The Use of Movement-Based Interventions Targeting Psychosocial Outcomes for Children Diagnosed with Autism

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A good traveler has no fixed plans, and is not intent on arriving.

– Lao Tzu

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ABSTRACT

From its first description by Leo Kanner in 1943, the autism spectrum disorder (ASD) has raised considerable attention, and subsequent understandings of the disorder have followed a variety of perspectives and trends. Initial perspectives of the ASD were from a dominant social-cognitive stance and led to behavioral and social cognitive training for individuals with autism. These approaches have shown limited results in terms of efficacy and their generalization of skills in the day-to-day life of children with ASD remains unclear. A subsequent perspective expanded the focus to include bodily challenges (e.g. sensory and motor), and has led to interventions which target the body. These types of interventions resulted in motoric (praxis, imitation) and psychosocial (such as participation and social interaction skills) outcomes, and thus, provided new focus to target psychosocial outcomes. **Objective:** The overarching objective of this thesis is to report on and to present the scope of movement-based interventions (MBIs) that target psychosocial outcomes with children diagnosed with autism in terms of efficacy, knowledge-use and specification in treatment. **Methods:** The present study is a two-fold review and analysis of the current literature on the use of MBIs targeting psychosocial outcomes in children diagnosed with ASD. The first phase follows a scoping review methodology involving a thematic and descriptive numerical analysis. The second phase builds on a multiple case synthesis methodology using hermeneutic and component analysis of 12 published articles that describe and report on the efficacy of specific MBIs. **Results:** In the first phase, we reported on the efficacy and the range of outcome measure used to capture psychosocial outcomes. In the second phase, we elaborated on the theoretical foundations and characteristics in terms of how they are used in research. **Conclusion:** The MBIs we analyzed show promising signs of efficacy, however intervention research on the use of MBIs targeting psychosocial outcomes in children with ASD is still in its infancy in terms of proof of significance, use of embodied knowledge and specification in treatment.
Depuis sa première description par Leo Kanner en 1943, le trouble du spectre autistique (TSA) a fait l’objet d’attention considérable et fut perçu et expliqué sous différentes perspectives. La première génération de recherche sur le TSA fut dominée par des modèles cognitivo-comportementaux menant à des interventions sociocognitives et comportementales. Cependant, ce type d’intervention auprès d’enfants ayant un TSA demeure limité en terme d’efficacité et de la généralisation de leurs acquis au quotidien. Une deuxième vague de recherche a élargi le focus en incluant également les déficits corporels de ces enfants (sensoriels et moteurs). De ce fait, des interventions ayant comme cible le corps ont vu le jour aboutissant à des résultats moteurs (praxis, imitation), mais également au niveau de la participation et d’interactions sociales.

Objectifs : L’objectif global de cette thèse vise à montrer et à comprendre l’étendue de recherche actuellement présente dans la littérature en ce qui a trait aux interventions axées sur le mouvement ciblant le fonctionnement psychosocial d’enfant ayant un TSA. Méthodes : Ce projet de recherche comprend deux phases distinctes. La première phase suit une méthodologie d’examen de la portée incluant une analyse thématique et descriptive des interventions axées sur le mouvement ciblant le fonctionnement psychosocial d’enfant ayant un TSA. Le deuxième volet de cette thèse s’inspire d’une méthodologie de synthèse méta-narrative basée sur une analyse hermétique des modèles et composantes présentes dans les interventions revues. Résultats : Les résultats des douze études revues ont pu démontrer l’efficacité de ce type d’intervention en plus de signaler le vaste éventail d’outils et de méthodes pour évaluer le fonctionnement psychosocial. De plus, nous avons pu mettre en évidence les bases théoriques ainsi que certaines caractéristiques communes de ces interventions. Conclusion : Les interventions axées sur le mouvement ciblant le fonctionnement psychosocial d’enfant ayant un TSA démontrent des signes prometteurs d’efficacité. Cependant, l’état actuel de la recherche à ce niveau ainsi que la rigueur dans leur développement théorique demeure dans leurs premières phases.
PREFACE

This thesis does not contain material that has been published elsewhere or written by someone else, with the exception of specific referenced sections. This thesis is made of original material and contributes to emerging knowledge in innovative intervention research in the field of autism.

Author’s contributions

This manuscript-based thesis is the result of multiple steps. This research began with several discussions and meetings with Dr. Melissa Park to discuss of research interests. Following steps include the protocol presentation prepared by Keven Lee and his committee, and its approval by the School of Physical and Occupational Therapy at McGill University. Following approval, Keven Lee conducted the research project with the support and guidance of his research committee: Dr. Eva Kehayia, Dr. Walter Wittich, thesis co-supervisor, and Dr Melissa Park, thesis advisor. The present manuscripts are the product of Keven Lee with feedback and editing from Dr. Melissa Park, Dr. Walter Wittich, and Dr. Eva Kehayia.

Organization of thesis

This thesis is organized as six separate chapters including two manuscripts. Chapter 1 provides the foundation of the thesis and consists of an overview of the different descriptive and research trends within the field of autism. The overview of the current literature sets the stage for the use of movement-based interventions (MBIs) targeting psychosocial outcomes in children diagnosed with ASD by tracing the evolution of the diagnosis and perspectives over time, the impacts of core deficits on participation, communication, and the relevance of emerging model towards the use movement as a core intervention for psychosocial outcomes.

Chapter 2 introduces the rationale and general objective of the thesis in addition to the objectives of the two manuscripts.

Chapter 3 is the first manuscript of the thesis, which consists of a scoping review of the present literature on the use of movement-based interventions targeting psychosocial outcomes in children diagnosed with autism.
Chapter 4 is the bridge between the first and the second manuscript. In this section we describe the findings of the first manuscript and provide the rationale for the second manuscript.

Chapter 5 consists of the second manuscript, which is a multiple case synthesis (MCS) of the literature on the use of movement-based interventions targeting psychosocial outcomes with children diagnosed with autism. This MCS aims to compare the reviewed articles in order to identify the underlying theories of the interventions and identify patterns within their operationalization.

Chapter 6 is a general conclusion and summary of the thesis and highlights implications for future research.

Tables, figures, and references specific to each manuscript are presented at the end of their respective chapter. The references for all chapters are displayed at the end of the thesis.
CHAPTER 1: OVERVIEW OF THE LITERATURE

1.1 General introduction of the overview

From its first description by Leo Kanner (1943), the body of research on the autism spectrum disorder (ASD) has followed different perspectives over time. Although ASD was initially understood within a cognitive-behavioral perspective, evidence of the sensory motor challenges that are associated with children with ASD have led researcher and clinician to question this unilateral focus on psychosocial deficits (Volkmar, State, & Klin, 2009). By including the bodily challenges (e.g. sensory and/or motor) associated with ASD, the researchers shifted focus from a behavioral-cognitive perspective of ASD towards one that is more holistic and embodied. An embodied perspective examines sensory and motor action experiences as the foundation for internal structures such as cognition, emotions, communication, and abstract thoughts (Johnson, 1999). Thus, an embodied perspective takes into account the sensory and motor challenges to participation, defined as “involvement in life situations” (World Health Organization, 2007, p. 229). Using this shift in perspective as a starting point, in this thesis we explore the effects of movement-based interventions (MBIs) targeting psychosocial outcomes in children diagnosed with autism. The following overview of the literature traces the evolution of the autism diagnosis and the different perspectives over time, the impact that core deficits have on participation, communication, and the relevance of the emerging model towards the use of movement as the core of interventions which aim to improve psychosocial outcomes.

1.2 Identification and evolution of the autism spectrum disorder diagnostic

In the biomedical community, the ASD is viewed as a lifelong neurodevelopment condition (Bracher, 2012). Yet, the diagnosis, name and criteria have changed numerous times over the past 70 years since the first description by Kanner (1943). This first section will focus on the historical evolution of the diagnosis of the autism spectrum disorder – from Kanner (1943) to the current DSM-V (2013).
1.2.1 Kanner’s autistic disturbance of affective contact

The psychiatrist Leo Kanner (1943) first described what we now know as the autism spectrum disorder (ASD) from an extensive description of 11 cases of young children with a special condition. Kanner (1943) made a clear distinction between the extreme aloneness in *autistic disturbance of affective contact* and the childhood schizophrenic phenomena. In his description, children did not respond to the outside world such as not showing anticipatory posture adjustment upon being picked up. Furthermore, Kanner (1943) described the children as “strangers from the beginning” who gradually find a way to compromise with the world as opposed to an individual with schizophrenia who “tries to solve his problem by stepping out of a world of which he has been a part” (p.249).

Although the children showed reluctance and anxiety resulting from contact with other people, they demonstrated awareness of others’ names and characteristics. When the contact became inevitable, they were also able to temporarily enter into relationships with others. However, similar to their ability to establish and maintain purposeful relation to objects, their relationships to others remained at the level of *object relation* because the body parts involved were perceived as detached objects from the whole person. Kanner (1943) also described these children as presenting obsessive desire for experience of sameness. For example, once they experienced their world in a certain way, they could not tolerate it in any other way.

1.2.2 Evolution of diagnostic criteria

The autism diagnosis has changed in criteria and name from its first description by Kanner in 1943. Neither of the two first editions of the Diagnostic and Statistical Manual of Mental Disorders (DSM) published by the American Psychiatric Association (APA, 1955, 1968) included the autism spectrum disorder and were classified as having childhood schizophrenia. Its first appearance was in the DSM-III (APA, 1980) named as *infantile autism* under a group of five overlapping pervasive developmental disorders (Huebner, 1992). The revised version of the third DSM (DSM-III-R; APA, 1987) published by the American Psychiatric Association acknowledged the *autistic disorder* and the *pervasive developmental disorder* (PDD). This new version attempted to establish a developmental orientation and to cover the entire spectrum of this disorder by using a series of set criteria (Volkmar, Bregman, Cohen, & Cicchetti, 1988). One effect of this broadening of the diagnosis criteria was an increase in the number of diagnosed
children. Furthermore, at least eight of the 16 criteria had to be met for a diagnosis of autism. The resulting thousands of possible combinations of criteria reflected the heterogeneity of the spectrum and created the possibility of a variety of subtypes (Factor, Freeman, & Kardash, 1989). The subsequent increase in incidence and awareness given to the ASD resulted in autism being seen as an area in need within the community, and thus had an impact on policy-making and resource allocation (Huebner, 1992).

In 1994, the APA published the DSM-IV and included different subtypes and categories of pervasive development disorders (PDD). In this version, an individual only needed to exhibit six of the 16 criteria in order to be diagnosed. The three main categories of criteria for an diagnosis were: 1) qualitative impairments in social interaction, 2) qualitative impairments in communication, and 3) restricted, repetitive patterns of behavior, interests, or activities (APA, 1994). These categories stayed the same for the DSM-IV-TR (APA, 2000). As a result of the increased research attention given to the ASD over the past decade, the PDD subtypes were eliminated in the publication of the fifth version of the DSM. The three main categories of diagnostic criteria were also reduced to two: 1) persistent deficits in social communication and interactions across contexts, and 2) restricted repetitive patterns of behavior (RRB) (APA, 2013). As opposed to a checklist of 16 criteria organized into three categories of the earlier version, from which 6 criteria needed to be met for diagnosis, the DSM-V diagnosis requires deficits in the three areas of social communication and interaction category (i.e. social-emotional reciprocity; nonverbal communication; developing, maintaining, and understanding relationships) and manifestation of at least two areas of RRBs (i.e. stereotyped or repetitive motor movements, use of objects, or speech; insistence on sameness, inflexible adherence; highly restricted, fixated interests; hyper- or hypo-reactivity to sensory input or unusual interest in sensory aspects of the environment).

According to Lord and Bishop (2015), the elimination of the subtypes and the broadening the diagnostic criteria was an attempt to account for the heterogeneity of the spectrum. For an ASD diagnosis, the criteria may be met by historical behaviors but must also include concurrent impairments in functioning. These more inclusive principles for diagnosis encourage clinicians to pay closer attention to and describe more precisely how the ASD is reflected within an individual across gender, age, and cultures, which recognizes the fundamental role of context (e.g. spatial,
temporal, cultural, developmental) in the assessment of social-communication and repetitive behaviors (Lord & Bishop, 2015).

1.3 Impact on participation and communication

Core deficits, which make up the ASD diagnostic criteria, are defined as impairments in social communication and interaction, as well as the presence of restricted, repetitive patterns of behaviors (APA, 2013). In occupational therapy, participation has become a main focus of intervention goals and research outcomes. The focus of the following section is to provide an overview of the concept of participation as well as the research done on participation of children with ASD. Communication, a core deficit of an autism spectrum disorder, is also essential for participation. Thus, an overview of communication and research on the communication of children with ASD will follow.

1.3.1 Participation

Many scholars have attempted to define participation and develop specific measures for this complex construct. The World Health Organization (2007, p. 229) defines it as “involvement in life situations”. Mallinson and Hammel (2010) define participation as what one can do, wants to, and has the opportunity to do. Participation has been examined using both objective and subjective components (Coster & Khetani, 2008; Maxwell, Augustine, & Granlund, 2012; McConachie, Colver, Forsyth, Jarvis, & Parkinson, 2006; Seekins et al., 2012). The objective component of participation is what we can observe such as the types of activities, the frequency of engagement, and with whom individuals engage with during these activities. These components can be used to identify limitations to guide intervention as well as policies about universal design (Coster & Khetani, 2008). Although objective components are essential to understand function, establishing a “gold standard” should not be the focus of rehabilitation research (Hammel et al., 2008).

The International Classification of Functioning, Disability and Health: Children and Youth Version (ICF-CY) identifies the sense of belonging or satisfaction with the extent of one’s involvement as the subjective components of participation (WHO, 2007). Researchers within occupational therapy claim that the subjective component of participation is the most crucial component of the ICF as it is essential to understand what is meaningful to an individual (Coster
& Khetani, 2008; Hemmingsson & Jonsson, 2005; Ueda & Okawa, 2003). Hence, researchers claimed that we should focus on the individual’s perspective (Brown, 2010), such as the ability to choose, control over, freedom to participate in meaningful activities (Hammel et al., 2008), satisfaction, sense of fulfillment, enjoyment, and the experience of being recognized by others (Seekins et al., 2012). Researchers also note the importance of considering contextual factors, such as the social environment of the task and family (Coster & Khetani, 2008; DeGrace, 2004; LaVesser & Berg, 2010; Law, 2002; Mallinson & Hammel, 2010; McConachie et al., 2006). Yet, Seekins et al. (2012), in their systematic scoping review, found that measures used in current research rarely captured the subjective experiences of participation. When this experience was accounted for, it was relatively simplistic and did not appear to be based on theory or previous research.

### 1.3.1.1 Participation and autism

Research demonstrates differences in the participation patterns of children with autism as opposed to typical children. Children with autism demonstrate engagement in a limited range of activity types (Hilton, Crouch, & Israel, 2008; Hochhauser & Engel-Yeger, 2010) and more home-based and solitary leisure activities (Potvin, Snider, Prelock, Kehayia, & Wood-Dauphinee, 2012; Solish, Perry, & Minnes, 2010). For example, in their study of 103 children with ASD and 41 typically developing children, LaVesser and Berg (2010) reported that children with ASD participated in fewer activities in all seven domains of the Preschool Activity Card Sort (Preschool ACS). Children with autism also engaged in activities with a smaller range of persons (Hilton et al., 2008; Potvin et al., 2012). In addition, Reynolds, Bendixen, Lawrence, and Lane (2011) reported that children with low sensory registration appeared to be less engaged with their environment.

Research using objective components explain the child’s non-participation profile in terms of impairments in communication, social interaction, atypical behaviors (Hughes, 2009; LaVesser & Berg, 2010; Potvin et al., 2012), sensory challenges (Reynolds et al., 2011), and/or motor skills deficits (Green et al., 2002; Molloy, Dietrich, & Bhattacharya, 2003; Rinehart, Bradshaw, & Brereton, 2001). LaVesser and Berg (2010) also note family and environmental reasons for non-participation, such as parental assumptions that their child will not or cannot engage in certain activities, fear of stigmatization, and availability or accessibility of activities.
They still suggest that, ultimately, the children’s challenges with communication interfered with their parents’ ability to determine whether or not their children were ready to or able to engage in an activity. Although the objective component of participation has been extensively researched, only a few studies examine the subjective components for children with autism. For example, Potvin et al. (2012) reported that even if children with ASD demonstrated a different pattern of participation, they showed the same level of enjoyment in and preferences for activities as their typically developing peers. Ethnographic studies also report that children and adults with ASD have many meaningful activities, but may have different ways in how they participate in activities and may use activities as a mode of communication (Bagatell, 2012; Spitzer, 2003).

1.3.2 Communication

The process of communication involves the sharing and co-construction of meaning between partners (Jaegher & Paolo, 2007) through the use of both verbal and nonverbal symbols. Nonverbal communication includes many forms such as bodily contact or orientation, facial expression, eye contact, and gestures (Sparaci, 2007). Gestures hold a close relation to speech (Kendon, 2004) and its development (Volterra, Caselli, & Capirci, 2005). However, Volterra et al. (2005) suggest that gestures are not to be considered as pre-linguistic, but as part of a continuum from the preverbal to the linguistic phase. In fact, McNeill (2008) considers gestures as a single system of communication based on underlying common thought processes. Thus, for successful communication to happen, participants must be bound by a common understanding of shared and co-constructed meaning, which is synchronized through verbal and nonverbal forms (Kelly et al., 2002; Rossetti, Ashby, Arndt, Chadwick, & Kasahara, 2008; Spitzer, 2003; Stern, 1985). Furthermore, the meaning and understanding of gestures is context-dependent (Jaegher & Paolo, 2007; Sparaci, 2007). For example, Cattaneo et al. (2007) make the distinction between understanding a single motor action (grasping) and the global goal of the entire motor action (eating). This distinction between the single act and the contextualized action establishes two levels of observations 1) what the person is doing and 2) why or the meaning of action, which is context related.

1.3.2.1 Communication and autism

Children with autism present, to various extents, deficits in communication (Prelock & Nelson, 2012). Considered as a red flag for diagnosis and intervention (Mays & Gillon, 1993;
Siegel, Pliner, Eschler, & Elliott, 1988), communication impairments are well established within the core deficits of children with ASD (Hobson, Lee, & Hobson, 2007; Owens, Granader, Humphrey, & Baron-Cohen, 2008; Prelock & Nelson, 2012; Volkmar, Lord, Bailey, Schultz, & Klin, 2004). In addition to verbal communication deficits, children with ASD also have impairments in the use of nonverbal communication in terms of frequency of use, the way they are used (why and how), and also in their understanding of other’s gestures (Boria et al., 2009; Sparaci, 2007). For example, Sparaci (2007) showed that children with ASD are more likely to show more demonstrative gestures and lack in the use of expressive gestures, such as when communicating emotions. This is also supported by studies which show a deficiency of facial expressions recognition by children with ASD (Adolphs, Sears, & Piven, 2001; Clark, Winkielman, & McIntosh, 2008; Humphreys, Minshew, Leonard, & Behrmann, 2007). In addition, Cattaneo et al. (2007) found that children with ASD failed to recognize the intention behind others’ actions as they tended to refer to the action itself and not the global context of the action, such as grasping versus eating.

1.4 Evolution of explanatory perspectives on autism

For the purpose of this thesis, we broaden the concept of participation and communication to the more generic terms of psychosocial outcomes. Further, this section aims to guide the reader on how the different perspectives on autism changed and shaped psychosocial interventions in regards to the development and attention given to new models and perspectives. Thus, we describe the trend in perspectives which examined autism in terms of social cognitive components, sensory and motor components, and neuroscience, and finally towards a more embodied perspective. An embodied perspective is defined as one that takes into account sensory and motor experiences as the foundation for internal structures, such as cognition, emotions, communication, and abstract thoughts (Johnson, 1999).

1.4.1 Social cognitive perspectives

The first generation of research focused on a social cognitive perspective to explain the behaviors and main symptoms of failure to develop normal social relationships, such as underlying cognitive deficits (Huebner, 1992; Leslie & Frith, 1990). At the time, the beliefs were that the majority of children with ASD demonstrated mental retardation (DeMyer et al., 1974 in
Baron-Cohen, Leslie, & Frith, 1985) and that a large number of their symptoms could be explained by this fact (Hermelin & O’Connor, 1970). However, Baron-Cohen et al. (1985) argued that mental retardation was not sufficient to explain their social impairments so they proposed the theory of mind (ToM) as the underlying cognitive mechanism essential for social skills. Premack and Woodruff (1978) first defined ToM as the ability to impute one’s mental states to oneself and to make inferences about what other people believe in a given situation. Thus, ToM provides the basis for individuals to predict and respond to others’ behaviors and mental states, such as: intentions, feelings, beliefs, and desires on the basis of verbal and non-verbal cues (Baron-Cohen et al., 1985; V. E. Stone, Baron-Cohen, & Knight, 1998) by putting aside their own current perspective (Baron-Cohen & Wheelwright, 2004; Leslie, 1987). With their experiment on 20 children with autism, 14 children with Down syndrome, and 27 typically developed children, Baron-Cohen et al. (1985) showed that children with autism failed ToM testing and that such failure could explain their inability to represent mental states and beliefs of others. They also showed that such deficits could not only be attributed to mental retardation as children with Down syndrome performed close to ceiling, and children with autism did not.

With the dominant focus on behaviors and social skills that result from this social cognitive perspective, research and interventions development primarily focused on the remediation of deficits in social skills with behavioral and social-cognitive training. Social skills are defined as the use of both verbal and non-verbal behaviors (e.g. gestures, body language) for effective interpersonal communication (Rao, Beidel, & Murray, 2008). Social skills trainings (SSTs) are well-established interventions for different populations of children with social deficits, such as oppositional behavior or attention deficit hyperactivity disorder (Schneider, 1992; Spence, 2003). Such interventions are commonly designed to teach children the specific skills necessary to navigate their social environment (Rao et al., 2008). Using primarily behavioral and social learning techniques (S. W. Williams, Keonig, & Scahill, 2007), SSTs are developed to help children learn and practice specifics steps involved in social interactions, such as turn-taking, joint attention, eye contact, and language (Case-Smith & Arbesman, 2008; Rogers & Williams, 2006).

In the past decades, SSTs have been studied with children with ASD. However, their adaptation for children with ASD is challenging because of the nature of their social impairments is qualitatively different from other populations (Rao et al., 2008) and their efficacy is not clear.
For example, Koenig et al. (2010) studied the feasibility and efficacy of a manualized group designed SST in conjunction to peer mentors to improve social impairment in school-aged children with ASD. In order to increase rigor in research, they implemented a SST including a fidelity to treatment measure and its manualization. The latest described the theoretical foundations of the intervention on social learning and theories and principles of behavioral therapy, in addition to teaching principles for children with ASD. Koenig et al. (2010) thus demonstrated the feasibility of a 16 weeks weekly SST program by the high level of attendance in addition to the parents’ satisfaction in terms of logistics, their child’s satisfaction, and their perception of the program as fitting their child’s needs. However, results of Koenig et al. (2010) converged with reviews on the use of SSTs with children with ASD (Rao et al., 2008; S. W. Williams et al., 2007) and remained inconclusive in terms of efficacy despite indication of improvement in discrete skills. Further, Rao et al. (2008) identified other limitations in studies of SSTs for children with ASD such as their challenges to address generalization issues (i.e. the transference of the skills learnt in treatment setting into the community). In addition, the SSTs also demonstrated limited use of theories in their development (Rogers, 2000; S. W. Williams et al., 2007). Ultimately, reviews also report that empirical evidence for the use of SSTs remains in its infancy (Paul, 2008; Rao et al., 2008; Rogers, 2000; S. W. Williams et al., 2007). Further, another concern raised among the reviews on the use of SSTs with individuals with ASD was the inconsistency in outcome measures used (De Los Reyes & Kazdin, 2005; Koenig, De Los Reyes, Cicchetti, Seahill, & Klin, 2009; Koenig et al., 2010) and thus reflect on the multi-dimensionality of the construct of social impairments of children with ASD (Koenig et al., 2010).

### 1.4.2 Sensory and motor perspectives

A second generation of research expanded the focus of the dominant social cognitive impairment of children with ASD to include their bodily challenges. Over the years, researchers have given more attention to sensory deficits (Baranek, 2002; May-Benson & Koomar, 2010), motor impairments (Fournier, Hass, Naik, Lodha, & Cauraugh, 2010; Green et al., 2002), and imitation deficit (Rogers & Williams, 2006). For the purpose of this thesis, we will use the term **bodily** as a holistic term that includes both the sensory and the motor aspect of the body.
1.4.2.1 Sensory processing

In this second trend of research, scholars have confirmed the existence of sensory deficits for children with autism (Baranek, 2002; Ornitz, 1974) which could account for some of the symptoms related to ASD (Peters, 1986).

Specific to occupational therapy, the sensory integration framework originally developed by occupational therapist Jean Ayres (1979, 1989). This framework proposes that effective sensory perception, modulation, and integration is fundamental for production of organized and purposeful behaviors that provide the foundation for learning, motor planning skills, emotional and self-regulation (May-Benson & Koomar, 2010). Ayres (1979) proposed a conceptual model for this process based on her extensive work on the neurological processing of sensory information in brain functions (Ayres, 1991; Baranek, 2002; Watling & Dietz, 2007) and its impact on learning, behavior, and occupations on patients with neurological conditions, such as stroke, cerebral palsy, and learning disorders. She also created a series of assessment instruments, such as the Sensory Integration and Praxis Test (SIPT; Ayres, 1989), to ensure that practitioners could evaluate the concepts and constructs in a reliable and valid way to inform treatment.

In the case of children with ASD, the increasing attention to sensory deficits led to a wide use of the Ayres Sensory Integration (ASI) framework for this population, as they certainly have measurable deficits related to sensory processing (Baranek, 2002). Findings from reviews on the use of sensory integration therapy with children with autism reported positive outcomes in motor, sensory processing skills, behavioral and functional outcomes (Baranek, 2002; May-Benson & Koomar, 2010), individual and client-centered goals (May-Benson & Koomar, 2010), as well as social and interactional skills (McCleery, Elliott, Sampanis, & Stefanidou, 2013 & Stefanidou, 2013) and participation (Park, 2012). However, the studies reviewed showed limitations such as the use of small and convenient sample sizes and uncontrolled designs, which restricted the conclusive statements and generalizability of these studies. Further, the biggest limitation of ASI is the failure to directly link the observed changes to the hypothesized principles of the interventions. However, such interventions rest on a strong theoretical foundation and on empirical findings converging to show patterns of efficacy for children with ASD (Baranek, 2002; May-Benson & Koomar, 2010).
Beside the methodological flaws reported, another limitation reported by the reviews on the use of ASI was the inconsistency on how it was delivered because research may arise from different conceptualizations about the ASI framework (Case-Smith, Weaver, & Fristad, 2014). Therefore, the development of the Ayres Sensory Integration Fidelity Measure© (May-Benson et al., 2014; Parham et al., 2007; Parham et al., 2011) intended to help measuring adherence to the underlying intervention principles in research and also in practice. The creation of such a fidelity measure clarified the inconsistency in the use of the terms related to ASI therapy by differentiating it from sensory-based interventions or sensory stimulation, which lack in evidence of their efficacy.

1.4.2.1 Motor and imitation components?

A massive body of research on motor features of children with ASD converged in identifying widespread motor deficits among individual with ASD, and thus, qualifying such impairment as a core symptoms of ASD (Sigman, 1994). Still, their motor feature, alongside with the sensory challenges, received later attention in comparison to communication and social interaction deficits (McLaughlin-Cheng, 1998). Early studies on the motor component of children with ASD revealed greater clumsiness, motor coordination abnormalities, postural instability, and poor performance on standardized tests of motor functioning (Molloy et al., 2003; Rogers, Bennetto, McEvoy, & Pennington, 1996; Vilensky, Damasio, & Maurer, 1981). For example, in their meta-analysis of 51 studies of the existing literature, Fournier et al. (2010) found a large effect that clearly indicates pronounced motor impairments widespread among individual with ASD as compared to neurologically normal control groups. However, specific patterns and causes remained unclear (Noterdaeme, Mildenberger, Minow, & Amorosa, 2002) and await further research (Fournier et al., 2010). Nevertheless, Fournier et al. (2010) reported recent neuroanatomical and neurophysiological studies suggesting the implication of the cortical and subcortical areas including the motor cortex, supplementary motor area, basal ganglia, and cerebellar dysfunction as possible contributor to the observed impairments in motor performances.

Furthermore, similar to the motor impairment aspect, research on imitation deficits of individuals with ASD has received considerable attention over the past years. Therefore, findings from reviews and empirical research demonstrated strong evidence of the significance of the
centrality and pervasiveness of imitation deficits as a core symptom of ASD (Rogers & Williams, 2006; I. M. Smith & Bryson, 1994; J. H. G. Williams, Whiten, & Singh, 2004). The deficits in imitation are observed in multiple areas such as in actions on objects, manual and postural movements, and oral-facial movements (Rogers, Young, Cook, Giolzetti, & Ozonoff, 2008). In their review of 21 studies involving 281 children with ASD over the past 30 years, J. H. G. Williams et al. (2004) further add that non-meaningful gestures appeared to be more difficult than familiar, and meaningful actions. However, the cause of imitation deficits in ASD remains unclear and studies suggest that it lies in abnormal functioning of neural processes (Rogers & Williams, 2006).

Furthermore, recent research studies are clearly linking imitation deficits and others challenges of individuals with ASD such as social interactions and reciprocity (Ingersoll, 2012; Rogers, Hepburn, Stackhouse, & Wehner, 2003), symbolic play (Ingersoll, 2008; Rogers et al., 2008), and with the development of language and communication (Charman et al., 2003; Rogers et al., 2003). Hence, the increasing attention on autism’s imitation is providing strong support for the relationship between imitation impairments and interactional aspects. Rogers and Williams (2006) further add that interactional difficulties of children with ASD do not only lie at the psychological level, but also in coordinating the self with others at the bodily level as well. Such assumptions are leading researchers to a new body of research such as the mirror neuron system.

1.4.3 Mirror neuron system

The identification of the mirror neuron system (MNS) led to a stream of brain-based studies on the role of the MNS in languages and gestures for social communication (Rizzolatti & Arbib, 1998) and imitation (Rogers & Williams, 2006). The MNS was initially identified by studies on monkeys, which provided evidence of the same network of neurons firing whether a monkey executed an action or observed the same action being done by another (di Pellegrino, Fadiga, Fogassi, Gallese, & Rizzolatti, 1992; Rizzolatti, Fogassi, & Gallese, 2001). This discovery demonstrated that doing an action and perceiving another person doing an action are linked at the level of a single neuron. By matching the observed action onto its motor counterpart coded by the same neurons (Iacoboni et al., 2005), MNS is believed to be the neurological basis to understand others’ emotions (Rizzolatti, Fabbri-Destro, & Cattaneo, 2009). Further, Cossu et al. (2012) suggested that early and profound damage within the MNS is likely to interfere with
the organization of motor representation, and therefore disrupt the development of the link between action, intention, and thus, the growth of social knowledge. Given this physiological evidence of the MNS linked to imitation and its key role in social development, it is highly plausible that dysfunction of this system could lead to deficits in social behaviors and/or cognition. Such assumptions raise questions about the relationship of such deficits to social challenges of individuals with ASD.

1.4.3.1 Broken mirror neuron system

The broader neurodevelopmental deficits of the ASD seem to match the functions mediated by the MNS (Rizzolatti et al., 2009), what Ramachandran and Oberman (2006) called the broken mirror neuron system. Studies showed the lack of activation of the MNS of children with ASD as opposed to typically developing peers during both the observation and imitation of actions (Cattaneo et al., 2007) and emotional expression (Dapretto et al., 2006). Furthermore, Rizzolatti et al. (2009) demonstrated that children with ASD interpreted the behaviors of others on the basis of the semantic (logical meaning) of the objects rather than the actual contextualized behavior as they failed to recognize why the action was performed. For example, the children with ASD systematically attributed the actor the intention to cut when scissors were shown regardless of how they were grasped (e.g. handles versus blades). These difficulties of individuals with ASD to represent goal-directed and contextualized actions, both at the level of observation and execution, suggest a new perspective on ASD deficits. This new perspective could possibly lead to new rehabilitation strategies based on motor approaches with the underlying assumptions that improved motor knowledge would enhance social knowledge (Cossu et al., 2012; Iacoboni & Mazziotta, 2007; Rizzolatti et al., 2009).

1.4.3.2 Emergent models of ASD using mirror neuron theory

The etiology of the lack of understanding the other’s perspective evolved over time from the assumption of the lack of theory of mind (Baron-Cohen et al., 1985; Leslie, 1987) or inability to identify with or take the psychological stance of another (Hobson, Lee, & Hobson, 2009) to neuroscience based research. Evidence of the broken mirror neuron system (Ramachandran & Oberman, 2006) underlined the role of the MNS as the mechanism that could account for the ASD symptoms such as impairment in communication, language and emotion, and capacity to
understand others (Rogers & Williams, 2006; J. H. G. Williams, Whiten, Suddendorf, & Perrett, 2001).

Rizzolatti et al. (2001) suggested that it is through the processes of the mirror neuron system that allow the recognition and production of imitation. In this process, they explain that in order to imitate an observed action there needs to be a sensory copy of this produced action within one’s own body. The role of the MNS is to code the observed motor acts and then allow imitation to take place. This idea of the existence of an internal sensory copy of the executed action has a far-reaching consequences for understanding how an observed action can be precisely imitated. Acceptance of such hypothesis suggests that the imitation process is divided into three sub-mechanisms: 1) retrieval of a motor act, 2) construction of a motor act or sequence, and 3) refinement of the motor act or sequence. Such processes is aligned with the thoughts of Rogers et al. (2008) that an abnormal functioning of neural processes is at the basis of imitation problems among children with ASD. It also suggests that the dysfunction of coordination of bodily movements and actions with others may be at the foundation of affective and social challenges. Thus, resulting in deficient capacity to map other’s actions and perspectives. The following models are building on the MNT to explain how one can understand how others do.

1.4.3.2.1 Self–other mapping

The self–other mapping hypothesis starts from the assumption that two individuals are separate but bear some resemblance, i.e. seeing others as a template of the self (Rogers & Pennington, 1991). This hypothesis suggests that the capacities seen in young infants to detect correspondence among stimuli, and thus recognizing aspects of themselves that correspond to others, rather than sameness (Rogers & Williams, 2006). Williams et al. (2004) attributed the movement difference (i.e. imitation deficits) of individuals with ASD to difficulties in self-other mapping ability and that the mirror neuron system could provide a neural mechanism explanation of the deficits (Rogers & Williams, 2006; J. H. G. Williams et al., 2001).

1.4.3.2.2 Identification

In the identification hypothesis, the observer is believed to register and assimilate a person’s bodily stance, that whether anchored a feeling or action of being in the world, in a way that it becomes a potential stance for the observer himself. It also suggests that such process determines the human form of sharing and communication (Hobson et al., 2007). Identification
(Hobson & Lee, 1999; Hobson et al., 2007) refers to the aspects of one’s that are the same within other as opposed to self-other mapping (Rogers & Williams, 2006; J. H. G. Williams et al., 2004) that relies on correspondence of a stance. In autism, impairments in the identification process may be a specific component of the deficit in engagement and understanding of others by an inability to move to the psychological stance of someone else (Hobson et al., 2009).

1.4.4 Embodied Social Cognition perspective

An embodied perspective takes into account sensory and motor experiences as the foundation for the cognitive processes, emotions, communication, and abstract thoughts used in social interaction (Johnson, 1999). The embodied perspective, in this thesis, includes the trend in autism research that seeks to link bodily challenges with impairments in social skills (Bhat, Landa, & Galloway, 2011; Dowd, Rinehart, & McGinley, 2010) and the development of conceptual models that focus on reconnecting the Descartian’s separation between the mind and body, such as the Enactive Mind (EM) (EM; Klin, Jones, Schultz, & Volkmar, 2003 & Volkmar, 2003) and Position Exchange (Gillespie, 2012).

1.4.4.5 Enactive Mind

The Enactive Mind (Klin et al., 2003) is based on emerging neuroscience theories on embodied cognition and eye tracking experiments. It views cognition, especially social cognition, as embedded in the experience resulting from a body in action (e.g. social interaction) upon salient information from the environment. Building on eye-tracking studies, Klin et al. (2003) developed the concept of topology of salience which suggests the separation of the irrelevant aspects of the environment from those that are essential. The EM approach views embodied social cognitions as tools required to produce “moment-by-moment social adaptive reactions in naturalistic social situations” (Klin et al., 2003, p. 357).

In autism, the set of embodied social cognition required for social adaptation differs from typically developed peers. They result in “social behavior [that] becomes truncated, slow and inefficient” (Klin et al., 2003, p. 357). Such perspective is based on the difference of children with ASD in topology of salience as the overriding salience of social stimuli is not present and replaced by a range of material stimuli leading to a path of ever-greater specialization on objects and characteristic rather than on people. Thus, the EM framework acknowledges the fact that individuals with ASD are able to acquire skills and to learn information on others (e.g. name, hair
color, specific characteristics) in a way that is different to active social engagement and embodied experience of being with someone else. However, they are yet “unable to translate this knowledge into real-life social adaptive actions” (Klin et al., 2003, p. 357).

1.4.4.6 Position exchange

The concept of position exchange, introduced by Gillespie (2012), stipulates that experiencing others’ perspectives is not a process of mind reading, but a process of exchanging positions with others. He suggests that the practice of exchanging positions with others is crucial in one’s understanding of the experience of another. As opposed to the theory of mind, the position exchange hypothesis reflects that understanding others is a matter of social transactions and not a mental act alone. Gillespie (2012) further explains, by citing Harris (2000), how this phenomenon is observed in young children playing with dolls as they play and perform the complete range of parental activities associated with caregiving as they put themselves in the position of the caregiver, and, at the same time, they learn more about receiving care. Furthermore, Gillespie (2012) cites C. Howes, Rubin, Ross, and French (1988) who reported that children playing more than average are usually more sociable and more likable by their peers.
CHAPTER 2: RATIONALS AND OBJECTIVES OF THE THESIS

2.1 Rationals

The overview of the different descriptive and research trends within the field of autism raised questions on whether the most recent perspectives on ASD are reflected in current intervention designs. In fact, reviews showed the limitation of social skills training in terms of acquisition and generalization of skills (Koenig et al., 2010; Paul, 2003 2008) while interventions that included sensory and motor perspectives showed promising results in terms of psychosocial outcomes, such as social interaction (Baranek, 2002; May-Benson & Koomar, 2010) and participation (Park, 2008).

In conceptualizations of embodiment, our internal structures (e.g. cognition, emotion, concrete, and abstract thoughts) are grounded in patterns of sensory and motor experiences (Johnson, 1999) within an environment (Fuchs, 2009). Thus, the concept of embodiment unifies emotions and abstract thoughts, used in language and communication with sensory and motor experiences. Embodied perspective of autism, such as the Enactive Mind (Klin et al., 2003) and Position Exchange (Gillespie, 2012) broaden interventions for autism beyond a unilateral focus on discrete social skills, by including the complex experiences of persons with ASD. Integrating the evidence of MNS to understand and replicate gestures (Rizzolatti & Arbib, 1998; Rizzolatti et al., 2009) in the development of meaning and communication (Boria et al., 2009; Sparaci, 2007) proposes that a focus on bodies and experiences is essential for psychosocial interventions.
2.2 Purpose

In light of the trend in perspectives on ASD, the overarching objective of this thesis is to report on the scope of intervention research on movement-based interventions and outcomes on participation and communication, which we broadened to the more generalized concepts of psychosocial outcomes.

Manuscript 1:

To report on what is known on the use of movement-based interventions for children diagnosed with autism targeting psychosocial outcomes.

Manuscript 2:

To deepen our understanding of the use of movement-based interventions that are targeting psychosocial outcomes with children diagnosed with ASD, specifically with respect to the theoretical basis of their development and their specification in treatment (i.e. operationalization of the intervention).
CHAPTER 3: MANUSCRIPT 1

The use of movement-based interventions with children diagnosed with autism for psychosocial outcomes – A Scoping review

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3.1 Abstract

The past decade of research evidence on the sensory motor challenges associated with autism spectrum disorder (ASD) raises questions about the unilateral focus on psychosocial criteria for the diagnostic category and shifts attention from models that focus on behavioral deficits towards an embodied or more holistic view of the spectrum and its challenges. In fact, early conceptualizations of embodiment—the examination of sensory motor actions and experiences as the foundation for cognition, emotions and communication—had sought to unify theoretical divisions between body and mind. This trend in autism research reinforces the link between psychosocial deficits and sensory motor challenges and raises the question of whether or not there is a gap between emergent research knowledge and its implementation in practice. Thus, the aim of this scoping review was to report on research on interventions that focused on the use of sensory motor based or movement based interventions (MBI) to target psychosocial outcomes for children with autism using a combination of a descriptive numerical analysis and a thematic analysis. From the twelve reviewed studies, this scoping review builds on the evidence for the use of MBI with children with autism, and is a major step in moving emergent theories into clinical practices.

Key words: Autism spectrum disorders, movement-based intervention, scoping review, psychosocial, social, participation, embodiment, sensory integration, physical activity, imitation, role-play, evidence-based practices
3.2 Introduction

Autism Spectrum Disorder (ASD) is a lifelong neurodevelopmental condition (Bracher, 2012), whose prevalence in school-aged children has increased from one in 88 to one in 50 (CDC, 2013). The diagnosis of autism is based on observations of behaviors and impairments in three main domains – stereotyped and atypical behaviors, social interaction, and communication (American Psychiatry Association, 2013). First generation research on autism focused on mentalization and Theory of Mind challenges (Baron-Cohen et al., 1985; Baron-Cohen & Wheelwright, 2004), which led to interventions for children with autism based primarily on cognitive and/or behavioral models (Case-Smith & Arbesman, 2008). Yet, the results of these interventions remain inconclusive (Case-Smith & Arbesman, 2008; Koenig et al., 2010) and the generalization of the targeted skills or behaviors to natural environment, such as school or home, remains unknown (Paul, 2008; Rao et al., 2008).

Second generation of research focused on sensory-motor challenges such as sensory deficits (Baranek, 2002; May-Benson & Koomar, 2010), motor impairments (Fournier et al., 2010; Green et al., 2002), and imitation challenges in novel tasks (Rogers & Williams, 2006). Sensory motor interventions, such as Ayres’ Sensory Integration (ASI) uses play or activity-based approaches to engage or provide opportunities for movement, focused on remediating the underlying challenges of the neurological system’s ability to process and modulate sensory information necessary for emotional regulation and motor planning (May-Benson & Koomar, 2010). In addition to expected gains in motor skills, sensory processing, behavioral and/or functional outcomes (Baranek, 2002; May-Benson & Koomar, 2010), these interventions led to demonstrated outcomes in social and interactional skills (McCleery et al., 2013) and participation (Park, 2012). These findings align with emergent theories linking bodily challenges (e.g. sensory and motor) to the social deficits characteristic of children with ASD (Bhat et al., 2011; Dowd et al., 2010).

The focus on embodiment foregrounds how sensory motor experiences and feelings form the basis of abstract thought and meaning (Johnson, 1989; Lakoff & Johnson, 1980), and reconnects the Cartesian dualism; the separation between mind and body (Johnson, 2006). Thus, from the interdisciplinary perspective of embodied or enactive cognitive science, communicative processes with others — such as the ability to grasp what type of situation we are in, to evaluate
the range of meaning and options in those situations, and use symbolic representation — originate in sensory motor experiences (Fuchs, 2009). The integration of embodiment into emerging conceptual models on social interaction include the Enactive Mind (Klin et al., 2003), Embodied Simulation (Gallese, 2005), Position Exchanges (Gillespie, 2012), and Participatory Sense-Making (De Jaegher, 2013). Although empirical research and conceptual models have begun to shift from behavioral models towards an embodied view of the spectrum, it is not clear if this shift is evident in intervention research. Hence, the purpose of this scoping review is to report on the extent of what is known on the use of movement-based interventions for children with ASD targeting psychosocial outcomes and their reported findings.

3.3 Methods

Scoping review methodology was developed to “map rapidly” a specific practice area for research (Arksey & O'Malley, 2005, p. 5), which was then enhanced by healthcare researchers to provide greater clarity (Colquhoun et al., 2014; Daudt, van Mossel, & Scott, 2013; Levac, Colquhoun, & O'Brien, 2010). We use these existing methods to examine and summarize the extent, range, and nature of research activities and findings in movement-based interventions (MBI) targeting psychosocial outcomes for children diagnosed with autism.

3.3.1 Identifying the research question

This scoping review answers the following question: “What is known in the existing literature regarding the use of movement-based interventions (MBI) that target psychosocial outcomes in children with autism?” Specifically the aims of this study are to identify: (1) the range of MBIs targeting psychosocial outcomes and findings, and (2) the range of psychosocial outcomes and how they were measured.

3.3.2 Identifying and selecting relevant studies

Searches were conducted using online database (Embase, CINAHL, Ovid MedLine, and PsychINFO) with no limit in publication dates. A combination of key words and MeSH terms was used based upon the identified core concepts of the research question – children with autism, movement-based interventions, and psychosocial outcomes. Terms such as autism, movement, dancing, tai chi, sensory integration, occupational therapy, physical therapy, exercise, communication, socialization, interpersonal relations, social, participation, pleasure, and
emotions were included in the searches. The initial search was generated in Ovid Medline, and was then adapted for different databases (PsychINFO, Embase, CINAHL). Using snowballing techniques, the reference lists of selected studies were manually searched to capture all relevant studies.

### 3.3.3 Selecting Inclusion and Exclusion Criteria

Prior to studies selection, inclusion and exclusion criteria were created. Through an iterative process, these criteria were refined and the resulting studies were imported into EndNote. After duplicates were deleted, and in line with scoping review methodology (Daudt et al., 2013), a small and suitable research team established the final inclusion and exclusion criteria based on a screening of titles and abstracts. Studies were included for full-text review if they (1) included children with autism, (2) consisted primarily of movement-based interventions (MBI) and (3) targeted psychosocial outcomes. Movement-based interventions (MBI) were defined as interventions that focused on the child’s own full body movement through space where the movements were guided, proposed and imitated, or child-initiated.

Full-text review included all methodologies and excluded syntheses or reviews of existing evidence, theoretical and empirical articles, grey literature, and editorials. In order to ensure interreviewer reliability throughout this process and contribute to the confidence in the consistency of the study selection and charting of the data, the first author executed these two steps and consulted with the expert team when required. Following recommendations to add quality appraisal of selected studies to scoping review methodology (Daudt et al., 2013), we used the Mixed Methods Appraisal Tool (MMAT), developed by Pluye, Gagnon, Griffiths, and Johnson-Lafleur (2009). Designed for systematic reviews, the MMAT is an efficient tool as it can be used for quantitative, qualitative and mixed method studies. Content validity (Pluye et al., 2009) and reliability (Pace et al., 2012) were tested for the use of the MMAT. We excluded two studies who did not meet quality appraisal criteria (see Figure 1 for full flow chart).

[Insert Figure 1]

### 3.3.4 Charting the data

A charting form was developed to retrieve data from the selected studies: author, year of publication, research question and design (methodology, data collection, analysis), population,
sample size and characteristics, intervention characteristics, intervention/research frameworks, findings, limitations, and direction for future research.

3.3.5 Collating, summarizing, and reporting the results

In accordance with Levac et al. (2010) and Colquhoun et al. (2014) guidelines, we conducted a descriptive numerical and a thematic analysis. The descriptive numerical analysis focused on the characteristics of the studies (year of publication, design, sample/population). We conducted a thematic analysis from the extracted data to answer our scoping review questions. Themes emerged around: (1) types of MBI and related outcomes, and (2) types of instruments used to measure outcomes.

3.4 Results

Following the descriptive numerical analysis of the study characteristic, we will present the results of the thematic analysis on the twelve studies of MBIs targeting psychosocial outcomes and findings.

3.4.1 Study characteristics

Initial search of articles included all studies published before the end of 2013, which is when the online searches were executed. After study selection and review, the publication dates range from 1999 to 2013. Only two studies were published in 1999; the majority (10) were published between 2007 and 2013 (mean of year of publication = 2008, median = 2010). We also noticed an increased curve in research (67%) after 2010.

The dominant study design was single case study (SCS, 75%) and included two qualitative case studies drawn from an ethnography, which appeared in 2008 and 2012. The first randomized control trials (RCT, 25%) appeared in 2011. Among these studies, we identified three types of study objectives: To identify the outcomes of an intervention (nine studies), to identify outcomes as well as describe the intervention process, including social interactions between therapist and child with autism (two studies), and to describe changes over time (one study). Data collection will be described in the thematic analysis section below. Data analysis for the quantitative studies were either: descriptive analysis, including measures of central tendency (means, standard deviation, median, mode), or inferential analysis (paired T-test, ANOVA/
ANCOVA, linear regression, mediation). The qualitative studies used narrative analysis and microanalysis – guided by a conceptual framework, which included theories from anthropology, psychology, literary criticism, neurology, and rehabilitation – of interactions between a therapist and a child.

Population samples varied between one to 32 children with autism. The samples of the SCSs were, in majority, between one and five participants. Within the SCSs, four studies were multiple SCSs which included two and five participants, one study was a case report from an ongoing RCT (Schaaf, Hunt, & Benevides, 2012), and two cases were drawn from ethnographic studies (Park, 2008, 2012). One SCS was a cohort type and had a sample of 16 children (Pan, 2010). The three RCTs included samples between 26 and 32 children (mean of 28 children) (Ingersoll, 2012; Movahedi, Bahrami, Marandi, & Abedi, 2013; Pfeiffer, Koenig, Kinnealey, Sheppard, & Henderson, 2011).

3.4.2 Types of movement-based interventions and reported outcomes

After an in-depth and iterative thematic analysis of the extracted data, four types of MBIs emerged (see Table 1). In chronological order of emergence, the identified MBI types were role-playing, physical activity based, and imitation. The last type was the only MBI defined by a clinical practice-based framework, Ayres Sensory Integration (ASI). Within its related theme, we provide a description of the studies and reported outcomes below.

3.4.2.1 Role Play

Two interventions were based on motoric role-playing (Gutman et al., 2010; Gutman, Raphael-Greenfield, & Rao, 2012). In the first study, two 15 year-old adolescents with high functioning autism (HFA) were paired to a peer with similar social skills functional in a 7-week after-school program using role play to promote foundational social skills use. In this program, the intervention sessions were divided into four phases: (1) warm-up using sensory modulation activities, (2) activities linking motor behavior with cognitive intention and emotional understanding, (3) role play activities, and (4) cool-down using sensory modulation activities. The reported psychosocial outcomes were determined in terms of frequency of targeted verbal and non-verbal behaviors. Findings from the role-playing intervention indicated increases in the use of facial and body language for emotional expression both within intervention sessions and at probes. In addition, the authors found that greater impairments in social skills required increased
emphasis and flexibility during the second phase of their intervention (i.e. activities linking motor behavior with cognitive intention and emotional understanding) (Gutman et al., 2010). The authors repeated and expanded this 2010 study using three periods of treatment across one academic year in 2012. Similar results were reported in terms of the frequency of the targeted verbal and non-verbal behaviors. In addition to the replication of previous results from the first study, they found that one participant showed a greater increase in his targeted social behaviors when paired with a college student that had a higher social skills level as opposed to a peer at a similar level of social skills.

3.4.2.2 Physical activity

Pan (2010) looked at the effect of a Water Exercise Swimming Program (WESP) enhanced with components that focused on social skills and behaviors. The WESP consisted of 20 sessions of 90 min over 10 weeks. Each session was divided into four phases: (1) warm-up for limbs and trunk using social and floor activities, (2) small group instruction of specific water skills using a one-to-two ratio (one instructor for two children), (3) whole group activities consisting of cooperative games and activities, followed by (4) cool-down activities which were not specified. In this cohort study design, 16 children (5-9 year-old) diagnosed with HFA and Asperger Syndrome demonstrated gains in aquatic skills and a sustained decrease in antisocial behaviors post intervention and at follow-up; although social competence behaviors did not significantly change over the course of this study. Qualitative reports from parents, however suggested improvement in self-confidence, social and athletic performances suggesting that such a program shows potential for social skill improvement.

Movahedi (2013) looked at the effect of a 14 weeks karate kata techniques program on social dysfunction of 26 children diagnosed with ASD and aged between five and 16 year-old. Katas are defined as a logical arrangement of set sequences consisting of blocking, punching, sticking, and kicking techniques. In this RCT, the karate kata group consisted of 13 participants while the control group was randomized to an educational skills program. In this study, the Heian Shodan Kata was taught with one-to-one instruction for multiple pairs in the same room, and then performed in a group setting. Each session consisted of a warm-up, followed by kata teaching, and cool-down. Reported results showed a greater improvement in social dysfunction in the karate kata group.
3.4.2.3 Imitation

Ingersoll (2012) described the use of Reciprocal Imitation Training (RIT) on social function with 27 children with ASD aged between 27 and 47 months. In RIT, the therapist contingently imitated the child’s verbal and nonverbal behaviors, described the child’s actions using simplified language, and expanded the child’s utterances. In this RCT, 14 children were randomized to the RIT group and 13 to the control group, which received the usual community treatment. Children in the treatment group received three hours per week for 10 weeks of RIT to promote reciprocity. The therapist modeled an action once every minute up to three times to teach imitation. If, by the third time, the child did not imitate the action, the therapist then physically prompted the child to complete the action. Findings showed that a greater gain in joint attention in the treatment group. Changes in social functioning could not be related to gain in imitation skills with the mediation analysis. The author however suggested that an intervention mechanism, such as imitation recognition, was responsible for the social functioning with triangulation from previous studies (e.g. see in Ingersoll, 2012).

3.4.2.4 Ayres Sensory Integration

Occupational therapist, Jean Ayres (1979, 1989) developed the practice framework of sensory integration for which fidelity measures were later established (May-Benson et al., 2014; Parham et al., 2007; Parham et al., 2011). The seven studies using Ayres Sensory Integration (ASI) aligned with the 10 key principles of the fidelity measures to: (1) ensure physical safety, (2) present sensory opportunities (3) facilitate the child’s self-regulation of arousal level, attention, and emotion, (4) challenge postural, ocular, and bilateral motor development, (5) promote praxis and organization of behavior, (6) tailor activities to provide the just-right challenge, (7) collaborate with the child on activity choices, (8) create a context of play, (9) ensure success, and (10) foster a therapeutic alliance with the child.

Among these studies, three were quantitative SCSs including the first two published studies that examined the effect of MBI on psychosocial outcomes. Linderman and Stewart (1999) reported increased functional behaviors at home and decreased frequency and duration of disruptive behaviors for two, three year-old boys after their participation in an 11week ASI based occupational therapy program (OT-ASI). Case-Smith and Bryan (1999) found a decrease in non-engaged behaviors and increase in purposeful play for five children with ASD, aged between four
and five year-old, after their participation in a 10 weeks preschool OT-ASI program. They reported no change in frequency of interaction between peers and adult. The authors contributed the latest to the data collection context, which was during free play when there were no instruction for interactions given to the children.

In the third study, Watling and Dietz (2007) reported no immediate effect after treatment sessions on engagement or undesirable behaviors of four children with ASD aged between three and four year-old during participation in selected table top activities over an 18 week program of ASI-OT. The authors attributed the lack of change on how they operationalized their outcome measures (i.e. undesirable behaviors interfere with task engagement, while engaged behaviors were defined as intentional, persistent, active, and focused interaction with the environment), and by their small sample size. However, qualitative reports from the parents and research personnel suggested that some characteristics of the child’s behaviors may have changed during and generalized following the program to natural contexts.

Pfeiffer et al. (2011) published the first RCT across all studies, which compared the effectiveness of an ASI group with a fine motor skills (FM) group on the adaptive behaviors and functional goals of 32 children with autism (N=20 for ASI group) across 18 weeks. They reported a significant decrease in autistic mannerisms and greater outcomes on functional goals measured by Goal Attainment Scale (GAS; Kiresuk, Smith, & Cardillo, 1994; Mailloux et al., 2007) in the ASI group in comparison to the FM control group. Additionally, they reported qualitative findings that children in the ASI group demonstrated more abilities to complete the Quick Neurological Screening Test (QNST-II; Mutti, Martin, Sterling, & Spalding, 1998), which is a measure of neurological integrity. Furthermore, Schauf et al. (2012) described a case report on an ongoing RCT linking sensory processing deficits to praxis and functional abilities. Following 10 weeks of intervention, the five year-old boy with ASD demonstrated changes in behaviors (less rigid, increased tolerance of unexpected changes, decrease in activity level), motor skills, and functional and individualized goals using the GAS. He also showed overall gain in participation in social, play, home, and community activities. These changes were also linked to gains in the ability to process and integrate sensory information. Qualitative reports from the child’s parents and teachers also describe the child as happier, less rigid, and more tolerant to unexpected changes. Moreover, they reported that he showed increased attention in his classroom, which suggested improvements in adaptive behaviors and participation.
Within this MBI theme, the purpose of the only two qualitative studies was to understand both the process and effects of child-therapist interaction in a play-based clinic where ASI was the dominant treatment framework. In the first case study, Park (2008) used participant observations, fieldnotes, and audio-taped and transcribed interviews with therapists and primary caregivers from an 18 month ethnographic study. In addition, videotaped treatment sessions were also transcribed. In the study, the author described how a 5 year-old boy, diagnosed with ASD, moved from falling and from challenges with praxis to being visibly grounded and more coordinated across a session. The microanalysis of the therapist-child interactions focused attention on how they jointly created symbolic scenes that align with the unfolding imaginary story that structures their interactions. Descriptions of the qualitative changes in both therapist and child actions over the course of the session were used to support the finding that making imaginary scenes – based on what the child wanted and the therapist’s focus on the child’s bodily and sensory challenges and capacities – led to the child’s increased sensory motor organization and sense of belonging – which is defined as “the creation and embodiment of moments of visibility and recognition as human being” (Park, 2008, p. 246). Park’s (2012) data collection for the second case study, of a different five year-old boy with ASD, included the same methods as in the previous case study. In 2012, Park describes how the therapist’s attention to the child’s sensory and bodily experiences support his transformation from a child who has difficulty with motor planning and emotional regulation into a child who compromises and initiates an activity to help another child. The changes were traced from the moment when the child literally became a twister within the pretend play that structured their interactions. In addition, the thick descriptions of the changes in the child’s postural stances and therapist-child actions – prior and after the emergence of the child’s twister – were used to support the finding that active ingredients of change include: (1) the cultivation of bodily-sensing pleasure and (2) the creation of embodied metaphors associated with significant experiences that occur with particular others in particular social and symbolic contexts.

[Insert Table 1]

3.4.3 Types of psychosocial outcomes

In order to understand the types of psychosocial outcomes linked to, or hypothesized to result from, the use of MBIs, we did a numerical descriptive and thematic analysis on the range
of instruments used for data collection. The two qualitative studies did not use any instruments to capture psychosocial outcomes, but methods of observation used in ethnography guided by a narrative and phenomenological theoretical framework (See Table 2). Across the 12 studies reviewed, we identified 17 instruments and/or methods used for data collection. Six of these instruments and/or methods were based on direct observations, which were either: (a) kept as direct observations (17%), (b) transformed into a scale for analysis (33%), or (c) counted as frequency of occurrence (50%). Nine were classified as “reported by the parents and/or teachers”, which were then either kept as reported or transformed into a scale. Two methods used mixed sources of data collection including both direct observations and reported data (e.g. the ethnographic methods and the GAS). Further, we identified that only seven studies collected data continuously over time, which included five quantitative studies and the two qualitative SCS studies. The other reviewed articles (5), including all four of the RCTs and one SCS-cohort study, had three or less data collection points or collected data pre and post the studied MBI.

Thematic analysis of the types of psychosocial outcomes collected resulted in four general types: (1) functional behaviors, (2) social behaviors and interaction, (3) sensory focused, and (4) comprehensive/global (see Table 2). Data collection of psychosocial outcomes defined as specific functional behaviors included engaged, nonengaged and/or undesirable behaviors that impact on everyday functioning. Specific instruments used to collect such behaviors were the Engagement Check (Parson, McWilliam, & Buysese, 1989), the Revised Functional Behavior Assessment for Children with Sensory Integrative Dysfunction (Cook, 1991), and a specific method used for the operationalization of such functional behaviors (Watling & Dietz, 2007).

Data collected on specific social interaction skills and behaviors used observational based methods. Instruments used to collect these skills and behaviors included the: Early Social Communication Scale (ESCS; Seibert, Hogan, & Mundy, 1982), Social-Emotional Scale of the Bayley Scales of Infant Development, 3rd ed. (SES; Bayley, 2005), Pervasive Developmental Disorder Behavioral Inventory (PDDBI; Cohen & Sudhalter, 2005), Vineland Adaptive Behavioral Scales, 2nd Edition (VABS-2; Sparrow, Cicchetti, & Balla, 2005), Social Interaction Subscale of Gilliam Autism Rating Scale-Second Edition (SIS-GARS-2; Gilliam, 2006), School Social Behavior Scales (SSBS-2; Merrell, 2002), Social Responsiveness Scale (SRS; Constantino & Gruber, 2005), and/or a developed record sheet on verbal and non-verbal behaviors (Gutman et al., 2010).
Further, the following type of data collection that emerged from the thematic analysis aligned with the theoretical and philosophical basis of the ASI – i.e. from the underlying assumption that sensory integration deficits interfere with function (Ayres, 1979). Such data collection focused on sensory-based features and behaviors impacting the everyday life of children and their family. The instruments used in the studies were all parents reported such as the Sensory Profile (SP; Dunn, 1999), the Sensory Experiences Questionnaire (SEQ; Baranek, David, Poe, Stone, & Watson, 2006), and the Sensory Processing Measure (SPM; Parham et al., 2007).

Finally, we classified data collection as global or comprehensive when they did not rely only on specific behaviors or instruments to frame outcomes and observations. This type included the GAS (Kiresuk et al., 1994; Mailloux et al., 2007) and ethnographic method – which included a mix between direct observation and microanalysis of bodily-sensing social interactions in videotaped sessions and unstructured interviews designed to ascertain what is most meaningful to those interviewed.

[Insert Table 2]

Other instruments were also identified in the studies reviewed, however, they were not directly related to psychosocial outcomes. These instruments were the: Sensory Integration and Praxis Tests (Ayres, 1989), Adaptability Scale of the Carey Temperament Scales (Carey & McDevitt, 1995), Quick Neurological Screening Test, 2nd Edition (Mutti et al., 1998), Motor Imitation Scale (W. L. Stone, Ousley, & Littleford, 1997), and Unstructured Imitation Assessment (Ingersoll & Dvortcsak, 2010). These instruments were used to either get a better understanding of the data collected or to correlate potential mediating variables with changes in psychosocial outcomes.
3.5 Discussion

The findings from the present scoping review builds preliminary evidence on the effectiveness of MBIs for improvement in psychosocial outcomes for children with ASD. We discuss the implications of these findings for implementation research on, and clinical practice using, MBIs.

3.5.1 Historical trends – Increasing rigor in building evidence

T. Smith et al. (2007) published guidelines and recommendations for the design of research on psychosocial interventions in autism. The proposed steps for the development of innovative psychosocial interventions for children diagnosed with ASD include four phases: (1) formulation and systematic application of a new intervention technique, (2) developing a manual and research plan for evaluation of the intervention across sites, (3) randomized clinical trials (RCTs), and (4) community effectiveness studies. They proposed that new interventions should go through these four stages to increase their research rigor and validity before dissemination in the community. Findings from the present scoping review suggest that research in the field of MBIs is not only increasing in terms of numbers of publications (i.e. 8 out of 12 studies were published after 2010), but also in scientific rigor and within intervention approaches. Looking at the historical trend that drafted from the reviewed articles, the majority of the reviewed studies were published in the past decade. Further, we also observe an evolution in the study design that progressed from the first SCS studies linking MBI to psychosocial outcomes (Case-Smith & Bryan, 1999; Linderman & Stewart, 1999) to more recent RCTs (Ingersoll, 2012; Movahedi et al., 2013; Pfeiffer et al., 2011; Schaaf et al., 2012). In addition, a close examination of the studies on the use of MBIs based on ASI framework shows a steady progression in validation and rigor of treatment from its initial theoretical development (Ayres, 1979), the first SCSs (Case-Smith & Bryan, 1999; Linderman & Stewart, 1999; Park, 2008, 2012; Watling & Dietz, 2007), and more recent RCTs (Pfeiffer et al., 2011; Schaaf et al., 2014; Schaaf et al., 2012). In fact, this type of MBI is the only one that shows a progression following the proposed guidelines by T. Smith et al. (2007) – i.e. evidence of efficacy and it’s later manualization (May-Benson et al., 2014; Parham et al., 2007; Parham et al., 2011).

In their study on the relationship between motor skills and social communicative skills, MacDonald, Lord, and Ulrich (2013) showed that children with weaker motor skills have higher
calibrated overall severity scores; however, the depth of this relationship still needs to be further explored. Alongside such finding, our scoping review reports on the evidence of efficacy of the use of MBIs for psychosocial outcomes and is a milestone in significance of the use of MBIs with children with ASD; however, the large amount of SCSs (67%) suggests that the field of research on MBIs as psychosocial interventions in autism is still at the very first phase. Often criticized for their lack of rigor and challenges with generalizing findings to larger groups, the use of SCS design in initial efficacy studies however provides valuable advantages. In fact, this design allows more detailed analysis of changes within specific interventions and also requires fewer resources then larger designs. These characteristics of SCS are effective to refine techniques and to document the clinical significance of the effects of a given interventions (T. Smith et al., 2007). Further, single case study methodology are of choice to investigate contemporary phenomenon in depth and within real-life context especially when the boundaries around the observed phenomenon are not clear and/ or evident (Yin, 2009). The comprehensive approach afforded by well-designed SCSs is an important first step towards building evidence on the effect of a specific treatment with a specific individual in a specific context (Doucet, Woodson, & Watford, 2014), so are experimental designs (T. Smith et al., 2007).

Similar to the findings of MacDonald et al. (2013), the reviewed MBIs are reporting positive evidence in some aspects of the psychosocial construct; however, the relationship between the intervention and the reported outcome remains unclear. Longitudinal designs may help in understanding these relationships and to isolate the active ingredients in autism interventions (Lord et al., 2005). Their purpose is to describe patterns of change and to establish the direction and magnitude of causal relationships (Menard, 2002). Yet, the quantitative longitudinal studies, among the reviewed articles, were not able to provide such knowledge on how and why change happened.

### 3.5.2 Psychosocial outcomes: Combining methods

Evidence-based research aims at measuring treatment efficacy by changes in concrete, observable behaviors or pivotal skills that have multiple effects (Rogers, 2000; Rogers & Vismara, 2008). In the present review, we focused on psychosocial outcomes following the use of MBIs. Among the studies, we identified four types of outcomes, which were collected in over 15 different ways in twelve studies. This diversity and range of the instruments and methods
identified reflects the complexity of the psychosocial construct (Koenig et al., 2009) and stresses the challenge in attempt to measure change. In fact, although quantitative studies revealed changes in targeted psychosocial behaviors and skills, they also showed limitations in capturing the full impact of their interventions. For example, in order to explain the observed phenomenon, quantitative researchers turned toward qualitative statements and reports in attempt to fully grasp the changes related to the MBI (Pan, 2010; Schaaf et al., 2012; Watling & Dietz, 2007). On the other hand, longitudinal qualitative study designs can inform and shape evidence-based practice by explaining the why and the how of a phenomenon in addition to what changed (Frank & Polkinghorne, 2010).

Grounded on thick description (Geertz, 1973) of particular persons and their interactions in particular contexts, ethnography aims at understanding another way of life from the participants’ viewpoints. In intervention research, such methodology provides an in context perspective that allows the identification and analysis of factors that may affect quality of performance (Spencer, Mattingly, & Krefting, 1993). Further, microethnography – the study of a smaller experience and the details of a situation — has been effectively used in autism intervention research to provide thick descriptions of the interactions of children with autism in naturalistic contexts, such as in a classrooms (Bagatell, 2012), or of adults with ASD within community (Bagatell, 2007). In the reviewed studies, the two qualitative SCSs drawn from an ethnography (Park, 2008, 2012) provided descriptive data on the design of the MBI (e.g. details on the space, materials and equipment, others present, and etc.), the actual process of the MBI during the intervention sessions.

Ultimately, as suggested by Thorne, Jensen, Kearney, Noblit, and Sandelowski (2004), combining both qualitative and quantitative methods may result in a better understanding of the meaning and implication of findings. Among the selected studies, Watling and Dietz (2007) were not able to statically capture the change in the targeted children’s behaviors with their quantitative results. Their recommendation was when working with ASI approach, occupational therapist and researcher should also collect data on the subtle nuances of children’s behaviors such as socialization. They proposed that such example of data collection methods could be open-ended interviews with parents, caregivers, and teachers. Likewise, other authors (Pfeiffer et al., 2011; Schaaf et al., 2012) demonstrated that the use of the GAS – a method using open-ended interviews to generate and quantify meaningful outcomes – is a useful supplement to other
behavioral measures. In fact, the GAS provides a way to link proposed and/or hypothesized mechanisms affecting goal attainment, but it also provides a measure of the change on individualized, functional, parent’s generated goals.

In light of the complexity of social interaction and range of variables that could be included in psychosocial outcomes, researchers need methods that can provide a nuanced understanding of the intervention process and a range of variables that could be included in psychosocial outcomes that may not be captured in existing instruments alone. Video methods of data collection can focus on the analysis of transactional acts that can be easily missed in real time (Pierce, 2005). In autism intervention research, videotaped interventions have been used effectively to strengthen rigor during analysis by allowing the training of raters and also by achieving interraters agreement on the use of specifics instruments or even of specific operationalized behaviors prior to scoring or analysis. The use of videotapes in research may allow the capture of fine details of particular interactions with the social or material environment. Such fine-grained data may help to determine the impact of a specific intervention. Also the use of videos allows repeated reviewing of the data to observe subtle changes in behaviors or even mark new behaviors that may have been missed when using specific checklists or instruments (Bagatell, 2012; Park, 2012). In the present reviewed intervention studies, videotaped sessions facilitated the microanalysis of verbal and nonverbal actions that suggested mechanisms of change as well as additional psychosocial outcomes that behavioral criteria alone or existing instruments could not capture (Park, 2008, 2012).

3.6 Conclusion

Although there is emerging evidence on the use of MBIs with children with autism that targets psychosocial outcomes, the current literature lacks in making explicit the link between underlying theory and the variables in the MBI design that lead to such outcomes. Process evaluation in future intervention studies could provide a more detailed understanding of the underlying mechanisms of change. In addition, instruments used during data collection determine which outcomes are looked for in research and guide clinicians to assess the effectiveness of their interventions in practice. Yet, the vast range of instruments and methods used in current MBI research raises questions on what measures could most efficiently capture such changes in research and clinical practice. Conducting an in depth analysis of patterns in the study designs in
relation to the design of MBIs of the reviewed studies could guide future research and facilitate implementation of research in clinical practice by identifying possible core features of such intervention and the best means to capture them in future research.

3.7 Acknowledgements
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3.8 Funding Acknowledgement
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3.9 Declaration of interest
The authors report no conflict of interest.
### 3.10 Tables and figures for manuscript one

#### Table 3.1: Study characteristic and finding

<table>
<thead>
<tr>
<th>Authors</th>
<th>Design</th>
<th>Population / sample</th>
<th>Data collection (Methods(^1,^2,^3)), type of data</th>
<th>Data analysis</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ROLE PLAY</strong></td>
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<tr>
<td></td>
<td></td>
<td>N=2 [boys]</td>
<td>Age: 15 y</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Gutman et al. (2012)</td>
<td>SCS</td>
<td>HFA</td>
<td>3, Social behaviors</td>
<td>Descriptive, Inferential (repeated ANOVA)</td>
<td>↑ Targeted verbal and nonverbal behaviors</td>
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<tr>
<td></td>
<td></td>
<td>N=3</td>
<td>Age: 15-17 y</td>
<td></td>
<td>↑ Facial/body language for emotional expression</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Gain sustained in probes phases (1mo)</td>
</tr>
<tr>
<td><strong>IMITATION</strong></td>
<td></td>
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<td></td>
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<tr>
<td>3. Ingersoll (2012)</td>
<td>RCT</td>
<td>ASD</td>
<td>3, Social behaviors</td>
<td>Inferential (ANOVA, Mediation)</td>
<td>↑ Joint attention greater in Tx group post intervention and at follow-up (2-3mo)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N=27 [24 boys]</td>
<td>Age: 1,10-3,11 y</td>
<td></td>
<td>Ø relationship between change in &amp; changes in imitation skills</td>
</tr>
<tr>
<td><strong>PHYSICAL ACTIVITY</strong></td>
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<tr>
<td>4. Pan (2010)</td>
<td>SCS</td>
<td>HFA/ ASD or Asperger</td>
<td>3, Social behaviors</td>
<td>Inferential (Two-way ANOVA, Paired T-test)</td>
<td>↑ Aquatic skills</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N=16 [boys]</td>
<td>Age: 5-9 y</td>
<td></td>
<td>✓ Antisocial behaviors</td>
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<td></td>
<td></td>
<td>Gain sustained at follow-up</td>
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<td></td>
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<td></td>
<td>Ø change in social competence behaviors</td>
</tr>
<tr>
<td>5. Movahedi et al. (2013)</td>
<td>RCT</td>
<td>ASD</td>
<td>3, Social behaviors</td>
<td>Inferential (Independent T-test, Repeated ANOVA)</td>
<td>✓ Social Dysfunction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N=26 [boys]</td>
<td>Age: 5-16 y</td>
<td></td>
<td>Changes sustained after 30 days follow-up</td>
</tr>
<tr>
<td><strong>AYRES SENSORY INTEGRATION</strong></td>
<td></td>
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<tr>
<td>6. Case-Smith and Bryan (1999)</td>
<td>SCS</td>
<td>ASD</td>
<td>1, Functional behaviors</td>
<td>Descriptive (Mean), Simple regression</td>
<td>✓ Non-engaged behaviors</td>
</tr>
<tr>
<td></td>
<td></td>
<td>N=5 [boys]</td>
<td>Age: 4-5 y</td>
<td></td>
<td>↑ Purposeful play</td>
</tr>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ø change in frequency of interaction</td>
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<td></td>
<td></td>
<td>N=2 [boys]</td>
<td>Age: 3 y</td>
<td></td>
<td>✓ Disruptive behaviors (frequency/ duration)</td>
</tr>
<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>↑ Social interaction, response to holding/ movements, and hugging</td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>↑ approach to new activities</td>
</tr>
<tr>
<td>Study</td>
<td>Design</td>
<td>Condition</td>
<td>Sample Size</td>
<td>Data Collection</td>
<td>Analysis</td>
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</table>
| 8. Watling and Dietz (2007)                                          | SCS    | ASD       | N=4 [boys]  | 1. Functional behaviors | Descriptive (Study log) | ∅ change in undesired behaviors immediately after intervention  
∅ change in engagement immediately after intervention |
Therapist and child making imaginative scenes provides the opportunities for children to experience and embody a sense of belonging as children  
Healing is linked to transformation of experience from a child with a diagnosis to a child who can experience power and substance |
↑ ability to complete part of the QNST-II for children in Tx group |
Theoretical findings: Cultivation of pleasure may be the ingredient that facilitates transformation in social relatedness and reciprocity.  
By focusing on bodily and sensing challenges associated with ASD diagnosis, ASI simultaneously address the foundations of abstract thought; that is, how the body and its sensing provides the grounds for the “metaphors we live by” (Lakoff & Johnson, 1980/2003).  
Methodological findings: In knowledge translation, what may be most at stake is not ”what” healing transformations occur, but ”how” the terms by which we examine therapeutic practices transform what we are able to see.  
Behavioral criteria alone could not capture the quality of adaptive responses OR transformational processes |
| 12. Schaaf et al. (2012)                                             | RCT    | ASD       | N=1 [boy]   | 2. Social behaviors, functional behaviors, sensory processing | Descriptive | Confirmed hypothesis that deficits in sensory processing and praxis affect the ability to participate in social, play, home, and community activities.  
Changes in behavior and participation linked to the ability to process and integrate sensory information  
Provides preliminary evidence for ASI approach  
↑ motor skills |

**Legend:**  
RCT = Randomized Control Trial, SCS = Single Case Study, SCS-e = Single Case Study - Ethnographic, ↑ Over time, ◐ Pre-post, ◐ Pre-post-Follow up
Table 3.2: Data collection for psychosocial outcomes

<table>
<thead>
<tr>
<th>Instrument name</th>
<th>Type</th>
<th>Description</th>
<th>Administrator</th>
<th>Used in study #*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Functional behaviors</strong></td>
<td></td>
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</tr>
<tr>
<td>Revised Functional Behavior Assessment for Children with Sensory Integrative Dysfunction (Cook, 1991)</td>
<td>O Sc</td>
<td>This scale allows the identification of functional skill and is used for the documentation of progress (duration, quality, and frequency) as measured by the levels of the scale (higher score is an indicative of better performance).</td>
<td>Rater</td>
<td>7</td>
</tr>
<tr>
<td>Engagement Check (Parsons, McWilliam, &amp; Buysee, 1989)</td>
<td>O C</td>
<td>Measures spontaneous and responsive behaviors in the preschool environment. The tool specifically measures the frequency of three categories of behavior: (a) mastery and nonmastery play, (b) non engaged behaviors, and (c) interaction with peers and adults.</td>
<td>Researcher</td>
<td>6</td>
</tr>
<tr>
<td>Operationalized behaviors (Kazdin, 1982; Deitz, 2006)</td>
<td>O C</td>
<td>Target behaviors (undesirable behaviors, engagement) were selected and operationally defined and strategies for assessment were identified to ensure the relevance and repeatability of these measures, means of operationalization include: consultation with an interdisciplinary team, literature review, and pilot ratings.</td>
<td>Researcher</td>
<td>8</td>
</tr>
<tr>
<td><strong>Social skills/behaviors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early Social Communication Scales (ESCS; Seibert et al., 1982)</td>
<td>O Sc</td>
<td>Structured assessment to provide measures of nonverbal communication skills in children with mental ages between 8 and 30 months of age. It is a 15-25 min assessment of approximately 17 tasks. They include the presentation of object spectacle toys, turn-taking tasks, social interaction, gaze following tasks, and opportunities to respond to an invitation to play. Observers classify children’s behaviors into the following mutually exclusive categories of early social-communication: joint attention behaviors (use of nonverbal behaviors to share experiences), behavioral requests (use of nonverbal behavior to obtain objects or events), and social interaction behaviors (ability to engage in playful turn-taking behavior). These behaviors are also classified based on whether or not they are child-initiated bids (effort) or child responses to the examiner.</td>
<td>Clinician</td>
<td>3</td>
</tr>
<tr>
<td>Record sheet of targeted verbal and nonverbal behaviour (Gutman, 2010)</td>
<td>O C</td>
<td>Based on expert feedback, the recording sheet lists 12 verbal and non-verbal social behaviours and specific skills, defined and operationalized, that are commonly considered as core foundational social interaction skills.</td>
<td>Researcher, RA</td>
<td>1, 2</td>
</tr>
<tr>
<td>Study log of behaviors and social interactions</td>
<td>O</td>
<td>Clinical observations of each child’s behavior and social interactions were recorded in study logs. In addition, caregivers provided written weekly reports of their children’s behavior and engagement in their home environments.</td>
<td>Clinician, RA</td>
<td>8</td>
</tr>
<tr>
<td>Pervasive Developmental Disorder Behavioral Inventory (PDDBI; Cohen &amp; Sudhalter, 2005)</td>
<td>R, Sc (S, NR)</td>
<td>This assessment captures behavior in two areas: approach and withdrawal problems and receptive and expressive social communication abilities. To assesses children with autism specifically and compare their patterns of behavior with same-age normative data of other children with autism and pervasive developmental disorder.</td>
<td>Parents</td>
<td>12</td>
</tr>
<tr>
<td>Vineland Adaptive Behavioral Scales, 2nd Edition-Parents’ rating scale (VABS–2; Sparrow, Cicchetti, &amp; Balla, 2005)</td>
<td>R, Sc (NR)</td>
<td>The VABS–2 is an individually administered measure of adaptive behaviors that assesses the domains of communication, daily living skills, socialization, and motor skills. The VABS–II yields a standard score for each domain and an adaptive behavior composite score.</td>
<td>Parents</td>
<td>10, 12</td>
</tr>
<tr>
<td>Measure of social and emotional development adapted from the Greenspan Social-Emotional Growth Chart (Greenspan 2004). It assesses the acquisition of social and emotional milestones in young children, including self-regulation and interest in the world, communicating needs, engaging others and establishing relationships, using emotions in an interactive, purposeful manner, and using emotional signals or gestures to solve problems.</td>
<td>Parent</td>
<td>3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The social interaction of GARS-2 contains 14 items that describe specific, measurable, and observable social behaviors. For each item, caregivers (or parents/teachers) are asked to mark 1 of 4 choices that best expresses the child’s specific social behavior using objective frequency-based ratings of four points. This scale measures the changes in the severity of social dysfunction.</td>
<td>Parent</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>It is a norm-referenced, standardized instrument developed to assess social competence (peer relations, self-management/compliance, academic behavior) and antisocial behaviors (hostile/irritable, antisocial/aggressive, defiant/disruptive). Each raw score can be converted into a T-score and percentile ranks to determine an individual’s social behavior performance.</td>
<td>Teacher</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The SRS is a 65-item rating scale for children aged between 4–18. It measures the child’s social impairments, including the components of social awareness, social information processing, capacity for social communication, social anxiety and avoidance, and autistic preoccupations and traits.</td>
<td>Parent</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Questionnaire used to assess current responses to sensory events in everyday life. Helps to identify and document how sensory processing may be contributing to or interfering with a child's participation at home, school, and the community.</td>
<td>Parent</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The SEQ is used to characterize the sensory features of children with autism and other developmental disabilities that may affect their engagement in their physical and social environments.</td>
<td>Parent</td>
<td>12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>The SPM is a 4-point Likert-type scale that assesses processing issues, praxis, and social participation in children ages 5–12. The tool takes approximately 15–20 min to complete and has seven indexes in the areas of visual, auditory, tactile, proprioceptive, and vestibular sensory systems as well as praxis and social participation.</td>
<td>Parent</td>
<td>10</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Therapist-child-parent interactions as recorded and observed by the researcher with additional interview material with therapist and parent to understand actions in context. Therapist, Mother, Child and Researcher perspectives included</td>
<td>Clinician, Researcher, Parents</td>
<td>9, 11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GAS is a goal-setting process used to determine intervention outcomes expressly relevant to individuals and their families. GAS is able to depict functional and meaningful outcomes that are often challenging to assess using standardized measures. It is a quantitative alternative to traditional goals and objectives that allows for individualized goal setting and measurement.</td>
<td>Clinician, RA, Parents</td>
<td>10, 12</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

R = Reported, Sc = Scale, C = Checklist, I = Interview, O = Observations, S = Standardized, NR = Norm references, RA = Research assistant *Refer to table 1
Figure 3.1: Scoping review flow chart

Initial search within Embase, CINAHL, Ovid MedLine, and PsychINFO  
$n = 6562$

Duplicates excluded  
$n = 986$

Articles for first screening  
(Title and abstract)  
$n = 5576$

Articles for second screening  
(Full text)  
$n = 69$

Articles excluded  
$n = 5507$

Articles excluded  
$n = 55$

Articles retained for quality assessment  
(MMAT)  
$n = 14$

Articles added after reference lists review  
$n = 0$

Articles excluded after MMAT  
$n = 2$

Selected articles  
$n = 12$
3.11 References for manuscript one


CHAPTER 4: THE BRIDGE BETWEEN MANUSCRIPTS

This thesis examines the current state of intervention research on the use of movement based interventions (MBIs) targeting psychosocial outcomes with children diagnosed with autism. The scoping review methodology in manuscript one provided evidence on the effectiveness of MBIs on psychosocial outcomes and reflected the changing focus on perspectives of autism from component-based social cognitive perspectives towards the inclusion of sensory and motor perspectives. However, the scoping review methodology was not sufficient to make explicit the link between the theories underlying the interventions and their specification in treatment. This raised questions on whether the emerging embodied perspectives were used to guide the rationale, and thus, design of interventions. Furthermore, in manuscript one the vast range of instruments and methods used to capture psychosocial outcomes underlined the complexity of the psychosocial construct as more than just the sum of its parts (Koenig et al., 2009). Therefore, the second manuscript aims to get a deeper understanding of the movement-based intervention research reviewed in the first manuscript for both future research and clinical practice. In order to determine the theoretical basis and operationalization of the MBIs reviewed and identify possible patterns of therapeutic strategies, we chose to use a multiple case synthesis methodology (Pluye & Hong, 2014), which is described in more detail in manuscript two.
CHAPTER 5: MANUSCRIPT 2

A multiple case synthesis of movement-based interventions targeting psychosocial outcomes for children diagnosed with autism: Need for process evaluation

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5.1 Abstract

Over time, interventions for autism spectrum disorder (ASD) have shifted from a dominant focus on social-cognitive and behavioral components to an embodied perspective of social cognition, which links sensory and motor dysfunction to challenges with social cognition. This emerging perspective on ASD has led to a reconceptualization of existing sensory and motor interventions and provided a new focus on using movement to target psychosocial outcomes. Although movement-based intervention (MBI) research demonstrates its effectiveness for improved psychosocial outcomes, it is not clear if and how these MBIs are using the knowledge undergirding the emergent embodied perspectives of social cognition. Using a multiple-case synthesis methodology, this study provides an overview of the theoretical resources and knowledge integrated in the development of MBIs targeting psychosocial outcomes between 1999 and 2013. Findings from this synthesis situate the state of knowledge use in the development and operationalization of movement in interventions and suggest key therapeutic strategies for future research and clinical practice.

Key words: Movement-Based Intervention, Autism, Multiple case synthesis, Evidence-based practice, Intervention development, Theory, Psychosocial outcomes
5.2 Introduction

In the last decade, the evolution of research on the autism spectrum disorder (ASD) shifted its focus from deficits in social-cognitive and behavioral components towards a more embodied perspective of social cognition (Klin et al., 2003). An embodied perspectives foreground the experiences of sensory motor actions, engaged in particular activities in particular material and social environments as the foundation for abstract thoughts (Johnson, 1999, 2006), and influence theories about autistic sociality (Ochs & Solomon, 2010). The increasing prevalence rates of children with ASD (CDC, 2013) raises questions as to whether or not this shift in perspectives on autism has been integrated in intervention research.

The current body of research on psychosocial intervention for children with ASD, major attention was given to social-cognitive trainings targeting behavioral components. Reviews of such intervention show limited clinical evidence (Case-Smith & Arbesman, 2008), while the generalization of outcomes to other contexts remains unknown (Paul, 2008; Rao et al., 2008). Despite some indication of improvements, the effectiveness of social skills interventions with school-age children with ASD also remains inconclusive (Koenig et al., 2010). Yet, research that focused on sensory and motor challenges of children with ASD, such as sensory deficits (Baranek, 2002; May-Benson & Koomar, 2010), motor impairments (Fournier et al., 2010; Green et al., 2002), and imitation challenges (Rogers & Williams, 2006) not only resulted in improvements in motor, sensory processing, and functional outcomes (Baranek, 2002; May-Benson & Koomar, 2010), but also showed promising results in terms of social skills (McCleery et al., 2013 & Stefanidou, 2013).

The concept of embodiment focuses attention on the experience of mind-body in particular environments as the foundation for abstract thoughts crucial for communication and the creation of meaning (Johnson, 1999, 2006). This embodied perspective provides a link between the sensory motor challenges of children with ASD and social impairments (Bhat et al.; Dowd et al., 2010; MacDonald et al., 2013), including their ability to participate with others (Park, 2012). This embodied perspective of social cognition challenges the continued dominance of interventions focused solely on behavioral components of social-cognition for children with ASD. Although a recent scoping review supported the efficacy of movement-based interventions (MBIs) targeting psychosocial outcomes for children with ASD (Lee, Wittich, Kehayia, & Park,
submitted), they still remain in the first phase of their validation. In addition, the review also pointed out the wide range of psychosocial outcome measures used within the studies, which not only reflected the complexity of the psychosocial construct and how it is currently measure (Koenig et al., 2009) but also raised questions on whether or not emerging knowledge linking bodily challenges to social impairments were utilized in the development and research of MBIs.

Understanding how a treatment works requires more than elaborating on its efficacy. Rather, the identification of the underlying theoretical assumptions to activate such changes and how it is operationalized within an intervention is paramount (Kazdin, 2007). In addition to what needs to change, interventions must include a clear conceptualization of the clinical problem and explicit knowledge on how change should occurs (i.e. identifying and analyzing the processes which lead to change) (Kazdin, 2011). Hence, as current intervention research mostly examine the efficacy of MBIs, the purpose of this study was to understand the theoretical development and treatment specifics of MBIs that target psychosocial outcomes with children diagnosed with ASD, and thus, identify patterns within the operationalization of MBIs for future research and clinical practice.

5.3 Methods

The aim of this study was to identify patterns in theoretical resources and knowledge used within the development of MBI research, and how any theoretical resources and knowledge were operationalized in the MBIs. In order to do so, we used a multiple case synthesis methodology (MCS) to identify patterns across the cases studied. MCS methodology follows the approach of multiple case studies and is a research strategy to uncover the “when, how, and why” of a phenomenon when questions are being posed (Yin, 1994, p. 1). For the purpose of this MCS, the cases selected consisted of intervention studies that used MBIs to target psychosocial outcomes for children with ASD. In order to identify patterns across cases, we then extracted and analyzed similar data across the selected cases (Pluye & Hong, 2014), in order to answer our research questions. The steps of a MCS follow the same general steps used in systematic reviews, which are: 1) identifying the research question, 2) selection of the cases, 3) charting, synthesis, and analysis of data.
5.3.1 Identifying the research question

Our guiding question was: *Are there patterns in the knowledge and theoretical resources used in the design and operationalization of intervention research on the use of movement to target psychosocial outcomes for children diagnosed with ASD?*

5.3.2 Selection of cases

The procedures for selecting the studies followed the systematic steps used in scoping review methodology (Colquhoun et al., 2014; Daudt et al., 2013). First, we conducted extensive searches in four online databases (Ovid MedLine, PSYCHinfo, EMBASE, CINAHL) using the following MeSH terms: children with autism, movement-based interventions, and psychosocial outcomes. The resulting 6562 articles were imported into EndNote. Then we determined eligibility criteria by defining MBI as any approach using intentional body movement through space to target psychosocial outcomes, whether the movement was child-directed, proposed by adult, or guided. The primary author then identified eligible studies by screening titles and abstracts. When eligibility was not clear, the full articles were read in consultation with the last author of this present article. We then critically appraised the resulting 14 studies using the Mixed Methods Appraisal Tool (MMAT; Pace et al., 2012). The MMAT is a tool that can be used to critically appraise the rigor of quantitative, qualitative or mixed methods studies. Two were excluded in the screening process, which is step one of the MMAT, because they did not have clear research questions. A flow chart depicts the selection process for the 12 resulting cases (see Figure 1). The online database searches were conducted in September 2013 and thus only include publications prior to this.

[Insert figure 1]

5.3.3 Charting and synthesis, and analysis of data

We used Kazdin’s (1997) model for development of effective treatment to chart the data and look for patterns across cases. His model consists of seven steps: 1) conceptualization of the dysfunction, 2) research on processes related to dysfunction, 3) conceptualization of treatment, 4) specification of treatment, 5) test of treatment outcomes, and 6) test of treatment processes, and 7) test of boundary conditions and moderators. Steps one through four, which concern the use of research and how its used in the design of treatment, provided a heuristic device to systematically
extract the data from the identified cases. We then looked for patterns in the knowledge used in the conceptualization of the clinical problem by: 1) asking how the researchers conceptualized the dysfunction, 2) how they conceptualized the processes related and/or involved in the dysfunction, and finally, 3) if and what underlying working assumptions and/or principles were reported as possible causes of change.

In order to examine if any knowledge or theoretical resources were integrated into the design or specification of MBIs, we examined the characteristics of the interventions. The first and last authors determined the characteristics in a hermeneutic process between the initial definition of MBIs (i.e., as any approach which intentional body movement through space whether the movement was child-directed, proposed or guided), any guiding treatment principles given, and theories on *autistic sociality* from ethnographic research (Bagatell, 2012; Ochs & Solomon, 2010; Park, 2008, 2012). For example, we took a closer look at context as it is considered essential for the development of communication skills (Bruner, 1990) and embodied social-cognitive perspectives on ASD (Klin et al., 2003), which is supported by ethnographic research on the use of the symbolic meaning of the material context in clinical encounters (Park, 2008). Further, “child-directedness” is a principle of Ayres Sensory Integration (Ayres, 1979), which is the basis of MBIs in seven cases, and is supported by ethnographic research on autistic sociality in clinical encounters (Park, 2012). After the primary and last author calibrated how they were defining characteristics using two of the studies (out of 12), the primary author then used the resulting characteristics to extract the data on intervention specifics to: a) context of the intervention, and b) therapeutic strategies, which included child-directedness as well as the use of movement. Once data were extracted, we did a comparative analysis of the reviewed articles for any patterns in knowledge and theoretical resources used and design of the MBIs using a step-by-step approach (Cox, 1993), in which interventions are dismantled and unpacked, compared, and categorized.

### 5.4 Results and synthesis

The first part of the results section focuses on the extent of knowledge and theoretical resources used in the development of MBIs (see Table 1). The second part focuses on the operationalization of the MBIs (see Table 2).
5.4.1 The use of knowledge and theory in the development of MBIs

The first proposed steps of the model for the development of effective treatment by Kazdin (1997) is the conceptualization of the dysfunction, which examines what is known about the clinical problem and/or disorder. We found dysfunction to mirror the range of perspectives on ASD. For example, the authors largely used social-cognitive or behavioral criteria of the diagnosis to describe the dysfunction in children with ASD, such as challenges with gaze, attention, joint attention, conversational skills, and/or narrowed range of interests. Some researchers also used descriptions of motor (praxis, recognition and production used for imitation) and sensory challenges (processing, modulation, regulation, and discrimination of sensory information), as well participation patterns in physical activities. More recent studies also included research on the deficits in the mirror neuron system (Gutman et al., 2010; Gutman et al., 2012) to describe the dysfunction. Only one study cited emergent embodied perspectives on social cognition such as the Enactive Mind (e.g. see Park, 2012).

Kazdin (1997) also emphasized the need to use theories on the processes related to how dysfunction is conceptualized, which provides the foundation for the intervention by making “explicit views about what the treatment is designed to accomplish and through what processes” (p.119). Due to the overlap between these two categories and our focus on the quality and/or strength of the underlying theories or research evidence used in the MBIs, we then drew on Glaser and Strauss’ (1967) (e.g., see Carter & Little, 2007) categorization of knowledge as either substantive or formal. Substantive knowledge refers to theories regarding concrete issues, experiences, or activities. Formal theories are more abstract, build on substantive knowledge and, thus, are considered to be more generalizable or far-reaching (see Table 1). We present our findings relative to whether they were primarily based on substantive or formal theories.

5.4.1.1 Substantive knowledge as the foundation for MBIs

The relationship between undesirable and/or self-stimulative behaviors and impairments in functional behaviors, participation, and social relationships provided one major form of substantive knowledge (i.e. theories regarding concrete issues, experiences or activities) used in the rationale of MBIs. For example, Case-Smith and Bryan (1999) linked component-based challenges (e.g. orientation of gaze, attention) to deficits in imitation skills needed for
communication while Movahedi, Bahrami, Marandi and Abedi (2013) attributed poor social inclusion to emotional and social skills deficits.

Other substantive theories, such as the benefits of physical activity on psychosocial components and social development, also provided foundation for interventions. For example, Pan (2010) used empirical findings on the use of water activities and swimming to facilitate language, self-concept, adaptive behaviors, and child competence, increase exposure to larger social networks in addition to decreasing self-stimulatory behaviors. Movahedi et al. (2013) also included research on the positive effect of physical activity on the metabolism of neurotransmitters involved in social mechanisms, such as self-esteem and self-competence.

### 5.4.1.2 Formal knowledge as the foundation for the movement-based intervention

The use of formal knowledge appeared in the MBIs which cited substantive evidence related to Ayres Sensory Integration framework (ASI; Ayres, 1979), mirror neuron theory (MNT; Iacoboni & Mazziotta, 2007; Rizzolatti et al., 2009), imitation theories (Ingersoll, 2012), and embodied social cognitive models, such as the Enactive Mind (Klin et al., 2003). We will briefly define the formal knowledge in the order it first appeared in the reviewed cases to further illustrate the development of knowledge and its use in MBIs: a) ASI, b) MNT, c) imitation theories, and d) embodied social-cognitive theory.

The most expansively researched, and reviewed (seven studies), MBIs were based on the formal knowledge of ASI (Ayres, 1979, 1991). The underlying assumption behind the ASI theory suggests that effective sensory integration is fundamental for the production of organized and purposeful behaviors which provide the foundation for learning, motor planning skills, emotional regulation and self-regulation (May-Benson & Koomar, 2010). In practice, such interventions aim to provide opportunities for child-directed sensory-enhanced experiences that focus on remediating the underlying challenges of the nervous system through the exploration of playful and meaningful activities (Parham et al., 2007; Pfeiffer et al., 2011; Schaaf et al., 2012).

Substantive knowledge cited in the ASI cases included evidence of impairments within the underlying sensory processing mechanisms, which interfered with arousal and attention (Case-Smith & Bryan, 1999), functional and purposeful behaviors (Watling & Dietz, 2007), participation, play, social interaction, communication, and praxis (Linderman & Stewart, 1999; Schaaf et al., 2012). Over time, the substantive knowledge was used to support ASI formal
theory, such as the use of self-stimulative and stereotyped behaviors to self-regulate in order to regain homeostasis (Pfeiffer et al., 2011) as well the functional impact of sensory processing deficits on a person’s ability to organize their actions over time with others (e.g. see Blanche & Parham, 2001 in Park, 2008; 2012).

Based on neuroscience experiments, the mirror neuron system (MNS) was first identified from imitation studies on monkeys (e.g. see di Pellegrino et al., 1992 in Park, 2008; 2012), and further established as the basis for unifying action, perception and execution (Rizzolatti et al., 2009). Evidence demonstrates that through MNS one can recognize the actions of others by matching the observed action with its motor counterpart coded by the same neuron network (Iacoboni et al., 2005). Rizzolatti et al. (2009) further add the crucial role of MNS in understanding the emotions and actions of others. Therefore, dysfunctions within MNS are believed to disrupt the chain linking the sequence of motor behavior, sensation, intention, and cognitive and emotional understanding. Three of the reviewed cases cited the formal theory of MNT. Gutman et al. (2010; 2012) developed a role-playing intervention for children with autism based on the social impairments related to deficits in mirror neuron system (MNS) of children with ASD. They defined their role-playing intervention as linking motoric social skills with cognitive and emotional understanding. As opposed to pure imitation, copying of behaviors without understanding the imitator’s intention, role-playing involves the synthesis and understanding of motor, sensory, cognitive and emotional information, and thus, mirrors the assumptions of MNT (i.e. as the system that unifies action, perception and execution for on to recognize and understand). Further, Park (2012) used MNT as a lens for microanalysis of therapist-child interactions during a therapy sessions in an ASI-based clinic.

The Reciprocal Imitation Training (RIT) intervention builds off of formal theories on the role of imitation in social development, such as the relationship of imitation with social behaviors (Rogers et al., 2003), reciprocity and coordinated joint attention (Escalona, Field, Nadel, & Lundy, 2002). Only one case used imitation theories in its definition of the clinical problem and development of intervention. Based on the challenges of children with ASD in imitation, both in recognition and production, the RIT builds on research on the influence of imitation on long-term improvement in language and social responsiveness as well as earlier efficacy studies on the use of RIT to increase spontaneous objects and gestures imitation (Ingersoll, 2010). An underlying assumption of the formal theory of RIT is that improvement in social functioning can occur by

The Enactive Mind (EM) framework is based on emerging neuroscience theories on embodied cognition, and eye tracking experiments (Klin, Jones, Schultz, Volkmar, & Cohen, 2002a, 2002b). The Enactive Mind depicts social cognition as embodied experiences of acting with others, which are then resources to know what is salient information in the environment needed to produce “moment-by-moment social adaptive reactions in naturalistic social situations” (Klin et al., 2003, p. 357). Building on eye-tracking studies in which adults with autism focused on details in the material environment instead of facial expressions or gestures in the social environment, Klin et al. (2003) suggested that the embodied social cognition of children with autism differs from typically developed peers resulting in a greater specialization on objects rather than people. Thus, the EM acknowledges that although individuals with ASD are able to acquire and embody social experiences over time, children with autism are yet “unable to translate this knowledge into real-life social adaptive actions” (Klin et al., 2003, p. 357). Within the articles reviewed, only one case integrated embodied social cognitive perspectives (e.g., Johnson, 2007; Klin et al., 2003 in Park, 2012) as part of the conceptual framework used to micro-analyze therapist-child interactions in an ASI based clinic and child-sibling-mother interactions in their home. Describing the moment-by-moment interactions in the therapy session provided an illustration of how the child’s moment-to-moment social adaptation in the therapy session generalized to the child’s initiation of social interaction with others in the clinic and home contexts (Park, 2012).

We identified additional formal knowledge in the evaluations of the process of MBIs (Park, 2008, 2012). Based on longitudinal ethnographic accounts of the experiences of children with ASD and their families, both substantive knowledge (Cohn, 2001; Cohn, Miller, & Tickle-Degnen, 2000) and formal knowledge on autistic sociality (Bagatell, 2003; Ochs, Kremer-Sadlik, Solomon, & Sirot, 2001; Ochs & Solomon, 2004) were used to frame and discuss the evaluation of the child-therapist interaction in a sensory integration based clinic. Furthermore, these two process evaluations utilized a conceptual framework during the analysis of interactions which were built from formal theories on narrative reasoning in clinical encounters (Mattingly, 1998a; Mattingly & Garro, 2000) and multi-modal sensory experiences in healing practices (D. Howes, 2003; Lawlor & Mattingly, 2001; Stoller, 1997).
5.4.2 Operationalization of MBIs

In Kazdin’s (1997) model for the development of effective treatment, knowledge used in the design of the treatment must explicitly guide what the intervention is designed to achieve (i.e. change), how (i.e. processes responsible) and through which procedures (i.e. therapeutic strategies). As noted above in the methods, we determined two primary categories through a critical synthesis of the formal theories used in the MBIs and theories on communication across all studies: a) context and b) use of movement and child-directedness.

5.4.2.1 Setting and Social Context of MBI

The cognitive and cultural psychologist Bruner (1990) proposed that context is essential for the development of communication skills. We examined context in terms of the setting and social context described in the MBIs to see if and how knowledge used in the development of interventions was integrated into its specifications.

The settings of the MBIs reviewed included: seven sensory integration rooms (four in a clinic, two in a school and one in a summer camp), two non-specified types of rooms in a school, one swimming pool in the community, one non-specified type of gym in the community, and a room in a university-based clinic. Based on the MBIs which used an ASI intervention, the sensory integration clinical settings included specific equipment to provide multiple sensory experiences, such as: swings, suspended equipment, scooterboards, bounce ball, body sock, trampoline, large pillows, trapeze bar, medicine ball and various objects to stimulate the tactile, visual, and auditory systems (e.g., see in Case-Smith & Bryan, 1999; Linderman & Stewart, 1999; Park, 2008, 2012; Pfeiffer et al., 2011; Schaaf et al., 2012; Watling & Dietz, 2007). Further, these materials were also used for their symbolic values also in the sessions, as identified by the two process evaluation of MBIs (e.g. swing could provide sensory experiences, and could be a “car”) (Park, 2008, 2012).

In terms of the social context, seven MBIs, used a dyadic format (child-therapist), three used supervised matched pairs (therapist-child-child), and two used mixed settings. For the mixed settings, one MBI gave instructions individually (child-instructor) followed by a group performance in the same space (Movahedi et al., 2013) and another started as a supervised matched pair (instructor-child-child), followed by a group setting where children could interact through organized water-based activities (Pan, 2010). One process evaluation of an ASI
intervention also provided details of emergent spontaneous interactions, such as when the primary dyad (therapist-child) interacted with a triad (therapist-child-mother) who were engaged in a different activity in the same setting and also interactions in a home setting between the child with autism, his sibling and mother (Park, 2012).

5.4.2.2 Type and purpose of movement

Kazdin (1997) used the term procedure to account for the actions, principles and/or decisions underlying the treatment. For the purpose of this thesis, we used the more general term of therapeutic strategies to include the type of movement used in the interventions. In terms of the type, we looked at how much of the body was involved in the movement. For the involvement of the body, we classified the studies based on whether or not it involved full body movements. Studies were classified as full body when the main focus was not limited to the movement of specific body parts. Among the cases, eleven of the twelve MBIs were classified as involving the full body. Only the imitation study (Ingersoll, 2012) was classified as involving only body parts (e.g. functional use of objects at tabletop activities).

The purpose of the movement was classified as either (1) instrumental or (2) experiential. We classified the movement as instrumental when movement was the means towards an end, for example, to learn a skill through practice or replication of a pre-determined set of movements (e.g. imitation, karate kata, swimming). In contrast, we classified movement as experiential if the focus was on the movement was more of an end in itself, such as when engaged in a self-directed or chosen activity, task or exploration. Among the cases, five studies focused on skills (e.g. imitation for social role playing, karate kata, swimming and exercise), whereas the seven ASI studies focused on providing opportunities for child-directed, playful and sensory enhanced experiences.

[Insert table 2]

5.5 Discussion

The purpose of this MCS was to understand the theoretical development and treatment specifics of MBIs that target psychosocial outcomes with children diagnosed with ASD and thus, identify patterns within the operationalization of MBIs for future research and clinical practice. Our findings situate the state of knowledge-use among actual MBIs and how such knowledge
influenced the specification in treatment. We also attempted to identify possible key therapeutic strategies “of the treatment [that] are essential for therapeutic change to occur or for a particular level of change to occur” (Kazdin, 2011, p. 692).

5.5.1 State of knowledge use

Our findings reflected that MBIs grounded in substantive knowledge, such as physical activities benefits for global health, do not directly stress the embodied relationship between MBI and psychosocial outcomes. Nevertheless, other MBIs actually attempted to clearly emphasize this relationship by linking their underlying assumptions (i.e. knowledge-use) to psychosocial outcomes by using formal theories such as: the role of imitation on social development (e.g. see Ingersoll, 2012), motor neuron systems on action and imagination (Dapretto et al., 2006; Ramachandran & Oberman, 2006; Rizzolatti & Craighero, 2004; Rizzolatti et al., 2009), and most extensively, sensory integration on adaptive functioning more generally (Ayres, 1979, 1989).

In treatment development, formal theories provide the foundation and underlying assumptions of what the treatment ought to achieve. For example, what ASI ought to achieve is supported by a strong theoretical foundation (Ayres, 1979), specification in treatment (May-Benson et al., 2014; Parham et al., 2007; Parham et al., 2011), and process evaluation suggesting key ingredients of change (Park, 2008, 2012), which ultimately strengthens research on its effectiveness (Pfeiffer et al., 2011; Schaaf et al., 2012). Thus, as pointed out in Lee et al. (submitted), only ASI based MBIs build significance on multiple phases of research guidelines on psychosocial interventions as proposed by Smith et al. (2007). The four phases suggested include: (1) efficacy research, (2) manualization and across sites intervention research, (3) randomized clinical trials (RCTs), and (4) community effectiveness studies. In addition to efficacy research, ASI interventions also build on research on manualization (Parham et al., 2007; Parham et al., 2011) and also on research on process such as the two qualitative studies reviewed (Park, 2008, 2012). However, ASI interventions still require further investigation to support the underlying neurophysiological assumptions, such as the more recent diffusion tensor imaging (Owen et al., 2013) and fMRI studies (Wacker, Spitzer, Lützkendorf, Bernarding, & Blankenburg, 2011).
Formal theories, such as the MNT, provide physiological evidence linking imitation, observation, and understanding the emotion and action of others (Iacoboni & Mazziotta, 2007; Rizzolatti et al., 2009). Although there is some evidence of deficits in the mirror neuron systems of children with autism (e.g. see Ramachandran & Oberman, 2006), how these deficits directly result in psychosocial deficits still tends to be purely speculative (Gallese, 2003, 2006). In addition, the current state of knowledge-use of embodied social cognition perspectives on autism, such as the Enactive Mind (Klin et al., 2003), also appear to be still in it’s infancy. The inclusion of such perspectives in the development and research of MBIs targeting psychosocial outcomes for children with ASD broadens the unilateral focus on discrete skills. Further, it also highlights the complexity of psychosocial outcomes being more than the sum of its part (Koenig et al., 2009) as well as context, time, and culture dependent (Zahavi, 2001). Although Klin et al.’s (2003) Enactive Mind conceptual framework provides one of the most comprehensive frameworks to examine the role of action and experiences in material and social environments that most represents the complexity of social life, it is used in only one of the reviewed MBIs (Park, 2012) as part of the conceptual framework to examine the therapeutic processes within an ASI therapy.

5.5.2 Specification in treatment

Guidelines on psychosocial research with children with ASD (Lord et al., 2005; T. Smith et al., 2007) call for the operationalization of interventions and their manualization. Intervention’s manuals outline the instructions for each stage of the intervention, as well as common problems and problem-solving strategies (Hibbs et al., 1997). Further, manualization not only proposes a standardized way of administering an intervention, but also explains how an intervention addresses key features of the disorder, and the key aspects of the treatment that will lead to change and also serve for both research and practice (T. Smith et al., 2007). The use of formal theories in the description of the clinical problem and explanation of what a treatment ought to achieve should not only be evident in the conceptualization of the treatment, but should also propose key therapeutic strategies that result in change (i.e. specification in treatment).

One of the unresolved questions in autism research remains the gap between what children with ASD can do in explicit tasks with specific or discrete social demands in controlled settings and what they really do in day-to-day real-life social situations in which they must grasp
what is essential among a complexity of social cues needed to spontaneously adapt to rapidly changing social contexts (Klin et al., 2003; Rao et al., 2008). Across the cases, the community-based swimming pool (Pan, 2010) and school (Gutman et al., 2010; Gutman et al., 2012) could be considered as real life social situations encountered in the daily routines which would require children with autism to spontaneously apply their social reasoning skills. In contrast, the settings which could be considered as more controlled to facilitate the learning of discrete abilities through explicit teaching or provide certain therapeutic experiences consisted of an unspecified gymnasium (Movahedi et al., 2013), a university clinic (Ingersoll, 2012), and sensory integration rooms which included four clinic-based (Linderman & Stewart, 1999; Park, 2008, 2012; Watling & Dietz, 2007), two school-based (Case-Smith & Bryan, 1999; Schaaf et al., 2012) and one within a summer camp (Pfeiffer et al., 2011). However, taking into account Park’s (2008, 2012) ethnographic studies and ASI theory and its manualization (Ayres, 1979; Parham et al., 2007; Parham et al., 2011), we can consider sensory integration clinical rooms as what Klin et al. (2003) called naturalistic (i.e. where a multitude of elements must be accounted for and that resemble to real-life situations which require spontaneous social adaptations). In fact, Park (2012) provided essential process information and described how spontaneous interactions with others (e.g. therapist, child and mother triad who were present in the same setting) emerged from a child-therapist dyad within an ASI intervention context.

Further, we identified that seven MBIs across the cases focused on the experience of the movement as opposed to discrete skills (i.e. instrumental focus). From our MCS findings and previous scoping review (Lee et al., submitted), we can only acknowledge that both focuses showed signs of efficacy and that we can not identify if whether or not one works better then the other. Thus we could not clearly identify if either of the focuses as key therapeutic strategy. However, we could identify that the MBIs that focused on discrete skills were not child-directedness as opposed to the MBIs that focused on the experience. Only the ASI interventions (seven studies) were classified as experiential and child-directed based on the underlying principles of ASI theory (Ayres, 1979; Parham et al., 2007; Parham et al., 2011). However, we could not exactly determine the extent to which these ASI interventions were actually child-directed in throughout the research due to the lack of process information. Based on the studies’ description and use of either the pilot version or the ASI fidelity measure (Parham et al., 2007; Parham et al., 2011). We can thus assume that three of the cases (Pfeiffer et al., 2011; Schaaf et
al., 2012; Watling & Dietz, 2007) followed the ASI principles which adopt a child-directedness philosophy described as a collaborative process where the child is actively engaged in making choices and exerted some control over the intervention (Parham et al., 2007; Parham et al., 2011). In addition, the two ethnographic case studies of an ASI intervention (Park, 2008, 2012) provided enough process information on who directed the session depending on moment-to-moment decisions and/or negotiations between the participants (i.e. mainly a child, his therapist and meaningful objects), and thus, described moments that were or were not child-directed. Based on our findings alone, we cannot clearly identify the child-directedness aspect of MBIs as a key therapeutic strategy. However, both substantive and formal knowledge support the centrality of child-directedness within interventions for children with ASD (Kasari, Freeman, & Paparella, 2006; Kazdin, 2007; Koenig et al., 2010; Odom, Hume, Boyd, & Stabel, 2012; Rao et al., 2008) and the limitations of adult-directed interventions towards generalization of acquired skills into day-to-day life and across settings (Koenig et al., 2009; Paul, 2003).

Our MCS findings demonstrate evidence of the essential role of research on processes to not only describe what happened, but also how and why change occurred in treatment. Across the cases, the two ethnographic studies (Park, 2008, 2012) are example of research on processes within an ASI therapy context and provided essential information in understanding the breadth-and-depth of what happened during therapy sessions. The author provided thick descriptions of how transformational processes of a child, within an ASI intervention, were facilitated by the cultivation of significant experiences of pleasure and of belonging with someone else that matters (Lawlor, 2003) as they emerged from the interaction between a child with ASD and his therapist. Park (2008, 2012) also illustrates how interweaving between narrative and procedural reasoning guided a therapist’s actions and clinical reasoning (Mattingly, 1998b; Mattingly & Garro, 2000) which preceded moments of spontaneous social actions of reciprocity and care for others of the child with autism. Such process research provided essential information for specification in treatment and also showed new characteristics that may not have been captured otherwise. For example, Park (2008, 2012) underlined the crucial role of significant experience of pleasure and the essential role of clinical reasoning, which should be of interest for further investigation.
5.6 Conclusion

Despite the call for identifying key therapeutic strategies or active ingredients of change (Lord et al., 2005), the paucity of process research among the studies hinders the development of MBIs targeting psychosocial outcomes for children with ASD. Without knowing how, why, and with whom treatments work or do not work (i.e. process information), it is difficult to create specific manuals for intervention. Thus, we propose that in the process of validating an intervention significance and to facilitate implementation into clinical practice, initial intervention research should not just focus on outcomes. We suggest that process evaluation should be implemented at the onset of intervention research. Such studies would help us to determine what actually happens in what types of environments in addition to how, why, and with whom interventions do and do not work, and thus, build significant evidence for clinical practice.
## 5.7 Tables and figure for manuscript two

### Table 5.1: Current Development of Movement-Based Intervention

<table>
<thead>
<tr>
<th>Authors</th>
<th>Conceptualization of the clinical problem</th>
<th>Conceptualization of the treatment</th>
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<tbody>
<tr>
<td><strong>ASI</strong></td>
<td>Concept of dysfunction</td>
<td>Substantive knowledge</td>
</tr>
</tbody>
</table>
| Case-Smith and Bryan (1999) | C (Dx, SI, understanding others' point of view, [-] fct bh) | • Deficits in orientation towards social stimuli, social gaze, shared attention and motor imitation → Communication dysfunction | • ASI theoretical framework | • [-] impaired → [+]
| | | • Disturbances in sensory modulation → deficits in social relating, communication, and language | gains | • ASI theoretical framework |
| Linderman and Stewart (1999) | C (Dx, SI, imitation) | • Undesirable bh [-] engagement and function | • ASI theoretical framework | • Hypersensitive → [+]
| | | • SI deficits [-] production of organized and purposeful bh | framework | gain then hyporeactive |
| Watling and Dietz (2007) | C (Dx, SI, [-] engage) | • Deficits in imaginative play capacities, challenges reading the affective intentions of others and Dx criteria portrayed idea of autistic aloneness; | • ASI theoretical framework | • Active engagement → crucial for effective intervention |
| | | • Ethnographic research of individual with ASD on their use of symbolic or imaginative narratives to structure their action with others in meaningful ways challenging autistic aloneness; | framework | • ASI theoretical framework |
| | | • Perspectives of others on behavior of children with ASD as not socially accepted | | |
| | | • Experiences of patients, families and therapists | | |
| Park (2008) | C (Dx, SI, [-] engage) | • Mirror neuron system dysfunction of children with ASD | • ASI theoretical framework | • Narrative as an imaginative practice may be integral to healing and transformation of belonging |
| | | • Experiences of patients, families and therapists | framework | • Narrative and imaginative practices are not merely cognitive but inextricably entangled with the sensuality of bodily actions |
| | | | | • Making scenes provides the opportunity to experience and thus embody a bodily and social sense of belonging in actual worlds |
| | | | | • Narratives as cultural tools that (1) provide a window into the particularities of individual experience, (2) make emotional sense or meaning out of breaches or unexpected turns of events, and (3) organize joint action with others toward an unknown future. |
| Pfeiffer et al. (2011) | C (Dx, SI, [-] fct behaviors) | • Noncompliance/ unresponsiveness/wide variety symptoms → Standardized measures inappropriate with children with ASD | • ASI theoretical framework | • Narrative as an imaginative practice framework |
| | | • Narratives of people with ASD; Self-stimulative bh → [+]
| | | | sensory processing |
| | | • Mannerism perceived as socially inappropriate → communication and acceptance barriers → [-] QoL | | • Narratives as an Imaginative practices |
| | | | | • Anthropology of the Senses (Healing) |
| Park (2012) | C (Dx, SI, MNS, EM) | • Mirror neuron system dysfunction of children with ASD | • ASI theoretical framework | • Cultivating significant experiences with others leads to healing transformations |
| | | • Experiences of patients, families and therapists | framework | • Throwing breaches create inciting incidents that open up a gap between what is expected and what is actually achieved and lead to the emergence of healing |
| | | | | • Acted narratives emerge from moment-to-moment improvisation |

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<table>
<thead>
<tr>
<th>Schaal et al. (2012)</th>
<th>C (Dx, SI, [-] fct behaviors, perspective of parents)</th>
<th>• Embodied metaphors</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Gutman et al. (2010)</td>
<td>C (Dx, SI, [-] imitation, MNS)</td>
<td>[-] fluidity of movements → [-] anticipating behavior and to use movement to convey thought and feeling → Motor behavior, cognitive intention and emotional understanding seems unpredictable</td>
<td>• MNS</td>
</tr>
<tr>
<td>Gutman et al. (2012)</td>
<td>C (Dx, SI, [-] imitation, MNS)</td>
<td>• Although typical intelligence → emotions and social behaviors presents great challenges → [-] social participation and inclusion throughout life</td>
<td>• MNS</td>
</tr>
<tr>
<td>Movahedi et al. (2013)</td>
<td>C (Dx, SI, [-] imitation)</td>
<td>• Social skill deficits → [-] academic and occupational performance, [+]: anxiety problems, [+]: stereotypy, [-]: relationships, [+]: mental health problems • Abnormal oxytocin and serotonin metabolism in individual with ASD → [-]: adaptive, and social functioning</td>
<td>• PA → [-] stereotypic behaviors, self-injuries behaviors, aggression, inappropriate vocalization, attention, and stress and [+]: quality of life • [+]: psychosocial effects of PA • PA → [+]: synthesis and metabolism of oxytocin and serotonin → [+]: social functioning</td>
</tr>
<tr>
<td>Pan (2010)</td>
<td>C (Dx, SI, [-] active)</td>
<td>• Nature of challenges → difficulties for teachers and parents in fostering development • Self-stimulative behaviors → [-]: with functional behaviors</td>
<td>• PA → important part of a healthy lifestyle, [+]: physical and behavioral effects • Swimming → [-]: stereotypic autistic movements, [+]: child’s competence • Water activities → Facilitate language development and self-concept, [-]: adaptive behaviors → provide appropriate setting for learning</td>
</tr>
<tr>
<td>Ingersoll (2012)</td>
<td>C (Dx, SI, imitation – recognition/production)</td>
<td>• Significant relationship between imitation, social bh, reciprocity, and joint attention • [-]: responsive to being imitated and lack of understanding of the imitator’s intention</td>
<td>• Role of imitation in social development</td>
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</tbody>
</table>

Dx = Diagnosis, SI = Sensory Integration, ASI = Ayres Sensory Integration, MNS = Mirror neuron system, Ins = Instructor, Bh = Behavior, PA = Physical activity
<table>
<thead>
<tr>
<th>ASI</th>
<th>Setting</th>
<th>Social context</th>
<th>Therapeutic strategies</th>
<th>Body involvement</th>
<th>Purpose</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case-Smith and Bryan (1999)</td>
<td>School (SI room)</td>
<td>C – T</td>
<td>• ASI theoretical framework</td>
<td>Full body</td>
<td>Experiential</td>
</tr>
<tr>
<td>Linderman and Stewart (1999)</td>
<td>Clinic (SI room)</td>
<td>C – T</td>
<td>• ASI theoretical framework</td>
<td>Full body</td>
<td>Experiential</td>
</tr>
<tr>
<td>Watling and Dietz (2007)</td>
<td>Clinic (SI room)</td>
<td>C – T</td>
<td>• ASI: Pilot of Fidelity Measures (10 process elements) • Clinical reasoning</td>
<td>Full body</td>
<td>Experiential</td>
</tr>
<tr>
<td>Park (2008)</td>
<td>Clinic (SI room)</td>
<td>C – T</td>
<td>• ASI theoretical framework • Interweaving of procedural and narrative reasoning • Narrative structure to structure clinical time (trouble) • Creation of significant experiences (stance, power) • Improvisational nature of interaction between C-T • Making scenes that matters to children</td>
<td>Full body</td>
<td>Experiential</td>
</tr>
<tr>
<td>Water et al. (2011)</td>
<td>Summer camp (SI room)</td>
<td>C – T</td>
<td>• ASI: Fidelity Measures (10 process elements)</td>
<td>Full body</td>
<td>Experiential</td>
</tr>
<tr>
<td>Park (2012)</td>
<td>Clinic (SI room)</td>
<td>C – T and C – T with a C-T-P</td>
<td>• ASI theoretical framework • Interweaving between procedural and narrative reasoning to guide actions • Making scenes that matters to children and throwing breaches • Creation of significant experiences (pleasure, embodied) • Interaction between C-T</td>
<td>Full body</td>
<td>Experiential</td>
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<tr>
<td>Water et al. (2012)</td>
<td>Home (living room)</td>
<td>C-Sibling-Parent</td>
<td>• ASI: Fidelity Measures (10 process elements) • Clinical reasoning</td>
<td>Full body</td>
<td>Experiential</td>
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**Role playing**

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<tr>
<th>ASI</th>
<th>Setting</th>
<th>Social context</th>
<th>Therapeutic strategies</th>
<th>Body involvement</th>
<th>Purpose</th>
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<tbody>
<tr>
<td>Gutman et al. (2010)</td>
<td>School room</td>
<td>Sup. pair (C – C)</td>
<td>• Peer matching • Real-life scenario and creating narratives • Sensory stimulation for arousal • Feedback • Identification (self, peer, photo, mirror, YouTube) and experience (e.g. practice, repetition) of specific movements that convey intention, cognition and emotions • Use of an identification chart for verbal and non-verbal social cues</td>
<td>Full body and body parts alone (facial expression)</td>
<td>Instrumental (Discrete skills such as gestures, facial expression, body language for social interactions)</td>
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<tr>
<td>Gutman et al. (2012)</td>
<td>School room</td>
<td>Sup. pair (C – C)</td>
<td>• Peer matching; Equal level and higher level • Feedback • Real-life scenarios • Identification (self, peer, photo, mirror, YouTube) and experience (e.g. practice, repetition) of specific movements that convey intention, cognition and emotions</td>
<td>Full body and body parts alone (facial expression)</td>
<td>Instrumental (Discrete skills such as gestures, facial expression, body language for social interactions)</td>
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<td>Physical activity</td>
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<tr>
<td>Pan (2010)</td>
<td>Swimming pool</td>
<td>2:1 ratio (C – Ins); group</td>
<td>Full body</td>
<td>Instrumental (Water exercise swimming)</td>
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<td></td>
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<td>• Close bond between C-Ins</td>
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<td>• Social interaction and exposure to proper etiquette</td>
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<td>• Sense of being in a group</td>
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<td>• Instructor modeling social bh</td>
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<td>• Individualized instruction/ feedback</td>
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<td>• Halliwick Method for biomechanics natural progression of acquisition of movements</td>
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<tr>
<td></td>
<td></td>
<td>• TEACCH Model (organization of physical environment, visual schedules, work systems)</td>
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<tr>
<td>Movahedi et al. (2013)</td>
<td>Room not specified</td>
<td>1:1 ratio (C – Ins); Group practice</td>
<td>Full body</td>
<td>Instrumental (Karate kata)</td>
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<td></td>
<td></td>
<td>• TARGET model for motivation</td>
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<td>• Attentional directing strategies</td>
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<td>• Teaching strategies</td>
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<td></td>
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<td>• Karate as proper etiquette, exposure to social interaction, experience of practicing together</td>
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<th>Imitation</th>
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<td>Ingersoll (2012)</td>
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C = Child, T = Therapist, P = Parent, Ins = Instructor, Bh = Behavior, PA = Physical activity
Figure 5.1: Multiple case synthesis flow chart

- Initial search within Embase, CINAHL, Ovid MedLine, and PsychINFO: n = 6562
  - Duplicates excluded: n = 986
  - Articles for first screening (Title and abstract): n = 5576
    - Articles excluded: n = 5507
  - Articles for second screening (Full text): n = 69
    - Articles excluded: n = 55
    - Articles added after reference lists review: n = 0
  - Articles retained for quality assessment (MMAT): n = 14
    - Articles excluded after MMAT: n = 2
  - Selected articles: n = 12
5.8 References of manuscript two


CHAPTER 6: CONCLUSION, SUMMARY AND FUTURE HORIZONS

From the very beginning, the autism spectrum disorder has been a complex and not well-understood condition. Initially related to childhood schizophrenia, Kanner (1943) first identified the disorder as an *autistic disturbance of affective contact*. At present, there are emerging perspectives on the ASD which shift the focus from a social-cognitive and behavioral deficits towards more embodied perspectives of social cognition, which include sensory motor and integration dysfunction and deficits in mirror neuron systems, such as *Position Exchange* (Gillespie, 2012) and the *Enactive Mind* conceptual framework (Klin et al., 2003).

First generation interventions focused primarily on learning discrete skills, such as social skills training (SSTs). However, a review of SST research shows that their results are inconclusive and lack in generalization (Paul, 2008; Rao et al., 2008). On the other hand, second generation of intervention, which focused on sensory and motor deficits, actually showed promising results in terms of psychosocial outcomes. Such positive results, in addition to recent research studies linking bodily challenges to social impairments (Bhat et al., 2011; De Jaegher, 2013), broaden the foci of interventions to integrate sensory and motor challenges of children with ASD with their sociality. Thus, the aim of this thesis was to understand current state of the use of movement-based interventions (MBIs) targeting psychosocial outcomes with children diagnosed with ASD in terms of their efficacy, their theoretical development, and specification in treatment.

In the first manuscript, we reviewed the current intervention research on MBIs and reported on the extent of their psychosocial outcomes using a scoping review methodology. Our results supported the efficacy of MBIs, although they are still in there beginning phase of validation according to research guidelines on psychosocial interventions for children with ASD (T. Smith et al., 2007). We also reported on the instruments and methods used to capture these psychosocial outcomes. The vast variety in instrumentation and methods and the inconsistency of the terms used to define deficits led us to question whether or not there was an effective and efficient way to capture changes in psychosocial abilities, which has a complex nature. In fact, most of the instruments and methods used focused on specific behaviors or discrete skills. Yet psychosocial outcomes are far more then the sum of its parts (Koenig et al., 2009) and are dependent on context, time, and culture (Zahavi, 2001). Although our scoping review helped
provide evidence of the efficacy of MBIs targeting psychosocial outcomes with children with ASD, how knowledge and theoretical resources were used in the development of the MBIs remained unclear and required further analysis.

The second manuscript focused on the foundational elements of the reviewed MBIs, specifically in regards to how the knowledge was used within their development and the identification of patterns of therapeutic strategies (i.e. specification in treatment). Our findings suggest that the current state of knowledge-use of the current MBIs does not represent the prevalent state of knowledge linking the mind, body and psychosocial outcomes. The MBIs we reviewed used different types of knowledge, however the use of formal knowledge is still preliminary. In fact, despite the range of perspectives on the nature of ASD, MBI research continues to be dominated by a focus on social-cognitive and behavioral deficits of children with ASD. In addition, only four of the 12 cases integrated emergent formal knowledge, such as the MNT (Iacoboni & Mazziotta, 2007; Rizzolatti et al., 2009) in the design of the MBIs, while only one case integrated embodied social cognitive perspectives, such as the Enactive Mind (Klin et al., 2003) into the analysis of the process and outcomes of a MBI. This paucity of emerging knowledge and theoretical resources in treatment design represents a theory-to-research gap or a gap between theory linking movement to psychosocial outcomes and research on MBIs.

Practice guidelines on psychosocial intervention for children with ASD (Lord et al., 2005; T. Smith et al., 2007) within evidence-based medicine call for the manualization of interventions. Only one of the MBIs was manualized; The theory of Ayres Sensory Integration (Ayres, 1979) uses fidelity measures for specification of treatment. Thus ASI may provide a positive starting point for guiding future intervention development and research by theoretically explaining how the treatment ought to achieve change and through which assumptions. Yet, process research is needed for manualization in order to clarify how, why, and with whom changes in psychosocial outcomes are linked to movement-based interventions. Thus, even if our findings point to commonalities in the characteristics of MBIs, such as the child-directedness and the focus on experience, it is difficult to discern from reported descriptions of interventions what were actually the key therapeutic strategies responsible for change.

Further, emerging perspectives on embodied social cognition, suggest that interventions should take place into more naturalistic environments, where spontaneous adaptation in complex
social environments may facilitate generalization of emergent skills (Klin et al., 2003). Yet, it is also difficult to discern whether or not the context of treatment is or is not representative of potential real life social situations without process evaluation of interventions. For example, even though we might assume that schools or community-based swimming pools are more naturalistic than clinic settings, process research does show that children with autism and their therapists create real life social situations in creative and playful ways. It might also be possible that the actual interactions in school and/or community based settings is also regulated in such a way that it does not allow for the more spontaneous interactions representative of real life social situations.

6.1 Recommendations for future research

Ten of the twelve reviewed interventions studies build from a logical empirical foundation (Pluye & Hong, 2014), in which reality is perceived to be universal, objective, and quantifiable (Darlaston-Jones, 2007). These studies focused on causal relationships to provide evidence that MBIs result in therapeutic psychosocial benefits or improvements in discrete skills or behaviors. Only two of the reviewed intervention studies were built from a social constructivist, in which reality is perceived to be socially constructed (Gergen, 1999) from each individual’s unique experiences and understanding of the world (Berger & Luckman, 1966) within specific contexts (Darlaston-Jones, 2007). The two ethnographic single case studies (Park, 2008, 2012), which used a social constructivist foundation, yielded descriptive details of the actual processes of or how the session was constructed between the therapist and child. The use of the social constructivist foundation provided depth-and-breadth description of a phenomenon (Yin, 2009; Yin, Bingham, & Heald, 1976) by tracing the what, how and why the MBI may have resulted in or facilitated the emergent transformative process of a child from “conflict to compromise, care to share”, and thus, social relatedness and reciprocity (Park, 2012, p. S41), and illuminated possible new areas to examine in future intervention research in terms of both strategies, such as clinical reasoning of the therapist and the creation of pleasure and significant or memorable experiences.

The social constructivist stance also suggests another approach to future research directions by depicting ASD as another way of being with others. The concept of autistic sociality, defined as a range of possible coordination with others (Ochs & Solomon, 2010), also proposes an alternative research approach. Building on a decade-long ethnography of children
with ASD in quotidian life at home, school, and other community settings, Ochs and Solomon (2010) illustrate that children with autism display a greater predisposition for sociality than we believe, and that “every child is born equipped with potential for sociality, but some children are able to coordinate only under a narrow range of situational conditions” (p.87). Ochs and Solomon (2010) further add that the range of possibilities for autistic sociality is thus shaped by one’s place within the autism spectrum disorder and is context bound. Such concepts question the unilateral focus on discrete social skills towards a more complex experience of being with others under certain circumstances. This is also supported by Spitzer (2003) ethnographic study on how children with ASD communicate, example of highly individual communication strategies.

Future research using a social constructivist foundation could also integrate perspectives of persons with ASD more explicitly. These insider’s perspectives of individuals with ASD stress the idea of autistic sociality (Ochs & Solomon, 2010) and the complex nature of being with others as context-dependent and more than the sum of its parts (Koenig et al., 2009). For example Donna Williams (1992) describes her very own communication as symbolic and indirect, which was frequently misunderstood as her feelings could not be verbalized in the usual way. Moreover, Aultman (2010) quotes Dr. Temple Grandin, a professor as she described herself as one of many individuals “who have learned, in their own ways, to interact and connect with the world”. Such insider’s perspectives give us valuable insight on their unique sociality that criteria alone could not capture.
REFERENCES


APPENDICES

Appendix A: Rejection and review from Autism: The International Journal of Research and Practice

Autism

Decision Letter (AUT-15-0075)

From: jim.bodfish@vanderbilt.edu
To: keven.lee@mail.mcgill.ca, kevenlee13@gmail.com
CC:
Subject: Decision on manuscript AUT-15-0075
Body: Dear Mr. Lee,


Because of the growing number of submissions the journal receives, it is our practice to conduct an internal editorial review of each manuscript prior to sending it for external review. Based on this internal review, your manuscript has not been accepted for publication in the journal. Your manuscript is well written, and the review you have accomplished is thorough. Your work also covers a novel area of autism research. Unfortunately however, the available literature base you uncovered for your review appears to be very small (12 studies) and the vast majority of studies are case studies. This limits the extent of conclusions you can draw from such a review.

While I recognize that this is a disappointing outcome, I hope that the quick turnaround time will facilitate your finding another outlet for your work.

Thank you for considering our journal for the publication of your research. I hope the outcome of this specific submission will not discourage you from the submission of future manuscripts.

Yours sincerely,

Prof. James Bodfish
Editor
Autism: The International Journal of Research and Practice

Date Sent: 25-Mar-2015
Appendix B: Proof of submission to journal *Research in Autism Spectrum Disorder*

Dear Mr. Keven Lee,

We have received your article "The use of movement-based interventions with children diagnosed with autism for psychosocial outcomes - A Scoping review" for consideration for publication in Research in Autism Spectrum Disorders.

Your manuscript will be given a reference number once an editor has been assigned.

To track the status of your paper, please do the following:

1. Go to this URL: http://ees.elsevier.com/rasd/

2. Enter these login details:
   Your username is: keven.lee@mail.mcgill.ca
   If you need to retrieve password details, please go to:
   http://ees.elsevier.com/rasd/automail_query.asp

3. Click [Author Login]
   This takes you to the Author Main Menu.

4. Click [Submissions Being Processed]

Thank you for submitting your work to this journal.

Kind regards,

Elsevier Editorial System
Research in Autism Spectrum Disorders

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Please note that the editorial process varies considerably from journal to journal. To view a sample editorial process, please click here:
http://help.elsevier.com/app/answers/detail/a_id/160

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For further assistance, please visit our customer support site at http://help.elsevier.com/app/answers/list/p/7923. Here you can search for solutions on a range of topics, find answers to frequently asked questions and learn more about EES via interactive tutorials. You will also find our 24/7 support contact details should you need any further assistance from one of our customer support representatives.