

# **Let's Play! An Observational Study of Primary Care Physical Therapy With Preterm Infants Aged 3-14 Months**

## **Abstract**

**Introduction:** Sensory-motor play is at the core of child development and an important element in physical therapist(PT)s' work to improve infants' motor skills. In this study, we investigate how PTs scaffold and use play in physical therapy intervention with preterm infants at corrected age (CA) 3-14 months.

**Material and Methods:** We collected data by observing 20 physical therapy sessions. In the analysis, we connected to enactive theory on cooperation.

**Results:** Successful use of sensory-motor play in physical therapy requires cooperation toward common goals. This is achieved via an *enactive therapeutic sensory-motor play* approach, in which the PTs plan and tailor the intervention to match the infant's interests; attune themselves to the infant's intentions; and incorporate therapeutic measures in sensory-motor play interactions with the child.

**Conclusions:** Via cooperation and mutuality in therapeutic interactions, PTs can provide play situated learning opportunities that support the infants' development and understanding of the world.

Key words: physical therapy; preterm infants; sensory-motor play; enactive theory.

## 1 Introduction

Infants born preterm are at risk of developmental delays and impairments that can persist or aggravate during the first years of life (Sansavini, et al., 2014). In early infancy, preterm infants tend to be less attentive, less responsive and need more breaks from interaction than term infants (Wolf, et al., 2002). As these children grow older, they are at risk of learning disabilities, which can in turn affect cognitive, motor and social competencies (Michele A Lobo & Galloway, 2013; Spittle, Orton, Anderson, Boyd, & Doyle, 2012). Studies indicate that preterm infants are also at risk of delayed play skills (Korja, Lehtonen, & Latva, 2012; Vig, 2007). They profit from caregivers' structuring and scaffolding of play, by which they become more engaged, more attentive and more persistent in play activities (Childress, 2011; Cress, Arens, & Zajicek, 2007). Furthermore, interactions characterized by caregiver sensitivity and synchronized dyadic interactions correlate with better developmental outcomes for preterm infants (Forcada-Guex, Pierrehumbert, Borghini, Moessinger, & Muller-Nix, 2006; Treyvaud, et al., 2009).

Pediatric physical therapist (PT)s aim to alleviate preterm infants' movement problems, enhance motor development and support the infants' participation in age-appropriate activities (Blauw-Hospers, De Graaf-Peters, Dirks, Bos, & Hadders-Algra, 2007; Campbell, Palisano, & Orlin, 2012; Spittle, et al., 2012). In this work, attention and motivation are key factors for the infants' motor learning, mastery of new skills and sense of self-efficacy (Atun-Einy, Berger, & Scher, 2013; Brodal, 2010). Sensory-motor play is inherently motivating for young infants, and serves as a driving force of infants' motor, social, cognitive and language development (Lifter, Foster-Sanda, Arzamarski, Briesch, & McClure, 2011). Via gradually advancing fine and gross sensory-motor play, infants can express their intentions; discover emerging capabilities of their body; and develop their perceptions and understandings of the world (Adolph, 2008; Lifter,

Foster-Sanda, et al., 2011; M. A. Lobo, Harbourne, Dusing, & McCoy, 2013; Sheets-Johnstone, 2011). During this development, infants' interactions with objects and people co-emerge and co-develop (Rossmanith, Costall, Reichelt, López, & Reddy, 2014). This indicates a close link between play, interaction and learning; it is via interactive play with others that infants learn how to move and act upon their world (Bigelow, MacLean, & Proctor, 2004; Rossmanith, et al., 2014).

Therefore, to promote learning and development for preterm infants with potential attention, responsiveness and endurance problems; PTs need to engage these infants in interactive sensory-motor play activities, and scaffold the infants' ability to play. Motivation, play and sensitivity in interaction are recognized as important elements in physical therapy (Blanchard & Øberg, 2015; Lifter, Foster-Sanda, et al., 2011; Majnemer, 2011; Øberg, Blanchard, & Obstfelder, 2014). However, play is primarily referred to as a developmental domain and a context in which intervention occurs (Lifter, Foster-Sanda, et al., 2011), and knowledge is lacking regarding the use of play as a therapeutic tool in interventions for children with developmental delays (Lifter, Mason, & Barton, 2011). In this study, we explore this merging of play and therapy based on the research question:

In what ways do PTs scaffold and use preterm infants' sensory-motor play engagement in their work to achieve therapeutic goals?

## **1.1 Theoretical Framework**

In our investigation, we connect to enactive and phenomenological views on cooperation, attention and intentions (Fantasia, De Jaegher, & Fasulo, 2014; Fiebich & Gallagher, 2013; Pacherie, 2012). In cooperation, the subjects take into account the other's interests and

intentions, and act to complement the other's responses (Fantasia, et al., 2014). Cooperating individuals communicate by verbal and bodily expressions, movements and behavior. Thus, via these embodied interactions, cooperation is possible even for young infants. Even more, cooperation is fundamental to infant development, in three interdependent ways (Fantasia, et al., 2014). First, cooperation is the infant's mode of being with others. Second, within the framework of cooperation development occurs. Third, development entails an advancement of the infant's cooperative abilities.

Cooperation builds on intentions that are generated and transformed as interaction proceeds (Fantasia, et al., 2014; Fiebich & Gallagher, 2013; Pacherie, 2012). This requires joint attention, which moves from simple to more sophisticated forms as the infant develops (Fiebich & Gallagher, 2013); and engagement, in which the subjects connect to each other and allow the interaction to acquire its own momentum (Fantasia, et al., 2014). Furthermore, cooperation is dynamic; interactions fluctuate between the participants' mutual *coordination with* each other and one participant's uni-lateral *coordination to* the other (Fantasia, et al., 2014). Consequently, cooperation is not always successful. Within the momentum and dynamics of interaction, coordination can break down and repairs must be made for cooperation to continue.

## **2 Material and Methods**

### **2.1 Study Design**

This is an interpretive study based on observational data from physical therapy sessions. We video recorded the sessions to enable a detailed analysis of the interactional nature of clinical practice (Heath, Hindmarsh, & Luff, 2010). The study was approved by the review board at NSD - Norwegian Centre for Research Data.

## **2.2 Study Setting**

The study was conducted in Norwegian primary health care, where preterm infants and their parents receive physical therapy as both a preventive and a therapeutic service. Most families in Norway receive paid maternity or paternity leave and stay at home during the infant's first year of life. Thus, all physical therapy sessions were with one or both parents present. The sessions took place either in the family's home or at the PT's workplace. Floor space was an available and natural site for the conduction of physical therapy. The infants quickly adapted to the researcher's presence. The PTs and parents were encouraged to proceed with the session as usual and not make changes to accommodate the researcher.

## **2.3 Study Sampling and Recruitment**

PTs at three hospitals distributed inquiries of participation to parents of infants born preterm with a gestational age (GA)  $\leq 33$  weeks, who received primary care physical therapy. Parents gave their consent via regular mail, upon which the first author contacted the families and obtained consent from the local PT. Parents of 11 infants consented to the study. Due to cessation of therapy or PTs' declination of participation, 7 triads of preterm infant, parent(s) and PT were finally included in the study (see Table 1). Each triad received three visits over a 5-10 months period, amounting to 20 physical therapy session observations (due to cessation of physical therapy, one triad received only two visits).

**Table 1: Information about study participants.**

<b>Infant*</b>	<b>Medical condition and motor impairments</b>	<b>Frequency of physiotherapy</b>	<b>PT's experience</b>	<b>Researcher visits</b>
<b>John</b>	Born at 29 weeks GA. Bilateral hemorrhages, grading unknown. Diagnosed with CP** at 6 months age. Severe spasticity in legs, low truncal tone, asymmetric use of arms.	1 per week	5-15 years, mostly with children 0-18 years.	5, 7 and 14 months CA
<b>Irene</b>	Born at 24 weeks GA. Typical motor development, minor deviations in movement quality.	1 per month	5-15 years, mostly with children 0-18 years.	8, 9 and 12 months CA
<b>Samuel</b>	Born at 28 weeks GA. Delayed motor development.	1-2 per week	< 5 years, patients of all ages.	4, 6 and 12 months CA
<b>Leonard</b>	Born at 28 weeks GA. Delayed motor development during infancy, age adequate at 12 months CA***.	1-2 per week	< 5 years, patients of all ages.	4, 6 and 12 months CA
<b>Hannah</b>	Born at 26 weeks GA. BPD****, tracheostomy from 3 months CA. Delayed motor development during infancy, age adequate at 13 months CA.	1 per week – 2 per month	15 years +, mostly with children 0-18 years.	3, 8 and 13 months CA
<b>Vanessa</b>	Born at 29 weeks GA. Typical motor development, minor deviations in movement quality.	1 per month	5-15 years, recent years with children 0-18 years.	3 and 6 months CA
<b>Anna</b>	Born at 27 weeks GA. Left hemisphere hemorrhage grade IV. Delayed motor development during infancy, age adequate at 13 months CA.	1 per week	5-15 years, recent years with children 0-18 years.	6, 9 and 13 months CA

\* Infant names are fictional. \*\*CP: Cerebral palsy. \*\*\*CA: Corrected age. \*\*\*\*BPD:

Bronchopulmonary dysplasia.

## **2.4 Data Collection**

The physical therapy sessions were observed and video recorded by the first author, from December 2012 to November 2014. The duration of sessions ranged from 21 to 54 minutes, with a mean of 33 minutes. With a handheld camera, the researcher stayed in the background but moved around as necessary to make observations and recordings. Video angling and zoom were adjusted to capture interactions between PT, infant and parent. The observation guide covered 1) The treatment setting, 2) Content of physical therapy, 3) PT-Infant-Parent interactions, and 4) Changes in the infant's function during sessions.

## **2.5 Data Analysis**

In the initial, inductive phase of analysis we summarized the impressions from observations and the topic of play emerged (Malterud, 2012; Wang & Lien, 2013). Next, all sequences involving play were viewed, transcribed and analyzed with a focus on interactional and therapeutic aspects of the situations. At this stage, we recognized that the PTs' utilization of play had two main purposes: 1) To observe the infant's motor performance, and 2) Intending to improve the infant's motor performance. In the proceeding analysis we focused on the latter. Using NVivo 10 (QSR International Pty Ltd, 2012) as a sorting tool, we systematically coded the characteristics of these events; and compared events in which the PTs succeeded with their intent to improve the infant's motor performance, with the contrasting failures of fulfilling this intention. Thereby, we were able to identify key factors of the PTs' successful merging of play and therapy, and could use the comparisons to challenge, confirm and enrich our interpretations of the material. All three authors watched and discussed the selected video sequences together. The first author was responsible for summarizing, transcribing and coding the data material. This

written material was reviewed by the co-authors and the analysis was discussed and developed in collaborative meetings with all three authors.

## **2.6 Trustworthiness and Reflexivity**

Efforts to establish and maintain trustworthiness exist throughout the study. The longitudinal design and variety in the infants' conditions gave a rich, nuanced data material and allowed for in-depth analyses in accordance with the scope of the study. The maintenance of a natural treatment setting was confirmed during debriefing; the PTs and parents expressed that the observations were representative to their usual sessions. In preparations for the second and third visits, the first author reviewed notes of impressions and thoughts from previous sessions. This ensured a focus and adaptability to each situation. The initial inductive approach, together with systematic analytical steps and discussion of biases between authors; provided a nuanced and comprehensive analysis of our data and supported the validity of findings (Malterud, 2001).

The first author is a pediatric PT with work experience from primary health care. The last author, also a pediatric PT, has her work experience from secondary health care. Their shared interest toward interactional aspects in physical therapy has guided the direction of the study. The second author, who is a nurse and sociologist, has contributed to the study perspectives, application of theory and analysis.

## **3 Results**

Distinctive in our material were the instances in which interactive sensory-motor play not only served as a context, but actually became part of the PTs' intervention strategy. This scaffolding and use of play during therapy was conditioned by the PTs' sensitivity in interaction,



together with the integration of targeted therapeutic actions into the ongoing sensory-motor play activities. These interaction processes, and their fluctuations between failure and success; relied on the PT's ability to attend and respond to the infant's expressions of initiative, engagement and distress.

In our analysis of the PTs' successful merging of play and therapy, our findings were sorted into three categories: 1) Arranging the therapeutic space, 2) Sensitivity in interaction and 3) Targeted therapeutic actions. In our presentation of findings we provide examples from sessions with John, Hannah, Anna and Vanessa; which illustrate the variations and contrasts of our findings throughout the data material. To provide coherency and illustrate the interdependency between categories, examples from the session with John runs as a story trail throughout our presentation of results.

### **3.1 Arranging the Therapeutic Space**

Both at the PTs' offices and in the families' homes, the PTs organized a therapeutic play arena with equipment and toys that enabled therapeutic activities in accordance with the infants' developmental stage and interests. This organization was based on the PT's previous knowledge about the infant, and on information retrieved from the parent(s) at the onset of sessions. As sessions proceeded, the PTs gradually adapted the therapeutic space to introduce variations and new challenges to the infants' play activities. For the infants who had developed mobility skills, the PTs typically arranged the room with toys on top of foam blocks or furniture at different heights, to motivate the infants' practice of movement and transitional skills.

At the younger ages, the PTs would often start the session by positioning the infant in an aligned supine position, either on a play mat or on the lap of the parent or PT, and then introduce

toys for the infant to look at and potentially grab. This is exemplified in the session with Hannah, 3 months CA:

Mom and the PT sit next to each other on the family coach. Hannah is held in a half sitting position on Mom's lap, face-to-face with Mom, yet slightly angled toward the PT. "Look at her looking at you", the PT says. Mom smiles and says: "Hey, hey you!" The PT continues: "Now that's a really good contact you've got with her. But you do it like this too, that you hold her here?" The PT gesticulates placing Hannah in a more symmetric position on Mom's lap. "Yes, I hold her, I sit a lot like this" says Mom, and places Hannah in better alignment, resting in midline against Mom's elevated thighs before she continues: "With one hand behind her head to really get her upright". The PT responds: "Yes, right right". The PT turns to Hannah: "Hi my friend, hi! Now you saw me you know, yes. Hi! Look at that, now you got yourself up, yes. There you go." Next, the PT introduces a toy in Hannah's visual field, but Hannah is more interested in the PT: "You want to look at me? That's very nice of you. Yes." Mom jumps in: "Yes, ha ha, likes people the most." The PT switches to a second toy, more colorful than the first and with rattling sounds. This toy catches Hannah's attention, she tracks it with her eyes and head as the PT moves it in different directions.

Turning to the session with John, 7 months CA, the PT arranges the therapeutic space in accordance with their therapeutic goal of achieving a more functional prone position. John has resisted the prone position since birth. He prefers an asymmetric posture when placed in prone (see Figure 1) and quickly falls over to his right side. The PT is searching for ways to motivate

John to play and improve his motor skills in prone. From previous sessions she is aware of John's interest in sounds and music. Therefore, she has brought a new keyboard to motivate him.

The PT places John in prone on a play mat on the floor. As the PT introduces the keyboard, she also arranges for Mom to join in the play interaction with John: *"Maybe you can come down on the floor and play around with this?"* Mom sits down on the floor facing John: *"Hello"*, she says and pushes a button to start a melody.



*Figure 1: John's starting position in prone*

### **3.2 Sensitivity in Interaction**

The infants communicated their motivation, interest and engagement via a range of bodily expressions; mimicking, gaze, vocalizations, respiration, body orientation and movements. The PTs attended to these expressions and strived to adjust their therapeutic strategy according to them. The PTs communicated with the infants to support their play engagement, allowed the infants to guide their field of attention; explored and selected toys to engage the

infant; and made alterations to the task and environment to promote the infants' activity and performance.

In the session with John, the PT quickly picks up on his initial signals of distress and makes alterations to the activity to accommodate him. As he becomes engaged in the activity, the PT attends closely to his bodily expressions, and both Mom and the PT continuously encourage him:

John's initial response to the keyboard is one of discomfort; he moans and squirms while the keyboard is playing automatic melodies at high volumes. The PT retrieves the keyboard from Mom, and says: "*Let's see if we can do something else with it*". As she switches to the playing of single tunes with each key, John's engagement awakens. Every time the PT presses a new key, John makes cheerful '*Heeh*' sounds, lifts his head and looks interchangeably at the keyboard, Mom and the PT. They both respond with laughter, smiles and small talk. Mom says: '*What is my little drooly boy doing?*' As they proceed with the activity, the PT monitors John's gaze and head position to decide when he is ready for the next tune, and both the PT and Mom scaffolds John's engagement with their smiles and '*Oh!*' whenever there is a new tune. John continues to respond with '*Heeh*', smiles and gazes at Mom and PT. '*Yes, you're doing very well*', says the PT as John looks at her.

However, the PTs' responses were not always supportive of the infants' engagement. When the PTs were preoccupied by their own agenda, they were less attentive toward the infants' engagement and sometimes disrupted the infants' play activity. As an example we present a situation from the session with Anna, 9 months CA. While Dad and the PT have been

conversing Anna has been playing in solitude. Now, the PT wants to undress Anna before the continuation of the session:

Anna is laying in prone in front of a mirror, she is making low, babbling sounds and claps at her own reflection. The PT approaches her: *“Are we grown-ups just talking now? And you found a girl there, did you?”* The PT grabs Anna, turns her away from the mirror and pushes a squared cushion in front it. *“Now it was gone, yes yes, oh well”*, says the PT.

Anna moans and tries to pull herself up to the cushion. The PT responds: *“Yes yes, I know you understand there is someone there, but it’s gone now you know”*. After terminating the mirror activity, the PT starts to pull a toy across the floor. Anna gets interested and starts crawling toward it. Before Anna reaches the toy, the PT takes hold of her, rolls her over to supine and says: *“Yes, now we’re going to try to take off some clothes”*. After her bodysuit is removed, the PT again introduces the toy and entices Anna to roll into prone to fetch it. But Anna merely glances at the toy and remains passive in the supine position.

### **3.3 Targeted Therapeutic Actions**

For sensory-motor play to become more than a context for intervention, the PTs had to incorporate therapeutic measures toward motor goals into the activities. As the PTs identified the infant’s motor problems and decided on an adequate strategy for improving the infant’s functional skills, they made modifications and introduced new motor challenges to the activities. Therapeutic handling was a key feature of this incorporation of therapeutic measures into play. For the infants, therapeutic handling could improve their motor performance and enable their discovery and pursuance of new sensory-motor play possibilities. For the PTs, handling enabled their detection of the infant’s directional movements, use of force and changes in muscle tone; all

of which informed PTs about the infant's engagement, compliance and capacity during the play activity.

In the keyboard play with John, the PT incorporated her targeted therapeutic actions toward a functional prone position for John. Therapeutic handling informed her about John's capabilities and compliance, and facilitated John's play engagement and motor abilities:

During the keyboard play, the PT repeatedly positions John's arms to provide him with bilateral elbow support, but every time John moans and wiggles back into his preferred position (see Figure 1) with his left arm flexed under his chest, his right arm extended and slightly across midline, and his head rotated left. In spite of his strong engagement with the keyboard play, John's head frequently drops, he starts to complain and is given a break. Later in the session they return to the keyboard. Again, John resists positioning of his arms. This time, Mom administers the keyboard. As John gradually becomes absorbed with her playing, the PT is able to align his arms and shoulders. The PT continues to support his shoulders to help him maintain the position, and pushes gently down through his shoulders to facilitate his active elbow support (see Figure 2). Mom engages with John and plays short melodies, while John holds a stable and symmetric prone position and switches his gaze between Mom and the keyboard. When the PT removes her hands, John's complaints increase and his head quickly drops. The PT brings her hands back to his shoulders, and John's neck extension immediately improves. *"Hello!"* says Mom with a cheerful voice as she plays a couple of tunes. John lifts his head and smiles at her, then returns his gaze to the keyboard and stares intensely as Mom's fingers move from key to key. *"This is a new record when it comes to tummy time"*, the PT says.



*Figure 2: John's improved elbow support and head stability in prone*

However, therapeutic handling was not always beneficial. On some occasions the PTs interrupted the infants' play or induced sudden shifts of position that startled the infants. If these interruptions were not successfully repaired, they could lead to breakdowns in interaction that were detrimental to the therapeutic process. As an example, we look at a sequence with Vanessa at 3 months CA:

Laying in supine, Vanessa is putting her right hand into her mouth. "*There you found your hand*", says the PT, before she grabs Vanessa's feet and moves them up toward her mouth. "*Oh, that's so good*", she says and puts Vanessa right foot and then the left into her mouth. As the PT moves the feet away, Vanessa puts her left hand into her mouth. The PT makes additional attempts at putting Vanessa's feet to her mouth, but Vanessa is eagerly chewing her fingers and grunts with discontent at the disturbance of her feet. For a brief moment, however, Vanessa looks at her feet, removes her left hand from her mouth and tries to reach for her feet with both arms. The PT overlooks this initiative from

Vanessa and once again brings Vanessa's feet to her mouth. As a consequence, Vanessa's complaints increase and she is on the verge of crying. The PT discontinues the activity and picks Vanessa up.

## **4 Discussion**

Our findings demonstrate that successful sensory-motor play interactions during therapy are funded on mutuality between the PT and the infant. The PTs strive to connect with and uphold the infant's engagement, and simultaneously proceed with their targeted therapeutic actions. The PTs have to attune themselves to the infant's signals and act in concurrence to them. They arrange the therapeutic stage, incorporate relevant therapeutic measures into play activities and adjust their strategy in accordance with the infant's signals of initiative and interest; and on signs of disengagement and distress. Successful attunement and interaction, including repairs of interactional mismatches, facilitate prolonged training sessions and provide the infants with novel motor challenges that promote the emergence of new skills.

### **4.1 The Meeting of Intentions in Therapeutic Play Interactions**

Interactive sensory-motor play is infants' way to develop new skills and learn about their world (Adolph, 2008; Lifter, Foster-Sanda, et al., 2011; M. A. Lobo, et al., 2013; Sheets-Johnstone, 2011). The infants in our material, as exemplified by John, Hannah, Anna and Vanessa; all demonstrate this urge to explore their own motor abilities and possibilities offered by the surroundings. Whereas Hannah's and John's play engagement was reinforced by their PTs, Anna's and Vanessa's play initiatives were disrupted. This demonstrates the encountering of intentions that occur within the PT-infant interactions. While the PTs want to acknowledge



and scaffold the preterm infants' inherent drive to play, they also have another intention; they are there to work on certain therapeutic goals together with the infant and parents (Campbell, et al., 2012). Amid these different intentions, cooperation must proceed and continuously govern the therapeutic process. At the core of successful cooperation lies the establishment and maintenance of a shared intention. This is what Anna and Vanessa did not achieve with their PT; what Hannah and her PT quickly established and were able to maintain; and what John and his PT worked toward and accomplished at the end of their keyboard play.

According to Pacherie (2012), intentions can be at different levels. The infants' intentions are pre-reflective; they are action oriented and formed in the moment, in terms of engaging sensory-motor play activities. The PTs' intentions extend beyond these momentary actions, on to a reflective level of therapeutic measures and goals that are considered beneficial for the infant. This can explain cooperative breakdowns during the therapy sessions; the infants cannot cooperate in activities that comes into conflict with their own intentions. However, it can also explain successes in interaction, in spite of diverging intentions. When the PT is able to link therapeutic intentions and actions with the infant's play intentions and engagement, cooperative opportunities become available. Therefore, therapeutic interactions need to co-develop in a mutuality that maintains both the infant's intention to play and the PT's targeted therapeutic actions. By this, therapeutic measures such as motor challenges, positioning, handling and alterations of tasks can be accepted by the infant, and may even become part of the game, e.g. when the PT's handling scaffolds and extends John's engaged keyboard play with Mom.

## 4.2 Let's Play!

Thus, successful cooperation is achieved when the PT is able to detect and act in compliance with the infant's intentions. In the examples with Anna and Vanessa, the PT detected the infant's signals of intention and interest (although Vanessa's reaching initiative toward her feet was overlooked). In spite of their good intentions, however, both PTs displayed a lack of sensitivity and proceeded with actions that disrupted the infants' play engagement. As a result, Anna was no longer interested in chasing the toy, and Vanessa needed soothing before they could proceed with therapy. In comparison, John's PT successfully detected and complied with his intentions throughout their keyboard play. She complemented John's play, via a sensitive *coordination with* him. In accordance with the descriptions of Øberg, Blanchard and Obstfelder (2014), this sensitivity in interaction enabled the PT's comprehension of John's objections to being positioned, and his concurrence with the same adjustments as John was gradually engaged in the keyboard play with Mom. Their dyadic bodily coordination facilitated their cooperation toward the therapeutic goal of playing in an aligned prone position. For John, said cooperation also made him discover new movement strategies, which in turn improved and extended his ability to play with Mom and the PT. This merging of play and therapy entails an acknowledgement of the infant, as a cooperative partner and contributor of meaning and intention in interaction. By this, in alignment with the fundamental role of cooperation in infant development (Fantasia, et al., 2014); sensory-motor play can become both a framework for and events of interactional sensory-motor learning and development during therapy.

Via such successful cooperation, the infant's motivation increases and gives momentum to the interaction; a momentum which can in turn influence and guide the therapeutic process (Fantasia, et al., 2014). John's engagement with the keyboard provided such a momentum to

their record-breaking therapeutic work in prone. His motivation to play gradually brought the activity to a new level; John forgot about his objections and discovered the benefits of a more aligned position. In this way, John's submission to the momentum of the interaction enabled him to make new motor achievements. The PT was also led by the same momentum. As she realized and continued to act upon John's urge to play, she was able to bring John's motor performance beyond previous limits. In a self-reinforcing process, the PT's handling and adjustments gave John a better motor function, which in turn enabled a prolonged interactive play engagement in prone. This demonstrates that infants' play can be more than just a context for intervention. Interactive sensory-motor play provides a powerful momentum that needs to be utilized in PTs' work to promote infants' discovery and learning of motor skills.

#### **4.3 Enactive Therapeutic Sensory-Motor Play**

As we have shown, cooperative sensory-motor play interactions evolve via the emergence of shared intentions; in coordination with each other; by a mutual submitting to the momentum of the interaction. PTs have a professional, decisive role regarding the content and development of these interactions (Lifter, Foster-Sanda, et al., 2011; M. A. Lobo, et al., 2013). As highlighted in the literature (Childress, 2011; Cress, et al., 2007; Fantasia, et al., 2014; Lifter, Foster-Sanda, et al., 2011), scaffolding of sensory-motor play is important for the preterm infants in our material. Thus, their solitary play is not sufficient. To support development and learning, PTs needs to engage in play together with the infant and be sensitive to the infant's responses to their handling and alterations of the ongoing play activities. In accordance with our findings, we suggest that PTs' targeted therapeutic actions can be successfully merged with infants' intention to play; within what we denote as an *enactive, therapeutic sensory-motor play* approach. Said

approach entails an establishment and work toward therapeutic goals, in successful cooperation with the infant. As our examples with John, Hannah, Anna and Vanessa demonstrate; this successful cooperation relies on several requirements that all need to be fulfilled. The PT needs to be competent at recognizing and pursuing the infant's signs of intention, attention and motivation. Simultaneously, the PT must plan and put a therapeutic strategy into action; and find ways to merge these processes into engaging, interactive sensory-motor play activities with the infant. To uphold the infant's engagement, therapeutic actions and handling, choices of toys and changes to the task or environment all need to be part of the game, not a disturbance to it. As the play interactions proceed, the PT needs to continuously address the infant's specific motor impairments and facilitate improvements to the infant's motor performance. By this, the PT can establish a therapeutic play arena of cooperative and interactive learning, in which the infant can develop appropriate motor strategies and extend their movement and sensory-motor play repertoire.

#### **4.4 Study Limitations and Future Directions**

In this study we have investigated PTs' scaffolding and use of play in physical therapy with preterm infants. Based on a small sample of preterm infants with variable medical conditions and motor impairments, we have identified principles of what we denote as *enactive therapeutic sensory-motor play*. We consider this concept to contain elements that might transfer to PTs' work with infants and young children in general. However, enactive theory primarily describes typical development, and investigations of its application in therapeutic settings with children with developmental impairments are limited. Therefore, our study is only an initial exploration of the utilization of play as a therapeutic tool, based on the enactive theoretical

perspective. More investigations are needed to explore the content, variations and application of *enactive therapeutic sensory-motor play* across different therapeutic settings. Moreover, studies to investigate the potential effects of an *enactive therapeutic sensory-motor play* approach on infant learning and development should be developed.

## **5 Conclusions**

Sensory-motor play is unequivocally tied with infants' attention and motivation, motor and social competencies, learning and development. This study demonstrates that PTs must be aware of these relationships and develop their therapeutic approach accordingly, as they engage in therapeutic interactions with preterm infants. We suggest that this can be achieved via an *enactive therapeutic sensory-motor play* approach, by which the PT cooperates with the infant and incorporates new motor challenges in the infant's movement learning and understanding of the world.

## **Acknowledgements**

We extend our gratitude to the PTs who assisted in the recruitment process, and to the participating PTs and parents with their infants.

## **Funding**

This work was supported by grant from The Norwegian Fund for Post-Graduate Training in Physiotherapy (grant 1/370-00/10-A).

## References

- Adolph, K. E. (2008). Learning to Move. *Current Directions in Psychological Science*, *17*, 213-218.
- Atun-Einy, O., Berger, S. E., & Scher, A. (2013). Assessing motivation to move and its relationship to motor development in infancy. *Infant Behavior and Development*, *36*, 457-469.
- Bigelow, A. E., MacLean, K., & Proctor, J. (2004). The role of joint attention in the development of infants' play with objects. *Developmental science*, *7*, 518-526.
- Blanchard, Y., & Øberg, G. K. (2015). Physical therapy with newborns and infants: applying concepts of phenomenology and synactive theory to guide interventions. *Physiotherapy Theory and Practice*, *0*, 1-5.
- Blauw-Hospers, C. H., De Graaf-Peters, V. B., Dirks, T., Bos, A. F., & Hadders-Algra, M. (2007). Does early intervention in infants at high risk for a developmental motor disorder improve motor and cognitive development? *Neuroscience and Biobehavioral Reviews*, *31*, 1201-1212.
- Brodal, P. (2010). *The central nervous system: structure and function* (4th ed.). Oxford: Oxford University Press.
- Campbell, S. K., Palisano, R. J., & Orlin, M. N. (2012). *Physical therapy for children* (4th ed.). St. Louis: Elsevier Saunders.
- Childress, D. C. (2011). Play behaviors of parents and their young children with disabilities. *Topics in Early Childhood Special Education*, *31*, 112-120.
- Cress, C. J., Arens, K. B., & Zajicek, A. K. (2007). Comparison of engagement patterns of young children with developmental disabilities between structured and free play. *Education and Training in Developmental Disabilities*, *42*, 152-164.
- Fantasia, V., De Jaegher, H., & Fasulo, A. (2014). We can work it out: An enactive look at cooperation. *Frontiers in Psychology*, *5*.
- Fiebich, A., & Gallagher, S. (2013). Joint attention in joint action. *Philosophical Psychology*, *26*, 571-587.

- Forcada-Guex, M., Pierrehumbert, B., Borghini, A., Moessinger, A., & Muller-Nix, C. (2006). Early dyadic patterns of mother-infant interactions and outcomes of prematurity at 18 months. *Pediatrics*, *118*, e107-114.
- Heath, C., Hindmarsh, J., & Luff, P. (2010). *Video in qualitative research: Analysing social interaction in everyday life*. Los Angeles: SAGE.
- Korja, R., Lehtonen, L., & Latva, R. (2012). The effects of preterm birth on mother-infant interaction and attachment during the infant's first two years. *Acta Obstetrica et Gynecologica Scandinavica*, *91*, 164-173.
- Lifter, K., Foster-Sanda, S., Arzamarski, C., Briesch, J., & McClure, E. (2011). Overview of play: Its uses and importance in early intervention/early childhood special education. *Infants and Young Children*, *24*, 225-245.
- Lifter, K., Mason, E. J., & Barton, E. E. (2011). Children's play: Where we have been and where we could go. *Journal of Early Intervention*, *33*, 281-297.
- Lobo, M. A., & Galloway, J. C. (2013). Assessment and stability of early learning abilities in preterm and full-term infants across the first two years of life. *Research in Developmental Disabilities*, *34*, 1721-1730.
- Lobo, M. A., Harbourne, R. T., Dusing, S. C., & McCoy, S. W. (2013). Grounding early intervention: physical therapy cannot just be about motor skills anymore. *Physical Therapy*, *93*, 94-103.
- Majnemer, A. (2011). Importance of motivation to children's participation: A motivation to change. *Physical & Occupational Therapy In Pediatrics*, *31*, 1-3.
- Malterud, K. (2001). Qualitative research: Standards, challenges, and guidelines. *The Lancet*, *358*, 483-488.
- Malterud, K. (2012). Systematic text condensation: A strategy for qualitative analysis. *Scandinavian Journal of Public Health*, *40*, 795-805.

- Pacherie, E. (2012). The phenomenology of joint action: Self-agency vs. joint-agency. In A. Seeman (Ed.), *Joint attention: New Developments in Psychology, Philosophy of Mind, and Social Neuroscience* (pp. 343-389). Cambridge: MIT Press.
- QSR International Pty Ltd. (2012). NVivo qualitative data analysis software Version 10. In.
- Rossmann, N., Costall, A., Reichelt, A. F., López, B., & Reddy, V. (2014). Jointly structuring triadic spaces of meaning and action: Book sharing from 3 months on. *Frontiers in Psychology, 5*.
- Sansavini, A., Pentimonti, J., Justice, L., Guarini, A., Savini, S., Alessandrini, R., & Faldella, G. (2014). Language, motor and cognitive development of extremely preterm children: Modeling individual growth trajectories over the first three years of life. *Journal of Communication Disorders, 49*, 55-68.
- Sheets-Johnstone, M. (2011). *The Primacy of Movement: Expanded second edition* (2nd ed.). Amsterdam/Philadelphia: John Benjamins Publishing Company.
- Spittle, A., Orton, J., Anderson, P., Boyd, R., & Doyle, L. W. (2012). Early developmental intervention programmes post-hospital discharge to prevent motor and cognitive impairments in preterm infants. *The Cochrane Database of Systematic Reviews, 12*.
- Treyvaud, K., Anderson, V. A., Howard, K., Bear, M., Hunt, R. W., Doyle, L., Inder, T., Woodward, L., & Anderson, P. (2009). Parenting behavior is associated with the early neurobehavioral development of very preterm children. *Pediatrics, 123*, 555-561.
- Vig, S. (2007). Young children's object play: A window on development. *Journal of Developmental and Physical Disabilities, 19*, 201-215.
- Wang, T.-L., & Lien, Y.-H. (2013). The power of using video data. *International Journal of Methodology, 47*, 2933-2941.



Wolf, M. J., Koldewijn, K., Beelen, A., Smit, B., Hedlund, R., & de Groot, I. J. M. (2002). Neurobehavioral and developmental profile of very low birthweight preterm infants in early infancy. *Acta Paediatrica, 91*, 930-938.

Øberg, G. K., Blanchard, Y., & Obstfelder, A. (2014). Therapeutic encounters with preterm infants: Interaction, posture and movement. *Physiotherapy Theory and Practice, 30*, 1-5.