-IQ, t (184) = 0.87, p = .387, and Performance-IQ, t (184) = -1.17, p = .243. For this reason we included the 14 questionnaires in the CBCL data.

After administering the questionnaire we obtained both profiles of scores on empirically based syndromes and scores on *Internalizing*, *Externalizing*, and *Total Problems* scales.

3.2.3 Statistical analyses

To identify different linguistic groups, children were considered as having a language impairment whenever their standardized scores were below a cut-off for normal variation (z-score ≤ –2 SD) in at least one of five linguistic tests administered.

Characteristics of the study population are described using means ± standard deviation or median and range for continuous variables and percentages for categorical variables. Data were tested for normal distribution using the Shapiro-Wilk test. The t-test or Mann-Whitney test, as appropriate, was performed to compare continuous variables. Cross-tabulations were generated for categorical variables, and a Chi-Square or Fisher Exact test was used to compare distributions.

Furthermore, ANalyses of COVAriance (ANCOVAs) were performed to take into account the potential confounding effects of Full Scale-IQ and gender. ANCOVAs were used in presence of homoschedasticity, based on Levene's test results, otherwise non parametric techniques were applied. Effect sizes (partial eta squared, η_p^2) were reported together with the significance level for statistically significant univariate group-factor effects. Scores on the three CBCL total scales were not available for one child with language impairments because of a data-entry error. Another child in the same group had not any score on the *Aggressive Behaviour scale*, due to omissions in the compilation of the questionnaire. Listwise deletion was adopted in analyses of covariance for these children.

A conventional significance level was used throughout the analyses ($\alpha = .05$). Bonferroni's correction was adopted in ANCOVAs to maintain significance in multiple independent comparisons (with: $p \leq .017$, for single comparisons on the three CBCL total scales; $p \leq .006$, on eight CBCL syndromic scales). If results did not survive to correction, they were considered only close to statistical significance.

All statistical analyses were performed using SPSS for Windows, version 15.0 (SPSS Incorporated, 2006).

3.3 Results

Table 3.1 shows comparisons between children with language impairments and children with unimpaired language development, according to gender, age at evaluation, and performances on Wechsler's intelligence scales.

The two groups do not differ in gender distribution, χ^2 (1, N = 186) = 0.25, p = .620. Group-related differences emerge for Full Scale-IQ, t (184) = 4.45, $p < .001$, Verbal-IQ, t (184) = 3.05, p = .003, and Performance-IQ, U = 2730.00, $p < .001$, being higher in children with unimpaired language development, but not for age, U = 3981.00, p = .407.

Table 3.1 Comparisons between groups according to gender, age at evaluation and scores on Wechsler's intelligence scales.

	Children with unimpaired language development (N = 102)		Chidlren with linguistic impairments (N = 84)			
Number of girls (%)	25 (24.5%)		18 (21.4%)		$\chi^2(1, N = 186) = 0.25$	.620
	Mean ± SD	Median (min, Max)	Mean ± SD	Median (min, Max)	Statistic	*p*
Age	8.4 ± 1.88	8.05 (4.45, 12.95)	8.0 ± 1.40	7.95 (5.02, 11.88)	$U = 3981.00$	.407
FS-IQ	107.5 ± 13.17	108 (79, 142)	98.3 ± 14.89	96 (73, 139)	$t(184) = 4.45$	* < .001
V-IQ	104.0 ± 12.76	102.5 (78, 131)	97.9 ± 14.50	96.5 (67, 139)	$t(184) = 3.05$	* .003
P-IQ	109.6 ± 15.38	109 (79, 151)	99.7 ± 15.36	98 (71, 147)	$U = 2730.00$	* < .001

Note. FS- = Full Scale; IQ = Intelligence Quotient; Max = Maximum observed value; min = minimum observed value; P- = Performance; SD = Standard Deviation; V- = Verbal. *: $p < .05$.

Figure 3.1 summarizes the linguistic features of the experimental group (n = 84). Figure 3.1a shows frequencies of children with impaired performance on just one linguistic test (n = 57). Frequent impairments are evident on those tests assessing morphosyntactic comprehension (nearly 51%) and word repetition skills (nearly 32%). Similar results are found in children with impaired performance on more linguistic tests (n = 27), too. This group presents two, three and even four linguistic impairments at the same time for a total of 63 impairments. As shown in Figure 3.1b, impaired performances are more frequent on Word Repetition (nearly 40%), Morphosyntactic Comprehension (27.0%), and Non-Word Repetition (nearly 24%) tests.

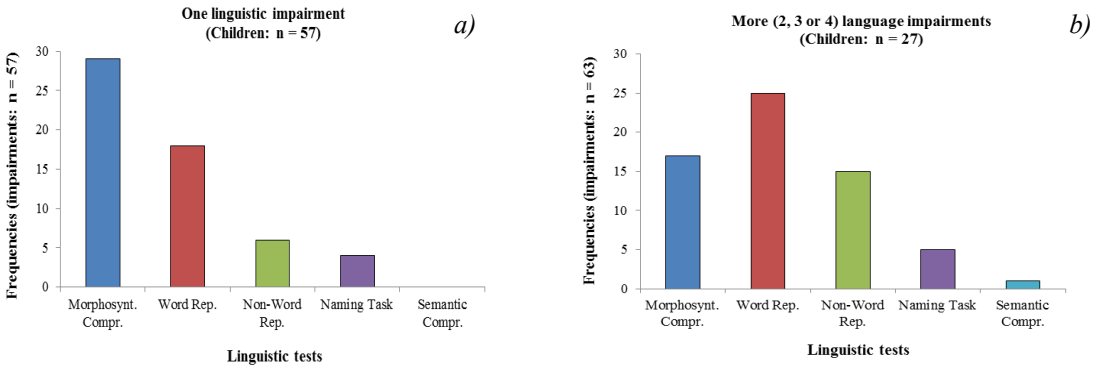

Figure 3.1 Linguistic features of the experimental group: *a)* Frequencies of children with impairments in one linguistic test (number of children and number of impairments are the same); *b)* Frequencies of impairments in more linguistic tests (27 children presented two, three or four linguistic impairments at the same time for a total of 63 impairments).

CBCL scores were used to identify children with behavioural-emotional problems, as reported by parents. Table 3.2 shows frequencies and percentages of children positioned above subclinical cut-off for each scale (T-score ≥ 60 for total scales; T-score ≥ 65 for syndromic scales).

There is a statistically significant difference in frequency distribution between groups on the *Internalizing Problems*, χ^2 (1, N = 185) = 5.70, p = .017, and *Withdrawn/Depressed* scales, χ^2 (1, N = 186) = 6.51, p = .011, showing a positive association of language impairments with internalizing problems, especially about withdrawal.

Table 3.2 Group differences (with frequencies and percentages) on behavioural assessment.

	Children with unimpaired language development (N = 102)			Children with language impairments (N = 84)				
	Mean ± SD	Median (min, Max)	(Sub-)Clinic (%)	Mean ± SD	Median (min, Max)	(Sub-)Clinic (%)	χ^2 (1, N = 186)	p
TOT [n]	61.4 ± 8.58	62 (41, 81)	60 (58.8%)	62.9 ± 9.15	63 (33, 80)	55 (66.2%)	1.08	.299
INT [n]	59.8 ± 8.67	61 (34, 78)	55 (53.9%)	63.2 ± 8.90	65 (41, 87)	59 (71.1%)	5.70	* .017
EXT [n]	58.9 ± 9.45	59 (40, 76)	50 (49.0%)	59.1 ± 9.41	60 (33, 80)	42 (50.6%)	0.05	.830
ANX	61.1 ± 8.28	62 (50, 88)	33 (32.3%)	63.3 ± 8.40	64 (50, 84)	38 (45.2%)	3.24	.072
WIT	59.6 ± 7.99	58 (50, 89)	30 (29.4%)	63.4 ± 10.10	63 (50, 88)	40 (47.6%)	6.51	* .011
SOM	55.4 ± 5.97	53 (50, 74)	10 (9.8%)	57.5 ± 7.11	56 (50, 78)	10 (11.9%)	0.21	.645
SOC	62.2 ± 7.33	60 (50, 85)	33 (32.3%)	63.4 ± 7.45	62 (51, 88)	36 (42.8%)	2.18	.140
THO	57.4 ± 7.15	54 (50, 79)	15 (14.7%)	59.0 ± 7.61	58 (50, 83)	16 (19.0%)	0.63	.429
ATT	65.1 ± 9.27	66 (51, 93)	55 (53.9%)	66.4 ± 10.52	65 (50, 93)	42 (50%)	0.28	.594
RUL	57.7 ± 6.69	57 (50, 76)	14 (13.7%)	57.9 ± 6.70	57 (50, 73)	16 (19.0%)	0.97	.326
AGG [n]	60.5 ± 8.90	59 (50, 83)	29 (28.4%)	60.3 ± 8.45	59 (50, 87)	24 (28.9%)	0.01	.942

Note. AGG = *Aggressive Behaviour scale*; ANX = *Anxious/Depressed scale*; ATT = *Attention Problems scale*; EXT = *Externalizing Problems scale*; INT = *Internalizing Problems scale*; Max = Maximum observed value; min = minimum observed value; RUL = *Rule-Breaking Behaviour scale*; SD = Standard Deviation; SOC = *Social Problems scale*; SOM = *Somatic Complaints scale*; THO = *Thought Problems scale*; TOT = *Total Problems scale*; WIT = *Withdrawn/Depressed scale*. [n]: percentages for these scales were calculated on the 83 available participants in group with language impairments; Chi-Square tests were performed on the 185 available participants. *: $p < .05$.

One-way between-groups ANCOVAs, with *group* as two-levels factor (children with and without language impairments) and *Full Scale-IQ* (FS-IQ) and *gender*[4] as covariates, were performed for mean T-scores on CBCL total scales. Age was not included as covariate because no group-related difference was found for this variable and result from Levene's test was significant. In all other cases, the results from Levene's test do not indicate violations of homoschedasticity assumption. *FS-IQ* and *gender* do not show any statistically significant effect on CBCL total scales. Univariate results, as displayed in Figure 3.2, show statistically significant between-groups differences on the *Internalizing Problems scale*, F (1, 181) = 8.36, p = .004, statistically significant after Bonferroni's correction, η_p^2 = .044. As a consequence, children with language impairments evidence more internalizing problems than children with unimpaired language development.

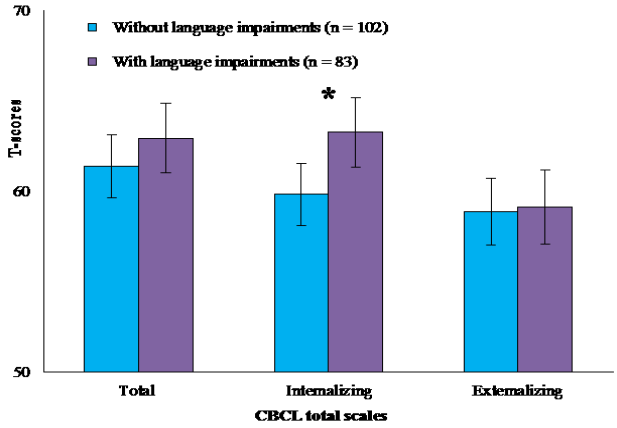

Figure 3.2 Comparisons between groups on *Internalizing, Externalizing* and *Total Problems* scales.
Note. CBCL = *Child Behaviour Checklist*; N = Number of available participants. *: p < .05 in univariate ANCOVA after correction for multiple comparisons.

Similar ANCOVAs, with *group* as two-levels factor and *Full Scale-IQ* (*FS-IQ*) and *gender* as covariates, were performed using the results on syndromic scales as dependent variables (considering eight independent comparisons in the subsequent

[4] Although normative scores on CBCL scales are corrected for 'Gender', we included it as covariate in order to investigate whether there was a gender-related effect on the observed behavioural-emotional profiles.

univariate analyses). The results from Levene's test do not indicate violations of homoschedasticity assumption. In univariate analyses, *gender* does not show any statistically significant effect on CBCL syndromic scales, whereas *FS-IQ* is close to significance for the *Thought Problems*, F (1, 181) = 4.08, p = .045, and *Attention Problems* scales, F (1, 181) = 4.68, p = .032. As shown in Figure 3.3, there is also a statistically significant group-related difference on the *Withdrawn/Depressed scale*, F (1, 181) = 9.14, p = .003, statistically significant after Bonferroni's correction, η_p^2 = .048. Results are close to significance for the *Somatic Complaints scale*, F (1, 181) = 5.86, p = .016, but they do not survive to corrections for multiple comparisons.

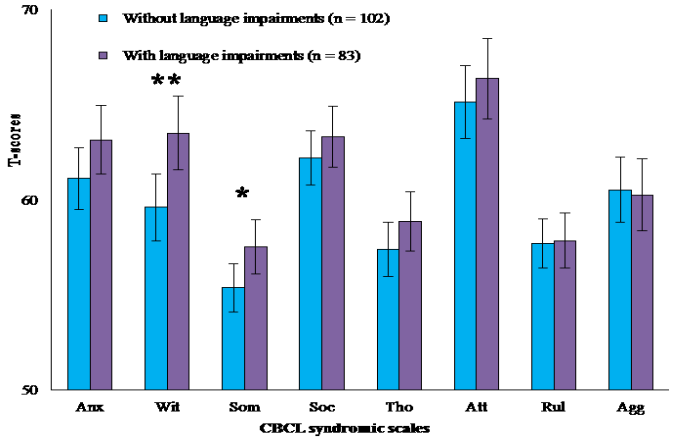

Figure 3.3 Comparisons between groups on the eight empirically based syndromic scales.
Note. AGG = *Aggressive Behaviour scale*; ANX = *Anxious/Depressed scale*; ATT = *Attention Problems scale*; CBCL = *Child Behaviour Checklist*; N = Number of available participants; RUL = *Rule-Breaking Behaviour scale*; SOC = *Social Problems scale*; SOM = *Somatic Complaints scale*; THO = *Thought Problems scale*; WIT = *Withdrawn/Depressed scale*. *: p < .05 in univariate ANCOVA only without correction for multiple comparisons. **: p < .05 in univariate ANCOVA after correction for multiple comparisons.

3.4 Discussion

In this study, cognitive levels, linguistic performances, and behavioural-emotional profiles were evaluated in a representative sample of children 4 to 12 years old.

Differently from previous studies, we focused cross-sectionally on a wide age range taking into account children from preschool to puberty.

We noted significant IQ differences between children with language impairments and children with typical language development and included them in our analysis, using IQ as a covariate element. Studies usually compare subjects with an average IQ or specific IQ values (Cohen *et al.*, 1998; Coster *et al.*, 1999; Noterdaeme & Amorosa, 1999; Willinger *et al.*, 2003), avoiding to consider between-groups differences.

Language impairments were assessed administering a series of tests about lexical and grammatical comprehension, naming, and word and non-word repetitions. The results indicate that frequent impairments are evident on those tests assessing morphosyntactic comprehension and repetition skills. These results are similar to those found with the same test by Marini *et al.* (2008) in a study focused on children with SLI. They also assessed linguistic performance on a narrative task elicited by a cartoon story (the Nest Story; Paradis & Libben, 1987), showing severe deficits on all measures aimed at assessing the morphosyntax and syntax domains.

Even without any specific linguistic diagnosis, we found that the presence of one deficit in linguistic tests was enough to show some associated internalizing problems. The behavioural assessment confirmed the association between internalizing problems and language impairments reported in other studies (Coster *et al.*, 1999; Redmond & Rice, 2002; Stanton-Chapman *et al.*, 2007; Keegstra *et al.*, 2010), for withdrawal and somatic complaints. However, withdrawal probably represents the main emotional marker in children with language impairments.

Limited communication skills may influence the self-esteem and social roles perceived by children with language impairments (Rice *et al.*, 1991). Peer interactions take a risk of being reduced or characterized by inappropriate initiation attempts (Hadley & Rice, 1991). In addition, communicative skills contribute to establish peer acceptance (Gertner *et al.*, 1994), that is, children with speech and/or language impairments may result unpopular among peers and feel a sense of inadequateness. In this regards, preschool children with SLI have shown lower social skills than their peers without any language impairments (McCabe & Meller, 2004). According to a longitudinal perspective, Durkin & Conti-Ramsden (2007)

investigated the quality of friendship in adolescents with a SLI story (n = 120) and their peers with a typical development (n = 118). The authors reported that the adolescents with SLI were at risk of developing poorer friendships than the typically developing participants. Receptive language problems at the age of 7 were recognized as significant predictors for poorer friendship quality at 16.

In general, children with language impairments tend to be rated as more withdrawn and less socially equipped than children without such disturbances. According to a contextualist approach, Vigotsky's theory (Vygotsky, 1962) is centred on the dynamic relation between language and thought. Getting older, children involve in more internalizing dialogues which are important for problem solving and self-control. Cohen *et al.* (1998) hypothesized an interference between language disorders and children's creation of internal representations of their social contexts and behaviours.

Carpenter & Drabick (2011) proposed an interesting model to explain the co-occurrence of language impairments and behavioural problems in early childhood and preschool children. They suggested that difficult temperament and deficits in working memory contribute initially to account for the comorbidity between language and behaviour problems. Factors depending on children (type of language impairment, level of adaptive communication and emotion regulation skills) and on context (quality of parent-child interactions and level of expressive language used at home) may increase or decrease the risk of developing this comorbidity.

Our results, in accordance to literature, shed light on the strong relation between early language impairments and future social problems, which should be controlled and avoided by implementing specific prosocial intervention strategies. Therefore, in patients with linguistic problems not only linguistic rehabilitation but also social and emotional interventions should be considered.

3.4.1 Limits

We had no previous specific diagnoses of SLI according to the main manuals of disorders classification (i.e. ICD-10 or DSM-IV-TR). However, we used a screening linguistic instrument evaluating phonological, lexical and syntactic skills and consisting of tests investigating production, comprehension and repetition.

Moreover, a well-established predictive instrument (CBCL) assessed behavioural-emotional profiles.

The comorbidity between attentional and linguistic difficulties has been widely investigated (Baker & Cantwell, 1992; Cohen *et al.*, 1998; Camarata & Gibson, 1999; Oram *et al.*, 1999; Cohen *et al.*, 2000; Kim & Kaiser, 2000; McInnes *et al.*, 2003; Jonsdottir *et al.*, 2005; Martinussen & Tannock, 2006; Bellani *et al.*, 2011). Our study failed to corroborate this association but, as shown in Table 3.2, the mean T-scores relative to children with and without language impairments are positioned above subclinical cut-off (T-score = 65) on the *Attention Problems scale*. On the *Total Problems scale* both groups score above subclinical cut-off (T-score = 60).

As attentional and total problems were strongly represented in our sample, comparisons were performed between groups with high scores of attentional and total problems.

3.4.2 Conclusions

Our results confirm the association between language impairments and internalizing problems found in other studies, but focus on a sample of children characterized by a wide age range. Therefore it is necessary to consider the psychiatric symptoms associated with language impairments: screening instruments for behavioural-emotional problems should be used regularly during linguistic evaluation. According to our results, also the influence of cognitive level on linguistic impairment effects should not be underestimated. Future longitudinal studies might be useful to detect how behavioural-emotional problems and language impairments evolve and what are the distinct qualitative characteristics over the time. The identification of specific development parameters, depending on children/adolescents age, might have important implications for clinicians and educators, who could direct their interventions not only on language abilities but also on behaviours and emotions.

4

Study 2: A longitudinal study with ADHD children/adolescents

4.1 Introduction

A research project coordinated by Dr. Paolo Brambilla (from 2009 to 2011 titled GENESIS/Gene-Environment interaction and NEurodevelopmental markers in pre-psychosiS and depression: an Integrated multidisciplinary Study; from 2012 called CABALA/Caratterizzazione di bambini e adolescenti con profilo comportamentale di deficit di autoregolazione-Dysregulation Profile-DP) is now in progress in four Child Psychiatry centres of the "E. Medea" Scientific Institute in the North of Italy (Bosisio Parini/LC, Pasian di Prato/UD, San Vito al Tagliamento/PN and Conegliano/TV). The study aims to explore the neuropsychological, genetic and morpho-functional features of children and adolescents referred for behavioural problems and emotional disturbances.

4.2 The research phases

The research is longitudinal and characterized by three phases: 1) retrospective and epidemiological phase; 2) base-line and experimental phase and 3) follow-up phase. This study might allow to individuate early risk factors that predispose children to develop psychiatric disorders in adult life: the follow-up phase provides that adolescents who participated in the baseline and experimental phase are

recalled for evaluation at a distance of years. In the next paragraphs the first and second phase will be described.

4.2.1 The retrospective and epidemiological phase

In the first phase, we carried out an archival work in the four Child Psychiatry centres mentioned, aiming to identify children and adolescents, aged 2 to 17, who came under observation between 2003 and 2011 for the following disturbances: schizophreniform, mood, anxiety, personality, hyperkinetic, conduct and emotional disorders. Examining clinical records, our research group could collect emotional, cognitive and behavioural assessments, diagnostic practices and rehabilitative procedures adopted over time.

Within the GENESIS/CABALA project I was involved in administration of identified tests and updating of the database created after the first phase. Database includes data about children and adolescents (N = 1466) aged 2 to 17 (Mean age at referral = 9.0 years; SD = 2.66), referred for behavioural-emotional problems to the four Child Psychiatry centres of the "E. Medea" Scientific Institute (see Table 4.1).

Table 4.1 Sample distribution according to gender and Child Psychiatry centre of referred children/adolescents.

		CENTRES				
		LC	**PN**	**TV**	**UD**	**Tot**
Gender	**F**	90	59	20	166	335
	M	265	257	102	507	1131
	Tot	355	316	122	673	**1466**

Note: F = Females; LC = Lecco; M = Males; PN = Pordenone; TV = Treviso; UD = Udine.

4.2.2 The base-line and experimental phase

The second phase is under way in three centres (Bosisio Parini, Pasian di Prato and Conegliano); the next year it will start also at San Vito al Tagliamento. It consists in:

- psychopathological and personality assessment coming from multiple sources (child/adolescent and family) through the use of the following questionnaires/interviews: CBCL 6-18, ASR 18-59, ABC 18-59, YSR 11-18 (Achenbach & Rescorla, 2001, 2003); Temperament and

Character Inventory (Cloninger *et al.*, 1994); Parental Bolding Instrument (Parker *et al.*, 1979); DAWBA interviews (Development and Well-Being Assessment; Goodman *et al.*, 2000a); PAS (Premorbid Adjustment Scale; Cannon-Spoor *et al.*, 1982); SCICA 12-18 (Semistructured Clinical Interview for Children and Adolescents; McConaughy & Achenbach, 2001); PDS (Pubertal Development Scale; Petersen *et al.*, 1988); Edinburgh Inventory for handedness (Oldfield, 1971);

- neuropsychological assessment through the administration of the following tests: *Vocabulary*, *Block Design* and *Digit Span* tests from WISC III/WAIS-R (Laicardi & Orsini, 1997; Orsini & Picone, 2006); *Manual Motor Sequences*, *Visuomotor Precision*, *Visual Attention*, *Arrows*, *Memory for Faces*, *Affect Recognition*, and *Theory of Mind B* tests from NEPSY II (Korkman *et al.*, 2007; Urgesi *et al.*, 2011); three computerized tests (Ax-CPT-Continuous Performance Task, Ax version; SoA-Span of Apprehension, IGT-Iowa Gambling Task);
- linguistic assessment through the administration of four tests (*Narrative Task*, *Test of Syntactic Structures Comprehension*, *Test of Sayings and Proverbs Comprehension*, *Test of Linguistic and Emotional Prosody Comprehension*) from *Battery for Linguistic Assessment in Children from 4 to 12 years* (Batteria per la Valutazione del Linguaggio in Bambini dai 4 ai 12 anni; Marini & coll., *in fieri*);
- instrumental and laboratory examinations (multimodal MRI, EEG and VEP; immunology and genetics);
- application of an experimental design in fMRI (comparison between children/adolescents with emotional disorders, selected during the second phase, and a control group in a task of mental imagery on emotional and motion verbs).

Nowadays, 236 children/adolescents (and their parents) have accepted to participate in different phases of our research, after being informed about its aims. Their mean age at recall was 15.1 years (SD = 2.24). Performances on the above listed tests have been assessed from 2010 to 2012. Children/adolescents and their

family components were asked to give a sample of saliva useful to future genetic examinations. Resonance studies began in Bosisio Parini centre, but not in the others. During 2013, participants from Friuli Venezia Giulia and Veneto will be contacted for the application of experimental design in fMRI.

The DAWBA interview was administered to at least 11 years old children/adolescents and their parents in two « E. Medea » centres (Bosisio Parini and Conegliano) and in the psychiatric clinic of Udine Hospital. The administration usually occurred at the same time and in two different rooms of the structures. In both cases its duration varied depending on the presence or absence of those symptoms expected for each problem investigated. The duration was longer (about 2 hours) for parents who answered also to questions about their children's development stages.

At the moment it is not possible to present the preliminary results of any psychiatric diagnosis made after administration of DAWBA interviews, because the collected data must be submitted to clinical evaluation by an expert rater. After this rating, the sample will be updated based on new (or confirmed) associated diagnoses that will be compared with the first diagnoses at referral.

Data about ASEBA questionnaires (Achenbach & Rescorla, 2001) are available for the 236 children/adolescents and their family components recalled in the second phase. The ADM software allowed our research group to correct and maintain these data.

4.3 Method

As my specific task within the GENESIS/CABALA project, I focused my attention on data about children and adolescents with ADHD diagnosis, whose performances on different tests were evaluated in the four Child Psychiatry centres involved. I was interested in collecting a cluster of data through neuropsychological, linguistic and personality assessments, using the help of children's families, too. I aimed to investigate whether there was a relation between specific behavioural-emotional profiles at referral and the same at a distance of time. Then, I aimed to explore the relation type between different cognitive and linguistic tests administered during the base-line and experimental phase.

4.3.1 Participants

Based on data collected during the retrospective and epidemiological phase (N = 1466), I selected a group of 426 children/adolescents (Mean age at referral = 8.8 years; SD = 2.36) with at least one ADHD diagnosis (combined type, predominantly inattentive type, predominantly hyperactive/impulsive type or not otherwise specified) at referral. During the recording of diagnoses from archival work, corrispondence between diagnostic nomenclatures DSM IV/ICD10 has been observed. Most children (n = 285; girls = 42) presented an ADHD diagnosis and other diagnoses in comorbidity (learning and specific language disorders, mood, anxiety, personality, conduct, and emotional disorders, specific or social phobias, enuresis/encopresis, etc…). The other 141 children (Girls = 20) evidenced an ADHD diagnosis without any associated disturbances. The ADHD prevalence in males and association with other disorders confirm the estimates provided by the main diagnostic manuals.

On 236 children/adolescents recruited during the second phase (T1), 64 adolescents (Girls = 7; mean age = 15.0 years; SD = 2.36) presented at least one ADHD diagnosis at T0, i.e. at referral or in the retrospective phase. On 64 adolescents with ADHD, 41 evidenced other diagnoses in comorbidity at T0.

4.3.2 Procedure

For these 64 adolescents I considered the following questionnaires and tests available at T0:

- ASEBA questionnaires (Achenbach & Rescorla, 2001) in different forms (Parent Report and Teacher Report forms) and depending on age (CBCL/1 ½-5, CBCL/4-18, CBCL/6-18, TRF/6-18). The CBCL/4-18 (Achenbach, 1991) was administered to two parents, whilst the CBCL/6-18 was given to 57 parents. Four parents filled in the CBCL/1 ½-5, whilst one teacher filled in the TRF/6-18. Questionnaires were administered especially to mothers (n = 60);
- Italian versions of Wechsler's intelligence scales depending on age (WPPSI, WISC-R, WISC-III; Rubini & Padovani, 1986; Orsini & Picone, 1996, 2006). Three adolescents presented no scores on these scales.

The questionnaires and tests administered at T1 and selected for my research aims were :

- CBCL/6-18 (Achenbach & Rescorla, 2001), filled in by parents (for one adolescent only scores on two *Competence Scales* were available);
- three tests (*Test of Syntactic Structures Comprehension*, *Test of Sayings and Proverbs Comprehension*, *Test of Linguistic and Emotional Prosody Comprehension*) from BVL_4-12 (Marini & coll., *in fieri*); twelve adolescents presented no scores on these tests because they refused to participate in such research module. Another participant evidenced a score only on the *Test of Syntactic Structures Comprehension*;
- *Vocabulary*, *Block Design* and *Digit Span* tests from WISC-III/WAIS-R; (Laicardi & Orsini, 1997; Orsini & Picone, 2006); ten adolescents presented no scores on these tests because they refused to participate in such research module.

Based on retrospective data at T0 and collected data at T1, a series of correlations were performed using as variables:

- T-scores on CBCL *Attention Problems*, *Attention Deficit Hyperactivity Problems*, *Internalizing*, *Externalizing*, and *Total Problems* scales;
- raw scores on the mentioned tests from BVL_4-12;
- age-corrected scaled scores on the mentioned tests from WISC-III/WAIS-R;
- scores on *Full Scale-IQ* at T0 and *Estimated-IQ* at T1 (based on the *Vocabulary* and *Block Design* tests).

All statistical analyses were performed using SPSS for Windows, version 15.0 (SPSS Incorporated, 2006).

4.4 Results

As shown in Table 4.2, significant correlations (in many cases $p < .01$) emerged between T-scores at T0 and T-scores at T1 on the CBCL total, syndromic and DSM-oriented scales mentioned. Positive correlations were found between T-

scores at T0 and T-scores at T1 on *Attention Problems* (r = 0.425, p < .01), *Attention Deficit Hyperactivity Problems* (r = 0.611, p < .01), *Internalizing* (r = 0.562, p < .01), *Externalizing* (r = 0.459, p < .01), and *Total Problems* (r = 0.632, p < .01) scales. Figures 4.1, 4.2, 4.3, 4.4 and 4.5 show the straight-line equation and *r-squared* value, relative to every linear regression performed.

Table 4.2 Correlations between T-scores at T0 and T-scores at T1 on the CBCL total, syndromic and DSM-oriented scales.

		A_TOT_T1	A_INT_T1	A_EXT_T1	A_ATT_T1	A_D_ADHD_T1
A_TOT_T0	*r*	0.632(**)	0.598(**)	0.515(**)	0.499(**)	0.543(**)
	Sig. (2-t)	.000	.000	.000	.000	.000
	N	63	63	63	63	63
A_INT_T0	*r*	0.423(**)	0.562(**)	0.252(*)	0.236	0.262(*)
	Sig. (2-t)	.001	.000	.046	.063	.038
	N	63	63	63	63	63
A_EXT_T0	*r*	0.503(**)	0.399(**)	0.459(**)	0.414(**)	0.412(**)
	Sig. (2-t)	.000	.001	.000	.001	.001
	N	63	63	63	63	63
A_ATT_T0	*r*	0.351(**)	0.249(*)	0.290(*)	0.425(**)	0.369(**)
	Sig. (2-t)	.005	.049	.021	.001	.003
	N	63	63	63	63	63
A_D_ADHD_T0	*r*	0.490(**)	0.283(*)	0.505(**)	0.513(**)	0.611(**)
	Sig. (2-t)	.000	.030	.000	.000	.000
	N	59	59	59	59	59

Note. A_D_ADHD = Achenbach_DSM-oriented_*Attention Deficit Hyperactivity Problems scale*; A_ATT = Achenbach_*Attention Problems scale*; A_EXT = Achenbach_*Externalizing scale*; A_INT = Achenbach_*Internalizing scale*; A_TOT = Achenbach_*Total Problems scale*; N = Number of available participants; *r* = Pearson correlation; Sig. (2-t) = Significant (2-tailed); T0 = retrospective and epidemiological phase; T1 = base-line and experimental phase. **: correlation is significant at the .01 level. *: correlation is significant at the .05 level.

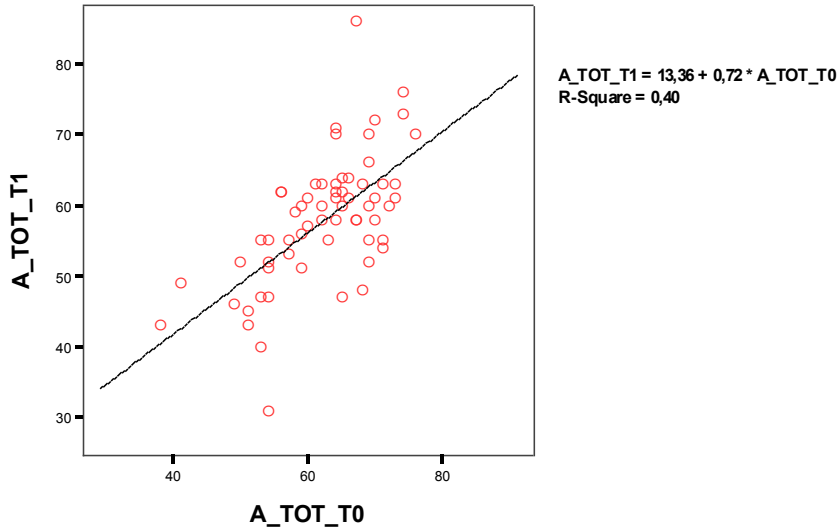

Figure 4.1 Relation between T-scores at T0 and T-scores at T1 on *Total Problems scale*. Linear regression is reported in the plot.
Note. A_TOT = Achenbach_*Total Problems scale*; T0 = retrospective and epidemiological phase; T1 = base-line and experimental phase.

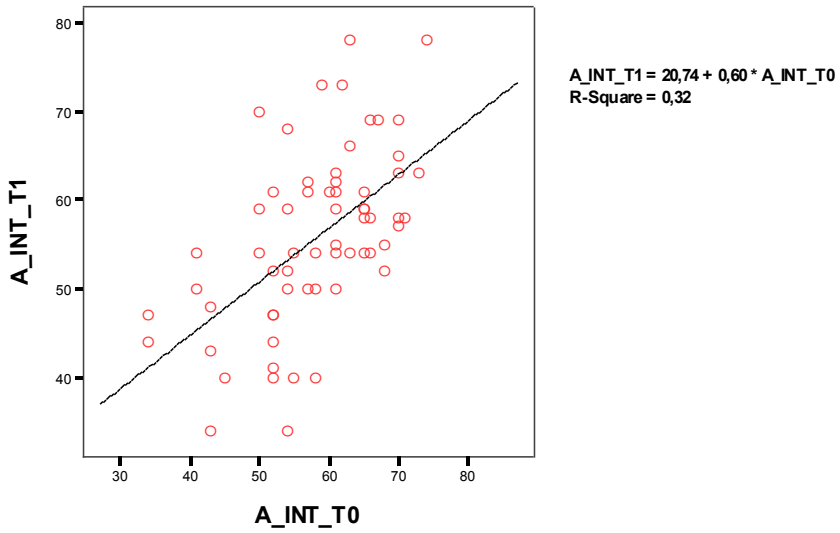

Figure 4.2 Relation between T-scores at T0 and T-scores at T1 on *Internalizing scale*. Linear regression is reported in the plot.
Note. A_INT = Achenbach_*Internalizing scale*; T0 = retrospective and epidemiological phase; T1 = base-line and experimental phase.

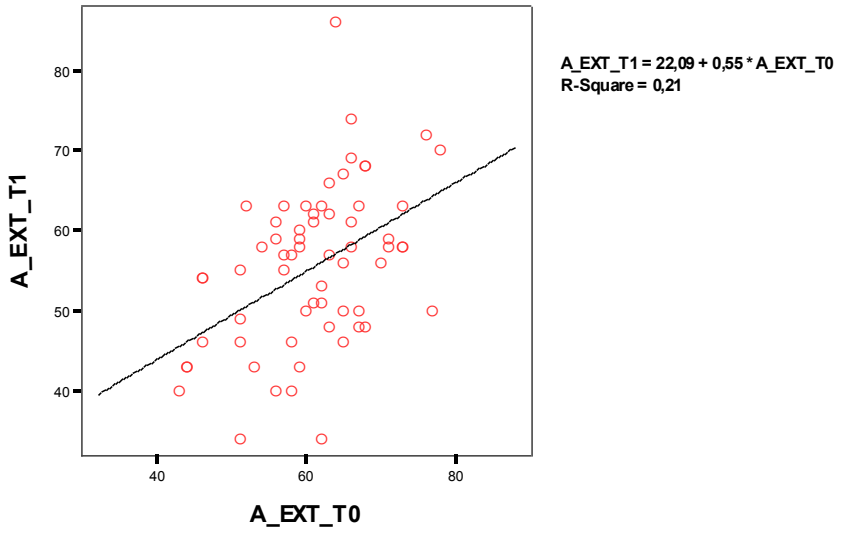

Figure 4.3 Relation between T-scores at T0 and T-scores at T1 on *Externalizing scale*. Linear regression is reported in the plot.
Note. A_EXT = Achenbach_*Externalizing scale*; T0 = retrospective and epidemiological phase; T1 = base-line and experimental phase.

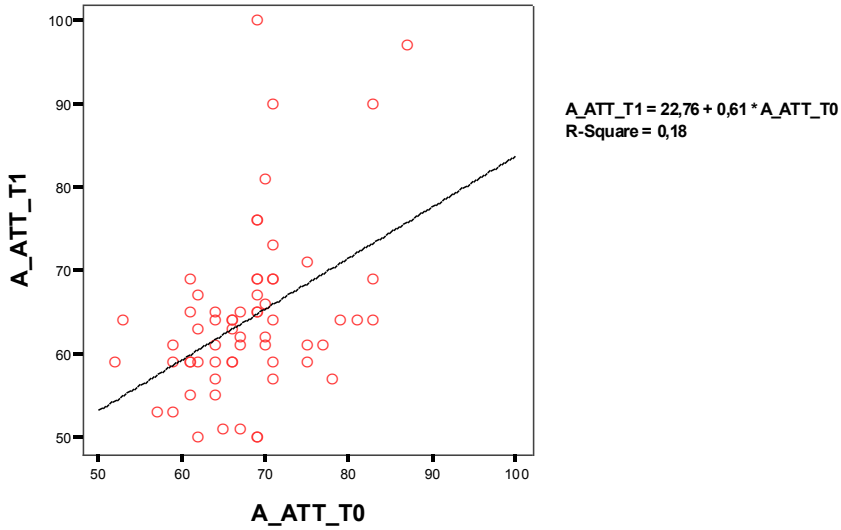

Figure 4.4 Relation between T-scores at T0 and T-scores at T1 on *Attention Problems scale*. Linear regression is reported in the plot.
Note. A_ATT = Achenbach_*Attention Problems scale*; T0 = retrospective and epidemiological phase; T1 = base-line and experimental phase.

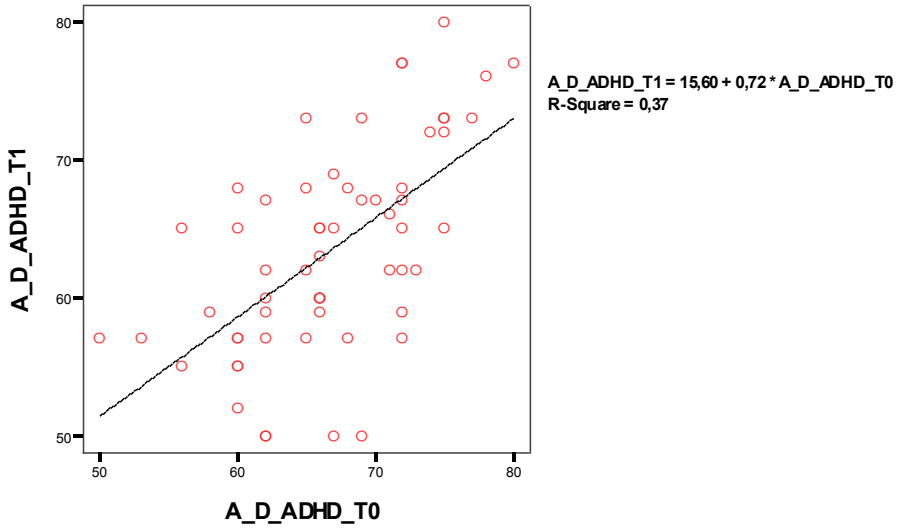

Figure 4.5 Relation between T-scores at T0 and T-scores at T1 on *Attention Deficit Hyperactivity Problems scale*. Linear regression is reported in the plot.
Note. A_D_ADHD = Achenbach_DSM-oriented_*Attention Deficit Hyperactivity Problems scale*; T0 = retrospective and epidemiological phase; T1 = base-line and experimental phase.

No significant correlation was found among T-scores on CBCL scales and scores on cognitive and linguistic tests at T1 (see Table 4.3). The same results were confirmed by performing a series of correlations among T-scores on CBCL scales at T0 and scores on cognitive and linguistic tests at T1, with the exceptions of three statistically significant correlations: in this case, the *Total*, *Internalizing*, and *Attention Problems* scales correlate negatively with *Digit Span* test from WISC-III/WAIS-R (respectively, $r = - 0.310$, $p < .05$; $r = - 0.352$, $p < .01$; $r = - 0.308$, $p < .05$).

Table 4.3 Absent correlations among T-scores on CBCL scales and scores on cognitive and linguistic tests at T1.

		CSS_T1	CSP_T1	CLP_T1	CEP_T1	VOC_T1	BLD_T1	DS_T1
A_ATT_T1	*r*	0.041	-0.009	-0.058	-0.059	0.085	0.082	-0.177
	Sig. (2-t)	.774	.951	.689	.685	.544	.558	.204
	N	51	50	50	50	53	53	53
A_INT_T1	*r*	0.024	-0.092	-0.162	0.030	-0.156	-0.055	-0.168
	Sig. (2-t)	.866	.524	.261	.835	.266	.698	.228
	N	51	50	50	50	53	53	53
A_EXT_T1	*r*	-0.041	-0.064	0.078	-0.090	-0.114	-0.040	-0.099
	Sig. (2-t)	.777	.658	.591	.533	.417	.779	.482
	N	51	50	50	50	53	53	53
A_TOT_T1	*r*	0.017	-0.083	-0.061	-0.095	-0.088	-0.014	-0.226
	Sig. (2-t)	.904	.568	.674	.509	.529	.921	.104
	N	51	50	50	50	53	53	53
A_D_ADHD_T1	*r*	-0.017	-0.122	-0.037	-0.059	-0.055	-0.020	-0.174
	Sig. (2-t)	.908	.400	.796	.684	.694	.889	.214
	N	51	50	50	50	53	53	53

Note: A_D_ADHD = Achenbach_DSM-oriented_*Attention Deficit Hyperactivity Problems scale*; A_ATT = Achenbach_*Attention Problems scale*; A_EXT = Achenbach_*Externalizing scale*; A_INT = Achenbach_*Internalizing scale*; A_TOT = Achenbach_*Total Problems scale*; BLD = *Block Design* test; CEP = *Test of Emotional Prosody Comprehension*; CLP = *Test of Linguistic Prosody Comprehension*; CSP = *Test of Sayings and Proverbs Comprehension*; CSS = *Test of Syntactic Structures Comprehension*; DS = *Digit Span* test; N = Number of available participants; *r* = Pearson correlation; Sig. (2-t) = Significant (2-tailed); T1 = base-line and experimental phase; VOC = *Vocabulary* test.

As shown in Table 4.4, a significant correlation ($r = 0.566$, $p < .01$) emerged between scores on *Full Scale-IQ* at T0 and those on *Estimated-IQ* at T1 (see Figure 4.6).

Table 4.4 Correlations among scores on cognitive and linguistic tests.

		F-IQ_T0	CSS_T1	CSP_T1	CLP_T1	CEP_T1	VOC_T1	BLD_T1	DS_T1	E-IQ_T1
F-IQ_T0	*r*		0.258	0.343(*)	0.270	0.220	0.500(**)	0.430(**)	0.336(*)	0.566(**)
	Sig. (2-t)		.064	.014	.055	.122	.000	.001	.014	.000
	N		52	51	51	51	53	53	53	53
CSS_T1	*r*			0.334(*)	0.475(**)	0.444(**)	0.287(*)	0.312(*)	0.398(**)	0.367(**)
	Sig. (2-t)			.016	.000	.001	.037	.023	.003	.007
	N			52	52	52	53	53	53	53
CSP_T1	*r*				0.290(*)	0.034	0.255	0.276(*)	0.384(**)	0.325(*)
	Sig. (2-t)				.037	.809	.068	.048	.005	.019
	N				52	52	52	52	52	52
CLP_T1	*r*					0.452(**)	0.297(*)	0.203	0.192	0.298(*)
	Sig. (2-t)					.001	.032	.149	.172	.032
	N					52	52	52	52	52
CEP_T1	*r*						0.169	-0.027	0.278(*)	0.072
	Sig. (2-t)						.232	.851	.046	.614
	N						52	52	52	52
VOC_T1	*r*							0.364(**)	0.129	0.786(**)
	Sig. (2-t)							.006	.348	.000
	N							55	55	55
BLD_T1	*r*								0.224	0.862(**)
	Sig. (2-t)								.101	.000
	N								55	55
DS_T1	*r*									0.219
	Sig. (2-t)									.109
	N									55

Note: BLD = *Block Design* test; CEP = *Test of Emotional Prosody Comprehension*; CLP = *Test of Linguistic Prosody Comprehension*; CSP = *Test of Sayings and Proverbs Comprehension*; CSS = *Test of Syntactic Structures Comprehension*; DS = *Digit Span* test; E- = *Estimated*; F- = *Full Scale*; IQ = *Intelligence Quotient*; N = Number of available participants; *r* = Pearson correlation; Sig. (2-t) = Significant (2-tailed); T0 = retrospective and epidemiological phase; T1 = base-line and experimental phase; VOC = *Vocabulary* test. **: correlation is significant at the .01 level. *: correlation is significant at the .05 level.

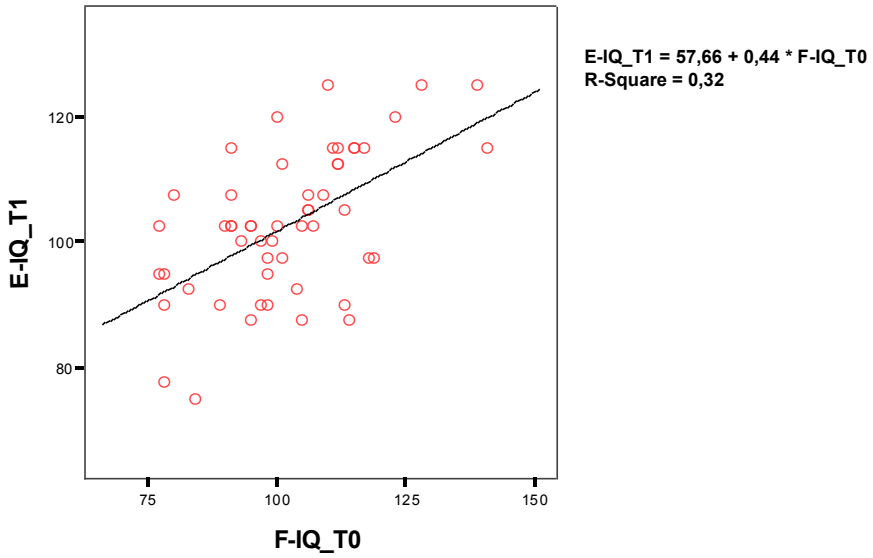

Figure 4.6 Relation between scores on *Full Scale-IQ* at T0 and those on *Estimated-IQ* at T1. Linear regression is reported in the plot.
Note. E- = *Estimated*; F- = *Full Scale*; IQ = *Intelligence Quotient*; T0 = retrospective and epidemiological phase; T1 = base-line and experimental phase.

Table 4.4 shows significant internal correlations among tests from the same cognitive or linguistic battery. The *Test of Syntactic Structures Comprehension* correlates significantly with *Vocabulary* (r = 0.287, $p < .05$), *Block Design* (r = 0.312, $p < .05$) and *Digit Span* (r = 0.398, $p < .01$) tests from WISC-III/WAIS-R. Moreover, the *Test of Sayings and Proverbs Comprehension* correlates significantly with *Block Design* (r = 0.276, $p < .05$) and *Digit Span* (r = 0.384, $p < .01$) tests.

4.5 Discussion

According to my results, children with high scores on total and attentive scales at referral might maintain these problems even at a distance of years (average time between the two CBCL assessments = 5.5 years; SD = 1.59). Nevertheless, the group of adolescents was characterized by a wide diagnosis variability: forty-one participants had other comorbid diagnoses at referral (i.e., learning and specific language disorders, mood, anxiety, conduct, and emotional disorders). Then,

adolescents might have received some form of rehabilitation or psychological support after five years from the first evaluation. Some symptoms associated with ADHD disorder might be attenuated or resulted in symptoms of different origin. The possible and subsequent confirmation of ADHD diagnoses through DAWBA interviews will allow our research group to collect a detailed cluster of data based on multiple sources of information (children/adolescents and parents). Moreover, we will be able to monitor the ADHD evolution and association with other disorders.

No significant correlation was found between scores on CBCL scales and scores on linguistic tests proposed, probably because most adolescents were over linguistic battery threshold age and some linguistic competencies were acquired. It's interesting to note that the syntactic and proverbs comprehension tests from BVL_4-12 correlated significantly with tests from WISC-III/WAIS-R, especially *Digit Span* test. This task is used to measure working memory number storage capacity. Verbal working memory is involved in many everyday tasks, from remembering telephone numbers to understanding long and difficult sentences. The *Test of Syntactic Structures Comprehension* requires children to listen carefully target sentences uttered by the examiner and choose pictures corresponding to them. In this test complexity is increasing depending on different kinds of sentences (relative, reflexive, negative, passive, etc.). Attentive and mnestic skills are probably involved in this task such as in the *Test of Sayings and Proverbs Comprehension*, involving the ability of interpreting and using figurative language. In this case too, children listen to target sentences uttered by the examiner but choose the correct meaning among the three presented for each sentence.

On the other side, significant correlations were found between T-scores on three CBCL scales at T0 (*Total*, *Internalizing* and *Attention Problems* scales) and *Digit Span* test at T1. These correlations do not remain at a distance of years, probably because in the transition from childhood to adolescence some ADHD symptoms may decrease in intensity.

4.6 Conclusions and future developments

The longitudinal study described in this chapter is in progress and new data will be collected over the time. In the future it will be interesting to link behavioural-

emotional profiles with genetic and morphofunctional studies. Performances of children/adolescents with ADHD will be compared with those of peers with typical development, matched for age and sex.

I hope to be still a member of this research group to go on in such an ambitious project because, owing to the long time requested for stories transcriptions and evaluations, I could not analyze yet narrative competences and pragmatic skills in adolescents with ADHD we examined.

My participation in GENESIS/CABALA project has represented a challenge against my previous idea of research field. As a psychodinamic psychologist and psychotherapist, I had difficulties in linking clinics and research. On the contrary, now I believe that there is no research without clinics and no clinics without research. I agree with José Bleger, psychiatrist and psychoanalist, who already in 1964 said that observation, hypothesis and check are processes used by both clinicians and researchers (Bleger, 2011). « Research » can be considered as a mental state shared by both professionists.

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