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Self-Regulation, Dysregulation, Emotion Regulation and Their Impact on Cognitive and Socio-Emotional Abilities in Children and Adolescents with Autism Spectrum Disorders

Nader-Grosbois Nathalie
Catholic University of Louvain
Belgium

1. Introduction

The literature about typically developing children describes the development of models and the results of empirical studies focusing on self-regulation, emotion regulation and co-regulation during interactions with adults or peers. By contrast, it is only in the last decade that these processes have been examined in atypical children, including children with ASD. Infantile autism is a pervasive developmental disorder characterized by disturbances concerning not only the areas of socialization and communication but also the ability to modify and change behaviour. In recent studies on children with ASD, in order to better understand their deficits in cognitive and social activities, the specificities of their ability or inability to manage and regulate their own behaviour and emotions have been considered. Before the appearance of conceptual models and studies on regulation processes in children with ASD, several models of their deficits or specificities in the mobilization of their executive functions had previously been developed; these models cannot be ignored for the understanding of new conceptions of regulation.

This chapter focuses on the impact of specificities of executive functioning, self-regulation and dysregulation on cognitive and socio-emotional abilities in children and adolescents with autism spectrum disorders (ASD). Firstly, we define self-regulation and emotion regulation and explain briefly how these processes develop during typical childhood, and what factors play a role in this evolution. This may help to identify more accurately the differences that appear in children with ASD. Secondly, we present several conceptual models of executive function and regulation in children with ASD, in order to approach their atypical micro-genetic functioning and macro-genetic development, as well as some empirical studies that have confirmed these models. The impact of deficits of self-regulation and dysregulation on their functional abilities and on their development in different areas is highlighted. In particular, we point to the specificities of children with ASD in the area of emotion regulation. On the basis of this literature, we propose an integrative model of functioning and development of children with ASD. Finally, we suggest some perspectives for future research and we give guidelines for assessment and intervention.

2. Self-regulation, emotion regulation and executive functions: definitions

Particularly over the last two decades, self-regulation has often been studied in typically developing people, generating a range of conceptions and methodological approaches in the areas of developmental psychology, learning psychology and cognitive education (Bandura, 1997; Boekaerts, 1999; Boekaerts et al., 2000; Bronson, 2000; Vygotsky, 1978; Zimmerman, 2000). Self-regulation uses executive functions, which are neuropsychological processes that permit the physical, emotional and social self-control necessary to maintain goal oriented-actions; they include inhibition of responses, working memory, shifting attention, cognitive flexibility, planning of actions and fluency (Corbett et al., 2009; Motttron, 2004; Ozonoff et al., 1991; Rajendran & Mitchell, 2007; Russell, 1997).

On the basis of a review of literature generated by various theories of self-regulation in the areas of developmental psychology, learning psychology and cognitive education, an integrated model of self- and other-regulation has been developed (Nader-Grosbois, 2007a; Nader-Grosbois et al., 2008). This model approaches self-regulation as a dynamic process that mobilizes one's personal resources and resources in the material and social environment in order to solve various goal-oriented problems. It distinguishes seven self-regulated strategies in the learner (operationally described in a validated coding grid): identification of objective, planning or exploration of means, self-regulated attention, self-motivation, joint attention, behaviour regulation and self-evaluation; it also distinguishes seven corresponding other-regulation strategies that could be displayed by the partner or the adult. This other-regulation could be favourable or unfavourable to the development of self-regulation in children, depending on its adjustment (Nader-Grosbois et al., 2008).

In addition, emotion regulation corresponds to a set of processes by which an individual assesses, controls and modifies his or her spontaneous emotional responses in order to accomplish his or her goals or to express socially adequate emotional behaviour (Eisenberg et al., 2000, 2006, 2007; Gross & Thompson, 2007; Luminet, 2002; Mikolajczak et al., 2009; Nader-Grosbois, 2009; Thompson, 1994). According to these authors, by his or her manner of mentally conceiving an emotional situation, a person may modify the type of his or her emotional states and the duration of his or her emotional responses or their intensity: the regulation may amplify or inhibit emotional responses, using various strategies¹. Various levels of regulation come into the picture: emotions may act as regulators themselves, or they may be regulated or it could at any rate be desirable to regulate them in social interactions (Rimé, 2007). Emotion regulation is therefore regarded as an element in emotional intelligence², which plays a role in the construction of social intelligence (Salovey et al., 1993). Emotion regulation has implication for social communication, in which emotions have the function of organizing the relationships of individuals to their environment, and are the basis of socialization, and also of social sharing (Eisenberg et al., 2000, 2006; Rimé, 2007; Thompson, 1994). The regulation contributing to individuals'

¹In this instance, the person may select the situation (according to the probability of desirable or non desirable emotions); modify the situation (according to emotional impact); focus her attention only on particular aspects of the situation; operate a cognitive change about the meaning of this situation in order to appreciate her abilities to cope with it; and finally, regulate her emotional, behavioural, verbal and physiological responses (Eisenberg et al., 2006; Gross, 1998; Luminet, 2002).

²Emotional intelligence corresponds to the ability to control and differentiate between our own emotions and those of others, and to use these indications to guide our actions and thoughts.

adjustment to the environment activates internal and external processes responsible for supervising, assessing and modifying emotional reactions in the course of realization of goals (Brun & Mellier, 2004³; Thompson, 1994).

3. Self-regulation and emotion regulation in typically developing children

3.1 How does self-regulation develop in typically developing children?

The ability to identify objectives and to plan sequences of actions emerges when the child becomes capable of mental representation around the age of two years, and develops in later periods of life. In various contexts, even in daily scripts, the child aims at more and more complex goals; his or her planning becomes more systematic and varies depending on the requirements of the task (Bronson, 2000; Chang & Burns, 2005; Friedman & Scholnick, 1997; Gardner & Rogoff, 1990; Gauvain, 1999; Hudson & Fivush, 1991; Hudson et al., 1995; Nader-Grosbois, 2007a; Parrila et al., 1996; Prevost et al., 1995; Sethi et al., 2000; St-Laurent & Moss, 2002). Strengthened by the metacognitive awareness of the child's own cognitive process, self-regulated attention enables attention to the task to be controlled by removing distractions (Chang & Burns, 2005; Friedman & Scholnick, 1997; Zimmerman, 2000) and helps with planning (Parrila et al., 1996; Silverman & Ippolito, 1997). By identifying errors, the learner adjusts his or her actions, inhibits inadequate responses and initiates alternative strategies; he or she self-evaluates (Boekaerts, 1996; Nader-Grosbois, 2007a; Pintrich, 1999; Stipek et al., 1992; Wood & Wood, 1999; Zimmerman, 2000). Self-motivation guides the choice of goals, and implies the maintenance of a plan of action despite obstacles and required effort; the learner self-administers consequences for his or her behaviour, displays positive self-reinforcement, and experiences emotional reactions depending on the feeling of self-efficacy (Boekaerts, 1996; Chang & Burns, 2005; Nader-Grosbois, 2007a; Pintrich, 1999; Wolters, 2003; Zimmerman, 2000).

Moreover, the learner may adapt conditions in the learning environment (Zimmerman, 2000). Depending on his or her difficulty in solving tasks, the learner mobilizes the social environment, through communicated requests. He or she regulates the partner's behaviour by requesting help or a demonstration, or by seeking approval for his or her actions; he or she initiates referential joint attention toward the partner (Bandura, 1997; DeCooke & Brownell, 1999; De la Ossa & Gauvain, 2001; Nader-Grosbois, 2007a; Puustinen, 1998; Stipek et al., 1992; Szepkouski et al., 1994; Wood & Wood, 1999; Zimmerman, 2000).

According to Perry (1998), several conditions help the development of self-regulated learning strategies in children: challenges in complex meaningful tasks, the possible modification of the task and of assessment criteria in order to obtain an optimal challenge, potential support from others, and opportunities for self-evaluation. In empirical studies, the most frequent contexts used for studying self-regulation have been: planning of daily tasks (Hudson & Fivush, 1991; Hudson et al., 1995) or of itinerary (Nader-Grosbois &

³Brun and Mellier (2004) conceived an evolution of three types of emotion regulation. First, "intra-personal regulation" includes vigilance, regulation of stress and the application of emotional representations. Second, "inter-individual regulation in imaginary situations" refers to the recognition of facial expressions, evocation, identification of mental states and the understanding of emotional terms; it reflects the child's level of emotional knowledge. Third, "interpersonal regulation in interactive situations" concerns emotional language, shared and joint attention, empathy and looking for social references on other people's faces.

Vieillevoeye, 2011; St-Laurent & Moss, 2002), Tower of Hanoi (Klahr & Robinson, 1981; Welsh, 1991), labyrinths (Gardner & Rogoff, 1990), problem-solving or learning situations (De la Ossa & Gauvain, 2001; Nader-Grosbois & Thomée, 2007; Nader-Grosbois & Lefèvre, 2011; Puustinen, 1998; Winnykamen, 1993), computer tasks (Chang & Burns, 2005; Nader-Grosbois et al., 2008; Nader-Grosbois & Lefèvre, 2011) or standardized assessment situations of cognitive functioning (Nader-Grosbois, 2007b, 2007c) and various situations of pretend play in dyads of peers (Nader-Grosbois & Vieillevoeye, 2011; Vieillevoeye & Nader-Grosbois, 2008). Some of these empirical studies have shown inter-situational variability of self-regulation and of mobilization of specific self-regulatory strategies, not only in typically developing children, but also in children or adolescents with intellectual disability (see Nader-Grosbois & Lefèvre, 2011; Nader-Grosbois & Vieillevoeye, 2011; Vieillevoeye & Nader-Grosbois, 2008).

In addition, a child's self-regulation may help to increase his or her level of mastery of the task (Wolters, 1999). Some self-regulated strategies are more efficient in specific contexts: notably goal-oriented planning, sustained by proper self-attention and by the control of on-going actions and results (Bauer et al., 1999; Cuskelly et al., 1998; Focant et al., 2006; Gauvain & Rogoff, 1989; Gilmore et al., 2003; Parrila et al., 1996; Pintrich, 2000). Moreover, fewer requests for help by a child during a teaching session were predictive of good performance (Wood & Wood, 1999). Higher achievers easily identify when they need help from the adult, and in this way the child-adult dyad may function at the upper bounds of the child's zone of proximal development (as observed by Nader-Grosbois et al., 2008; Puustinen, 1998; Winnykamen, 1993; Wood & Wood, 1999).

3.2 How does emotion regulation develop in typically developing children?

3.2.1 Evolution of strategies of emotion regulation

In typically developing babies, the emotions are expressed in early social interactions by means of various cues that induce reactions from the caregivers. They produce more and more differentiated expressions of emotions, such as interest, disgust, joy, sadness, anger and fear, which are recognizable to those around them (Harris et al., 1989; Haynie & Lamb, 1995; Izard & Malatesta, 1987; Lewis & Sullivan, 1996). From early infancy, they respond to emotions in their interactions with others. At the beginning of the second year of life, they become able to express "social emotions" such as empathy (Lewis et al., 1989). During the first three years of life, infants increase their expressiveness of emotions and they begin to verbally express their emotional states (Harris et al., 1989; Malatesta-Magai et al., 1994).

From the age of 3 years, the child starts to modify the intensity of her or his emotional expression depending on the situation, in conformity to social rules (Cole et al., 2009; Nader-Grosbois & Baurain, 2011; Saarni, 1999). From preschool age, children intentionally control their emotional expressions, in order to induce a false belief in their partner (Perron & Gosselin, 2004) or in order to avoid hurting others' sensibility or to protect their own feelings (Saarni, 1999). Although children develop skills to express their emotions, the imperatives of social life imply that they learn to dissimulate, control their own emotional states and regulate their expressive behaviour in particular contexts; children begin to distinguish between real and apparent emotions at 3 to 4 years old, and the dissimulation of emotions develops particularly from 6 to 10 years old (Banerjee, 1997; Gosselin, 2005; Harris et al., 1989; Nader-Grosbois & Baurain, 2011; Perron & Gosselin, 2004; Sissons Joshi & McLean, 1994; Zeman et al., 2006).

By the end of the preschool period, when the child feels negative emotions, he or she is able to use diverse strategies of emotion regulation: to regulate the expression of emotions, to comfort himself or herself, to self-distract by redirecting his or her attention away from whatever is causing him or her stress or engage in some other activity, to manage his or her frustration, to inhibit emotional behaviours which are socially inappropriate, to postpone a waiting, to approach or withdraw from situations, to stay organized when he or she faced with powerful emotional events, or to negotiate with others (Denham et al., 2002; Dennis & Kelemen, 2009; Macklem, 2008; Stansbury & Sigman, 2000).

The development of emotion regulation has a potential role in social interactions between preschoolers and in the evolution of their social competence (Cole et al., 2004; Dennis, 2006; Dennis et al., 2009a-b; Eisenberg et al., 1995, 1997a-b, 2006; Eisenberg & Spinrad, 2004; Fabes et al., 1999; Nader-Grosbois & Baurain, 2011; Rieder et al., 2007; Spinrad et al., 2006). In other words, the children's abilities to regulate and control their emotional and behavioural responses could help them to have good interactions with peers, and could contribute to social adjustment, including in school (Eisenberg et al., 1995, 1997a-b; Fabes et al., 1999). Emotion regulation comprises intra-individual processes related to cognitive and control processes (Dumas & Lebeau, 1998; Harris et al. 1989; Stein et al., 1993) and inter-individual social processes (Campos et al., 1989; Eisenberg & Fabes, 1992; Eisenberg et al., 1997a-b, 2000; Walden & Smith, 1997), both of which play a basic role in the stable development of social competence during preschool and school age (Sallquist et al., 2009).

3.2.2 What are the factors in the development of emotion regulation?

First, social interactions with peers offer children opportunities to exercise their emotion regulation; emotional and behavioural responses from peers should provide them with feedback on their own abilities (Bronson, 2000; Dunn, 2003; Nader-Grosbois & Baurain, 2011; Parker & Asher, 1987). The less they regulate their emotions, the more they have difficulties in establishing relationships with peers (Eisenberg & Fabes, 1995a; Eisenberg et al., 1997a), the more they focus on themselves, the less they are empathic toward others' distress (Eisenberg et al., 1998a) and more they display poor social abilities, in the form of intensely externalized or stressed behaviours (Fabes et al., 1999). Depending on the interactive context, emotion regulation in preschoolers could potentially vary, in order for their emotions to be adequately adjusted. For example, during cooperative play between peers, children display exchanges, are emotionally expressive and positive, or are particularly engaged towards their partner and express joy (Gottman, 1986; Herbé et al., 2007).

Second, through social referencing behaviour and socio-cognitive development, the child acquires an understanding of emotions (causes and consequences), ToM emotions, and a knowledge of social rules that allows him or her to determine which emotion should be expressed when, towards whom and in what circumstance. Social abilities in children are linked with their skills at expressing and recognizing emotions and at understanding others' emotions and intentions (Denham & Burton, 2003; Dodge et al., 1986; Fabes et al., 1999; Nader-Grosbois, 2011). Effectively, the understanding of emotions should favour emotion regulation by the child, because the identification of his or her feelings and emotions becomes conscious; this consciousness allows him or her to link his or her emotions with events and helps him or her to regulation his or her emotions appropriately (Denham & Burton, 2003; Gottman et al., 1997; Liew et al., 2004). The understanding of emotions is a

mediator in the link between emotion regulation and social adjustment (Izard et al., 1999, 2000; Lindsey & Colwell, 2003). Conversely, the level of regulation in preschoolers predicts their understanding of emotions (Schultz et al., 2001).

Third, among cognitive processes that could support emotion regulation, we would draw attention to executive functions allowing inhibition, planning and persistence. Although theoretically and in the definition of emotion regulation, the link between executive functioning and emotion regulation is present, most empirical studies examine them separately. In the model of Zelazo and Cunningham (2007), emotion corresponds to a motivational aspect of cognition in goal-oriented problem-solving, and emotion regulation may be primary or secondary, but is always at least partially linked with executive functioning. In problem-solving in daily life, emotion regulation is considered as secondary in relation to executive functioning, in sustaining motivation or self-control in order to persevere or to suppress frustration. By contrast, in other situations, the problem that needs to be solved is disturbing for the child, who must remain calm; in this case, emotion regulation is considered as primary if it is linked to executive functioning throughout the goal-oriented behaviour. In this model, reciprocal relations are postulated, since the two processes influence each other in variable ways depending on the type of problem to be solved. Empirical studies need to be conducted in order to improve our knowledge of this subject, in the same vein as some recent studies. Carlson and Wang (2007) observed in 3- to 5-year old children a positive link between the development of inhibition controlling attention and motor responses and emotion regulation (even when age and verbal abilities were controlled for), whatever the expression of positive or negative emotions. By means of a battery of direct tests administered to 7- to 8-years old children and of reported assessments by parents and teachers, Garcia-Andres et al. (2010) found that socially popular children obtained better scores in both emotion regulation and executive functioning than socially rejected children. Lengua (2002) reported that emotionality and self-regulation (sustained by executive functioning) predicted social adjustment in children: negative emotionality predicted problems in adjustment and positive emotionality predicted positive adjustment; moreover, self-regulation both predicted and moderated the effect of multiple risks of vulnerability *versus* resiliency.

Fourth, the child's language also helps him or her to understand his or her emotions, to self-regulate, to learn adequate manners, to manage his or her emotions and to regulate them. However, its role varies depending on the period of infancy and childhood (before three years, from three to six years, and of school age) (Eisenberg et al., 2005). Empirical studies highlighted that preschoolers' language abilities were positively linked with their ability to distract themselves in frustrating situations (Stansbury & Zimmerman, 1999) and a specific impairment in language was associated with difficulties in emotion regulation (Fujiki et al., 2002⁴, 2004⁵).

Fifth, pretend play offers opportunities to experience emotional and social situations, to control negative emotions, to solve conflicts and to negotiate rules with partners (Fantuzzo et al., 2004; Howes et al., 1992; Lemche et al., 2003). In their study, Galyer and Evans (2001)

⁴ Children with specific language impairment (aged from 6 to 9 years and from 10 to 13 years) had significantly lower levels of emotion regulation than typically developing children.

⁵ Emotion regulation and level of language skills in children with specific language impairment (aged from 5 to 8 years and from 9 to 12 years) were significant predictors of their reticence as measured by their teachers.

found that the level of involvement in pretend play by preschoolers with their parents was positively linked with their capacity for emotion regulation. Lindsey and Colwell (2003) reported that girls who engaged in a high level of pretend play regulated their emotions better, according to their mothers.

Sixth, family or parental factors could also have an impact on the child's emotion regulation. The parents contribute to the socialization of their child's emotion regulation by means of supportive strategies, displayed through verbal and non-verbal behaviours in response to the child's emotions, including distress. The parents may facilitate emotion regulation in their distressed child by means of supportive strategies, by encouraging him or her to turn his or her attention away from the sources of distress, or by comforting him or her; conversely, the parents may display non-supportive strategies⁶ such as punitive attitudes, minimization or expression of anger, that impede emotion regulation in the child and consequently, increase his or her distress (Calkins & Johnson, 1998; Calkins et al., 1998; Daffe & Nader-Grosbois, 2011; Davidov & Grusec, 2006; Mirabile et al., 2009; Scaramella & Leve, 2004; Thompson & Meyer, 2007).

3.2.3 How can emotion regulation be assessed in children?

Several studies concerning the process of emotion regulation have used questionnaires⁷ completed by parents and/or teachers of typically developing children of preschool or school age (Contreras et al., 2000; Eisenberg et al., 1995b, 1997a-b, 2000a-b, 2001a; Eisenberg et al., 1996b; Guthrie et al., 1997; Rydell et al., 2003). Some other studies have analyzed direct observations⁸ of typically developing children of preschool or school age (Cole et al., 2009; Dennis, 2006; Dennis et al., 2009a; Eisenberg et al., 1997a-b, 2000a-b, 2001a; Spinrad et al., 2006).

A review of instruments used (for details, see Baurain & Nader-Grosbois, 2011, in press) has emphasized the variety of components and types of behaviour taken into account by researchers interested in emotion regulation, as well as the lack of instruments enabling nuanced observations of young children in various contexts. The authors have pointed out that there were good reasons to work out a methodological design⁹ allowing the observation

⁶ For example, Spinrad et al. (2004) found that maternal questioning of the child's emotions was related to his or her lack of self-regulation skills during a disappointment task.

⁷ Emotion Regulation Checklist (ERC, Shields & Cicchetti, 1997), Emotional Regulation Rating Scale (ERRS, Carlson & Wang, 2007), Emotion Regulation Subscale of the Social Competence Scale (Conduct Problems Prevention Research Group, 1999).

⁸ Children on their own confronted with tasks inducing frustration or disappointment, or requiring persistence or the simulation of positive emotions; dyads of children occupied in cooperative or competitive play; or a child playing with an adult (parent or examiner) and being confronted with situations inducing distress. The coding is performed by macro-analysis or by micro-analysis of behaviours involving positive or negative emotional expressions, verbal and non-verbal behaviours reflecting cues of emotion regulation; or strategies of emotion regulation.

⁹ To this end, Baurain and Nader-Grosbois (2007, 2011, in press) have designed a coding grid for observations, featuring the distinct categories of behaviour identified in the literature. These categories are as follows: (1) the child's behaviour with respect to social rules; (2) the child's social behaviour while playing (prosocial behaviour, behaviour showing respect for the task); (3) emotional expressions (positive and negative; joy, anger, sadness, fear) by the child while playing, and adaptation of emotion; (4) consciousness of the felt emotion and evocation at the end of game. These categories were also constructed according to the types of situations and interactive contexts in which the children could be

of the variability of emotion regulation in interactive contexts (cooperative, competitive and neutral) in typically developing children and in atypical children, in order to allow future comparative studies to be performed.

4. Self-regulation, dysregulation and emotion regulation in children and adolescents with autism spectrum disorders (ASD)

Few studies have examined the variability of self-regulation in people with ASD or other developmental disorders, depending on contextual and environmental factors and on their individual characteristics, although such studies could generate guidelines for improving interventions oriented towards the development of their self-regulated learning. Several theories and hypotheses have been developed about people with ASD to explain deficits in executive functioning, self-regulation, emotion regulation or dysregulation and their impacts on cognition, emotional abilities or social cognition, including theory of mind.

4.1 Executive control dysfunction

According to the “executive control dysfunction” hypothesis, a deficit in their executive control system¹⁰ generates a set of problems in people with ASD, including lack of flexibility in behaviour, disorders in inhibition, difficulties to postpone immediate goals, deficits in planning, in strategy selection, in shifting attention (Corbett et al., 2009; Griffith et al., 1999; Hugues et al., 1994; Joseph et al., 2005; Mc Evoy et al., 1993; Mottron, 2004; Ozonoff et al., 1991; Ozonoff, 1997; Russell, 1997; Turner, 1997¹¹); they could create obstacles in several areas of development (notably in cognitive domains, such as pretend play¹², or in communicative domains, such as joint attention¹³) and in the construction of social cognition, including the development of theory of mind (ToM)¹⁴.

observed during the “Dyadic Game of Socio-Emotional Problem-Solving”. This game aims to make children engage in socio-emotional problem-solving (by means of 13 challenges) in different interactive climates in order to observe and analyze their behaviour in a direct way. This game is designed like a Snakes and Ladders game, but presents socio-emotional situations and problems, illustrated by pictures, that are situated along four possible courses drawn on a plate. The purpose of the game is to resolve several problems in order to reach the end of a course (represented by a star), by engaging in an interactive climate which varies according to the context: neutral (the child plays only with an adult), or competitive and cooperative (the child plays with another child-partner). This game was designed in order to assess two aspects: (1) performance in socio-emotional problem-solving; (2) variation of socio-emotional regulation depending on the interactive context, assessed by means of the “coding grid of socio-emotional regulation” (applied by viewing videos of the children’s performance in the game).

¹⁰ For a review, see Hill (2004).

¹¹ Turner (1997) explained that the repetitive behaviours of people with ASD are a consequence of their difficulties with generating alternative actions, managing their attention, and monitoring their own actions, particularly in new situations; their executive dysfunction could make them less flexible, slow in their activity or too impulsive.

¹² In an empirical study, Jarrold (1997) emphasized that during pretend play, children with ASD encountered difficulties in goal selection and in executive control, notably inhibition of dominant response.

¹³ For example, there is a link between joint attention and set-shifting (Stahl & Pry, 2002).

¹⁴ For a review of emotional competences in children with ASD, see Begeer et al. (2008). Specifically for a review of emotional cognition, theory of mind and specificities of face recognition in children with ASD, see Nader-Grosbois and Day (2011).

Russell (1997) suggests that early dysfunction in the action-monitoring system and in developmental features of executive functioning, and memory problems, have an impact in children with ASD in terms of their self-awareness, their development of knowledge regarding their own actions, their regulation through inner speech, and their imitation of others' actions, as well as their understanding of others' intentions and minds.

Some researchers argue that executive abilities may be linked with ToM; conversely, others suggest that executive abilities are needed for ToM. There is a debate as to whether ToM tasks can be reduced to executive processes (e.g. Russell, 1997; Russell et al., 1991; Russell & Hill, 2001; Russell et al., 2003; Pellicano, 2007) or whether ToM is required for executive control (e.g. Perner et al., 2002).

A study led by Fischer and Happé (2005) compared three groups of children with ASD: ten who received training in ToM beliefs (using "photos in the head"); ten who were trained in set-shifting using cards; and seven children in a control group who received no intervention. Both types of individual training (25 minutes per day, for five to ten days) led to an improvement in ToM skills based on beliefs.

The link between executive functions and ToM was examined by Pellicano (2007) in thirty children with ASD (5 to 6 years old) and in forty typically developing children, matched for chronological age, in order to examine issues of developmental primacy. These children were assessed by means of a battery of tasks measuring ToM (first- and second-order false belief tasks) and components of executive functioning (planning, set shifting, inhibition). A significant correlation was obtained between ToM and executive function components in the ASD group, independent of age and ability, while ToM and higher-order planning ability remained significantly linked in the typically developing group. Examination of the relational pattern of ToM executive functioning impairments in the ASD group showed dissociations in only one direction: impaired ToM with intact executive functioning. Even if these results support the view that executive functioning may be an important factor in the acquisition of ToM in children with ASD, it is not enough on its own to explain their difficulties with ToM. In their studies, Pellicano and his colleagues (2007; Pellicano et al., 2006) showed that as children with ASD present differentiated executive profiles in taking into account several processes (assessed by means of a set of tasks), it could implicate specific links between their particular executive (dys)functions and their particular (dis)abilities in ToM.

This hypothesis of dysfunction in executive control may help to explain several features in cognitive strategies and behaviour in people with ASD. However there is variability in their executive function profiles, and certain executive problems are not specific to them, but are shared by people presenting other disorders (Rajendran & Mitchell, 2007).

4.2 Cognitive complexity and control theory

In the "Cognitive complexity and control theory" (CCC, Frye et al., 1995; Zelazo & Frye, 1997; Zelazo et al., 2001, 2002), executive functioning is related to ToM in typically developing children and atypical people because both ToM and measures of executive functions include higher-order rule use (leading to a correct judgement in belief tasks, for example). Three main arguments are advanced by Zelazo et al. (2001) in favour of the potential utility of the CCC approach in order to understand people with developmental disorders. First, they argue that each developmental disorder may have an impact on consciousness, control of behaviour and rule complexity, and that researchers should not

overlook the fact that a large proportion of people with ASD in particular are intellectually impaired. This intellectual deficit may interact with other inabilities to account for various findings observed in studies of both their executive functioning and their ToM development. Second, they suggest that the CCC conception makes it possible to identify, in people presenting distinct disorders (including ASD), what the specificities are in particular components of executive functions and in ToM. Third, the CCC approach enables participants' performance to be observed in various tasks from different domains, in order to assess the specificity in each developmental disorder. Some empirical studies support the CCC conception. In their study of children with ASD and with Down syndrome, Zelazo et al. (2002) reported that individual differences in ToM are correlated with individual differences in performance in two tests of rule use, except in children with ASD who present a severe intellectual deficit (VIQ <40). This study was replicated by Colvert, Cusack, and Swettenham (2002) with other samples, in which children with high functioning ASD were compared with two typically developing groups.

4.3 "The development of autism: a self-regulatory perspective"

In his model "the development of autism: a self-regulatory perspective", Whitman, (2004) emphasized the essential role of self-regulation in several processes of development and functioning in children with autism, including sensory, motor, cognitive, emotional, communicative and social processes. Whitman (2004, pp.153-164) explains several characteristics of this dynamic model. It corresponds to a multivariate theory that takes into account multiple factors to understand the development of autism in its various manifestations. It is based on the triad of symptoms of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) (deficits in social interaction, in communication and language, stereotypical responses) and on symptoms described in several specific theories about their specificities in all areas of development. As shown in Fig. 1, the self-regulatory construct refers to adaptive and maladaptive coping processes of various natures: motor¹⁵, cognitive¹⁶, linguistic¹⁷, and social¹⁸. Each of these processes may be considered either directly or indirectly as a "cause" that could influence other processes (primarily, secondarily or minimally) and it could constitute a complex system or chain of causal factors in the emergence of symptomatology of autism (see Fig. 1. inspired by the diagram in Whitman, 2004, p.156). The changes in each process over time involve a reorganization of this dynamic system. All these constructs are considered at either a psychobehavioural level

¹⁵ Repetitive stereotypic movements, such as rocking, hand flapping, and head banging; poor motor imitation (Receveur et al., 2005); overall clumsiness (Ghaziuddin & Butler, 1998); and atypical gait (Hallett et al., 1993). Gepner and Mestre (2002) reported dissociation between the motor system and visual input of children with ASD: they are less reactive posturally to visually perceived environmental motion than typically developing children; their hyporeactivity to such visual input is linked with motor impairments.

¹⁶ Notably, deficits in attention (Allen & Courchesne, 2001) and in joint attention (Filipek et al., 2000; Maestro et al., 2002) were described in infants and in children. Their cognitive style is characterized by its extreme concreteness: they solve tasks requiring rote memory well but they have more difficulties in tasks requiring abstraction or higher-order conceptual processes (Filipek et al., 2000).

¹⁷ For example, their deficits in joint attention are linked to their later language deficits and to their difficulties in understanding and inferring others' states of mind (Phillips et al., 1992).

¹⁸ Ruble (2001) observed that they engage less frequently in goal-directed behaviours in social situations, and these behaviours are less self-initiated and simpler (than those of typically-developing children).

or a neurobiological level. Whitman indicated that it is possible to identify individual dynamic trajectories of development by applying this approach.

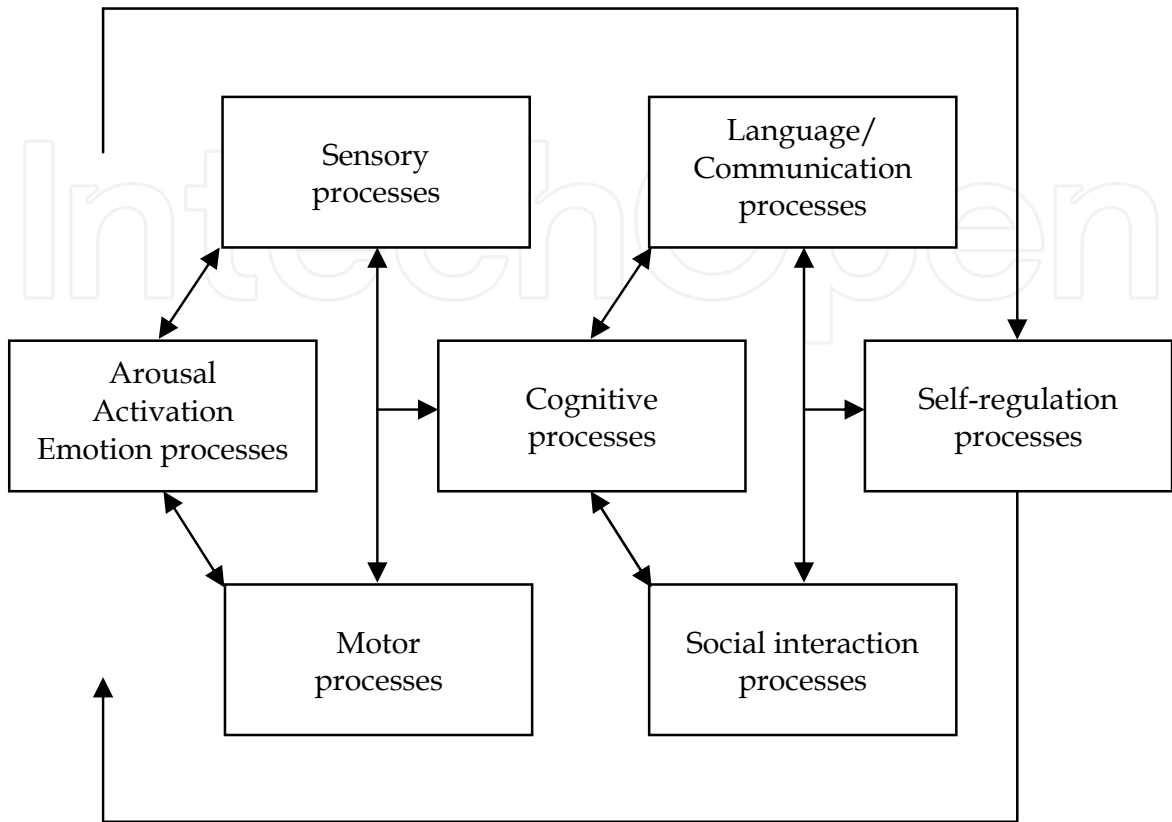


Fig. 1. Whitman’s model of self-regulation in the development of autism.

Whitman (2004, p.155) specifies: “although individuals with autism differ in their specific pattern of symptoms, they share in common an inability to self-regulate”. Observation of persons with ASD reveals that even if they are sometimes able to use some self-regulatory strategies, they mobilize these strategies with low efficiency or by means of unconventional behaviours.

More specifically, this author suggests that emotions and self-regulation must be taken into account in conjunction, because they can be either risk factors or protective factors in the social adjustment of children with ASD. He specifies that children with ASD may be vulnerable to stress if their arousal¹⁹ and state-regulation dysfunction, if their self-regulatory

¹⁹ Arousal is defined as a physiological state of readiness, an overall state of nervous excitation that could be influenced by the environment and by the individual’s perception of the environment. It is situated on a continuum from hypo-arousal (low excitation, associated with inattention, even sleepiness, apathy, indifference) to hyper-arousal (high excitation, associated with high distractibility, intensity of feelings). The middle of the continuum corresponds to moderate arousal with focused attention and alertness. On basis of the numerous findings on arousal-activation problems in individuals with ASD, Huebner and Dunn (2001) postulated that they have an inability to modulate or regulate arousal. According to them, hyper-arousal can be associated with avoidance or immobility. Paris (2000) also hypothesized that regarding abnormalities in their arousal, if over-stimulated, they display disorganized, impulsive or even inhibited responses as a consequence of avoidance or withdrawal. According to Whitman (2004, p.116), they could differ in the way they experience stimuli

system is poorly developed or if environmental stressors are too intense or prolonged. His theory also describes how the emotions in children with ASD indirectly influence the development of self-regulation through their impact on sensory, motor, social, cognitive, and language or communicative processes. Not only do these latter processes directly affect the development of self-regulatory behaviour (through the tools they provide for self-regulation), but self-regulation provides individuals with the capacity to control their emotions.

According to Whitman (2004, p.167), children with ASD could present different self-regulatory styles; in particular he refers to “over-controlling” and “under-controlling” styles. “Over-controlling” children are described as obsessive, self-protective, wary, socially withdrawn, uncomfortable with ambiguities, preferring a structured environment, and reactive to new situations. By contrast, “under-controlling” children do not develop complex form of self-regulation (such as planning or self-monitoring), ask for more social support and are impulsive, distractible and disturbed by unexpected events, and seek immediate gratification.

In order to integrate reciprocal influences between the neurobiological and psychobehavioural characteristics of children with ASD and the social and parental environment, Whitman (2004, p. 168-170) also proposes multiple bi-directional inter-relations between these factors. When parents are confronted with a child who displays peculiar and ambiguous behaviour (for example, behaviour that is hypersensitive, socially avoidant, communicatively and cognitively delayed or ritualistic), they have little insight into why he or she acts in this way and how they could help or support for him or her. This situation induces parental stress that could lead to assistance being sought. This author gives several guidelines for intervention with respect to children with ASD and their parents, in connection with his model, including support with self-regulation development. On basis of the theoretical model of Vygotsky (1978), Whitman suggests that the scaffolding provided by parents and social workers should induce engagement with challenging task; they should do this by adjusting their physical guidance, verbal prompting and modelling and reducing their other-regulation in order to allow the child to assume responsibility and learn to self-regulate. Gradual support and the encouragement of self-instruction in problem-solving help the child to acquire new cognitive and behavioural abilities to self-regulate.

4.4 The dysregulation model

Based on studies of autism in the fields of neurophysiology, neuropsychology and developmental psychopathology, Adrien’s model (1996, 2005) designates all deficits in regulation processes in autism using the concepts of “functional dysregulation” and “developmental dysregulation”. Adrien distinguishes between the micro-genesis of autistic children’s dysregulation that occurs in problem-solving contexts, during activities, and the macro-genesis of dysregulation that has an impact in various developmental domains. This model represents part of a similar approach to that of the model devised by Whitman.

and their intensity, in the way they react to stimuli, and in their sensitivity (hyper- or hypo-sensitive) and coping style (such as withdrawal). When variations in routines occur, negative emotional hyper-reactivity can be displayed; basic sensory stimuli (such as noise, smells, or light touch) can be emotional triggers. By contrast, hypo-responsiveness can be displayed in response to other stimuli, in particular social stimuli (such as one’s name being called, facial reactions, or praise, O’Neill & Jones, 1997; Volkmar & Pauls, 2003).

4.4.1 Functional dysregulation

In ASD, functional dysregulation could be explained by basic neurophysiological disorders such as cerebral modulatory insufficiency (Lelord, 1990), or by disorders with regard to sensory modulation (focusing on a stimulus, filtering its relevant information and processing overall stimulus information, Ornitz, 1985). Several empirical studies have shown that this deficient modulation is observed in the irregular morphology and amplitude of cortical responses to sound stimuli and in the unstable inter-modal “sound-light” association²⁰ recorded by means of cortical evoked potentials (Bruneau et al., 1999; Martineau et al., 1992a, 1992b). A link has been emphasized between a deficit in maintaining cross-modal associative responses and disturbances in regulatory behaviour: children with ASD who presenting the highest functional dysregulations, take few initiatives to play or to interact and do not finish their activities, have a deficiency in inter-modal cortical associations (Martineau et al., 1998). Difficulties in temporal cortical regions implicated in the regulation of auditory perception and vocal information processing are identified in children with ASD (Gomot et al., 2002; Khalfa et al., 2001; Zilbovicius et al., 2000).

Specifically, in problem-solving situations, five types of dysregulation²¹ of activity are distinguished by Adrien et al. (2001a): “breaking off” of action sequences; “perseveration” of some actions; “slowness” in the rhythm of activity; “variability” in levels of behaviour during the activity; and “lack of synchronization” between actions usually coordinated in a sequence of actions. These disorders may appear at three phases of activity: initiation (becoming involved in the activity by producing actions), maintenance (maintaining the initiated activity) and achievement (completion of the action sequence).

In cognitive activity such as object permanence tasks, children with ASD display a pervasive difficulty in maintenance, make more perseverative errors when the abstraction degree of task was higher (tasks at sensory-motor Piagetian stage VI, prevision of actions), and are more variable in their behavioural strategies (Adrien et al., 1995); they produce an incomplete and atypical sequence of actions in searching for an object hidden by a screen (Adrien, 2005). In symbolic play activities, functional dysregulation affects the quality of pretend play in limiting the diversification of actions and of sequences of behaviours (Blanc et al., 2001). Instead, children with ASD may tenaciously persevere with respect to specific features of a toy, and they often play with it according to a very specific routine. In joint attention episodes, at 10 and 24 months, infants with ASD present visual-motor discordances, perseveration, slowness and a significant variability in their responses to joint attention elicited by others (Gattegno et al., 1999).

4.4.2 Developmental dysregulation

In order to explain intra- and inter-domain heterochrony in the development of children with ASD, Adrien (1996, 2005) conceptualized developmental dysregulation. He postulated that the importance of heterochrony in their developmental profiles is linked with the intensity of their dysregulation.

²⁰ The methodological design is as follows: a sound and a flash of light were presented several times to the child; responses in the auditory and visual cortex and also in inter-modal associations were recorded.

²¹ In order to measure them, they have devised the Regulation Disorders Evaluation Grid (RDEG, Adrien et al., 2001). The fifteen items are divided according to five types of disorders and three phases of activity.

Adrien's view (1996, 2005) is supported by the results of some empirical studies and also by clinical observations, showing the impact of dysregulation on the cognitive, socio-emotional and interactive development of children with ASD (Adrien et al., 2001a; Blanc et al., 2005; Huebner & Dunn, 2001; Nader-Grosbois, 2007b; Paris, 2000; Rossignol et al., 1998; Seynhaeve, 2006; Seynhaeve & Nader-Grosbois, 2008a, Seynhaeve et al., 2008b²²). Some studies have highlighted negative relations between dysregulation and several developmental domains such as social interaction, joint attention, behaviour regulation (Blanc et al., 2005), language understanding, emotional expression, affective relationships, schemes, symbolic play (Adrien, 1996; Blanc et al., 2005) and theory of mind (Rossignol et al., 1998) in children with ASD.

In a comparative study of 18 children with ASD, 18 children with intellectual disabilities and 18 typically developing children (matched for developmental age), Adrien et al. (2001a) emphasized the presence in the ASD group of frequent and numerous types of dysregulation disorders, occurring at all times in sensory-motor actions during the performance of object permanence tasks²³. They also discovered significant links between the intensity of regulation disorders and developmental levels in the initiation of and in response to social interaction: perseveration and lack of achievement were higher in children with ASD presenting the lowest developmental level (level 1 simple, from 4 to 7 months) or the highest developmental level (level 4 symbolic including the use of verbal communication with two words, from 20 to 30 months). These last two subgroups of children with ASD usually displayed previous action schemata in new situations. These authors interpret this observation as a defect of flexibility and a central executive dysfunction (as was suggested by Hugues et al., 1994).

These results are coherent with the classical diagnostic criteria of ASD, which refer to impairment in reciprocal social interactions and in verbal and non-verbal communication as well as a restricted repertoire of activities and interests (DSM-IV, APA, 1994).

4.5 Emotion regulation in children with ASD

Because of late reliable diagnoses of ASD, it is usually around the age of 6 to 12 years that children with ASD are studied (Dumont-Mathieu & Fein, 2005). However, in order to study emotional abilities (in expression, response, regulation and understanding of emotions) of young "autistic" infants and children, it is possible to use delayed diagnoses. Studies focusing on emotion regulation in atypical children are rare. However, poor emotion regulation is a characteristic frequently associated with autistic profiles (Southam-Gerow & Kendall, 2002).

How do their emotional expression and emotion regulation evolve?

During the first year of life, although infants with ASD show similar expressions of emotions, they are less attentive to faces and their affective behaviour is less oriented towards others than that of control TD or ID infants matched for IQ or mental age (Baranek, 1999; Maestro et al., 2002, 2005; Osterling et al., 2002; Palomo et al., 2006; Werner et al., 2000). Although children with ASD are sensitive to emotional cues emitted by others, such as distress (Nadel et al., 2000; Sigman et al., 1992), they do not easily express their own emotions appropriately (Brun et al., 1998; Loveland et al., 1994; Snow et al., 1987; Yirmiya et al., 1992).

²² Studies led by Nader-Grosbois and Seynhaeve will be detailed in a later section of this chapter.

²³ Assessed by means of the object permanence scale (Infant Psychological Development Scales, IPDS, Uzgis & Hunt, 1975).

Preschoolers with ASD, compared with children matched for MA, display similar emotional expressiveness in social interactions or when they are watching video sequences illustrating others' emotional expressions (Capps et al., 1993). By using the "Maximally Discriminative Facial Movement Coding System" (MAX), Yirmiya et al. (1989) observed that although children with ASD show a similar quantity of positive and negative emotions to TD children, their facial movements often incongruously express more than one emotion (for example, joy and sadness). By contrast, Snow et al. (1987) reported that young children with ASD display fewer expressions of positive emotions than TD and ID children. Poorer emotional expressiveness in children with ASD was emphasized, in comparison with TD and Down syndrome children (Kasari & Sigman, 1996; Loveland et al., 1994). At preschool age, during social exchanges, children with ASD barely modify their emotional reactions in response to others (Konstantareas & Stewart, 2006), they show poor emotional coordination and timing of affect (Scambler et al., 2007) and they hardly initiate shared attention with others (Mundy et al., 1990; Travis et al., 2001; Warreyn et al., 2005). According to Saarni (1999), because of their cognitive specificities or deficits in the way they interpret their own emotional experiences and those felt by others, children with ASD are unlikely to convey their emotions conventionally.

At school age, they respond with less concern and comforting or empathic behaviours to others' emotional expressions; they do not easily share their emotional states with a partner (Bacon et al., 1998; Corona et al., 1998; Dawson et al., 2004; Kasari et al., 1990; Sigman et al., 1992). This weak responsiveness to others' emotions remains stable over a 5-year period (Dissanayake et al., 1996). This lack of empathy in children and adolescents with ASD has been widely reported, although it seems possible to specifically train them to make empathic responses in social scenarios (Argott et al., 2008; Charman et al., 1997, 1998; Dyck et al., 2001; Gena et al., 1996; Hudry & Slaughter, 2009; Sigman et al., 1992; Travis et al., 2001; Yirmiya et al., 1992). However, empathic behaviour may vary according to the individuals with ASD (McGovern & Sigman, 2005) and also according to specific emotional context, or familiarity with social agents (as is reported by parents who indicate that their children display empathy towards familiar agent, Hudry & Slaughter, 2009). At school age, in contrast with TD or ID children who spontaneously display their positive emotions in social interactions, children with ASD share their emotional expressions with others in a less spontaneous way (Attwood et al., 1988; Bieberich & Morgan, 2004; Snow et al., 1987), notably in unstructured situations in which the caregiver does not initiate the interaction (Kasari et al., 1993a). The combination of emotional expression on their part, eye contact and expressiveness in response to their caregiver's expressions is also exhibited less by them than by control groups (Dawson et al., 1990b). They therefore appear less expressive because they have neutral, flat or idiosyncratic expressions more frequently than MA controls; this continues into later life (Czapinski & Bryson, 2003; Hobson & Lee, 1998; Kasari et al., 1990; Loveland et al., 1994; Yirmiya et al., 1989). For example, these children displayed less attention and fewer smiles than children with Down syndrome when other children were laughing in play situations (Reddy et al., 2002). Sometimes, children with ASD display happy expressions in solitary or unpleasant situations more often than in social situations (Whitman, 2004). Individuals with ASD do not experience complex emotions such as embarrassment, pride and guilt in the same way as TD people (Grandin, 1995).

According to Begeer et al. (2008), in comparison with TD children, children with ASD present similar elementary emotional expressiveness and experiences, but differ in the inter-

and intra-personal integration of their emotions. These authors also specify that “empirical evidence found for the influence of age, intelligence and context factors on the level of emotional expressiveness in children and adolescents with ASD refines the marked impairments of emotional expressive behaviour that are suggested in the diagnostic manuals” (Begeer et al., 2008, p. 346). Tardif et al. (2007) reported that studies of emotional expressiveness have emphasized a deficit in expression, in modulation and in internal and external regulation of emotions in children with ASD. They are described as easily stressed, anxious and fearful. They have difficulty in self-regulating their emotions when their feelings become excessive.

Several authors postulate that there is a significant impairment of emotion regulation that could explain a set of disabilities in children with ASD in their social interactions (Gulsrud et al., 2009; Konstantareas & Stewart, 2006). Trevarthen (1989) suggests that autism is due to an early basic deficit in the production of emotions and of emotion regulation in reaction to environmental stimulations. He hypothesized a biological origin of this impairment: a dysfunction of central regulator systems. Children with ASD do not feel emotions related to exchanges initiated by others or to experiences they have in connection with objects. Moreover, poor, absent or unexpectedly excessive emotion in children with ASD does not play its role of regulator, as a means of seeking, producing, maintaining, inhibiting, and interrupting behaviours with respect to others or to objects (Tanguay, 1990). According to Adrien (1996), this deficiency of emotionality in children with ASD is more apparent in situations requiring regulation, due to the interruption, maintaining, amplification or reduction of emotional affects. These children prefer to resist change and conserve their initial state in order to avoid new social situations that may be sources of amplification or reduction of felt emotions, requiring regulation.

We consider that the study of specificities in emotion regulation in children with ASD should be included in a dynamic and integrative approach taking account of different levels of cognitive and socio-emotional competences or deficits (as suggested by Yeates et al. 2007, Nader-Grosbois, 2011): perceptual information processing²⁴, executive and cognitive abilities (attention, inhibition, etc.), social information processing (including ToM, making it possible to understand one's own and others' emotions), social problem-solving abilities, social interactions and social adjustment. To infer what other people think or feel and to regulate one's emotions in social interactions requires the perception of subtle face, voice and body movements, the processing of various sources of information simultaneously and in an integrated way, the selection of the most important and pertinent information in the context and the inhibition of an already given response in a similar situation in order to find another, more appropriate one. Emotion regulation in social situations could therefore depend on such factors, in which children with ASD present deficits.

4.6 Dysfunction in co-regulation

Environmental conditions, including parental strategies of social regulation or of socialization of emotions toward their child with ASD could contribute to support his or her emotion regulation or self-regulation, or conversely could help induce dysregulation. As children with ASD display maladaptive behaviours that predict maternal stress (Tomanik et al., 2004), it is plausible that stress may also interfere with the maternal support of emotion

²⁴ As suggested by Mottron (2004).

regulation in the child (Belsky, 1984). As their mothers have difficulties in interpreting and reacting to the ambiguous emotional signals of their child with ASD, the result may be less parental support for the development of new skills, including regulatory skills (Stansbury & Zimmermann, 1999). However, it seems that it is possible to improve maternal strategies, by means of specific intervention focusing on joint engagement, on joint attention and consequently improve emotion regulation in children with ASD; such interventions could help with the co-regulation of emotions between the two partners (Gulsrud et al., 2009).

In their study, Gulsrud et al. (2009) randomly assigned about 35 toddlers with ASD (with an average mental age of 19 months) and their mothers to both control and joint attention intervention conditions. In the intervention condition, mother-child dyads attended twenty-four ten-minute sessions, organized in ten modules, targeting early joint attention, language skills and joint engagement with the mother, three days a week for eight weeks. Videotape of the children and mothers was used to classify their emotion regulation behaviours using standardized coding, screening for the presence and the absence of any distress episodes. The following aspects of the children's behaviour was coded: "negativity" (in facial and body expressions) and regulation strategies, including symbolic self-soothing, physical self-soothing, repetitive or idiosyncratic behaviours, tension release, avoidance, distraction, maternal orientation, other-directed comfort seeking, and other-directed assistance seeking. The following maternal regulation strategies were coded: prompting/helping, following the child's lead, redirection of attention, active ignoring, reassurance, emotional following, physical comfort, vocal comfort. Moreover, behavioural strategy combinations were applied in order to classify mothers' and children's regulatory behaviours: (a) maternal vocal strategies consisting of the combination of maternal vocal comfort and reassurance; (b) maternal active strategies consisting of the combination of prompting/helping, redirection of attention and physical comfort; (c) children's comfort strategies consisting of physical self-comfort and comfort-seeking; (d) children's physical strategies consisting of tension release, avoidance, and distraction; and (e) children's verbal strategies consisting of cognitive/verbal self-soothing and assistance seeking. Their results showed variability in the intensity of negative expressions and in the number of distress episodes in toddlers with ASD, but almost all displayed an increase of negative arousal during play interactions with their mothers. This observation was interpreted by authors as evidence of profiles of dysregulation. However, these children engaged in a range of emotion regulation strategies, characterized as appropriate active strategies (distraction, avoidance, and tension release) and constructive strategies (orienting to mum, and seeking assistance). Like typical toddlers, they were able to request maternal support and assistance; however, they made less frequent use of sophisticated verbal strategies such as symbolic/verbal self-soothing (which may be impeded by their low expressive language level – less than 20 months). Emotion regulation strategies were used significantly more by toddlers with ASD during episodes of negativity than non-negativity. In addition, mothers of these toddlers with ASD engaged (as also reported for mothers of typically developing toddlers) in a variety of emotion regulation strategies when the child was in distress, from active strategies (redirection, prompting, physical behaviours) to vocal comforting strategies (vocal soothing and reassurance). They continued to use active strategies throughout the intervention more frequently than mothers of typically developing children. Moreover, specific characteristics in the child with ASD and the mother were associated with emotion regulation outcomes. For example, when interacting with their toddlers with behaviour problems, mothers were more stressed and used more active strategies and fewer vocal strategies. These mothers'

ability to redirect attention away from a source of distress for the child and reengage him or her in an ongoing play activity appears to be an important regulatory skill. Concerning the impact of the intervention, this study provides evidence for the effectiveness of an early mother-driven social-communication intervention in decreasing negativity and supporting emotion regulation capabilities in children with ASD. Mothers' improvements in motivational and emotional scaffolding were related to the socialization of emotion regulation in their toddlers with ASD.

These studies showed that it is important to assess and to intervene in co-regulation between children with ASD and those around them, and not only target children's dysregulation.

5. The integrative model of regulation in psychological functioning and development in children with ASD and its implications for assessment and intervention

5.1 Components of the integrative model

In order to integrate recent relevant models (notably Adrien's and Whitman's theories) and the results of empirical studies of regulation *versus* dysregulation processes, emotion regulation and co-regulation, we propose an integrative model including three levels: (1) micro-functioning, (2) functional abilities *versus* inabilities, and (3) macro-functioning or development (see Fig. 2). These three levels have dynamic and retroactive connections into "streams", and even in a "spiral" in the course of time. They involve different types of assessment and targets for intervention.

The micro-functioning level designates the micro-genetic functioning *versus* dysfunctioning that occurs in very specific contexts of problem solving. It corresponds to the regulation of activity, positive strategies of problem solving, self-regulatory strategies (sustained by executive functions) as well as negative dysregulatory behaviours and neuropsychological dysfunctioning displayed by the child. At this first level, assessment and intervention must focus on the executive functioning, self-regulation strategies, and functional dysregulation in challenging contexts. The examiner must select instruments²⁵ assessing very specific cognitive functions or strategies, such as self-regulated attention, goal-oriented planning, inhibition of non pertinent elements in tasks, regulation behaviour, etc. At this level, the highlighting of specific dysfunctioning could complement a diagnostic process by focusing on the assessment of specific disorders.

The level of functional abilities *versus* inabilities relates to abilities mobilized in daily life by the child; his or her social, cognitive, emotional and psychomotor functional abilities²⁶ and the combination of these abilities help the child to adjust his or her behaviour during life events or to respond to requests from the environment. Lack of ability or inabilities in these

²⁵ The following instruments could be used: the grid for coding self-regulation in problem solving (Nader-Grosbois, 2007); the Regulation Disorders Evaluation Grid, assessing dysregulation (RDEG, Adrien, 1996); and the Behavioral Functional Inventory (BFI, Adrien et al., 1995, 2001b). The neuropsychological instrument NEPSY-II (Korkman, Kirk, & Kemp, 2007), composed of 27 subtests designed for children aged 3 to 12, assesses five functions: attention/executive functions, language, sensorimotor, visuospatial, and memory and learning.

²⁶ At this level, Nader-Grosbois (2006) suggest that specific relations are constructed between specific abilities in different areas that create "local homology". This neo-Piagetian concept designates the variable intensity of coordination between specific domains (as opposed to Piagetian "general homology").

different areas reduce his or her adjustment to situations. Our definition of this level is founded on an ecological and curriculum-based approach to children. The level includes notably abilities or inabilities in emotion regulation when the child experiences distress, frustration and negative emotions²⁷ in daily life events. At this second level, assessment²⁸ and intervention must target abilities in multiple ecological situations.

The level of macro-functioning or development corresponds to a macro-genetic approach to the development profiles of children and to their developmental trajectories in several areas. It could give information about synchrony *versus* asynchrony in development; or in other words, about homogeneity *versus* heterogeneity in developmental profiles. It is possible at this level to identify weaknesses and strengths in domains of development. Our definition of this level is founded on neo-Piagetian conceptions of typical and atypical development. The level enables the developmental stage or developmental age to be identified in cognitive, communicative, psychomotor domains. For assessment, ordinal and multidimensional scales²⁹ of development, varying depending on the period of development, must be used. The intervention must focus on the emergence of the child's abilities and on the weaknesses in specific domains in order to choose eliciting situations that could improve developmental progression and reduce the heterogeneity of the child's development.

Concerning the connections between these three levels, empirical studies of children with ASD have emphasized:

- positive links between positive self-regulation and functional abilities;
- positive links between positive self-regulation and the developmental level/homogeneous development;

²⁷ The parents could complete other-reported scales, such as the Emotion Regulation Checklist (ERC, Shields & Cicchetti, 1997), the Emotional Regulation Rating Scale (ERRS, Carlson & Wang, 2007), or the Emotion Regulation Subscale of the Social Competence Scale (Conduct Problems Prevention Research Group, 1999). Moreover, the examiner could observe the child in a setting inducing emotion regulation in interactive and non-interactive contexts (see studies led by Baurain and Nader-Grosbois, 2011, in press).

²⁸ For example, the Assessment Evaluation Programming System for infants and children (AEPS, Bricker, 2002), which includes assessment by professionals and parents, and a programme of intervention targeting functional abilities in several domains (social, cognitive, motor, adaptive, communicative) for which training could be given in formal sessions by professionals and in daily life activities by people around the child. Another example: the Vineland Adaptive Behavior Scales-Second Edition (VABS-II, Sparrow et al., 2005) measures multidimensional adaptive behaviour from birth to adulthood: communication, daily living, motor skills and socialization. A Maladaptive Behavior Index is optional. There are four formats: semi-structured interview, expanded interview, parent or caregiver rating form and teacher rating form.

²⁹ For the sensory-motor period, several neo-Piagetian scales could be used. First, the Infant Psychological Development Scales, IPDS, Uzgis & Hunt, 1975) or the new version, Evaluation du Développement Cognitif Précoce (EEDCP, Nader-Grosbois, 2009) including seven scales: object permanence, means-end, vocal imitation, gestural imitation, operational causality, spatial relations, and schemes of action. Second, the Early Social Communication Scales (ESCS, Seibert & Hogan, 1982), which uses eight scales to assess three communicative functions (social interaction, joint attention, behaviour regulation) and distinct roles (responding to, initiating and maintaining). Third, the Batterie d'Evaluation du Développement Cognitif et Social (BECS, Adrien, 1996). For the symbolic period, standardized intelligence tests could be applied, but these are difficult to administer to children with ASD. The Snyders-Oomen (SON-R, Tellegen et al., 1998) is a measure of non-verbal intelligence which is easier to administer to children with poor language skills.

- negative links between dysfunctioning in executive function, dysregulation and functional abilities;
- negative links between dysfunctioning in executive function, dysregulation and the developmental levels/homogeneous development;
- positive links between functional abilities and the developmental level.

In other words, the more these children mobilize optimal neuropsychological functions, the more their self-regulatory strategies operate, the more they are able to adjust their functional behaviours in daily life, the more they progress positively in their development and the more their developmental profiles are harmonious, and *vice versa*. Moreover, the more children with ASD display neuropsychological executive dysfunctioning, or dysregulation, the more they present deficits in several self-regulatory strategies, the more they have difficulties in responding adequately to daily life events with efficient functional abilities and with adapting, the less they develop their abilities in several domains of development and the more their developmental profiles are heterogeneous due to the difference in the speed of development in different domains, and *vice versa*.

In order to appraise these inter-connections between the levels in children with ASD, several combinations of instruments could be chosen in an assessment procedure.

Concerning the risk and protective factors that could influence the three levels of functioning and development in children with ASD, on the one hand there are the individual characteristics of the child (gender, age, mental age, type of deficiency, severity of autism, temperament, health, etc.) and on the other hand social environmental factors, including family and parental factors (parents' characteristics, types of scaffolding, other-regulatory strategies, co-regulation, contingency, responsiveness, stress management, etc.) and all components of intervention by professionals. All these factors must be identified in order to adjust the choice of assessment and intervention with respect to children with ASD. In order to illustrate this integrative model of regulation in psychological functioning and development in children with ASD, we represent these components and links between them in Fig. 2.

In a longitudinal approach (see Fig. 3), the components of the three levels of functioning and development, as well as these positive *versus* negative connections between the components of these levels, could be viewed as a dynamic of mutual effects not only into "streams" but also in a "spiral" through time. In other words, specific deficits in the components of the three levels could get worse or decrease in future periods of development; and the intensity of the links between them could fluctuate in individual trajectories, depending in particular on risk and protective endogenous and exogenous factors.

5.2 Empirical studies using this integrative model

Nader-Grosbois (2007b) examined dysregulation³⁰ and self-regulation³¹ in 14 boys with ASD (aged from 36 to 92 months; mental age ranged from 10 to 24 months) when they were confronted with a problem-solving set corresponding to assessment situations of different cognitive domains of development (by means of BECS). Their mental age (but not their chronological age) was correlated positively with their self-regulation and negatively with their dysregulation. The severity of autism³² (mild to severe) was linked negatively to self-

³⁰ Assessed by means of RDEG (Adrien et al., 2001).

³¹ A grid of coding of self-regulation and other-regulation (Nader-Grosbois, 2000, 2007) was applied.

³² Assessed by means of Childhood Autism Rating Scale (CARS-T, Schopler et al., 1986).

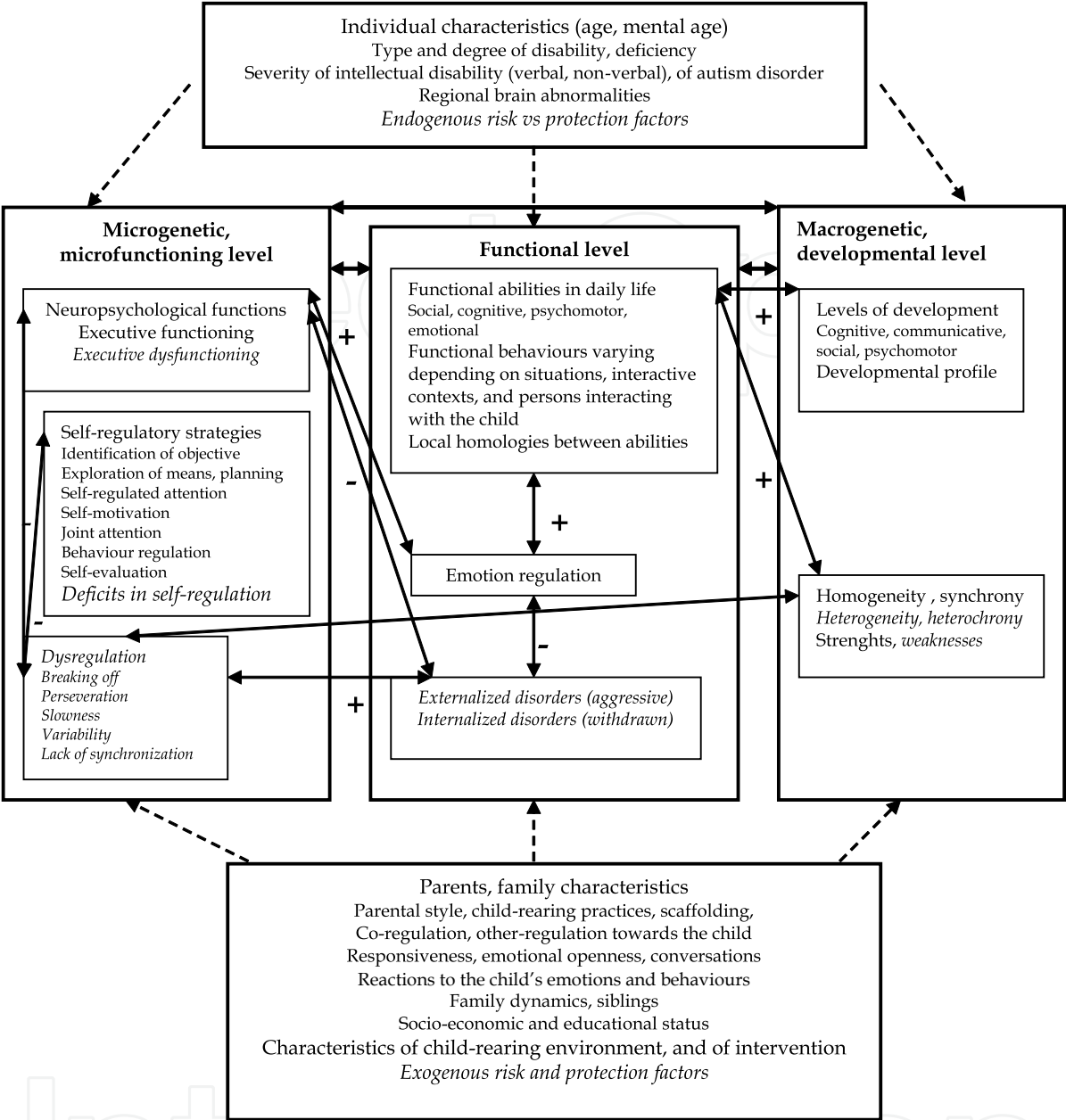


Fig. 2. Integrative model of regulation in the functioning and development of children with ASD

regulation and positively to dysregulation. The self-identification of objective was stronger than other self-regulatory strategies (planning, attention, motivation, evaluation, joint attention, request). Planning in particular was the weakest self-regulatory strategy. The cognitive developmental level was linked positively to overall self-regulation. The positive links between the majority of specific cognitive domains (object permanence, means-end, causality, self-image, symbolic play, schemes of action) and self-regulation varied in significance. Considerable inter-individual variability was observed in the degree of dysregulation and in the type of disorders of regulation. The cognitive developmental level was linked negatively to overall dysregulation. Significant negative links were obtained between specific cognitive domains (object permanence, means-end, self-image, symbolic play) and dysregulation.

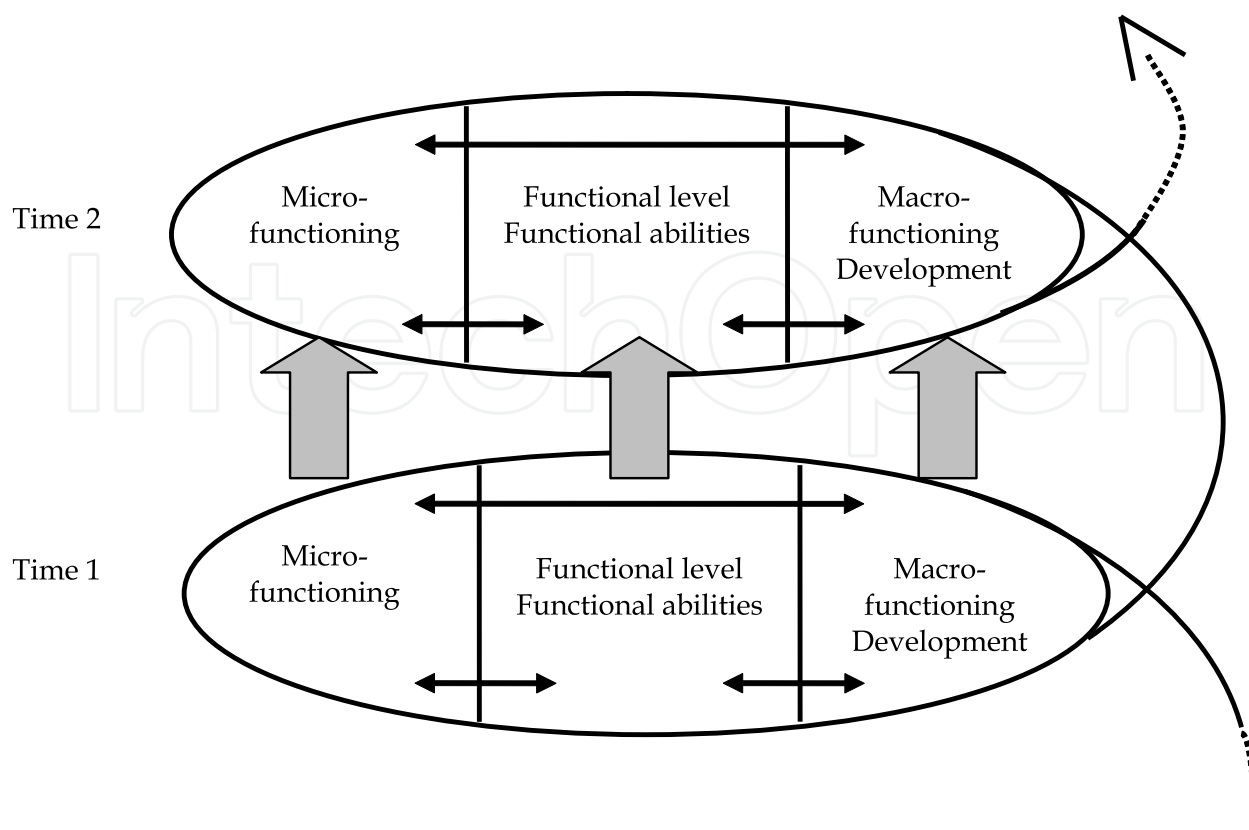


Fig. 3. Integrative, longitudinal “spiral” model of the development of children with ASD

Three comparative studies (Seynhaeve, 2006; Seynhaeve & Nader-Grosbois, 2008a, Seynhaeve et al., 2008b) focused on the impact of neuropsychological dysfunction³³ and of dysregulation³⁴ in activity on the development of 12 children with ASD matched for developmental age (18 months) with 12 children with intellectual disability (ID).

Seynhaeve (2006) analysed neuropsychological dysfunction in conjunction with cognitive and social development³⁵ in these both groups. Their results showed higher dysfunction scores in children with ASD than in children with ID. Patterns of neuropsychological dysfunction observed in the two groups presented some similarities concerning their most affected functions, including regulation, association and imitation. Significant negative correlations were found between dysfunction and several developmental scores in both groups, with variability in their patterns of links. These negative links were much more numerous and intense within the ASD group than in the group with ID. Specifically, dysfunction in regulation in the ASD group was negatively linked to overall development and socio-emotional scores, to specific scores in self-image, social interaction, behaviour regulation, joint attention, expressive and comprehensive language and vocal imitation. Within the ASD group, the agglomerate of dysfunctions (regulation, association and imitation) has a strong influence on their speed of development, and particularly on their heterogeneity of development. The more affected these functions are, the greater the overall, socio-cognitive and socio-emotional developmental heterogeneity.

³³ Assessed by means of Behavioral Functional Inventory (BFI, Adrien et al., 1995).

³⁴ Assessed by means of RDEG (Adrien et al., 2001).

³⁵ Assessed by means of Batterie d’Evaluation du Développement Cognitif et Social (BECS, Adrien, 1996).

In the same samples, Seynhaeve and Nader-Grosbois (2008a) examined more specifically regulation disorders in activity. Compared with ID children, children with ASD showed more intense and more frequent total dysregulation (as shown by Adrien, 1996; Adrien et al., 2001a; Blanc et al., 2005), dysregulation in maintenance (as shown by Adrien et al., 1995; Adrien et al., 2001a; Martineau et al., 1998) and breaking off as well as slowness dysfunction (as shown by Adrien et al., 2001a). The two groups also showed similarities in displaying greater dysregulation disorders during initiation and maintenance than during achievement of the activity. Dysregulation of activity was negatively linked to development in several domains, but correlations were much more numerous and intense within the ASD group than in the group with ID. Within the ASD group, the mean score for dysregulation as well as the mean scores for each specific disorder (except variability) and of the three times of activity were strongly negatively linked to overall development and, according to the types of regulation disorders, to socio-cognitive and socio-emotional development. The specific developmental domains that are particularly negatively linked to dysregulation are the following: self-image, symbolic play, social interaction, behaviour regulation, joint attention, expressive and comprehensive language and vocal imitation. Moreover, Developmental Quotient on the Brunet-Lézine-Revised scale (BL-R, Josse, 1997) was negatively correlated with the mean score in dysregulation in children with ASD: their cognitive impairments are more severe when dysregulation is more intense.

Seynhaeve, Nader-Grosbois and Dionne (2008b) observed, in the same two groups, the impact of dysregulation on functional abilities in daily life³⁶. They also concluded that in both groups total dysregulation was negatively linked to total functional abilities as well as to specific functional abilities in different domains (with and without controlling for chronological age). In the ASD group, as dysregulation decreases, the more functional abilities increase, both overall and in specific domains such as fine motor, cognitive and communicative domains (when not controlling for chronological age) and the social domain (when controlling for chronological age). This study showed that total dysregulation has a differentiated impact in each group: whereas in ASD children, it is linked to weaker communicational and social abilities as well as weaker cognitive or motor abilities, this is not the case in children with ID.

6. Perspectives for research

In a paper entitled "The development of emotion regulation and dysregulation: a clinical perspective", Cole, Michel and Teti (1994) encouraged research into these processes in developmental psychopathology. They suggested that they should be studied in children both with and without specific disorders, and in the latter case both at risk and not at risk of them, using a test design assessing various dimensions of emotionality in context, multiple assessments (including observations of children's reactions beyond what they are able to self-report) of their positive and negative emotions, and analyses of their dysregulation patterns. They noted that it is important to focus on the dysregulation process and its links with several dimensions of emotionality: diversity of positive and negative emotions, flexible modulation of their intensity and duration, transitions from one emotion to another, use of social and cultural rules in expression of emotions, reflexion on one's own emotions,

³⁶ Assessed by means of Assessment, Evaluation Programming System for Infants and Children (AEPS, Bricker, 2002) in its "Birth to three" version.

and emotion regulation strategies. They considered that a lack of flexibility in emotional reactions induces dysregulation and a dysregulatory pattern could gradually become stable in the child's development, generating a form of psychopathology. In developmental psychopathology, they pointed out that is important to examine the regulatory role of emotions, how emotion regulation changes over time and under what conditions dysregulation patterns appear in order to detect symptoms of disorders as soon as possible.

In future, we propose that inter-syndrome and inter-disability comparative studies should be conducted to investigate the dynamic between the components of the three levels of functioning and development included in our integrative model, in order to specify with more precision the types of links between them (differentiating bi-directional relations, direct, mediator or moderator effects of some components on others) according to types of psychopathology in children (ASD, with different genetic syndromes, with behaviour disorders)³⁷. Moreover, we suggest that future research could combine hierarchical cluster analyses of cases in which regulation disorders are included among the variables for regrouping clinical cases (such as the studies by Adrien, 1996; Seynhaeve & Nader-Grosbois, 2008a) and qualitative case studies (such as the study conducted by Wieder et al., 1999) in order to differentiate diagnosis and individual profiles more precisely; this could have implications for preventive and early intervention, targeting the regulation disorders in particular. Future studies should focus on the design of specific early intervention targeting emotion regulation during interactions and its efficiency; it should also examine the development of higher-order verbal strategies for emotion regulation in children with ASD with a good level of verbal ability (as suggested also by Gulsrud et al., 2010).

7. Perspectives for intervention

Early detection of dysfunction in self-regulation or of dysregulation could make it possible to specify which strategies are available to facilitate the acquisition of certain functional or developmental characteristics as well as to prevent the accumulation of dysfunction which could be reflected in the development of children with ASD. A choice of intervention objectives that aims in particular to support self-regulation strategies or to remedy regulation disorders, in various problem-solving situations with objects and/or with persons, could be made, in light of the prior developmental domains.

According to Adrien (2005, pp.10-11)³⁸, the remediation of functional dysregulation could help the child with ASD to coordinate her or his psychological activities better and consequently to undergo more harmonious development and social integration in his or her social and physical environment. This suggestion is consistent with our integrative model of regulation in the functioning and development of children with ASD. This model can serve as a frame of reference for selecting instruments of assessment according to the goal and the situation of assessment. It effectively permits a coordinated approach to the three levels of

³⁷ This has been done in studies of children with ASD and with ID conducted by Seynhaeve (2006), Seynhaeve and Nader-Grosbois (2008a) and Adrien and his collaborators.

³⁸ In the IDDEES programme (Gattegno et al., 2006), an intensive, longitudinal intervention in the ecological environment of young children with ASD aims to improve their regulation in a constant way, in social, interactive, emotional, cognitive activities and learning situations with professionals, in order to promote their development and their social integration.

functioning and development of atypical children for research or intervention purposes, and hence a better understanding of their deficits and their strengths according to the ease or difficulty with which they mobilize their strategies of problem solving or their self-regulation. Intervention could focus purely on the remediation of a dysfunction in the context of specific problem-solving; or coordinate several abilities in distinct areas of daily life; or elicit emerging developmental acquisitions in one or more domains of development by targeting the proximal zone of development; or elicit efficient co-regulation between the child and those around him or her. These types of intervention will have implications at other levels of individual dynamics.

If the intervention aims to improve self-regulation, we offer some suggestions here. As reported in the literature, the type of task, the material, the media (physical, computer) and their familiarity to the children influence their self-regulation and are associated with an inter-situational variability of strengths or weaknesses in self-regulatory strategies (Freund, 1990; Nader-Grosbois, 2007a; Nader-Grosbois & Thomée, 2007; Nader-Grosbois & Lefèvre, 2011). From a Vygotskian viewpoint (Vygotsky, 1978), various interactive games with adults and with peers and make-believe play (Elias & Berk, 2002, Kraft & Berk, 1998; Vieillevoys & Nader-Grosbois, 2008) between peers are privileged activities which provide an array of opportunities for practising various self-regulatory strategies in cognitive and socio-emotional problem-solving and the use of communicative and language abilities. Such play could consolidate coordination between functional abilities and self-regulatory strategies. In special education, training focusing on executive functions or on self-regulatory strategies (supported by the activation of the prefrontal cortex) in challenging and motivating situations with a varied degree of structure, and training in self-instruction during problem solving (Haelewyck & Nader-Grosbois, 2004; Kraft & Berk, 1998; Winsler et al., 2007), could be efficient at improving self-regulated abilities in children or adolescents with disability, their adjustment to changes and their socio-emotional self-regulation (Nader-Grosbois, 2007). Although some intervention programmes have developed objectives of training sessions focusing on self-regulation, initiatives for young children with ASD are not yet sufficiently supported in early intervention. It seems particularly important to provide training in self-regulation because children, especially those at risk, who begin school with a lack of self-regulation, are less likely to succeed in school and life (Raver & Knitzer, 2002). Pre-school self-regulation levels have stronger links with future school readiness, than with IQ (Blair, 2002) and with cognitive, coping and self-regulatory competence in adolescence (Eigsti et al., 2006).

In addition, if the intervention focuses on the improvement of emotion regulation in children with ASD or another psychopathology (as suggested notably by Cole et al., 1994; Southam-Gerow & Kendall, 2002), here are some guidelines. Some studies have shown the efficiency of programmes promoting the development of socio-emotional development in children with special needs³⁹ that include training in certain specific strategies, for example, self-control through verbal mediation or self-identification of emotions in order to manage them. Specifically in order to train emotion regulation in children with ASD, on the basis of

³⁹ Such as "Promoting Alternative Thinking Strategies" (PATHS, Kusché & Greenberg, 1994); the inhibitory control represents a main generative mechanism in the link between PATHS and behavioural outcomes.

a review of the literature and of some recent intervention programmes⁴⁰, Nader-Grosbois (2011) gives the following specific guidelines on interventions involving these children through the provision of training in the following skills:

- Identifying their physiological states according to their emotions (respiration, contraction, relaxation of muscles) and to learning to control them;
- Recognizing emotions from various types of stimuli (facial, vocal, gestural, body movements), socio-emotional cues, verbal and non-verbal (attitudes, postures, intonations), giving them meaning and interpreting them in an integrated manner;
- Identifying their emotional states when they are alone and in interactions with others;
- Linking their own emotional states with their own behaviour and that of other persons;
- Distinguishing inappropriate emotional state, inadequate intensity of emotional expression, depending on the circumstances;
- Using language to help modify their emotional states (negative or positive) or the intensity of their expression or of their behaviour;
- Minimizing the negative effect of environmental, social aspects to which they are over-sensitive;
- Discovering efficient emotion regulation strategies (distraction, seeking comfort, modification of emotional valence) when faced with frustrating situations;
- Practicing co-regulation of emotions⁴¹ by means of parental scaffolding or other-regulation likely to support joint attention.

These suggestions could be applied in play or interactive situations (cooperative, competitive, pretend) using various materials (vignettes, videos illustrating social scripts, software) and in daily life.

More generally, Nader-Grosbois (2011) has developed guidelines for intervention from infancy and childhood onwards to improve socio-emotional abilities and social adjustment in children with ASD and other developmental disorders, through the provision of training in:

- precursors of ToM: emotional recognition, using various media (photographs, videos, computer software); face processing; early imitation; joint attention;
- socio-perceptive processing and perceptive integration;
- executive functions and self-regulation strategies;
- social information processing, social knowledge;
- emotional expression, emotion regulation and conventional responses to others' emotions, empathic behaviours in various contexts and towards different persons;

⁴⁰ In their book "The incredible 5-point Scale: assisting students with autism spectrum disorders in understanding social interactions and controlling their emotional responses", Buron and Curtis (2004) propose a method to help these children and adolescents to understand and control their emotional reactions in daily life events that could provoke inappropriate reactions or behaviour disorders. Macklem (2008) gives a set of guidelines for professionals and parents to reinforce their ability to support the children in regulating their emotions, notably by improving their reactions to the child's negative emotions, their adjustment to the child's temperament, and their exchanges about positive and negative emotions (in critical situations or from examples of scripts); this could facilitate the child's emotion regulation and coping strategies.

⁴¹ According to Gulsrud et al. (2010), as children with ASD are at risk of dysregulation, early mother-child interactions (including joint attention) are an ideal context for socialization of their emotion regulation.

- ToM abilities, such as the understanding of causes and consequences of emotions;
- skills in socio-emotional problem-solving or challenges, social scripts.

8. Conclusion

As several authors have drawn attention to the fact that infants and young children diagnosed as presenting ASD display deficits in self-regulation or dysregulation in their activity, and in early emotion regulation, these specificities represent an early risk factor of severe autism and of intense behaviour disorders that need to be detected as soon as possible (Adrien, 2005; Bagnato & Neisworth, 1999; De Gangi et al., 1993, 2000; Gomez & Baird, 2005; Nader-Grosbois, 2007b; Whitman, 2004). It is indispensable to proceed to regular longitudinal assessments in the course of early development and during childhood by focusing on inter- and intra-individual variability, using instruments founded on an integrative model of functioning and development of atypical children and combining various sources of information from professionals and other people around the children (Greenspan & Meisels, 1999).

9. References

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Autism spectrum disorders are a major topic for research. The causes are now thought to be largely genetic although the genes involved are only slowly being traced. The effects of ASD are often devastating and families and schools have to adapt to provide the best for people with ASD to attain their potential. This book describes some of the interventions and modifications that can benefit people with ASD.

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University Campus STeP Ri
Slavka Krautzeka 83/A
51000 Rijeka, Croatia
Phone: +385 (51) 770 447
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InTech China

Unit 405, Office Block, Hotel Equatorial Shanghai
No.65, Yan An Road (West), Shanghai, 200040, China
中国上海市延安西路65号上海国际贵都大饭店办公楼405单元
Phone: +86-21-62489820
Fax: +86-21-62489821

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