SELF-DIRECTED LANGUAGE AND PRIVATE GESTURES IN THE EARLY EMERGENCE OF SELF REGULATION: CURRENT RESEARCH ISSUES

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Abstract: This paper gives an overview of the research concerning the mediating role of self-directed language (SDL) and private gestures (PG) in the early development of self-regulation, and discusses issues which arise from the presented studies in this area of research. In general, studies on the relationship between SDL and PG and higher mental functions have emphasised the importance of such semiotic systems in problem solving, suggesting that SDL and PG are one of the tools for thinking and learning. However, there are several issues arising from the research methodologies in this area, which include the overlooked early signs of self-regulatory skills in infants and toddlers in the preverbal stage, the reliance on level of performance as a proxy for self-regulation, and the lack of a microgenetic approach in exploring these phenomena. The review concludes with suggestions and directions for future research.

Key words: Private gestures, Self-directed language, Self-regulation

INTRODUCTION

There has been a considerable amount of research in the last twenty years, which has aimed to explore the function of self-directed language (SDL) produced by preschool children. The general conclusions of these studies have supported Vygotsky's claims

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about the important role of SDL in the early development of self-regulation. Research on private gestures (PG), on the other hand, has been much more limited with just a small number of studies providing interesting observations on the self-regulatory role of such behaviour. We argue that, although PG was not addressed in the original work of Vygotsky, his insights into SDL could be usefully extended to early gestures in young children. The aim of this paper is to discuss research on *self-directed language* in the verbal phase*, and self-directed (private) gestures* in the preverbal phase of a child's development and their role in the early development of self-regulation.

The main goals of this paper are (a) to give an overview of the literature on the role of SDL and PG in the development of early self-regulatory skills, (b) to present the most common methodologies used in exploring these phenomena, and (c) to propose new methodologies, which might be more productive in this area of study.

This paper is organised in the following sections. In the first section the theoretical background of the SDL and PG research in relation to their self-regulatory functions will be presented. This will also include a brief overview of the theoretical framework which we use in looking at self-regulation in young children. The second section aims to address methodological difficulties in existing research exploring SDL and PG in young children. Finally, in the third section of this paper, future directions in this area of research are proposed.

Background

The relationship between semiotic systems and early cognitive development was first presented within the work of Lev Semyonovich Vygotsky. In his works (Vygotsky, 1930/1978, 1962; Vygotsky & Luria, 1934/1994) Vygotsky discussed the important role of language, used in early social interactions within the development of higher mental functions. He believed that meaning making, self-guiding, and self-control develop through the progressive internalisation and transformation of mental processes that initially occur at the interpersonal level and which are represented (mediated) through *tools* and *signs*. For Vygotsky, unlike tools, which mediate the physical world, signs are psychological entities which mediate the mental world, such as language, gestures, mnemonics and so on. He argued that overt self-directed speech (what Vygotsky and Piaget called "egocentric speech") in particular, was indeed a bridge between social and inner speech, and served the purpose of self-guiding young children in problem solving.

In addition to the very specific relationship between language and thought described in the literature grounded in this sociocultural tradition, there has also been a considerable amount of research addressing the same issue within the information-

processing tradition. The sociocultural approach emphasised the regulating role of SDL as a mediator between thoughts and actions, while the information-processing, cognitivist approach focused more on SDL as a strategy in solving problems. These two approaches, while they use different terminology, are not in fundamental opposition, as they both recognise the important role of SDL in affecting concurrent and subsequent task-related actions. There is a clear difference, however, in emphasis between describing SDL as a "mediator" or a "strategy". While attempting to resolve this theoretical issue is beyond the scope of the present paper, we would argue that the methodological improvements to research in this area would make a significant contribution to this resolution and to other related theoretical issues.

Due to the predominant role given to speech, sociocultural psychologists have long ignored the role of other semiotic systems as tools of consciousness, and with that, the true ontogenetic roots of higher psychological processes. The assumption that children first need to master the use of language for communication, and only afterwards can use it to regulate their own cognitive processes, is expressed in this widely reproduced quotation: "the most significant moment in the course of intellectual development, which gives birth to the purely human forms of practical and abstract intelligence, occurs when speech and practical activity, two previously completely independent lines of development, converge" (Vygotsky, 1930/1978, p. 24).

Only recently, researchers studying cognitive and communicative development of very young children at a preverbal stage (e.g., Basilio & Rodríguez, 2011; Rodríguez & Palacios, 2007) have challenged this notion. They argue that not only infants and toddlers can communicate with others using gestures, but that these gestures can also serve a cognitive function with a self-regulatory purpose. From this point of view, what Vygotsky called "practical intelligence" and all cognitive processes are being supported from early in development by preverbal semiotic systems. They are not "independent lines of development" but developing together hand in hand from early in life, rather than converging later on in an enigmatic way.

Gestures directed to self and others, when related to problem solving, can support the transition from other-regulation to self-regulation in an analogous way to that which has been argued in relation to SDL. The core sociocultural principles of the double formation of psychological processes and the importance of social mediation through signs remain the same, but in this case they are applied to preverbal development.

The following section addresses these issues in more detail.

Self-directed language

Self-directed language (SDL) is an umbrella term used for both overt (language expressed out loud, also known as "private speech" or "self-directed speech [SDS]) and covert self-verbalisations ("inner speech", expressed internally), which is believed to be used for the purpose of self-regulation. Vygotsky argued that these earliest emerging utterances in children are essentially social, not egocentric, as suggested by Piaget (Vygotsky, 1962) and could influence the way children reason. It might be true to say that Vygotsky attempted to explore what we refer to today, as the self-regulatory function of SDL. Vygotsky (1962) wrote:

> we have seen that in real situations when the egocentric speech of a child is connected with his practical activity, things do shape his mind. Here, by 'things' we mean [...] reality that a child encounters in his practical activity. (p. 40)

These early self-verbalisations emerge sometime between the second and the third year of life and usually occur in a context where other-regulation is absent and when the child faces a challenge of intermediate difficulty. Furthermore, it does not gradually disappear, as suggested by Piaget. On the contrary, it "goes underground" (Vygotsky, 1962, p. 33), changes function and forms verbal thought. Overt self-verbalisation is now transformed into inner speech and directs children's actions.

> The internalization of cultural forms of behaviour involves the reconstruction of psychological activity on the basis of sign operations [...] The developmental changes in sign operations are akin to those that occur in language. Aspects of external or communicative speech as well as egocentric speech turn 'inward' to become the basis of inner speech. (Vygotsky, 1930/1978, p. 56).

Furthermore, Vygotsky was also interested in what he called the "genetic roots of thought and language" (Vygotsky, 1962, p. 68). He suggested that language and thought emerged from different genetic roots and, therefore, they developed ontologically along different lines, i.e., their developmental lines unite and separate along the developmental path. However, Vygotsky believed that language development follows the same pattern as other cognitive symbolic functions. This pattern is represented through four stages:

1. The primitive or natural stage when children still do not use language as a tool for cognitive processing. Rather, speech represents emotional and social forms of behaviour and it is manifested through crying, babbling, vocal play and so on. This is the stage of preintellectual speech and preverbal thought.
2. The naive psychology stage when children start to experiment with their environment, and attempt to use tools for manipulating the environment. At this

stage, language is more sophisticated in terms of morphosyntax. Discordance between linguistic and cognitive development is apparent. For example, children spontaneously apply grammatical rules and causal conjuctions in new original utterances without understanding the logic behind them.

3. The third stage when external tools facilitate internal cognitive processes. At a language level, overt self-verbalisations serve as a tool for facilitating and regulating inner cognitive activity.

4. The ingrowth stage is characterised by the internalisation of previously external tools, such as egocentric speech. Children start to manipulate inner verbal operations, where language serves as a tool for thinking. This is the first time when thought and language merge, i.e., when the developmental lines of language and thought meet and form verbal thought. Vygotsky believed that this is the moment when thought becomes verbal, and language intellectual.

Since the work of Vygotsky was published in the West in the 1960s, a profound relationship between language and the development of higher mental functions, such as metacognitive and self-regulatory abilities, has been recognised. Flavell was one of the first researchers to discuss the importance of overt SDL (which he called "private speech") as verbal memory rehearsal (Flavell, Beach, & Chinsky, 1966; Keeney, Cannizzo, & Flavell, 1967). He noted that children were using private speech as a form of verbal rehearsal in memory tasks and that overt self-verbalisations actually improved children's performance in these tasks. These findings in fact led Flavell to focus more on memory strategies in his later work (Flavell, 1992).

Twenty years later, a group of researchers published a number of papers on the role of SDL in early self-regulatory development suggesting that such language helps children to regulate their own behaviour (Berk, 1986; Berk & Landau, 1993; Diaz & Berk, 1992; Frauenglass & Diaz, 1985; Schunk, 1986).

Private gestures

We know that before being able to articulate spoken language, children can understand and produce gestures to communicate with others, but research in early communication usually focuses on gestures as predictors of later language development, but not on their intrinsic value for cognitive development.

The notion of *private gestures* (PG), a term coined by Rodríguez and Palacios (2007), focuses on the functions of gestures in relation to specific circumstances, not just their frequencies or morphology. It extends the Vygotskian hypothesis of the role of communicative semiotic systems in the regulation of behaviour to the preverbal

level. It is argued that the same communicative tools that children learn in social contexts of communication with others are internalised and used by themselves to serve a self-regulatory purpose. Using gestures in problem solving or challenging situations can help children to keep goals and instructions in mind, to monitor their performance, to think externally about object based problems, to evaluate their actions, and regulate their emotions, among other functions (Rodríguez & Palacios, 2007).

To differentiate any gesture that children produce from those that are self-directed with a self-regulatory purpose, the following characterisation can be made of PG. Signs that are:

- intentionally produced by the child
- not directed to another person (lack communicative elements such as the physical orientation towards the person, the interchange of gazes, and occuring in a turn taking dynamic)
- related to a practical problem or a challenging situation, in which a goal is clear. The child understands the goal, but it is challenging for her/his current level of development.

Although the evidence for PG is still limited, in a comprehensive literature review on SDL which included some studies which we will address later, Adam Winsler pointed out that "these findings show that self-regulation and the use of signs for one's own purposes appear, at least in some forms, preverbally, earlier than previously thought. Clearly, this is an area of research that will likely blossom in the years to come" (Winsler, Fernyhough, & Montero, 2009).

Self-regulation

Contemporary research on self-regulation has also been heavily grounded in the work of Lev Vygotsky and his sociocultural theory, and influenced by the cognitive information-processing tradition represented by the early work of Flavell and the later theoretical work of Nelson and Narens (1990) on metacognitive monitoring and control. Furthermore, Bandura's (1986) social cognitive approach has had an impact on broadening the definition of self-regulation. In his "Social Foundations of Thought and Action", Bandura (1986) emphasised behavioural and emotional components of self-regulation, suggesting that in addition to purely cognitive processes (such as memory), emotions and prosocial behaviour can be also directed and controlled. Within Bandura's later work on self-efficacy, regulation of motivation emerged as an additional regulatory area.

More recent models of self-regulatory development offer much broader definitions

of the concept, taking into consideration both explicit metacognitive knowledge and the abilities to monitor and control one's own emotional, cognitive, prosocial and motivational behaviour (Bronson, 2001; Efklides, 2006, 2008, 2011; Grolnick & Farkas, 2002). In her book, "Self-Regulation in Early Childhood", Bronson (2001) provides a thorough description of early self-regulatory development within several domains: emotional, prosocial, cognitive and motivational.

According to this author, the emotional component of self-regulation refers to children's ability to control and monitor their emotions such as controlling attention, asking for help, approaching tasks with confidence, persistence in challenging tasks and so on. Generally speaking, it refers to processes of initiating, maintaining and modifying one's own emotional responsiveness (Grolnick, Bridges, & Connell, 1996). In order to do so, children monitor, control and evaluate their emotional behaviour. The development of metacognitive abilities is of great importance for emotional self-regulation development. In order to emotionally self-regulate themselves, children need to understand behaviour and its consequences. Therefore, this demands metacognitive knowledge.

Prosocial aspects of self-regulation refer to children's understanding of other's perspectives and roles in solving problems. This includes the awareness of other's feelings which supports behaviours such as comforting and helping, negotiating and taking turns independently.

Furthermore, Bronson (2001) explained the cognitive aspect of self-regulation in young children as involving the capability of monitoring progress, planning and evaluating goal achievement. It manifests itself in children's ability to plan, monitor, control and evaluate their own performance such as asking questions about the task, using previously taught strategies for solving problems, awareness of their own strengths and weaknesses and so on.

Finally, the motivational aspect of self-regulation is reflected in children's ability to initiate activities, approach new tasks with enthusiasm, plan tasks, goals and targets, develop their own ways of working on tasks and to enjoy the challenges of the learning process.

Overall, this model's broad perspective on emotional, prosocial, cognitive and motivational aspects of self-regulation gives a clearer picture of each aspect's importance in children's overall self-regulatory development. Finally, it clearly illustrates the interrelation between all the self-regulatory aspects and explains them within the context of general self-regulatory development. Research on SDL has addressed the role of SDL in each of these self-regulatory domains, as discussed in the following sections.

Self-directed language and private gestures in the development of cognitive and prosocial self-regulation

As indicators of the underlying self-regulatory process, and as two of the many mediators or strategies impacting on task-related behaviour, SDL and PG are interesting phenomena which fascinate researchers. Most of the studies in this area have been focused on the influence of SDL occurrence on task performance and social-cognitive understanding. Research on PG, on the other hand, has just begun and mostly focuses on reporting the occurrence, and description of PG in very young children while solving challenging tasks.

Self-directed language

The terms "self-directed speech" (SDS), "self-directed language" (SDL) and "private speech" are nowadays widely accepted terms in describing the phenomenon of an expressive language which is directed to the self, mainly for the purpose of self-regulating one's own behaviour. However, contemporary research concerned with SDL still struggles to answer the question of whether such language has a positive effect on subsequent performance or is simply an accompanying activity or a proxy of internal self-regulatory processes, and simply serves as a window into observing these processes. Some researchers have claimed to find positive effects of SDL on problem solving and task performance (Flavell et al., 1966; Goodman, 1981; Lidstone, Meins, & Fernyhough, 2010; Schunk, 1986; Winsler, Diaz, McCarthy, Atencio, & Chabay, 1999) while others have found little or no correlations between the two (Berk, 1986; Frauenglass & Diaz, 1985).

However, Vygotsky's assumptions about the *adaptive function*[1] of SDS have been explored in a variety of studies (Duncan & Cheyne, 2001; Duncan & Pratt, 1997; Fernyhough & Fradley, 2005). This research has supported the model of a non-linear relation between task difficulty and occurrence of SDS. More precisely, these authors have found that the frequency of such speech does not linearly increase with the difficulty of the task. Rather, SDS is more likely to emerge while children are engaged in a task of intermediate difficulty. In other words, if the task is too challenging for the child, SDS will be ineffective and may result in failure, whereas if the task is too simple, the required regulatory processes will be already internalised and such speech will be unnecessary (Fernyhough & Fradley, 2005; Manning, White, & Daugherty, 1994).

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[1] The adaptive function of self-directed speech is demonstrated by the finding that, as a task becomes difficult, children become more likely to produce such speech as an accompaniment to their behaviour (Fernyhough & Fradley, 2005).

A more recent study conducted by Lidstone et al. (2010) explored the role of SDL in an executive task performance in 7- to 10-year-old children. They were exploring the influence of articulatory suppression[2] on the Tower of London task compared to performance in the same task in a control condition, within a dual task paradigm. The secondary task in the experimental condition involved a constant repetition of a word as a means of articulatory suppression, whereas in the control condition, the main task was accompanied by rhythmic motor tapping. The results showed that articulatory suppression had a negative effect on performance, suggesting that suppressing SDL actually had a negative effect on performance. In addition, there have been studies which have explored the executive role of inner speech (covert SDL) in guiding mental activity in adults (Baddeley, Chincotta, & Adlam, 2001; Emerson & Miyake, 2003; Miyake, Emerson, Padilla, & Ahn, 2004). These research findings are consistent with the findings of Lidstone et al. (2010) suggesting that SDL plays an important executive role in task performance.

Recent studies on SDL and social-cognitive understanding have explored the developmental relationship between SDL and the Theory of Mind (Carlson & Moses, 2001; Fernyhough, 2008; Fernyhough & Russell, 1997). These researchers have suggested that SDL in young children might facilitate their social-cognitive understanding. In particular, Fernyhough and Russell (1997) explored the awareness of self-talk in 5-year-old children. They found that 5-year olds recognised their own voices in the context of other children's voices and that this was due to their awareness of oneself as a speaking agent among other such speakers. The authors suggested that SDL in this case provides an opportunity for understanding the difference among themselves as thinking agents. In addition, Winsler and Naglieri (2003) have suggested that the use of overt SDS requires not only implicit understanding of the self but also the understanding that this entity can be verbally regulated.

The proposed relationship between SDL and self-regulation has mostly been explored through studies which have established correlations between the frequency of SDL use and measures of self-regulation. However, it is becoming increasingly clear that it may not be the mere frequency of SDL but its content related to the task and the temporal context in which it is used in relation to actual moments of self-regulatory behaviour, that may shed more light on the possible relationship between the two (Frawley & Lantolf, 1986; Kuvalja, Verma, & Whitebread, 2013; Winsler, Diaz, Atencio, McCarthy, & Chabay, 2000).

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[2] A participant uses overt SDL or covert SDL on an executive task. At the same time the experimenter attempts to prevent the participant from using SDL by giving them another simple verbal task, which they have to do at the same time as the main task.

These methodological issues and the proposed ways to address them are discussed further in the section describing future directions of research in this area.

Private gestures

In communicating with ourselves, apart from language, we also make use of body gestures to convey meaning. In emphasising the importance of SDL as a tool for self-regulation, we might be missing out information about cognitive processes that are not contained in children's discourse, but rather in their gestures. Several studies have shown how gestures inform us about mental cognitive processes and how they can be used as cognitive tools for learning in school-aged children and adults. Speakers spontaneously produce gestures in tasks involving spatial cognition (see Alibali, 2005 for a review), such as mental rotation (Chu & Kita, 2008) and the understanding of balance (Pine, Lufkin, Kirk, & Messer, 2007; Pine, Lufkin, & Messer, 2004). In a challenging balance beam task, older children who produced one idea in speech but a more advanced idea in gesture "made significantly more learning gains than children whose gestures and speech matched" (Pine et al., 2004, p. 1059). Children learning about a specific task through instruction accompanied by gestures were significantly more likely to produce the same strategy, with their own gestures, and those children who produced gestures were more likely to succeed in the task than children who did not; furthermore, instructing with gestures and encouraging children to gesture in specific tasks, has been found to improve children's learning of the task for longer (Cook & Goldin-Meadow, 2006; Cook, Mitchell, & Goldin-Meadow, 2008).

If we assume that gestures can also serve as cognitive tools, the question arises of whether we might be underestimating the self-regulatory capabilities of preverbal children. Even though there is a vast body of research concerning gestural communication and language acquisition in infancy and toddlerhood, the role of PG as cognitive tools has not been systematically studied.

Rodríguez and Palacios (2007) coined the term "private gestures", in analogy to "private speech", to describe self-directed gestures produced in the context of problem solving. These authors present a case study based on longitudinal observations (12 to 18 months) of a girl with Down's syndrome interacting with her mother and a toy that consisted of stacking rings around a vertical post. They argued that using the object in a *conventional way*, or by its social function, was a complex task for the girl, which had been scaffolded[3] by her mother by using both speech and non-verbal demonstrations and gestures. At 18 months of age, in contrast with observations made at 12 months, the

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[3] Assistance which encourages independent problem solving.

girl seemed to understand the function of the toy, but she encountered difficulties in the execution. She attempted, unsuccessfully, to stack rings around the post but failed to take into account the position of the ring and the trajectory she needed to follow with her hand in order to place it correctly. Two types of PG are described in the Rodríguez and Palacios' (2007) article, *private ostensive gestures* and *private pointing gestures.*

Ostensive gestures are those in which an object itself is used to communicate something about it, such as when showing an object, or demonstrating its use. A *private* ostensive gesture is described as a showing an object to oneself in order to *think externally* about how to solve a problem with the conventional use of the object. One of the observations provided describes the girl trying to place a ring on the vertical post, but failing to put it in the right position. Then she pauses the action and looks at the ring in her hand rotating it before trying to place it again, this time, successfully. In this case, the child is using the object, not to act upon it (pragmatic function), but to *think externally about it* (epistemic function).

Private pointing gestures, on the other hand, are described as self-directed indexical signs used to refer to the *direction* and the *place* in which the child should act upon the object in relation to its conventional. The girl *points* repeatedly at *the top of the vertical post* on which she tries to place the rings afterwards. Before the girl had understood the public function of the object, the mother produces similar pointing gestures to communicate where she should place the rings. According to the authors, private pointing gestures show that the girl is "regulating her own behaviour, using the same semiotic mediators previously employed by her mother" (Rodríguez & Palacios, 2007, p. 191).

Following the idea that preverbal children might use gestures to think about practical problems when using complex objects, Basilio and Rodríguez (2011) investigated 11- to 15-months-old children, using a hammering toy. The object consisted of a box with three holes on the top, and three balls that fitted tightly in these holes without falling through. The hammer was used to hit the balls and make them fall inside the box when they would exit through a lateral hole. Children were observed interacting with one of their parents and both parental mediation and children's uses of the object and gestures were analysed. No private pointing gestures were found, but private ostensive gestures were reported, used to solve how to grab the hammer correctly before using it to hit the balls. Also, *vocalisations* were described to be used in a similar way in which adults had used language for monitoring and evaluating actions. Both of these studies involved situations in which children are interacting with an adult, and therefore distinguishing between gestures that are directed to others, from those that are private, can be challenging. Delgado, Gómez, and Sarriá (2009) investigated specifically if 12 to 24-months-old toddlers would produce pointing

gestures in non-interactive situations, while being (a) completely alone in a room, and (b) in the presence of an adult who is not communicatively engaged (reading a book). They created a safe situation to observe these conditions and presented puppets out of the reach of the children to elicit pointing gestures. They found that more than 70% of the children used pointing gestures in a self-directed way, when they were completely alone or without seeking the adults' attention.

Delgado, Gómez, and Sarriá (2010) reported self-directed pointing gestures in naturalistic observations of 2 infants from 8 to 24 months old either to contemplate objects, or to maintain attention, or preceding actions upon objects. The functions attributed to these gestures differed from those described in Rodríguez and Palacios (2007) and Basilio and Rodríguez (2011) in that they were not associated with a specific practical task, and therefore were less specific.

The idea of infants being able to use gestures in a private way, or communicate to themselves with the same gestures which they use to communicate with others, is powerful because it changes our previous perception on the emergence of self-regulatory skills. The methodological limitations of correlational studies exploring the use of SDL for self-regulation in older children, which were mentioned earlier, also apply to the study of gestures in preverbal infants. Just as is observed in older children, mere frequencies or the self-directed nature of gesture are not as relevant to performance as whether the gesture is relevant to the task itself.

Self-directed language and private gestures in the development of emotional and motivational self-regulation

As already explained, the central idea of Vygotsky's sociocultural theory was the internalisation of language functions as a tool for the transmission of cognitive processes. Today there is an interest in extending this perspective to the linguistic and non-linguistic transmission of emotional and motivational behaviour.

Self-directed language

Self-regulation comprises cognitive, prosocial, emotional and motivational components, but fewer studies have addressed the role of SDL in the latter two aspects of self-regulation. Some authors have emphasised the importance of SDS in emotional control, suggesting that children use SDS for the purpose of managing intense emotions and for emotional release. This appears to be in line with Broderick (2001 as cited in Winsler et al., 2009), who reported a positive relationship between the occurrence of SDS in preschool children and their emotional self-regulatory

capabilities. Other researchers who examine verbal emotional self-regulation are interested in SDL as a *cognitive intervention* or *a strategy in behaviour modification* in psychological maladjustment in late childhood (Kendall & Treadwell, 2007; Treadwell & Kendall, 1996), adolescence (Calvete & Cardenoso, 2002), and adulthood (Calvete Zumalde, Landin, Estevez Gutierrez, Martinez, Cardenoso Ramirez, Villa Sanchez, & Villardon, 2005). The findings of these studies suggest that self-talk can have adaptive or maladaptive effects on behaviour. A more recent study conducted by Day and Smith (2012) focused on ways that preschool children's SDS was utilized during an emotion-eliciting task. They found out that sadness was associated with negatively valenced task-relevant SDS, and that anger was related to less facilitative task-relevant SDS and more negatively valenced task-relevant SDS (Day & Smith, 2012). These authors concluded that SDS had a self-regulatory function during a frustration task and they support its use in the classroom, due to its cognitive and emotional self-regulatory function (Day & Smith, 2012).

Apart from the important role in cognitive, prosocial and emotional behaviour, it seems that self-directed speech also helps children to maintain a positive task outlook (Schunk, 1986) and there have been a few studies which support this assumption. For example, Chiu and Alexander (2000) analysed the proportion of *metacognitive private speech* within 3 to 5 year old children's overall self-directed speech across three tasks. Metacognitive private speech was defined as self-directed speech which reflected children's awareness and regulation of their own thinking and which was particularly related to the children's task persistence and the desire to work independently of adult assistance (Chiu & Alexander, 2000). Their results indicated that the children's metacognitive private speech significantly correlated with their "disposition to strive for a challenging goal" (Chiu & Alexander, 2000, p. 133) and subsequent success on the tasks. Moreover, children who were engaged in such speech were more likely to strive to complete challenging tasks without direct involvement of an adult (Chiu & Alexander, 2000). Furthermore, results of the studies conducted by Montero and colleagues (de Dios & Montero, 2003; Montero & de Dios, 2006) were in line with the results of Chiu and Alexander (2000). They proposed that SDS helps children to internalise external motivation from the caregiver. The external motivation processes/strategies are transformed and internalised into an internal, intrapersonal motivation through SDL. In other words, they concluded that language served as a mediational tool during this process of internalisation of motivational regulation.

Private gestures

If we look at preverbal children, we notice that infants also encounter several cognitively and emotionally challenging situations in their everyday life. Being

separated from parents, receiving prohibitions about touching objects or approaching certain places, waiting for their turn, etc. can all be challenging for young children, especially at a preverbal stage. Several studies have investigated the early development of self-regulatory behaviours such as inhibitory control, compliance to adults' requests, effortful control, delay of gratification, and its relation to temperament, attachment, and even the genotype of certain alleles (Kochanska, Philibert, & Barry, 2009; Rothbart, Sheese, Rueda, & Posner, 2011; Rueda, Posner, & Rothbart, 2005). However, this research and the investigation of early communication have remained separate in the literature. The role of preverbal signs and early communicative behaviours in the development of emotional and motivational self-regulation remains largely unexplored.

Even so, two studies in this area have provided useful preliminary data. Vallotton, (2008a, 2008b) observed a small sample of children in a nursery setting in which caregivers regularly used and promoted baby signing, symbolic gestures similar to those of English Sign Language used by non hearing people. She explored how these symbolic gestures helped very young children to express and self-regulate their emotions and behaviour. The same author provides various examples of caregivers using these gestures to help children overcome challenging situations, and babies using these gestures by themselves. These include emotional soothing when parents leave by explaining that they are coming back later using the sign for "later" or a sign referring to a daily routine related with pick up time, waiting for a snack by signing "snack" and "wait", and participating by requesting a song using related signs.

Pea (1980) was not studying self-regulation and gestures directly, but investigating the development of negation in early development pointed out a type of gesture that constitutes a good example of preverbal self-regulation. Interestingly, among the semantic categories used to describe the functions of negation in young children such as head shakes and the word 'no', he described a *self-prohibition* function characterised as "a form of egocentric symbol use in which the child approaches a previously forbidden object or begins to do something which has been prohibited in the past and then expresses a negative" (Pea, 1980, p.164). During self-prohibition, the child enacted for herself the internalised social norm of "not-touching-hot-objects". The same author interpreted these types of self-prohibition negations from a Vygotskian perspective as a "turning *inward* of the externally accomplished interpersonal negation of prohibition" (Pea, 1980, p. 182).

METHODOLOGICAL ISSUES AND FUTURE DIRECTIONS

All the studies previously discussed appear to consistently support the importance of SDL and PG for the process of self-regulation. There remain, however, limitations in the research concerned with both SDL and PG which has been conducted to date. In general, these are mostly methodological issues and they will be addressed in the following sections.

Early emergence of self-regulatory skills

Research on self-regulation has been focused mainly on older children. In fact, the exploration of the development of the self-regulatory abilities in children under the age of six years was neglected until the early 2000s. This lack of attention was mainly due to the established idea that self-regulatory abilities have to be declarative, explicit (conscious) and as such cannot be expected in young children (Whitebread Coltman, Pino Pasternak, Sangster, Grau, et al., 2009). However, more recent research on metacognition and self-regulation in young children (Reder & Schunn, 1996; Siegler, 1996; Whitebread et al., 2005, 2009) clearly identifies the implicit (non-conscious) nature of self-regulatory processes at an early age. For example, as previously mentioned, recent research concerned with PG in preverbal children indicates early signs of semiotically mediated self-regulatory behaviours even in infants and toddlers. It seems that very young children's gestures during challenging problem solving also provides valuable information about how they think. In older children spontaneous gesturing prevails in concomitance with speech. However, in infants and toddlers in the preverbal stage, actions and gestures might be the only way to have access to their representations. Studying children's non-verbal means of communication is, therefore, imperative to understand the emergence of self-regulation in very early cognitive development. The ability to reflect upon problems using semiotic tools, and to be the producer and receptor of signs at the same time (as when producing PG), was thought to develop later in life through speech. Understanding the use of gestures in relation to self-regulatory development might lead to a more precise understanding of children's actual skills, and overcome a view by which infants and toddlers self-regulatory abilities are overlooked. Nevertheless, the research reviewed in this paper concerning the early use of PG with self-regulatory function is still in an initial state.

Correlational studies

Research on SDL and PG has predicted correlations (positive or negative) between presence and amount of task-relevant SDL and task *performance*, rather than actual

self-regulatory behaviour. Several methodological issues arise within this approach, which need to be addressed if we are to obtain meaningful insights into the relationship between children's self-regulatory processes, SDL and PG. Poor performance may not necessarily indicate a lower level of self-regulation. When looking at the performance and the use of SDS, we are in a way looking at the correlation between SDS and positive outcomes of a successful self-regulatory process, rather than a self-regulatory process and attempts at self-regulation themselves. Therefore, while the numerical values of these task-related variables may indicate a general degree of self-regulation employed in a task, not much can be inferred about what is actually being regulated during the task or activity and in what manner.
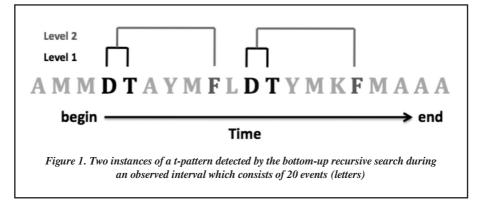
The inconsistent findings on the correlations between SDS and task performance might be partially explained by the work on strategy development (Fernyhough & Meins, 2009). Studies in this area have demonstrated that strategies such as SDS used in solving a task are not necessarily related to task performance and that children, even when engaging in the same task over multiple trials, will show inconsistent use of strategies (Bjorklund & Douglas, 1997; Miller, 1994; Schneider & Weinert, 1990). This might suggest that SDS and PG are strategies that children may employ when faced with a cognitive or emotional challenge, but that their occurrence and frequency in challenging situations may not be directly related to successful performance.

As a consequence, studies simply exploring SDL/PG-performance relationships may not help us to understand the role which language and gestures play in cognitive or emotional development. Therefore, one might argue that future research should focus on exploring the function of SDS and PG, investigating its relationship with the concurrent action and behaviour. This would help us to understand with more clarity the mechanism (if any) which underlies the self-regulatory function of language and gesture at the microlevel. In other words, it seems that the micro-analysis of children's actions while they are engaged in SDL and PG could offer a valuable contribution to understanding the actual role of those behaviours in the development of self-regulation.

Unlike contemporary research on SDL, Vygotsky's own observations (1962) focused on the actual moments of difficulty arising due to the introduction of an impediment to a task, when SDS increased, and on the role of the semantic content of self-directed speech, not merely its frequency, in self-regulation of behaviour. While Vygotsky's theoretical hypotheses regarding the relationship between SDS and self-regulation seem to be substantiated by existing correlational studies, they are limited in their potential to delineate the underlying processes through which SDS utterances afford the monitoring and control by children of their own behav-

iour. Correlations simply assume the co-occurrence of SDS and self-regulatory behaviour.
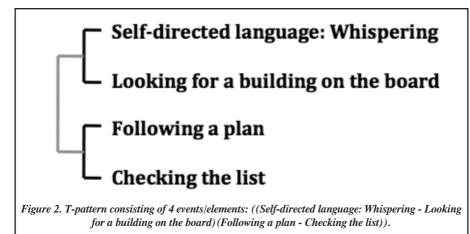
Hence it is imperative to examine the actual temporal co-incidence between spontaneous speech and nonverbal behaviours during children's daily activities and examine the contexts in which they occur. A recent study conducted by Kuvalja et al. (2013) demonstrated an innovative approach in analysing temporal co-incidence of SDS and non-verbal behaviour. They proposed the use of *t-pattern analysis* in detecting significantly recurring temporal patterns of verbal and non-verbal behaviour in this area of research. This method of identification of temporal patterns and co-occurrences in complex behavioural data is the pattern detection algorithm developed by Magnusson (1996, 2000). The algorithm detects repeated temporal patterns with a particular statistical relationship between their components, in any real-time data which has an underlying sequential structure (see Figure 1). These patterns do not comprise only of consecutive events occurring in real-time, they might also detect significantly recurring events which extend over a period of time, with intervening events of the real-time data occurring as random *noise events* present between the events detected as components of the temporal pattern (t-pattern) (Kuvalja et al., 2013).

Figure 1. Two instances of a t-pattern detected by the bottom-up recursive search during an observed interval which consists of 20 events (letters)

In Figure 1, the 2-level hierarchical pattern ((DT)F) comprising three events (black and dark grey letters) only becomes apparent when all other intervening events (light grey letters) are ignored.

We propose that the use of t-patterns can prove to be a powerful research tool particularly in investigating hidden temporal structures in behaviour, as it enables a robust quantitative analysis of data which picks up statistically significant patterns of behaviour, which can then be subjected to in-depth qualitative analyses (Kuvalja et al., 2013).

Their results demonstrate that this method has several advantages over standard frequency analysis and lag sequential analysis: (a) revealing the hidden temporal structure of a behavioural data, (b) going beyond global correlations or co-occurrence between pairs of events to detect complex temporal relationships between several behavioural events in real-time data, and (c) highlighting statistically relevant behavioural events for further qualitative analyses, thus, avoiding a biased selection of data. Figure 2 shows an example of a significant hidden t-pattern detected in the Kuvalja et al. (2013) study. The pattern was not identified by the other two types of analyses.

Figure 2. T-pattern consisting of 4 events/elements: ((Self-directed language: Whispering - Looking for a building on the board)(Following a plan - Checking the list)).

As gestures with self-regulatory functions have been only recently and not sufficiently described, it is still unknown if the use of PG and other-directed gestures in relation to specific problems, is positively related to children's ability to successfully solve problems. In the case of preverbal children, further studies analysing the temporal behavioural patterns between early communication and self-regulatory behaviours are likely to produce relevant information regarding the emergence of such mechanisms.

Microgenetic approach

The studies reported above concerned with gestures in infants and toddlers used a microgenetic approach to understand how early gestures were being used as tools for self-regulation, thus, providing valuable evidence on the actual behaviour of infants and toddlers during problem solving, in goal-directed activities and emotionally challenging

situations. However, there are many questions that remain unanswered by looking only at small samples of children from a microgenetic approach. For example, how does the production of early gestures and words relate to self-regulatory behaviours later in development? And what variables explain individual differences in the development of self-regulatory skills and early communication? We have learnt that young children are capable of using gestures and words in a self-regulatory way, but there is much more work to be done to investigate the cognitive value of these productions, their relation to other skills and variables such as gender, parental scaffolding strategies and language that may explain individual differences.

Developmental trajectories and individual differences

We know very little about the early trajectories of the development of the relation between language and gestures and self-regulation before the age of three, and especially during the second year of life. Changes in this stage are likely to be rapid, as language acquisition and goal-directedness are developing fast. Therefore longitudinal studies with several and frequent time waves are needed.

It is known that individual differences are found in the process of language acquisition and the use of gestures among children (Bates, Dale, & Thal, 1996; Bates & Dick, 2002). Further research is needed to understand the impact of such individual differences in early communicative skills and their impact on the development of self-regulatory skills.

Exploring parental mediation

Furthermore, according to Vygotsky's theory, the ability to use semiotic tools in a self-directed way is preceded by the learning of these tools in a communicative context. Therefore, in exploring the emergence of this skill, it is vital to also take into account the semiotic tools that parents use when interacting with their young children during problem solving. Research on early parent-child interactions shows that key aspects such as synchrony, and autonomy support, predict later success in self-regulatory tasks (Landry, Miller-Loncar, Smith, & Swank, 2002; Landry, Smith, & Swank, 2009). However, few studies focus specifically on the semiotic mediators that parents use together with language.

Conclusion

Research concerned with the early emergence of self-regulatory skills in young children has often been focused on the presence, frequency and content of SDL.

Some researchers have argued that such language has an important self-regulatory function and its use predicts subsequent performance, while others have suggested that SDL is one of the strategies which children use when in particular cognitively or emotionally challenging situations. Finally, some researchers have argued that such speech has no effect on subsequent behaviour and that it is merely an accompanying activity. What is similar in all of these studies is their correlational nature. In other words, they have mostly explored the relationship between task-relevant SDS and the child's subsequent performance on a specific task. However, it may be that the mere frequency of task-relevant SDS is not the crucial element, but that its content related to the task and the temporal context in which it is used in relation to actual moments of self-regulatory behaviour may shed more light on the possible relationship between the two. It seems that, in addition to correlational studies which investigate the relationship between SDS and task performance, studies exploring the significant recurring temporal patterns of SDS in the actual moments of emerging self-regulatory behaviour would contribute to an enhanced understanding of the functions of SDS. As we indicated earlier, whether these functions might be best described as "mediating" or "strategic" would be one theoretical issue which might be resolved through this enhanced analytical approach.

Very similar observations could be drawn from the research on PG in young children. In addition, research on PG is rather recent and only a few studies have explored in detail the function of such gestures and their role in the early emergence of self-regulatory behaviour. These mostly longitudinal studies have investigated the occurrence of SDS and its role in everyday challenging situations, suggesting that very young children might be using such gestures in a mediating way. It seems that by overlooking this phenomenon in infants and toddlers, we might be missing the first indicators if self-regulatory behaviour in very young children and its early development.

Finally, more in line with the research on strategy use, in their intent to understand the role of SDS and PG, researchers should perhaps address the use of both verbal and non-verbal semiotic systems and their interplay in the development of self-regulation. From the research on SDL and PG conducted so far, one might notice that children use the available and most appropriate semiotic system for self-regulation at a particular challenging moment. Investigating the function of only one modality of self-communication might, therefore, unnecessarily restrict our understanding of the early processes and development of self-regulation.

REFERENCES

Alibali, M. W. (2005). Gesture in spatial cognition: Expressing, communicating, and thinking about spatial information. *Spatial Cognition and Computation, 5*(4), 307-331.

Baddeley, A., Chincotta, D., & Adlam, A. (2001). Working memory and the control of action: Evidence from task switching. *Journal of Experimental Psychology: General, 130*(4), 641-657.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory.* Englewood Cliffs, NJ: Prentice-Hall.

Basilio, M., & Rodríguez, C. (2011). Usos, gestos y vocalizaciones privadas: de la interaccion social a la autorregulacion. *Infancia y Aprendizaje, 34*, 181-194.

Bates, E., Dale, P. S., & Thal, D. (1996). Individual differences and their implications for theories of language development. In P. Fletcher & B. MacWhinney (Eds.), *Handbook of child language* (pp. 96-151). Oxford: Wiley-Blackwell.

Bates, E., & Dick, F. (2002). Language, gesture, and the developing brain. *Developmental Psychobiology, 40*(3), 293-310.

Berk, L. E. (1986). Relationship of elementary school children's private speech to behavioral accompaniment to task, attention, and task performance. *Developmental Psychology, 22*(5), 671-680.

Berk, L. E., & Landau, S. (1993). Private speech of learning disabled and normally achieving children in classroom academic and laboratory contexts. *Child Development, 64*(2), 556-571.

Bjorklund, D., & Douglas, R. (1997). The development of memory strategies. In N. Cowan & C. Hulme (Eds.), *The development of memory in childhood* (pp. 201-246). Hove. East Sussex, UK: Psychology Press.

Bronson, M. (2001). *Self-regulation in early childhood: Nature and nurture*. London: The Guilford Press.

Calvete, E., & Cardenoso, O. (2002). Self-talk in adolescents: Dimensions, states of mind, and psychological maladjustment. *Cognitive Therapy and Research, 26*(4), 473-485.

Calvete Zumalde, E., Landin, C., Estevez Gutierrez, A., Martinez, Y., Cardenoso Ramirez, O., Villa Sanchez, A., & Villardon, L. (2005). Self-talk and affective problems in college students. *Spanish Journal of Psychology, 8*(1), 56-67.

Carlson, S., & Moses, L. (2001). Individual differences in inhibitory control and children's theory of mind. *Child Development, 72*(4), 1032-1053.

Chiu, S., & Alexander, P. (2000). The motivational function of preschoolers' private speech. *Discourse Processes, 30*(2), 133-152.

Chu, M., & Kita, S. (2008). Spontaneous gestures during mental rotation tasks: Insights into the microdevelopment of the motor strategy. *Journal of Experimental Psychology: General, 137*(4), 706-723.

Cook, S. W., & Goldin-Meadow, S. (2006). The role of gesture in learning: Do children use their hands to change their minds? *Journal of Cognition and Development, 7*(2), 211-232.

Cook, S. W., Mitchell, Z., & Goldin-Meadow, S. (2008). Gesturing makes learning last. *Cognition, 106*(2), 1047-1058.

Day, K. L., & Smith, C. L. (2012). Understanding the role of private speech in children's emotion regulation. *Early Childhood Research Quarterly, 28*(2), 405-414.

de Dios, M., & Montero, I. (2003, April). The motivational function of private speech: An experimental approach. *Paper presented at the Biennial Meeting of the Society for Research in Child Development*. Tampa, FL: Educational Resources Information Center.

Delgado, B., Gómez, J. C., & Sarriá, E. (2009). Private pointing and private speech: developing parallelisms. In A. Winsler, C. Fernyhough, & I. Montero (Eds.), *Private speech, executive functioning, and the development of verbal self-regulation* (pp. 153-162). Cambridge: Cambridge University Press.

Delgado, B., Gómez, J. C., & Sarriá, E. (2010). Funciones tempranas del gesto de señalar privado: la contemplación y la autorregulación a través del gesto de señalar. *Acción Psicológica, 7*(2), 59-70.

Diaz, R. M., & Berk, L. E. (1992). *Private speech: From social interaction to self-regulation*. Hillsdale, NJ: Erlbaum.

Duncan, R., & Cheyne, J. (2001). Private speech in young adults: Task difficulty, self-regulation, and psychological predication. *Cognitive Development, 16*(4), 889-906.

Duncan, R., & Pratt, M. (1997). Microgenetic change in the quantity and quality of preschoolers' private speech. *International Journal of Behavioral Development, 20*(2), 367-383.

Efklides, A. (2006). Metacognition and affect: What can metacognitive experiences tell us about the learning process? *Educational Research Review, 1*(1), 3-14.

Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. *European Psychologist, 13*(4), 277-287.

Efklides, A. (2011). Interactions of metacognition with motivation and affect in self-regulated learning: The MASRL model. *Educational Psychologist, 46*(1), 6-25.

Emerson, M., & Miyake, A. (2003). The role of inner speech in task switching: A dual-task investigation. *Journal of Memory and Language, 48*(1), 148-168.

Fernyhough, C. (2008). Getting Vygotskian about Theory of Mind: Mediation, dialogue, and the development of social understanding. *Developmental Review, 28*(2), 225-262.

Fernyhough, C., & Fradley, E. (2005). Private speech on an executive task: Relations with task difficulty & task performance. *Cognitive Development, 20*(1), 103-120.

Fernyhough, C., & Meins, E. (2009). Private speech and theory of mind: Evidence for developing interfunctional relations. In A. Winsler, C. Fernyhough, & I. Montero (Eds.), *Private speech, executive functioning, and the development of verbal self-regulation* (pp. 95-105). Cambridge: Cambridge University Press.

Fernyhough, C., & Russell, J. (1997). Distinguishing one's own voice from those of others: A function for private speech? *International Journal of Behavioral Development, 20*(4), 651-665.

Flavell, J. H. (1992). Perspectives on perspective taking. In H. Beilin, & P. Pufall (Eds.), *Piaget's theory: Prospects and possibilities* (pp.107-139). Hillsdale, NJ: Erlbaum.

Flavell, J. H., Beach, D., & Chinsky, J. (1966). Spontaneous verbal rehearsal in a memory task as a function of age. *Child Development, 37*(2), 283-299.

Frauenglass, M., & Diaz, R. (1985). Self-regulatory functions of children's private speech: A critical analysis of recent challenges to Vygotsky's theory. *Developmental Psychology, 21*(2), 357-364.

Frawley, W., & Lantolf, J. (1986). Private speech and self-regulation: A commentary on Frauenglass and Diaz. *Developmental Psychology, 22*(5), 706-708.

Goodman, S. (1981). The integration of verbal and motor behavior in preschool children. *Child Development, 52*(2), 280-289.

Grolnick, W., Bridges, L. J., & Connell, J. P. (1996). Emotion regulation in two-year-olds: Strategies and emotional expression in four contexts. *Child Development, 67*(3), 928-941.

Grolnick, W., & Farkas, M. (2002). Parenting and the development of children's self-regulation. In M. H Bornstein (Ed.), *Handbook of parenting: Practical issues in parenting,* Vol. 5 (2nd ed., pp. 89-110). Hillsdale, NJ: Erlbaum.

Keeney, T. J., Cannizzo, S. R., & Flavell, J. H. (1967). Spontaneous and induced verbal rehearsal in a recall task. *Child Development, 38*(4), 953-966.

Kendall, P., & Treadwell, K. (2007). The role of self-statements as a mediator in treatment for youth with anxiety disorders. *Journal of Consulting and Clinical Psychology, 75*(3), 380-389.

Kochanska, G., Philibert, R. A., & Barry, R. A. (2009). Interplay of genes and early mother-child relationship in the development of self-regulation from toddler to preschool age. *Journal of Child Psychology and Psychiatry, 50*(11), 1331-1338. doi:10.1111/j.1469-7610.2008.02050.x

Kuvalja, M., Verma, M., & Whitebread, D. (2013). Patterns of co-occurring self-regulatory behaviour and self-directed speech in typically developing children and children with Specific Language Impairment. *Metacognition and Learning* (Special Issue: *Understanding the sequential and temporal characteristics of self-regulated learning.* doi: 10.1007/s11409-013-9106-7).

Landry, S. H., Miller-Loncar, C. L., Smith, K. E., & Swank, P. R. (2002). The role of early parenting in children's development of executive processes. *Developmental Neuropsychology, 21*(1), 15-41. doi:10.1207/S15326942DN2101_2

Landry, S. H., Smith, K. E., & Swank, P. R. (2009). New directions in evaluating social problem solving in childhood: Early precursors and links to adolescent social competence. *New Directions for Child and Adolescent Development, 123*, 51-68.

Lidstone, J., Meins, E., & Fernyhough, C. (2010). The roles of private speech and inner speech in planning during middle childhood: Evidence from a dual task paradigm. *Journal of Experimental Child Psychology, 107*(4), 438-451.

Magnusson, M. S. (1996). Hidden real-time patterns in intra- and inter-individual behavior: Description and detection. *European Journal of Psychological Assessment, 12*(2), 112-123. doi:10.1027/1015-5759.12.2.112

Magnusson, M. S. (2000). Discovering hidden time patterns in behavior: T-patterns and their detection. *Behavior Research Methods, Instruments, & Computers: A Journal of the Psychonomic Society, Inc, 32*(1), 93-110.

Manning, B., White, C., & Daugherty, M., (1994). Young children's private speech as a precursor to metacognitive strategy use during task engagement. *Discourse Processes, 17,* 191-211.

Miller, P. (1994). Individual differences in children's strategic behaviors: Utilization deficiencies. *Learning and Individual Differences, 6*(3), 285-307.

Miyake, A., Emerson, M., Padilla, F., & Ahn, J. (2004). Inner speech as a retrieval aid for task goals: The effects of cue type and articulatory suppression in the random task cuing paradigm. *Acta Psychologica, 115*(2-3), 123-142.

Montero, I., & de Dios, M. (2006). Vygotsky was right. An experimental approach to the study of the relationship between private speech and task performance. *Estudios de Psicologia, 27,* 175-189.

Nelson, T. O., & Narens, L. (1990). Metamemory: A theoretical framework and new findings. In G. Bower (Ed.), *The psychology of learning and motivation: Advances in research and theory* (pp. 125-173). New York: Academic.

Pea, R. (1980). The development of negation in early child language. In D. R. Olson (Ed.), *The social foundations of language and thought: Essays in honor of Jerome S. Bruner* (pp. 156-186). London: Norton.

Pine, K. J., Lufkin, N., Kirk, E., & Messer, D. (2007). A microgenetic analysis of the relationship between speech and gesture in children: Evidence for semantic and temporal asynchrony. *Language and Cognitive Processes, 22*(2), 234-246.

Pine, K. J., Lufkin, N., & Messer, D. (2004). More gestures than answers: Children learning about balance. *Developmental Psychology, 40*(6), 1059-1067.

Reder, L. M., & Schunn, C. D. (1996). Metacognition does not imply awareness: Strategy choice is governed by implicit learning and memory. In L. M. Reder (Ed.), *Implicit memory and metacognition* (pp. 45-77). Hillsdale, NJ: Lawrence Erlbaum Associates, INC.

Rodríguez, C., & Palacios, P. (2007). Do private gestures have a self-regulatory function? A case study. *Infant Behavior and Development, 30*(2), 180-194.

Rothbart, M. K., Sheese, B. E., Rueda, M. R., & Posner, M. I. (2011). Developing mechanisms of self-regulation in early life. *Emotion Review, 3*(2), 207-213. doi:10.1177/1754073910387943

Rueda, M. R., Posner, M. I., & Rothbart, M. K. (2005). The development of executive attention: Contributions to the emergence of self-regulation. *Developmental Neuropsychology, 28*(2), 573-594. doi:10.1207/s15326942dn2802_2

Schneider, W., & Weinert, F. (1990). The role of knowledge, strategies, and aptitudes in cognitive performance: Concluding comments. In W. Schneider & F. Weinert (Eds.), *Interactions among aptitudes, strategies, and knowledge in cognitive performance* (pp. 286-302). New York: Springer.

Schunk, D. H. (1986). Verbalization and children's self-regulated learning. *Contemporary Educational Psychology, 11*(4), 347-369.

Siegler, R. S. (1996). *Emerging minds: The processes of change in children's thinking*. Oxford: Oxford University Press.

Treadwell, K., & Kendall, P. (1996). Self-talk in youth with anxiety disorders: States of mind,

content specificity, and treatment outcome. *Journal of Consulting and Clinical Psychology, 64*(5), 941-950.

Vallotton, C. D. (2008a). Signs of emotion: What can preverbal children "say" about internal states? *Infant Mental Health Journal, 29*(3), 234-258. doi:10.1002/imhj.20175

Vallotton, C. D. (2008b). Infants take self-regulation into their own hands. *Zero to Three Journal, 29*, 29-34.

Vygotsky, L. S. (1930/1978). *Mind in society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Vygotsky, L. S. (1962). *Thought and language*. Cambridge, MA: MIT Press.

Vygotsky, L. S., & Luria, A. (1934/1994). Tool and symbol in child development. In J. Valsiner, & R. Van Der Veer (Eds.), *The Vygotsky reader* (pp. 99-174). Oxford: Blackwell.

Whitebread, D., Anderson, H., Coltman, P., Page, C., Pino Pasternak, D., & Mehta, S. (2005). Developing independent learning in the early years. *Education 3-13, 33*, 40-50.

Whitebread, D., Coltman, P., Pino Pasternak, D., Sangster, C., Grau, V., Bingham, S., Almeqdad, Q., & Demetriou, D. (2009). The development of two observational tools for assessing metacognition and self-regulated learning in young children. *Metacognition and Learning, 4*(1), 63-85

Winsler, A., Diaz, R. M., Atencio, D. J., McCarthy, E. M., & Chabay, L. (2000). Verbal self-regulation over time in preschool children-at-risk for attention and behavior problems. *The Journal of Child Psychology and Psychiatry and Allied Disciplines, 41*(7), 875-886.

Winsler, A., Diaz, R., M., McCarthy, E. M., Atencio, D. J., & Chabay, L. (1999). Mother-child interaction, private speech, and task performance in preschool children with behavior problems. *Journal of Child Psychology and Psychiatry, 40*(6), 891-904.

Winsler, A., Fernyhough, C,. & Montero, I. (2009). *Private speech, executive functioning, and the development of verbal self-regulation*. Cambridge: Cambridge University Press.

Winsler, A., & Naglieri, J. (2003). Overt and covert verbal problem-solving strategies: Developmental trends in use, awareness, and relations with task performance in children aged 5 to 17. *Child Development, 74*(3), 659-678.