THE ACT OF PRETENDING:
PLAY, EXECUTIVE FUNCTION, AND THEORY OF MIND IN EARLY
CHILDHOOD

by

OLENA ZYGA

Submitted in partial fulfillment of the requirements for the degree of Master of Arts

Department of Psychological Sciences

CASE WESTERN RESERVE UNIVERSITY

August, 2016
CASE WESTERN RESERVE UNIVERSITY
SCHOOL OF GRADUATE STUDIES

We hereby approve the thesis of

Olena Zyga
Candidate for the degree of Master of Arts

Committee Chair
Dr. Sandra Russ, Ph.D.

Committee Member
Dr. Anastasia Dimitropoulos, Ph.D.

Committee Member
Dr. Norah Feeny, Ph.D.

Date of Defense
June 7, 2016

*We also certify that written approval has been obtained for any proprietary material contained therein.
# TABLE OF CONTENTS

List of Tables ........................................................................................................ 4

List of Figures ....................................................................................................... 5

Abstract ............................................................................................................... 6

Introduction ......................................................................................................... 7

Methods ............................................................................................................. 32

Results............................................................................................................... 41

Discussion ......................................................................................................... 49

Tables & Figures ............................................................................................... 62

References.......................................................................................................... 71
LIST OF TABLES

Table 1: Participant Demographics……………………………………………………………………………….. 62

Table 2: Correlations within Pretend Play Task ………………………………………………………… 63

Table 3 Correlations within Theory of Mind Tasks ………………………………………………… 64

Table 4: Correlations within Executive Function Tasks …………………………………………….. 65

Table 5: Mean Scores on Pretend Play, ToM, and EF tasks as a function of age ………………… 66

Table 6: Correlations across Pretend Play, ToM, and EF Measures …………………………….. 67

Table 7: Simultaneous Multiple Regression for predicting Digit Span Backward Scores from Pretend Play Performance ………………………………………………………………………………… 68

Table 8: Simultaneous Multiple Regression for predicting Hinting Task Scores from Pretend Play Performance …………………………………………………………………… 68

Table 9: Simultaneous Multiple Regression for predicting Hinting Task Scores from Pretend Play and EF Performance …………………………………………………………… 68
LIST OF FIGURES

Figure 1: Hypothesized Relationship between Pretend Play, EF, and ToM Ability ............. 69

Figure 2: Actual Relationship between Pretend Play, EF, and ToM ............................. 70
The Act of Pretending:

Play, Executive Function, and Theory of Mind in Early Childhood

Abstract

by

OLENA ZYGA

The current study examined the relationship between pretend play, theory of mind, and executive function in 50 typically-developing preschool children, ages 3-5 years. Tasks surrounding pretend play, inference and false belief understanding, and those that measured working memory and inhibitory control were administered to participants. Results suggest that pretend play ability did not relate to age or IQ, but EF and ToM performance did. Second, significant associations were found between pretend play, specifically imagination and organization, and ToM ability, as measured by the Hinting task. Further significant associations were found between organizational play ability and EF skill relating to short term/working memory. Follow-up multiple regression analyses revealed that an interaction of both pretend play, as measured by imagination ability, and EF skill, as measured by the digit span backward task, were predictive of ToM performance. Children who are higher in working memory capacity at this age seem to also show better imaginative ability in play. This combination may relate to an increased ability to infer other’s mental states.
The Act of Pretending:
Play, Executive Function, and Theory of Mind in Early Childhood

Current research in child development has been focused on better understanding how executive function (EF) relates to important areas of development early in a child’s life (Berk & Meyers, 2013; Carlson, Moses, & Breton, 2002; Carlson, White, & Davis-Unger, 2014; Devine & Hughes, 2014). Specifically, a newer line of research is trying to better understand how EF relates to pretense ability in preschool children (Berk & Meyers, 2013; Bodrova, Germeroth, & Leong, 2013; Carlson et al., 2014). Researchers theorize that EF may co-develop with pretense, while others believe that one domain may have a developmental causal effect on the other (Carlson et al., 2014). Further, there is a dynamic interplay between the development of EF and theory of mind (ToM) and how self-control and the ability to reflect upon and learn from experience bolsters a child’s ability to be able to understand others’ viewpoints and interact appropriately (Benson, Sabbagh, Carlson, & Zelazo, 2013; Carlson et al., 2002). Previous research has suggested that pretense, specifically imaginative pretend play abilities, may influence a child’s ability to understand others, which aids in ToM development (Benson et al., 2013; Lillard & Kavanaugh, 2014; Nielsen & Dissanayake, 2000). Understanding the interplay of these three domains is important not only in typical development, but also in disorders where children show pervasive deficits in these areas. For example, children who have an autism spectrum disorder (ASD) show low levels of EF and pretense ability and have pervasive ToM deficits throughout development (Abu-Akel, 2003A; Barnes, Dean, Nandam, O’Connell, & Bellgrove, 2011; Greene, Braet, Johnson, & Bellgrove, 2008; Kimhi, Shoam-Kugelmas, Ben-Artzi, Ben-Moshe, & Bauminger-Zviely, 2014). ToM interventions in ASD have also not been very successful, with lack of generalizability of
skills as a main issue (Brüne & Brüne-Cohrs, 2006; Kimhi et al., 2014). A successful intervention may instead focus on EF or pretense processes that relate to ToM, instead of focusing solely on ToM skills. In this way, delineating the relationship among these constructs could inform our understanding of typical development, atypical development, and also how to design intervention techniques for various populations. However, to date, there is only minimal empirical research on the overlap of these three constructs and how they may effect child development. Thus, the aims of this project are to: (1) better understand the impact age has on the developmental trajectory of pretense/pretend play, executive function, and theory of mind, (2) delineate the relationship among these skill sets through administering tasks surrounding these domains to preschoolers and (2) introduce and validate a new measure of pretend play that captures the integration of affective and cognitive processes within this skill set.

**Literature Review**

**Executive Function: The “Higher Order” Cognitive Domain**

**Definition & Various Components.** Executive Function (EF) is not an easy construct to fully define or capture. The history of EF has seen changes in viewpoint as to how to conceptualize this term – either as one over-arching skill set or as the combination of many different skill sets that lead to higher order cognitive processing (Carlson et al., 2002; Devine & Hughes, 2014). In reviewing the literature, it seems that the most supported definition of EF is that it refers to a set of cognitive processes and strategies necessary for overseeing and conducting challenging, goal-directed life tasks and that it encompasses higher order cognitive abilities needed to regulate one’s own thoughts and behaviors (Alvarez & Emory, 2006; Carlson et al., 2002; Devine & Hughes, 2014). The
operations and strategies included in EF are areas such as controlling attention, suppressing impulses, combining information in working memory, planning, and organizing. EF skills are key components in being able to successfully navigate through life and relate to many other domains of functioning, such as being able to regulate emotions and interactions with others, distress tolerance, and cognitive or academic achievement (Alvarez & Emory, 2006; Carlson et al., 2002; Devine & Hughes, 2014).

Developmentally, the emergence of executive function is tied specifically to the maturation of the prefrontal cortex (PFC) within the brain (Alvarez & Emory, 2006; Hsu, Novick, & Jaeggi, 2014). At birth, humans have relatively immature brains that still need to undergo development (Hsu et al., 2014). Postnatal development includes an initial rapid process of cell proliferation in the brain that leads to increases in synaptic connections (i.e. connections between neurons in the brain), dendritic and axonal growth (i.e. communication fibers in the brain), and myelination (i.e. insulation in the brain that helps with signal communication). This proliferation is then followed by pruning, or the elimination of synaptic connections. Importantly, this process last throughout the first few decades of life and the rate/timing at which this occurs is differentially tied to different areas of the brain. Parietal and temporal areas, implicated in sensory functioning, develop first before higher order areas of the brain. In relation to EF, the PFC and frontal cortices (which are responsible for higher order cognition) mature last and take longer to fully mature. So the development of EF skills is seen across the infant, preschool, childhood, adolescent, and young adult years (Hsu et al., 2014). The earliest executive functions to develop seem to be inhibitory control and working memory, which can be observed in rudimentary form in infants as young as 7 to 12 months of age.
(Alvarez & Emory, 2006; Devine & Hughes, 2014; Hsu et al., 2014). However, a spurt in
development of these skills is more typically seen between the ages of 3 to 5 years of age
(Hsu et al., 2014). It is important to note that the skills surrounding inhibitory control and
other executive functions are in no way fully developed in these preschool years and
children will continue to make errors in regards to skills such as impulse control and
attentiveness. The continued maturation of the brain through childhood and adolescence,
in combination with environmental experiences (such as schooling, good nutrition, lack
of stress on the brain) will lead to the full development of EF skills (Alvarez & Emory,
2006; Devine & Hughes, 2014; Hsu et al., 2014).

As noted earlier, EF is a broad term with a variety of constructs encompassed
within its definition. In relation to the aim of this paper, the primary focus of EF will be
on inhibitory control (IC) (also referred to as executive control, response inhibition) and
working memory (WM), which are the sub-domains that seems to be most consistently
implicated in both pretense/pretend play ability and theory of mind (ToM) (Carlson &
Moses, 2001; Carlson et al., 2002, 2014; Lillard, 1993). Globally, inhibitory control
refers to the ability to withhold a prevailing or prepotent response to a stimulus (Greene
et al., 2008). An example would be a child being able to not grab a piece of candy out of
a jar when told to wait until after dinner. It seems that inhibitory control encompasses
skills relating to set-shifting (i.e. cognitive flexibility or the mental ability to change
thinking or attention based on changing stimuli), impulse suppression, and gratification
delay (Carlson et al., 2002; Greene et al., 2008). Working memory, on the other hand,
refers to the ability to actively hold and manipulate a number of ideas, concepts, or
information in mind (Hala, Hug, & Henderson, 2003). An example would be a child
remembering where they did or did not leave their favorite toy, so that they may go find it and play with it again. Interestingly, factor analysis has confirmed that inhibitory control can be viewed as two separate factors or categories within the preschool period of child development – one category that includes only inhibition and a second that includes both inhibition and working memory (Carlson et al., 2002, 2014).

The first category is known as “delay” inhibitory control and it involves a child’s ability to delay, postpone, or all together suppress an impulse when a task calls for it. This type of inhibitory control involves only a delay of gratification for a tempting reward and is usually called “hot” EF because it includes an emotional component. The second category is known as “conflict” inhibitory control and it involves a child’s ability to not only withhold an impulsive response to a salient stimulus but also provide a novel response that is incompatible with the impulsive response (i.e. a child having to clean up their toys and place them in the correct location while still wanting to continue to play with them). This type of inhibitory control includes the use of working memory, in that a child has to remember to inhibit the expected response. Thus, it is usually called “cool” EF because it relates more to cognitive control and forces the child to use both IC and WM (Carlson et al., 2002, 2014). A series of studies conducted by Carlson et al. (2001, 2002) found that both “delay” and “conflict” IC related to ToM performance when age and verbal ability were controlled for. However, this same set of studies also found that “conflict” tasks, ones that require both IC and WM, were more highly related to ToM ability. These findings suggest that it is the combination of both IC and WM ability that may most strongly relate to ToM capability, rather than just one skill on its own.
**Neural Pathways.** In understanding such a complex construct, an important question also relates to what areas of the brain are involved in EF, more specifically IC and WM, and what pathways make this process possible. As stated above, the frontal lobes, specifically the PFC underlie global executive functioning abilities and in general EF can be viewed through a “distributed neuronal network model” (Alvarez & Emory, 2006; Hsu et al., 2014). Essentially, the central tenant of this model is that when an individual uses an EF skill, a wide range of subcortical and cortical regions (i.e. inferior parietal cortex, the basal ganglia, temporo-parietal association cortex, and temporal poles) are recruited that have neural pathways to the PFC (Alvarez & Emory, 2006). The PFC then orchestrates and integrates all of these inputs into higher order cognitive processes. In terms of understanding EF processes, it seems that the pathway extending to the dorsolateral prefrontal cortex (DLPFC) in the brain is most implicated in abilities surrounding set shifting, planning, response inhibition, working memory, organizational skills, reasoning, and abstract thinking (Alvarez & Emory, 2006). Neuroimaging studies have validated the finding that a bilaterally intact DLPFC is necessary for “normal” executive functioning (Alvarez & Emory, 2006; Hsu et al., 2014).

Narrowing more specifically into the neural networks associated with inhibitory control, the PFC and DLPFC are still primary areas of integration and processing but there is also extensive cross-communication between regions associated with higher cognitive functioning and other sub-serving regions related to perceptual, motor and emotional functions (Hsu et al., 2014; Müller et al., 2014; Wilmsmeier et al., 2010). The anterior cingulate cortex (ACC), located in the medial frontal cortex, is believed to be important in conflicting monitoring (Hsu et al., 2014). Information detected through
activation in the ACC is then sent to the PFC as a signal that behavior adjustments are necessary. The ventrolateral prefrontal cortex (VLPFC), located in the inferior frontal gyrus, seems to be involved in motor inhibition and in updating action plans (Hsu et al., 2014). When a child purposefully inhibits an act to reach out for a piece of candy, an intact VLPFC would be implicated in their ability to do this successfully. Further, it seems that activation in the posterior parietal cortex (PPC) is associated with focusing attention when there is an increase in executive demands and activation in the medial temporal lobe (MTL) has also been implicated in the ability to establish novel relations between objects (Hsu et al., 2014; Müller et al. 2014). Taken together, the hypothetical understanding of inhibitory control suggests that these areas receive various inputs from and projections out to basically all perceptual, motor, and affective areas and structures in the brain. This allows for the integration of multiple sources of information, which guides the processing of higher level thoughts and actions (Hsu et al., 2014; Wilmsmeier et al., 2010).

**Pretend Play and Pretense**

**Definition.** Play refers to a broad category of actions that can be rule-based, social, solitary, or competitive in nature. One type of play, known as pretend play, is naturally tied to early typical child development and provides the child with an outlet to practice various skill sets relating to emotional, cognitive, and social domains. Krasnor and Pepler (1980) defined this type of play using four specific criteria: nonliterality, positive affect, intrinsic motivation, and flexibility. Within play, nonliterality refers to the fact that a child’s behavior may lack its usual meaning or have a more figurative meaning. Positive affect pertains to when a child is visibly enjoying engaging in play. A
child is intrinsically motivated to partake in play, meaning that they play by choice because it is a pleasurable and rewarding experience. Lastly, flexibility refers to how play behaviors might vary in content and form from real life experiences (Krasnor & Pepler, 1980). Another hallmark of pretend play is its use of symbolism and make-believe scenarios (Russ, 2014). Fein (1987) stated that children engaging in pretend play will treat one object as something else, exemplifying using one object “as if” it was another. Vygotsky (1967) suggested that pretend play is comprised of 3 main components where children (1) create imaginary situations, (2) take on and act out roles, and (3) follow a set of rules determined by those specific roles (Bodrova et al., 2013). The use of roles and rule following within pretend play naturally connects it with self-regulatory skills and impulse control. Children can use play to better understand how to regulate their emotions, thoughts, and behaviors in various make-believe scenarios and extend that understanding to real-life situations (Bodrova et al., 2013).

Pretend play emerges in a child’s development around 18 months and hits its peak between the ages of three to five (Fein, 1987). Its emergence follows a developmental trajectory, where children’s abilities move from more concrete to abstract actions and themes (Bodrova et al., 2013). Within this developmental progression, early pretend play reflects pretense ability as a cognitive skill set. Specifically, pretending in play allows a child to practice holding two or more different representations of the same thing in mind without becoming confused regarding which is based in reality. Further, this ability to hold and manipulate various mental representations relates to the development of mentalization, or the ability to understand the mental states of oneself and others, an important skill in theory of mind development (Lillard & Kavanaugh, 2014). When a
child has developed full “mature play,” he or she is able to use object-substitutions that may bear little if any resemblance to the objects they symbolize, take on and sustain a specific role, and play through high quality scenarios that integrate many themes and span the time of several days or even weeks (Bodrova et al., 2013).

Researchers have found that the emergence and use of pretend play in children is associated with a multitude of cognitive and affective processes (Russ, 2014). Cognitive processes involved in play include organization, imagination, divergent thinking, and fantasy/make-believe. A child demonstrates organization and imagination when they are able to tell a coherent story where one object is used as another object, such as using a stick as a birthday candle. Divergent thinking is a child’s ability to transform objects and create a multitude of different ideas that are not confined to conventional ways of thinking. Lastly, fantasy/make-believe refers to a child’s ability to pretend that they are in a different place or time and role play with various objects and other people. Affective processes identified in play include expression of affect themes, expression of actual emotions, showing comfort and enjoyment while playing, and an ability to emotionally regulate and modulate the negative and positive emotions a child might experience during play. Factor analyses done at both the preschool and elementary school levels have confirmed the presence of cognition and affect as two distinct, yet overlapping, factors within pretend play (Russ, 2014).

A Physiological Understanding of Pretense and Pretend Play: More Theory than Practice. Given the importance of pretend play, a better understanding of underlying neural mechanisms could help elucidate how this construct is so impactful on development and how it relates to other areas of functioning. An interesting theoretical
framework has been suggested by Dietrich (2004) which divides pretend play processing in the brain based on the distinct cognitive and affective factors that have been delineated through behavioral research. Cognitive processes involved in pretense (imagination, ability to organize a narrative, complexity) are hypothesized to begin in regions such as the hippocampal formation, and the temporal, parietal, and occipital lobes. The information in these areas follow neural pathways to the PFC, more specifically the dorsolateral area (DLPFC), which is implicated skills such as working memory, directed attention, and inhibitory control (Damasio, 1994; Vogeley et al., 2001). The quality of pretense in this pathway depends upon the activation of memory and sensory-based brain areas within the non-frontal regions (Dietrich, 2004). On the other hand, emotional processes (such as frequency and variety of emotional expression), again use the PFC for integration of information, however, the relevant information is pulled from the limbic system (i.e. the amygdala) and the cingulate cortex instead of the temporal, occipital, and parietal lobes (Damasio, 1994; Dietrich, 2004). Within the PFC, it is theorized that this emotional content is processed first through the ventromedial prefrontal cortex (VMPFC) before projecting to the DLPFC (Damasio, 1994). Interestingly, full integration of the emotional and cognitive processing systems does not appear to happen until both types of content converge in the DLPFC, which, as reviewed earlier, is highly associated with executive functioning. Theoretically, executive functioning may be the “linch-pin” that allows a child to integrate emotional content with his or her cognitive acts during pretend play (Dietrich, 2004; Vogeley et al., 2001). The ability to create a measure that captured a child’s ability to integrate cognitive and affective processes while playing and show that
it positively related to EF ability could provide support for the theory posited above. However, to date, no such integrative measure of pretend play exists.

Results from the few neuroimaging studies that have been conducted do suggest that the areas mentioned above may be involved in pretense. Specifically, German, Niehaus, Roarty, Giesbrecht, & Miller (2004) had 16 adult volunteers watch videos of actors either performing a real act (putting a book on a shelf) or a pretend act (miming putting a book on a shelf). Greater activity was observed in pretend vs. real acts in areas typically involved in mental state reasoning, including the medial prefrontal cortex, temporo-parietal junction, and inferior frontal gyrus. Activation to pretend actions was also observed in the VMPFC, which has been hypothesized to be involved in the integration of information (German et al., 2004). Other work has shown that naming pretend actions after viewing them elicited activation in areas related the PFC, the superior temporal sulcus (STS), the amygdala, areas of the orbitofrontal cortex (OFC), and the inferior frontal gyrus (Whitehead, Marchant, Craik, & Frith, 2009). As will be explained later in this paper, these areas have high overlap with areas implicated in Theory of Mind (ToM) ability. Most recently, Smith, Englander, Lillard, and Morris (2013) investigated the neural correlates of viewing either pretense acts, imaginary substitute object acts, or parallel real acts in adults. Results showed that observing pretense acts, in comparison to real acts, elicited activity in the left middle frontal gyrus and the inferior frontal gyrus, regions associated with mentalizing and ToM ability. Further, the substitution-object pretense condition elicited activation in the superior parietal lobule, a region that is involved in the prediction and error-monitoring of actions,
which is also activated during certain tasks that tap into executive functioning (Smith et al., 2013).

**Theory of Mind: Understanding the Mental Representations of Others**

**Definition & Various Components.** Theory of Mind (ToM) relates to a specific skill set of understanding how mental states, such as beliefs and desires, govern human behavior (Brüne & Brüne-Cohrs, 2006; Carlson et al., 2002; Vogeley et al., 2001).

Sometimes described as “mentalizing capacity,” ToM is the ability to represent either one’s own or another individual’s mental states relating to concepts such as intentions, beliefs, wants, desires, and knowledge (Brüne & Brüne-Cohrs, 2006). This ability to understand others is believed to arise from human’s interest in socializing and most likely evolved as an adaptive response to increasingly complicated primate social behaviors (Brüne & Brüne-Cohrs, 2006). In line with this evolutionary conceptualization, ToM was first actually used by two primatologists, Premack and Woodruff, in an article suggesting that chimpanzees may be able to infer the mental states of members of their own species (Brüne & Brüne-Cohrs, 2006; Vogeley et al., 2001).

Interestingly, in understanding the development of human ToM, there is still an ongoing debate on the extent to which one’s own self-perspective is involved in modeling and understanding someone else’s state of mind (Vogeley et al., 2001). Two theories have arisen, which account for the self in different ways. Within “simulation theory,” it is believed that a capacity for ToM is based not only on taking someone else’s perspective but also on projecting one’s own attitudes onto someone else’s thinking (Brüne & Brüne-Cohrs, 2006; Vogeley et al., 2001). In this theory, the concept of self-perspective would be functionally related to ToM capacity and should employ the same neural mechanisms. Within “theory theory,” it is believed that
ToM ability is based on a distinct body of knowledge that is gained specifically in relationship to understanding others, which is different than acquiring a self-concept and perceptions. It seems that both theories hold true – ToM abilities and self-perception both share certain neural pathways and also have distinct brain regions that attribute to each construct (Brüne & Brüne-Cohrs, 2006; Vogeley et al., 2001).

Developmentally, ToM acquisition in children follows a set sequence that falls in line with the concept of brain maturation described earlier (Brüne & Brüne-Cohrs, 2006; Hsu et al., 2014). ToM is believed to recruit higher order brain processing involved in the frontal lobes and thus has an extended developmental period which can last up until pre-adolescence (Brüne & Brüne-Cohrs, 2006). The modularity hypothesis of ToM states that around 6 months of age, infants begin to distinguish between inanimate and animate objects, by 12 months, the infant develops joint attention (ability to meet an individual’s gaze and follow their point during a social interaction), and by 14 months an infant begins to have a nascent understanding of mental states relating to desire, intention and the relationship between emotions and goals. However, it is not until age 3 or 4 that a child is able to distinguish between his or her own and others’ beliefs about the world (i.e. that someone may hold a false belief about the location of an object or person). This understanding of false beliefs fully comes online around 5 to 6 years of age and then higher levels of ToM, such as understanding metaphors, irony, and faux pas, continue to develop until age 9 to 11 years old (Brüne & Brüne-Cohrs, 2006). As suggested from the developmentally trajectory of ToM, there are various skill sets that emerge and ways to measure the ToM ability. The skill set most connected with pretense and EF seems to be False Belief Understanding (FBU), which is an ability to recognize that others can have
beliefs, desires, intentions, or knowledge about the world that are divergent from one’s own understanding (Carlson et al., 2002; Devine & Hughes, 2014; Vogeley et al., 2001). FBU is measured in the preschool period by the classic “Sally-Ann” test, where a child watches a scene where Sally places something in a chest and then leaves the room. Next Ann comes in and moves the object from the chest to another location. The child is asked where they think Sally will look for the object. The correct answer is in the chest, because Sally does not know that Ann moved the object. Most 3 and 4 year olds have difficulty with this task, showing that their ToM skills are still emerging and developing (Carlson et al., 2002; Devine & Hughes, 2014; Vogeley et al., 2001).

**Neural Pathways: Posterior to Anterior Connections.** In better understanding the potential relationship between ToM, EF, and pretense, it is important to understand how our brains process the attribution of our own mental states and those of others around us. Research suggests that ToM ability involves the activation of three main areas in the brain: (1) posterior regions (such as the inferior parietal lobe (IPL) and superior temporal sulcus (STS), (2) limbic-paralimbic regions (including the amygdala, orbitofrontal cortex (OFC), the ventromedial prefrontal cortex (VMPFC) and the anterior cingulate gyrus (ACG), and (3) the prefrontal regions (including the DLPFC and the inferior lateral frontal cortex (ILFC) (Brüne & Brüne-Cohrs, 2006; Gallagher & Frith, 2003). Further, these three components are all connected to one another through reciprocal pathways, which suggests that the network for mental state attribution allows for feedback and recursive processing (Brüne & Brüne-Cohrs, 2006).

Typically, when an individual infers the mental state of another, this information is fed forward through the brain beginning with the detection of the stimulus in the IPL.
and STS regions (Brüne & Brüne-Cohrs, 2006; Vogeley et al., 2001). Next this information is relayed via electric signaling and neurotransmitter release to the limbic-paralimbic regions for emotional input and integration of emotional stimuli with incoming sensory information. Then this flow of signals activates the dorsal and lateral areas of the PFC for further integration and behavioral application. Interestingly, it seems that the reciprocal connections between the limbic-paralimbic and prefrontal regions serve to assimilate emotional and cognitive input, so these two domains can interact and mutually affect one other. It is theorized that this interaction takes place in the VMPFC, which is viewed as a convergence zone that receives all types of sensory and perceptual data (Vogeley et al., 2001). After synthesis in the VMPFC, this cognitive-affective information is forwarded to areas of the PFC, most notably the DLPFC, which again is involved in higher order executive functioning, the integration of cognition and affect in pretense, and now, perhaps in inferring the mental states of others (Brüne & Brüne-Cohrs, 2006; Vogeley et al., 2001).

**Putting it all together: The Overlap of EF, Pretend Play, and ToM**

**Current Theoretical and Empirical Findings in the Literature.** After reviewing EF, pretend play, and ToM, it becomes evident that these constructs have overlap that can easily be identified in a theoretical sense. EF is essentially an individual’s ability to self-regulate (Alvarez & Emory, 2006). As was theorized by Vygotsky, pretend play is naturally tied to self-regulation as a way to practice this skill across behavioral, social, and emotional domains (Bodrova et al., 2013).

Developmentally, pretend play emerges first in early childhood and is not as heavily focused on frontal cortex development as EF skills are. This suggests that pretend play may first act as a mode through which EF abilities can present themselves because play
allows the child to engage in planning, organizing, and sequencing events while also modulating their emotional and behavioral reactions (Lillard, 1993). These actions in play allow for brain pathways connecting to the frontal lobes to be used and strengthened. Once early EF skills present in a child, this higher-order cognitive functioning may then impact pretending ability. Specifically, EF skills may now potentially be able to bolster pretend play and allow for more abstract thinking, complex plots, and integration of emotion into storylines, which leads to the development of more mature pretend play, pretense as a cognitive skill, and also mentalization (Carlson et al., 2014).

In terms of mentalization, it has been theoretical postulated that pretend play ability and ToM have three overlapping skill sets: (1) the ability to have one object represent another, (2) the ability to represent one object as two things at once, and (3) the ability to use mental representations (Lillard, 1993). In essence, the goal in developing mature play is to be able to hold and manipulate multiple mental representations – which may be about objects (a pencil is an airplane and a writing utensil) or about people (my friend is a doctor in this story but really just a 5-year-old in real life) (Lillard, 1993). Interestingly, tasks used to measure ToM tap into this ability to understand that others have mental representations that differ from those around them (Carlson et al., 2002; Vogeley et al., 2001). It seems as though the earlier emergence of pretend play and the ability to view objects as having multiple representations may set the ground work for later ToM development. Pretense may be a building block to understanding the self and other’s mental states and pretend play, as an action, may be a mode through which this ability can be practiced (Lillard & Kavanaugh, 2014). Unfortunately, this overlap has only been tested empirically through correlational research and in separated domains –
EF has been found to positively correlate with ToM and pretense skills *separately* and pretense and ToM have also been found to positively correlate with one another (Carlson & Moses, 2001; Carlson et al., 2002, 2014; Devine & Hughes, 2014; Lillard & Kavanaugh, 2014).

Studies conducted on the relationship between pretense and ToM show that pretend play abilities do relate to ToM skills, specifically surrounding symbolic use in pretend play and false belief tasks in ToM (Lillard, 1993; Lillard & Kavanaugh, 2014). Specifically, Lillard and Kavanaugh (2014) gave pretend play and ToM task batteries to typically developing children at ages 2.5, 3, 4, and 5. Pretend play tasks included free play sessions with a variety of toys where ability to show object transformation, substitution, creation of an imaginative narrative, and use of multiple characters was recorded. ToM tasks included standard false belief and deception tasks. Results from this study showed that pretend production at 2.5 years, ability to complete a play narrative at 3 years, and role playing at 4 years related highly to ToM at ages 4 and 5. Nielsen and Dissanayake (2000) had forty children between the ages of 36 to 54 months free play with their parents and distinct acts of pretend play were coded. These same children then also completed standard false belief tasks. Researchers found that object substitution and role assignment ability during pretend play related to false belief performance. Children who performed more object substitutions in play and were able to assign various roles to characters scored better on ToM tasks (Nielsen & Dissanayake, 2000). These findings give support to the notion of pretense as a building block or mode through which ToM can develop.
In terms of EF, research conducted on connecting it to either ToM or pretense have studied this connection in relation to inhibitory control (IC) and working memory (WM), specifically the “delay” and “conflict” categories introduced earlier (Carlson & Moses, 2001; Carlson et al., 2002, 2014). Within ToM research, it seems that “conflict” IC significantly predicts performance on false belief tasks, meaning that an individual who is better able to suppress a cognitively conflicting response may also have a higher ability to understand that others hold beliefs or knowledge that may contradict with their own (Carlson et al., 2002; Devine & Hughes, 2014). Specifically, Carlson et al. (2002) found that children’s performance on the Day/Night Task, a task that taps “conflict” IC by measuring inhibition and WM ability together, was more predictive of ToM ability than measuring IC or WM in separate tasks. Further research has shown that early individual differences in EF may predict later variation in false belief understanding and this relationship is unidirectional, meaning that ToM abilities do not predict later variation in EF skills (Devine & Hughes, 2014; Muller, Liebermann-Finestone, Carpendale, Hammond, & Bibok 2012). Muller et al. (2012) provided support for the predictive power of EF on ToM skills through administering EF and ToM tasks to preschoolers at ages 2, 3, and 4 years. EF tasks included stroop, digit span, and delayed gratification tasks. ToM tasks included false belief, perspective taking, and deception tasks. Hierarchical regression analysis found that EF performance at age 2 significantly predicted ToM ability at age 3 and 4, even when taking effects of age, verbal ability and prior ToM performance into account. Inversely, ToM performance at ages 2 and 3 was not predictive of EF skill at age 4 (Muller et al., 2012). This may suggest that early EF ability relates to and may be implicated in ToM ability, which follows the developmental
trajectory of these two constructs (i.e. nascent impulse control manifests itself during the preschool years where false belief understanding comes about slightly later in development).

Turning attention to EF and pretense ability, research has found that understanding the distinction between pretend and reality during play is also strongly related to “conflict” IC (Berk & Meyers, 2013; Carlson et al., 2014). Carlson et al. (2014) explored this link between EF and pretense through administering batteries of these measures to 104 preschool children. EF tasks that combined both IC and WM abilities were administered (to capture “conflict” IC), along with tasks that targeted each skill separately. In measuring pretense, participants underwent a pretend-reality task, where they had to differentiate between the actual and pretend identities of different objects. Children were also asked to demonstrate four pretend acts: brush your teeth, comb your hair, drink out a of a cup, and put on sunglasses. Results showed that performance on the pretend-reality distinction task was most strongly related to “conflict” IC, or EF tasks that tapped into both IC and WM. This suggests that being able to hold multiple representations of the same thing in mind without becoming confused about which one is based in reality is related to IC and WM. These findings provide support for the notion that EF may be implicated in pretense, through the ability to inhibit reality and shift between multiple representations (Carlson et al., 2014). Tying these findings together suggests that there may be overlap between early ToM development, cognitive pretense ability, and “conflict” IC. Further, given the potential effect of early inhibitory control on later ToM skills and the fact that pretense develops before either EF or ToM, pretend play may be useful as an intervention to practice and increase certain EF abilities and
understanding mental representations of self and other. Lastly, only one study has examined the relationship between the actual act of pretend play and how it relates to EF ability. Hoffmann and Russ (2012) examined the relationship among pretend play, creativity, emotion regulation and executive functioning in 61 female participants, in kindergarten through 4th grade. Specifically, pretend play ability was assessed using the Affect in Play Scale (APS; Russ, 2004, 2014), which is a 5-min standardized pretend play task that measures the cognitive and affective processes in fantasy play. Further, the Wisconsin Card Sort Test, Short Form (WCST-64; Grant & Berg, 1948) was given as a measure of EF. In this task, participants are shown cards and have to learn which cards ought to be picked in order to earn them the most points. It is a measure of set-shifting ability, or the ability to display cognitive flexibility in the face of changing rules. In this study, no association was found between the cognitive or affective processes in play and the WSCT. The lack of relationship between pretend play ability and EF in this study may have been due to nature of the EF task, both in that only one measure was given, which related to a very specific domain, set-shifting, and that this cognitive ability is an advanced skill for this age range. Further, as theorized above, it may be that, within play, it is a child’s ability to integrate cognitive processes (such as imagination and organization) with affective processes (such as emotional expression). Creating a measure of this integration may better capture the relationship between pretend play as an act and EF skill.

**Connecting Correlational Research to Physiological Findings.** In review, current empirical findings and theoretical assumptions suggest that pretend play may be implicated in the emergence and strengthening of both EF and ToM skills, since it occurs
earliest in child development and relates to underlying abilities in both of these domains (Berk & Meyers, 2013; Bodrova et al., 2013; Lillard & Kavanaugh, 2014). The theoretical model posited thus far suggests that pretend play is first used as a means through which self-regulatory skills can be enhanced. Once EF skills begin to develop, they may work in a reciprocal nature with pretense, which causes a mutual effect of more sophisticated pretend and EF abilities. During this same time, pretend play development allows a child to manipulate and represent objects and others in his or her mind (Bodrova et al., 2013). This development may set the ground work for the emergence of ToM and the ability to represent and understand that others have differing mental states (Lillard, 1993; Lillard & Kavanaugh, 2014). As reviewed earlier, each of these domains relate specifically to neural networks in the brain and their behavioral presentation depends on the correct development and activation of these networks (Brüne & Brüne-Cohrs, 2006; Dietrich, 2004; Hsu et al., 2014). In better understanding the relationship between EF, pretend play, and ToM, a further theoretical model will be posited that aims at providing a cognitive perspective of how these processes may overlap in the brain.

As stated above, pretend play emerges first in a child’s development as compared to EF and ToM, usually around 18 months of age (Bodrova et al., 2013). Also described earlier was the process of brain maturation and that postnatally, connections between neurons are constantly being formed through synaptic proliferation and then pruned, or removed, if these pathways are not used (Hsu et al., 2014). Another concept underlying brain maturation is the fact that non-frontal regions develop first and that higher order cognitive processing associated with the frontal lobes undergoes a more gradual development that extends over the first few decades of life (Hsu et al., 2014). In relation
to pretend play, a host of regions in the parietal/temporal lobes and limbic system are theorized to be involved in processing this skill in its rudimentary form (German et al., 2004; Smith et al., 2013; Whitehead et al., 2009). As the brain continues to develop, more connections can be made with the frontal regions and more complex play skills, that pull at being able to organize and imagine within storylines, can develop. So the emergence of pretend play around 18 months of age ensures that the brain pathways needed for this process are used and not pruned. As the child engages in more pretend play and starts to incorporate self-regulatory acts, such as inhibiting impulses and emotional or behavioral regulation, the pathways leading from the posterior regions of the brain to the frontal lobes are continually strengthened, specifically to the ventral and dorsal areas of the PFC. Essentially, activation of these pathways in pretend play may relate to continued synaptic proliferation and myelination of regions associated with processing EF skills (Alvarez & Emory, 2006; Hsu et al., 2014). Once sufficient development of these frontal regions has occurred, nascent EF skills behaviorally manifest in a child outside of pretend play contexts (usually around 3 years of age) (Alvarez & Emory, 2006; Hsu et al., 2014). At this point, it is theorized by the author that pretend play and EF share a reciprocal relationship in that using pretend play still works to build EF skills and stronger connections in the frontal cortex, but now the use of EF skills and the activation of the PFC allow for higher forms of pretending to take place and for the integration of cognitive and affective processes in play (which is believed to occur in the DLPFC).

But how does ToM fit into this framework? Current neuroimaging research, some of which was reviewed above, suggests that there is high overlap between the regions needed to process pretend play actions and ToM – such as the STS, amygdala, OFC,
VMPFC, DLPFC, and the inferior frontal gyrus – and that processing of these skill sets may take place across similar pathways (Brüne & Brüne-Cohrs, 2006; German et al., 2004; Whitehead et al., 2009). So the early emergence of pretend play potentially ensures that these pathways first develop and then continue to strengthen so that higher level ToM abilities can be processed by the brain. This again suggests pretend play may set the groundwork for skills such as false belief understanding to emerge (Lillard, 1993).

Lastly, it seems that both pretense and ToM pathways extend through the DLPFC. This area is most associated with executive functioning, which suggests that EF may serve as a linch-pin that allows for (1) the continued development of these skills through the use of higher order cognitive processes such as inhibition, set shifting, and working memory and (2) the integration of pretense with ToM, which could function to continue to bolster ToM abilities that develop past the age of pretend play mastery.

**Summary: Aims & Hypotheses**

Thus far, the complicated relationship between the concepts of EF, pretend play/pretense, and ToM has been reviewed both through current empirical findings and also in positing a theoretical framework of how the three constructs may overlap neurologically in the brain. Current theoretical definitions and physiological understandings of these three domains suggest that they are heavily related to one another (Bodrova et al., 2013; Carlson et al., 2002, 2014; Lillard, 1993; Whitehead et al., 2009). Two separate views have emerged in positing how EF and pretense contribute to ToM development (Hala et al., 2003). The first view believes that the increase in ToM across childhood is based on domain specific shifts in understanding representations, such as appearance-reality distinctions and perspective taking, which naturally comes from pretense development. The second viewpoint posits that the transition reflects a more
general cognitive maturation in that gains in EF ability in the preschool years significantly contribute to ToM performance and development (Hala, et al., 2003). A mix of these two viewpoints is theorized here, in that the domain specific pretense shift is mediated by the more general cognitive maturation of EF skills relating to IC and WM. Together this leads to increased ToM ability and performance (Figure 1). Specifically, it seems that pretend play may set the stage behaviorally and neurologically for EF skills to develop and be processed in the brain (Bodrova et al., 2013; Carlson et al., 2014). After the emergence of EF, perhaps more specifically inhibitory control and working memory skills, pretend play and EF are theorized to have a reciprocal relationship, where each domain works to bolster development in the other (Carlson et al., 2014). Lastly, pretend play may act as a building block through which ToM skills develop (Lillard, 1993; Lillard & Kavanaugh, 2014). Physiologically, since pretend play emerges first in development, it ensures neural activation of brain pathways that overlap with ToM (Brüne & Brüne-Cohrs, 2006; Smith et al., 2013; Whitehead et al., 2009). Then the integration of both pretend processes and ToM in the DLPCF, which relates to EF, allows for the continued interaction of these two skill sets throughout later childhood development (Dietrich, 2004; Hsu et al., 2014; Vogeley et al., 2001). In essence, early pretend play skills transition into higher level pretense ability, through the potential help of EF skill development, which then may aid ToM performance. The theorized integration of these constructs has important implications for intervention development in disorders such as schizophrenia, ADHD, or ASD where individuals have deficits relating to each domain (Abu-Akel, 2003A; Brüne & Brüne-Cohrs, 2006; Greene et al., 2008; Kimhi et al., 2014).
Given the importance of these constructs, not only in typical child development but also in better understanding how to impact atypical development, further research is needed to support the theoretical relationship posited here and to provide continued validation of the suggested overlap of these domains. This project aims to explore the relationship among these constructs through the administration of EF, pretend play, and ToM measures to typical preschool children. Specifically, four key questions will be explored: (1) Does ability in pretend play, EF, and ToM task performance follow a developmental trajectory? (2) Do pretend play skills predict higher EF abilities? (3) Do pretend play skills predict higher ToM ability? (4) Does EF skill ability mediate this process and do age or IQ impact the relationship between these three domains? (see Figure 1 for hypothesized relationship).

First, based on previous findings in the literature (Carlson et al., 2001, 2002; Lillard & Kavanaugh, 2014; Nielsen & Dissanayake, 2000), it is hypothesized that the three domains will vary in their level of development within the studied age range of 3 to 5 years. Specifically, it is predicted that variables measured in pretend play will not be associated with age, suggesting that pretend play ability is fully present in this age range, while measures of EF and ToM ability will significantly be related to age. Second pretend play ability, specifically imaginative, symbolic, and organization skills, is predicted to be positively correlated with EF performance (Carlson et al., 2014). Further, given the mixed findings in the literature regarding the relationship between actual pretend play and EF ability and that, neurologically, researchers have theorized that the overlap of cognitive and affective processes in pretend play may occur in the DLPFC, which is highly associated with EF functioning, this study will pilot three new pretend
play measures that aim to integrate affective and cognitive processes in play (Carlson et al., 2014; Hoffmann & Russ, 2016; Vogeley et al., 2001). It is hypothesized that these cognitive-affective measures will positively correlate with measures of EF ability. Third, it is hypothesized that pretend play abilities, specifically involving imaginative and affective expression, will positively correlate with ToM ability (Lillard & Kavanaugh, 2014; Nielsen & Dissanayake, 2000). Fourth, it is hypothesized that ability to perform well on EF tasks will strengthen the relationship between pretend play and ToM (Figure 1). Findings from Carlson et al. (2002, 2014) provide support for the notion that cognitive aspects in play may relate most strongly to EF and ToM performance. For EF, these same findings suggest that the combination of IC and WM may most strongly relate to pretend play and ToM ability. Given these previous findings, composite scores in pretend play and EF will be created and used in analysis to see if they are stronger predictors of ability versus individual variables (i.e. imagination, organization for play; digit span forward, digit span backward, day/night task for EF). Lastly, it is hypothesized that age and IQ will be positively correlated with EF and ToM performance, suggesting that as age and IQ increases, these variables may account for a stronger portion of the relationship between EF and developing ToM abilities (Figure 1).

**Method**

**Participants**

58 typically developing children, between the ages of 3 – 5 years were recruited to be part of the current study. Recruited participants were English-speaking, had no prior diagnosis or evidence of a developmental or learning delay or disorder, and were at appropriate grade level for their age. Any children were excluded from the study if they were not able to physically sit at a table and complete the tasks. After consent forms had
been obtained, data was collected on 52 of the 58 participants. Two of the participants had incomplete data that could not be used within the study and four others were absent during the data collection period and thus were excluded from the study.

Previous research has shown that the skills of interest are emerging during this age range and can be reliably measured (Carlson, 2005). Specifically, pretend play abilities hit their peak during this time frame and the emergence of first order ToM and low level EF skills are also reliably present in this age group (Carlson, 2005; Russ, 2004). Research has also shown that interesting shifts in ToM skill performance occur between 3 and 4 years of age (Devine & Hughes, 2014). Measuring this change more closely can help identify what may aid or hinder typical development in these domains. Further, the relationships between the constructs of interest need to be studied more thoroughly within a typical population, as aimed in this study, before this work can be extended to children with various developmental disorders or atypical developmental trajectories.

**Procedures**

The research protocol was reviewed and approved by the Case Western Reserve University Social Sciences Institutional Review Board. After approval, participants were recruited through local area schools and preschools that have an established relationship with Case Western Reserve University and in doing research with the psychology department (Brunswick City Public Schools, Highland School District, University of Akron Child Development Center). Letters describing the study were sent home to typically developing children in the study age range (n = 80). Interested children and parents were asked to sign the consent form and return it to the school. If parents had any questions, the researchers made themselves available to help better explain the project before consenting.
After consent was obtained, testing occurred in a quiet room in each of the participating schools, during a regular school day. Test administration took 30 minutes per participant and included the tasks described below. Participants were video recorded during the APS-P, so that coding of the play task could occur at a later time point. Delayed coding of the play task ensured that the examiner did not bias coding skill based on EF or ToM task performance. All participants first completed the PTI-2, then the pretend play task, Band-Aid task, Digit Span tasks, Day/Night task, Hinting task, and finally the Delayed Gratification Task. If needed, breaks were built into the testing sessions, to ensure the child was focused and able to complete the tasks to the best of their abilities.

Measures

Cognitive Intelligence

*Pictorial Test of Intelligence, 2nd Edition (PTI-2; French, 2003)*. The PTI-2 is a revision of the Pictorial Test of Intelligence (French, 1964) and is an objectively scored, individually administered test of general intelligence for both typical and disabled children ages 3-0 through 8-11 years. The Test includes the administration of three subtests (verbal ability, form discrimination, and quantitative reasoning) which are combined to produce an Intelligence Quotient, which has been validated as a reliable global index of performance and a multidimensional measure of g. Factor analysis conducted found that the measure captures the same measure of g as the Wechsler intelligence tests for this same age range (WPPSI; WISC; French, 2003; Sawyer, Stanley, & Watson, 1979). Further, the PTI-2 has been shown to correlate with other standard measures of intelligence such as the Wechsler intelligence tests and The Cognitive
Ability Scales ($r = .67$ to $.82$; Swanson et al., 2008). Standardization of the PTI-2 was based on a sample of 970 children in 15 states across the United States. Measures of internal consistency are all above .80 for the three subtests. Further, test-retest reliability over an extended period was found to be .91. Other psychometric properties established include criterion-referenced validity, inter-rater reliability, item difficulty and item discrimination estimates (French, 2003).

**Executive Functioning**

*Day/Night Task (Gerstadt, Hong, & Diamond, 1994).* This task serves as both a measure of inhibitory control and working memory ability, thus capturing the “conflict” IC construct described in previous research (Carlson et al., 2002, 2014). In this task, the experimenter starts with having a conversation with the participant about when the sun comes up (during the day) and when the moon and stars come out (at night). Then a white card with a yellow sun drawn on it and a black card with a white moon and stars drawn on it are presented. Participants are instructed that in this “special game” they are to say *night* for the sun card and *day* for the moon/stars card. The experimenter then completes a brief warm-up with the child (one or two trials) and then administers 16 trials of the task. Each card is presented from beneath the table in a fixed, random order. There are no breaks or rule reminders. Accuracy (number correct out of 16) is recorded. This task has been validated on typically developing preschool children and found to reliably measure the combination of memory and inhibition in numerous studies (Carlson, 2005).

*Delay of Gratification Task (Mischel, Shoda, & Rodriguez, 1989).* In this task, which measures only inhibitory control (IC) ability, the experimenter first presents a choice of snack treats and allows the child to taste each (e.g. cereal, chocolate chip,
crackers). After the child makes a selection of their favorite snack, the experimenter places 1 of the selected treats in a bowl and 3 of the selected treats in another identical bowl. Next the experimenter asks the child which they would prefer (all select the larger amount with little or no coaching). The experimenter then explains that he or she has to leave the room to do some work but if the child is able to wait until he/she returns, they can have the larger amount. If the child does not want to wait that long, they can get up from their chair and the experimenter would return right away, but the child would only receive the smaller snack amount. After explaining the rules, the experimenter checks the child’s understanding by asking simple follow-up questions and then exits the room. Children are observed through a one-way mirror and the experimenter either returns if the child gets up from their seat, touches or eats the snack, or after the 2-minute waiting period has passed. Scores are recorded as seconds of time that the child is able to delay eating the snack. This task has been validated on typically developing preschool children and found to measure the variables of interest in numerous studies (Carlson, 2005).

**Digit Span Tasks (Davis & Pratt, 1996).** **Forward Digit Span.** In this task, which measures short term memory ability, the experimenter introduces the child to a puppet and explains that whatever he or she says, the puppet likes to repeat it. The experimenter demonstrates this by saying “1, 2” and then having the puppet say “1, 2.” The child is then asked to try, using the same example. The experimenter then says they are going to do more like that, reiterating that whatever he or she says, the child should just repeat it verbatim. The experimenter should begin with 2 digits and increase the number of digits until the child answers incorrectly on 3 consecutive trials. The number of successful trials and the highest level of success are recorded. **Backward digit span.** In this task, which
measures working memory (WM), the experimenter reintroduces the puppet but explains that whatever he or she says, the puppet likes to say it backwards. The experimenter demonstrates this by saying “3, 4” and then having the puppet say “4, 3.” The child is then asked to try, using the same example. The experimenter then says that they are going to do more like that, reiterating that whatever he or she says, the child should say backwards. Again, the experimenter should begin with 2 digits and increase the number of digits until the child answers incorrectly on 3 consecutive trials. The number of successful trials and the highest level of success are again recorded. These tasks have been validated on typically developing preschool children and found to measure constructs relating to memory and inhibition in numerous studies (Carlson, 2005).

**Pretend Play**

*Affect in Play Scale – Preschool Version (APS-P, Kaugars & Russ, 2009; Russ, 2014).* The APS-P is a standardized 5-minute play task designed to measure various dimensions of children’s pretend play. It has been validated for preschool children ages 4 – 5 years. This study was the first to extend its use to 3-year-old children, in the hopes of providing initial validity for use of the scale in a younger age range. In this task, various toys are laid out on a table (cups, stuffed animals, toy car) and children are provided with the following story stem and instructions:

“This is Mr. Bear. He is really hungry. Oh look, what’s in this cup. Cookies! Yum, yum, yum. I love cookies. Oh, what’s in this cup?! Yuck! I don’t like what is in that cup…Now you go ahead and keep playing. Tell me what happens next. Be sure to talk out loud. The video camera will be on so that I can remember what you say and do. I’ll tell you when to stop.”
The child is informed when there is one-minute left. If the child stops playing during the 5-minute period, the prompt, “There's still time left, keep playing,” is given. The task is discontinued if the child cannot play after a 2-minute period.

The child’s play is scored from the videotape using a criterion-based rating scale. There are five main scores, split into two domains, cognitive and affective processes. The cognitive processes include: (1) Organization, the quality of the plot and the complexity of the story, scored from 1 – 5 (one being the lowest and five being the highest); (2) Imagination, the novelty and uniqueness of the play including the child’s ability to use fantasy elements, to transform the blocks into different objects, and use object substitution, scored from 1 - 5; (3) Comfort, a global rating of the child’s comfort engaging in play and their level of enjoyment, scored from 1 -5. Affective processes include: (1) Frequency of Affect, a total frequency count of affect units expressed within every 10 seconds of the play narrative. For example, a child might have the puppets say “Yikes, a monster!” (Fear) or “Whee! This slide is fun!” (Happiness) and (2) Variety of Affect, a total count of the number of affect categories out of 11 possible categories, expressed during the play. The 11 affect categories include: Happiness/Pleasure, Anger/Aggression, Sadness/Hurt, Nurturance/Affection, Anxiety/Fear, Oral, Oral Aggression, Anal, Sexual, Competition, and Frustration/Dislike. Further, for each 20-second interval, the rater indicates which of three types of play (No Play; Functional Play; Symbolic Play) was the predominant activity – i.e. occurred for greater than or equal to 10 seconds within each 20-second interval. No Play is defined as the child not moving or interacting with the toys. Functional Play relates to a child making simple, repetitive muscle movements with or without the toys. Lastly, Symbolic Play is defined
as any instance of using toys in an unusual manner, substituting an object for another, or using the object in any way other than how it is intended.

A new measure was added to the scoring of the APS-P play task that aimed to capture the intersection of both cognitive and affective domains. The intersection of these skill sets is believed to be influenced by executive function ability and should tap into this domain within the play task. In order to measure this intersection between imagination and affect frequency (IA), every instance of when a child spends 20 seconds in symbolic play along with also expressing affect (as scored above for the frequency of affect expression measures) across those 20 seconds was recorded and a ratio score was calculated from dividing this number of time in symbolic play and affect expression by the total number of 20 second intervals in symbolic play. Next, a score of organization (from 1-5) was given to each 20 second symbolic play interval. The organization scores within these symbolic play intervals were then averaged to create an organization-affect expression score (OA). Lastly, in order to integrate imagination, organization, and affect expression (IOA), 20 second periods when the child was expressing affect the whole time and scored at least a 4 in organization were counted and a ratio score was calculated from dividing this number of times in symbolic/affect/high organization play by the total number of 20 second intervals in symbolic play. From this coding system, it was possible to delineate higher levels of cognitive skill associated with affect expressed during play. It was hypothesized that children who are able to combine these high levels of cognitive pretend play skills with affect (i.e. higher AO, AI, AOI scores) would also have higher levels of EF abilities, as measured by the Day/Night, Delayed Gratification, and Digit Span tasks, thus providing further support for the link between these two constructs.
Kaugars & Russ (2009) have developed a detailed scoring manual for the APS-P and interrater reliability is high, consistently in the .80s and .90s. Internal consistency for the affect scores on the APS-P using the Spearman-Brown split-half reliability is also high (.85; Seja & Russ, 1999). The APS-P has a large body of validity studies demonstrating associations with theoretically relevant criteria (see Kaugars & Russ, 2009; Russ, 2014). Factor analytic studies of the APS (a measure of pretend play appropriate for older children) have found 2 related but distinct factors, one cognitive and one affective, in US and Italian samples (Russ, 2014).

Theory of Mind

The Band-Aid Task (Bartsch & Wellman, 1989). In this task, which measures false belief ability, the child will be simultaneously presented with a standard Band-Aid box and an identically sized, but unmarked box. The false belief premise will be established by asking the child to choose the box he or she thinks contains the Band-Aids. The child will then be shown that the Band-Aids are actually in the unmarked box. Next a puppet will be introduced who “fell over” and needs a Band-Aid. The false belief question “Where do you think the puppet with look for a Band-Aid?” will be administered. The child will also be asked an attribute-to-self false belief question, “Where are the Band-Aids really?” Ability to answer each question correctly is given a score = 1 and incorrect answers are scored = 0. If the child receives a score of 2, meaning that they have answered both questions correctly, then they will have passed the false-belief task. If a child answers only one or zero of the questions correctly, they will have failed the task. Percentage of participants who pass the task will be calculated and reported across age groups. This task has been validated on typically developing
preschool children and found to measure the variables of mental state understanding in numerous studies and shows strong concurrent validity with other false belief tasks (Sprung, 2010).

*Hinting Task (Corcoran et al., 1995).* This task, which measures inference ability, is comprised of 5 vignettes involving two characters, one of whom drops a very heavy hint at the end of each story. For example:

Rebecca’s birthday is next week, so she says to her dad “I love animals, especially dogs.”

Question: What does Rebecca really mean when she says this?
*(If the child responds correctly, they receive a score of 2 and move on to the next vignette; if they respond incorrectly, the next hint is presented)*

Rebecca goes on to ask her dad: “Is the pet shop open on my birthday, dad?”

Question: What does Rebecca want her dad to do?
*(If the child responds correctly here, they receive a score of 1; if they respond incorrectly, they receive a score of 0 – both responses lead to the presentation of the next vignette)*

A correct response to the first question in a vignette receives a score of 2. If the child needs a subsequent hint, a correct response to the second question in each vignette can only be given a score of 1. If the child does not answer either question in a vignette correctly, they are given a score of 0. The highest obtainable score is a 2 across all 5 vignettes, or a total score of 10 points. ToM ability, specifically relating to inferring others mental states, is determined by total number of correct questions across the 5 vignettes. This task has been validated on typically developing preschool children and found to measure the variables of understanding other’s mental states and inference in numerous studies (Sprung, 2010).

**Results**

Demographics of the sample across school sites will first be described followed by the results for each construct individually (i.e. pretend play, ToM, and EF). Lastly, the
major analyses of the relation between the three constructs will be presented. Inter-rater reliability is currently being established on the APS-P coding system used in this study. It is important to note that the author of the study has established reliability on similar coding systems in both published and ongoing work (Zyga et al., 2015). Further, the coding system has proven to be reliable across a range of studies (see Russ, 2014).

**Demographics**

52 preschoolers between the ages of 3 years 0 months and 5 years 11 months underwent the full battery of assessments as part of this study. Overall, this resulted in a 65% participation rate in the current study, or the percentage of children that actually participated in the study against the total number of consent forms sent home across all three school sites. Preliminary analysis was conducted to ensure no outliers were present in the sample. An outlier was defined as any participant who scored above two standard deviations from the mean score on each variable of interest in the current study. From this initial analysis, 2 outliers were identified that were excluded from subsequent analyses. Thus, the remainder of the results will be reported with n = 50.

Overall demographics of the sample are presented in Table 1. Once the outliers were removed, the sample did not significantly differ in age, IQ, gender, race, or any of the pretend play, ToM, or EF measures across school sites. Mean age of the sample was 4.00 (0.76), mean IQ was 103.58 (9.80), 36% of the sample was male, and majority were Caucasian (76%).

**Pretend Play Assessment**

Pretend Play, as measured through the APS-P task, encompassed 11 variables including the newly created IA, OA, and IOA measures, in the current study. All original
variables were highly correlated with one other (Table 2). Only Organization
significantly correlated with age \( (r(50) = 0.33, p < .05) \). Further, none of the play
measures correlated with IQ (Table 2). In regards to the new measures of pretend play
created in this study (IA, OA, and IOA), all 3 measures did highly correlate with each
other and with the original APS-P variables. Further, none of the novel measures related
to age or IQ (Table 2).

Given that all variables were highly correlated with each other, and that previous
research suggests that cognitive skill in pretend play may be most highly related to EF
and ToM skill, a Pretend Play Cognitive Composite Measure was created by
standardizing and summing the Imagination and Organization variables. This composite
was used in subsequent regression analyses to better understand the relationship between
pretend play and the other constructs.

**Theory of Mind Assessment**

ToM performance was measured by two tasks in the current study: the hinting
task, which measures the child’s ability to infer the mental state of another individual,
and also a standard content false belief task, the Band-Aid task. Hinting task performance
did significantly correlate with age \( (r(50) = 0.45, p < 0.01) \), but performance on the Band-
Aid task did not \( (r(50) = 0.14, \text{ns}) \). Neither task correlated with IQ (Table 3). Further,
performance on the Hinting Task did significantly vary by age group, as determined by a
one-way ANOVA \( (F(2,47) = 7.184, p < 0.01) \), with significant improvement occurring
from 3 to 5 years. Follow-up post-hoc analyses revealed that 3-year olds’ ability
significantly differed from both 4 \( (p = 0.003) \) and 5 \( (p = 0.001) \) year olds’ ability.
Interestingly, performance on the Band-Aid task was low across this age range and did
not significantly differ by age group, with only 35.7% of 3 year olds, 22.7% of 4 year olds, and 42.9% of 5 years old actually able to pass the test. Further, the two tasks were positively but non-significantly interrelated, $r(50) = 0.23$, ns), which may suggest that the two tasks are measuring different facets of ToM ability. Given this nonsignificant relationship, the variables were examined separately in subsequent analyses.

**Executive Function Assessment**

EF ability was measured through four tasks in the current study: Digit Span Forward, which assessed simple short term memory ability, Digit Span Backward, which assessed a child’s ability to hold and mentally manipulate verbal information (working memory task), Day/Night task, in which a child had to both hold the rules of the game in his or her memory while also inhibiting the preferred response (inhibitory control and working memory task), and Delayed Gratification task, where a child had to inhibit his or her desire for a snack placed in front of them (inhibitory control). All measures were significantly correlated with IQ (Table 4). Given this, IQ was controlled for in subsequent analyses. Further, only Digit Span Forward ($r(50) = 0.28$, $p < 0.05$) and Digit Span Backward ($r(50) = 0.45$, $p < 0.05$) significantly correlated with age. One-way ANOVAs confirmed a significant difference by age only for Digit Span Backward ($F(2, 46) = 8.026$, $p < 0.01$; see Table 5). Subsequent post-hoc analyses revealed that 3-year-olds ability significantly differed from both 4-year-olds ($p = 0.04$) and 5-year-olds ($p = 0.001$) ability on the Digit Span Backward task. Lastly, only Digit Span Forward and Digit Span Backward were significantly related to each other, $r(50) = 0.58$, $p < .001$. The other measures did not relate to one another (Table 4). Given that previous research has found that combined scores across EF task domains have been shown to account for a greater
portion of variance than each task alone, the digit span variables were used in creating a
Digit Span composite score. This composite score was used only in subsequent
regression analyses to better understand the relationship between EF performance and the
other two constructs of interest.

**Specifying the Relationship between Pretend Play, EF, and ToM**

The next set of analyses centered on specifying the relationship between the three
constructs and relative contributions of pretend play, age, and IQ to EF and ToM ability
as measured by the tasks in the current study.

**Pretend Play and Executive Function.** Across the EF tasks and pretend play,
there was no significant correlation between Imagination or time spent in symbolic play,
as was hypothesized. Further, in relation to the newly created measures that integrated the
cognitive and affective aspects of pretend play (IA, OA, and IOA), none of these
measures individually correlated with EF skills either (see Table 6). However,
Organization in play did significantly correlate with performance on the Digit Span
Backward Task \( r(50) = 0.35, p < 0.05 \), even after controlling for age and IQ. Further,
Affect Categories did significantly correlate with Digit Span Forward \( r(50) = 0.37, p <
.05 \), even after controlling for age and IQ. Lastly, time spent in functional play
significantly negatively correlated with the Day/Night Task \( r(50) = -0.29, p < 0.05 \) and
trended toward significance with the Digit Span Forward \( r(50) = -0.28, p < 0.10 \) after
controlling for age and IQ.

Given that Organization and IQ were shown to significantly correlate with the
Digit Span Backward Task and Affect Categories and IQ were shown to significantly
correlate with the Digit Span Forward Task, these variables were subsequently placed
into regression models to determine if any one variable was significantly predictive of performance on either the Digit Span Forward or Backward tasks. As can be seen in Table 7, inclusion of both Organization and IQ in a simultaneous multiple regression model significantly predicted performance on the Digit Span Backward task ($F = 10.021$, $p < 0.01$, $R^2 = 0.299$, Adjusted $R^2 = 0.255$). Further, both Organization and IQ as predictors were significant in the model, suggesting that each variable contributed unique variance in predicting EF ability above and beyond the variance accounted for by the interaction between them. Affect Category did not prove to be a significant predictor of Digit Span Forward performance when placed in a regression model.

**Pretend Play and Theory of Mind.** As hypothesized, Imagination within pretend play did significantly correlate with the Hinting Task, a measure of ToM ($r(50) = 0.33$, $p < 0.05$). When age and IQ were controlled for, this relationship still trended towards significance ($r(50) = 0.26$, $p < 0.10$). Time spent in functional play significantly negatively correlated with the Band-Aid Task, a measure of false belief understanding ($r(50) = -0.35$, $p < 0.05$), even after controlling for age and IQ. Time spent in no play significantly correlated with the Hinting Task ($r(50) = -0.35$, $p < 0.05$), even after controlling for age and IQ. Further, the Hinting Task did correlate with both Organization and the novel OA score, however these relationships became non-significant when age and IQ were controlled for (see Table 6 for full details).

Given that Imagination, Organization, OA, and age were shown to significantly correlate with the Hinting Task, these variables were subsequently placed into regression models to determine if any one variable was significantly predictive of performance on the Hinting Task. As can be seen in Table 8, inclusion of both Imagination and age in a
simultaneous multiple regression model significantly predicted performance on the Hinting task ($F = 7.985, p < 0.01, R^2 = 0.254, \text{Adjusted } R^2 = 0.222$). Within this model, age as a predictor was significant, suggesting that it attributes unique variance above and beyond the relationship between Imaginative ability and Hinting Task performance. Organization and OA did not prove to be a significant predictors of Hinting Task performance when placed in a regression model.

**Pretend Play, Executive Function, and Theory of Mind.** In order to understand the relationship between all three constructs, both correlational and regression findings across pretend play, EF, and ToM will be presented in this section. Further, findings will be reported across both individual variables in each domain and composite scores. As noted above, two composite scores were created within the pretend play and EF domains. Specifically, within pretend play, the Imagination and Organization scores were standardized and combined to create a Pretend Play Composite. In EF, scores from Digit Span Forward and Backward were combined in the same process to create the Digit Span Total Composite score. Previous research has shown that composite scores may provide a more robust measure of a given domain and may help account for more significant portions variance when delineating relationships among constructs (Carlson et al., 2001, 2002, 2014; Devine & Hughes, 2014). In relation to individual variables across all three domains, Imagination significantly correlated with the Hinting Task ($r(50) = 0.33, p < 0.05$) and Digit Span Backward significantly correlated with the Hinting Task ($r(50) = 0.30, p < 0.05$). However, Imagination did not significantly correlate with Digit Span Backward ($r(50) = 0.18, \text{ns}$). Further, Organization trended towards significance with the Hinting Task ($r(50) = 0.25, p < 0.10$) and did significantly correlate with Digit Span
Backward \(r(50) = 0.32, p < .05\). In relation to the composite scores across all 3 domains, the Pretend Play Composite significantly correlated with the Hinting Task \(r(50) = 0.30, p < 0.05\) and the Digit Span Total Composite \(r(50) = 0.28, p < 0.05\). Further the Hinting Task and the Digit Span Total Composite also significantly correlated with each other \(r(50) = 0.31, p < 0.05\).

In moving into subsequent analyses, it is standard convention to have all variables placed into a regression model positively correlate with one another, especially when mediation and moderation analyses are planned. However, Preacher, Rucker, and Hayes (2007) provide support and evidence for running regression analyses when all variables may not be correlated, especially when the variables were previously hypothesized to relate with one another. Given this accepted viewpoint in the field, subsequent regression analyses were run across all individual and composite variables, given that at least two of the three domains significantly correlated with each other (Preacher et al., 2007). First, individual variables from each domain were entered into simultaneous regression models followed by composite scores. This led to three models, which looked at the power of components of pretend play and EF in predicting Hinting Task performance. The first, where Organization and Digit Span Backward were used as predictors, was nonsignificant \(F = 2.880, p = 0.07, R^2 = 0.10\). The second, where Imagination and Digit Span Backward were used as predictors, was significant \(F = 4.482, p = 0.02, R^2 = 0.16, \text{Adjusted } R^2 = 0.124\). Further, within this model, Imagination as a predictor was individually significant in the model, suggesting that it contributes a unique portion of the variance, above and beyond the interaction between itself and Digit Span Backward, in predicting Hinting Task Performance (Table 9). The third model, where the Pretend Play
composite and Digit Span composite were used as predictors of Hinting task performance, was again significant ($F = 3.642, p = 0.03, R^2 = 0.13$), but not at a level that was above and beyond model 2. Thus, results indicate that the most significant predictors of Hinting Task performance in this study were Imaginative ability in play and Digit Span Backward performance. When plotted against each other, a significant interaction was observed between Imaginative ability and Backward Digit Span performance. Specifically, it seems as children who have higher backward digit span ability also showed higher imaginative ability in pretend play. This interaction significantly predicts hinting task performance and accounts for more variance above and beyond either variable on its own.

**Discussion**

Overall, the findings of this study support the first hypothesis, in that the three domains did vary in their level of development across the age range studied. Specifically, pretend play ability did not relate to age, suggesting that this domain as a skill set is fully present and mastered across ages 3-5 years. However, EF and ToM performance did across certain tasks, again suggesting that certain aspects of these domains are still developing and becoming present across this same age range. The second hypothesis in this study, which predicted that imaginative, symbolic, organizational skills in play and the newly developed cognitive-affective play measures would positively correlate with EF ability, was mostly unsupported. Only organization significantly positively correlated with EF ability, as measured by the Digit Span Backward task. However, affect expression in play did significantly relate to EF ability and time spent in functional play negatively correlated with EF performance. These findings suggest that there is potential
overlap between these two domains, but it may be less straightforward than predicted.

Third, the prediction that pretend play ability would relate to ToM was mostly supported in that imagination did positively correlate with performance on the Hinting Task. However, affect expression did not relate to any of the ToM measures. Fourth, the prediction that EF would strengthen the relationship between pretend play and ToM performance was supported, but results delineated a different relationship than hypothesized (Figure 2). Lastly, age and IQ did significantly positively correlate with EF and ToM and accounted for significant portions of variance in predicting relationships between the constructs of interest.

The Stages of Development

In regards to the first aim of the study, the findings suggest that the developmental theoretical model posited was generally supported. Current empirical findings and theoretical assumptions suggested that pretend play may influence the emergence and strength of both EF and ToM skills, since it occurs earliest in child development and relates to underlying abilities in both of these domains (Berk & Meyers, 2013; Bodrova et al., 2013; Lillard & Kavanaugh, 2014). Next, it was theorized that early EF skills begin to develop, which may work in a reciprocal nature with pretense, causing a mutual effect of more sophisticated pretend and EF abilities. During this same time, pretend play development would allow a child to manipulate and represent objects and others in his or her mind (Bodrova et al., 2013). This development could then set the ground work for ToM, which was theorized to emerge last during this early childhood period (Lillard, 1993; Lillard & Kavanaugh, 2014). Specifically, this study found that all pretend play skills were evident in children ages 3 to 5 years and that these skills did not vary by age
or IQ. Thus, it seems as though pretend play as a skill set is present at this early age and can be used as a means of practicing other skills, such as EF and ToM. Further, this study was the first to use the APS-P with 3-year-old children. Since performance on the task did not vary by age, this study provides initial validation of the APS-P for this younger age range. It seems as though the APS-P is sensitive enough in measuring pretend play in children as young as 3 years old and that, even in this young age, play ability does not relate to cognitive performance.

The measures of EF ability also fell into the developmental trajectory posited, in that most skills measured were behaviorally present from ages 3 to 5 years. However, higher skills, such as digit span backward, were significantly related to age. This suggests that in this time period, EF skills may be emerging, but may not be fully developed and can be impacted by other skills or areas of development, given the interactive relationship that was found between performance on Digit Span Backward and Imaginative Play ability in this study. Further, the finding that digit span backward did significantly vary by age suggests that this age range may be when working memory (WM) ability is appearing in development, so variability and demarcation in skill performance is evident by age. On the other hand, short term memory (as measured by digit span forward) is already present, so it does not vary by age. Lastly, the measures of inhibitory control (delay gratification) and inhibitory control/working memory (day/night task) may still be consistently developing across these three years, so variability in performance is not seen across these skill sets either. It may be that a clearer demarcation by age for these skills appears as children continue to age (at years 6 or 7 versus 3 to 5). In relation to the notion of how the field currently defines EF as one overarching construct, composed of a
multitude of abilities and skill sets, this study provides interesting and potentially contradictory evidence given that only the digit span tasks positively significantly correlated with one another. As explained above, it may be that at this young age, these skills are still developing and EF as a domain is still emerging. However, these findings may also support the notion that constructs defined under the term “executive function” may actually be unique and distinct skill sets. More research is needed in this early age and across childhood and adolescence to better delineated which explanation is most appropriate.

Lastly, it seems as though, as theorized, ToM may be the least developed in this age range. Specifically, skill in being able to read inferences and other’s mental states as measured by the hinting task did show a significant difference by age. This finding suggests that big changes may be occurring in this 3-5-year age range. Follow-up analyses specifically showed that 3-year olds’ ability significantly differed from both 4 and 5 year olds’ ability, showing an incremental increase in these skills across the preschool period. Further, it looks as though this period may be too early in measuring true false belief ability – as evidence in poor pass rates across all age ranges in the standard band-aid task. As noted in table in table 5, only 32% of the total sample (16 participants) passed the task and understood that another individual would indeed look in the band-aid box for the band-aids versus the other box that they had been moved to. These findings fall in line with previous findings and theorized work. Specifically, other studies found that false belief understanding presents in children around 5 to 6 years of age (Carlston et al., 2001, 2002) and is potentially due to frontal lobe maturation and development, which occurs throughout childhood and early adolescence. Further, these
results are important in understanding what measures may be appropriate to give when working with various age ranges and also speak to the demands that can be placed on young children. It may be helpful for educators and parents to better understand what aspects of cognitive and social development have occurred at various stages to both ensure that their child is reaching milestones within a normal range and to also adjust tasks or demands accordingly.

**Play as a vehicle for skill development**

In regards to the subsequent aims of the study, the findings do provide support for the notion that the ability to pretend play may be related to skill in understanding mental representations and inferences from others (as measured by the hinting task) and executive function skill relating to short term working memory. Specifically, a child’s imagination score in play seems to be the best predictor of Hinting Task ability, where the child needs to read cues and understand inferences from others. In regards to executive functioning, it seems as though organization in play does relate to working memory ability, as measured by the Digit Span Backward task. As noted above, age is also an important predictor of these skills and does account for a significant portion of the variance in understanding the relationship between play and ToM. Similarly, IQ is an important predictor for the relationship between pretend play and EF. However, in both of these relationships, play does contribute a significant portion of variance and in the case of organization relating to EF skills, this variance is unique to the regression model.

Interestingly, the new measures of pretend play, which aimed at integrating the cognitive and affective processes in play, did not relate to EF. Similarly, neither did imagination or time spent in symbolic play directly, which replicates Hoffmann and
Russ’s (2012) findings, where ability to pretend play did not relate to performance on a cognitive set shifting task. However, in this study, the cognitive pretend play composite score, which averaged scores across the imagination and organization scores, did significantly positively correlate with the Digit Span Backward task. This finding may suggest that the overlap between pretend play and EF may not lie in the integration of affective and cognitive processes, but rather the integration of cognitive domains being expressed in pretend play. Results of this study provided support for the finding that children who can show higher ability in both organization and imagination in play may also show higher working memory ability. This relationship may relate to the finding that time spent in functional play did significantly negatively correlate with EF tasks, specifically Digit Span Forward, a measure of short term memory, and the Day/Night Task, a measure of both inhibitory control and working memory, but these same measures did not significantly correlate with time in symbolic play. The author postulates that perhaps the measures of imagination and time in symbolic play were not sensitive enough in capturing a child’s ability to distinguish pretense from reality. However, when imagination was integrated with organization, a significant relationship was strong enough to emerge. As Carlson et al. (2014) found, it was a child’s ability to see objects as having different, pretend functions (a pen as both a writing utensil and an airplane) that highly correlated with EF ability. In this study, a child’s imaginative ability in play and time in symbolic play encompassed many different actions. Some related to more simple imitation of pretending where others captured this novel, transformational ability. It is posited that if these measures of imagination and symbolic play were further delineated through a more sensitive coding system, then a clearer relationship between these specific
skills, irrespective of other cognitive play domains, and EF may become evident. In relation to functional play, the measure used in this study defined this type of play as any type of rigid and repetitive functional acts with the toys, such as pushing a car toy back and forth, stacking cups, and bouncing a rubber ball. The finding that functional play and EF performance are negatively correlated, even when controlling for age and IQ, suggests that a child’s inability to see the toys as anything other than their functional may relate to an ability to be cognitively flexible, which may detrimentally impact their EF performance.

Lastly, as noted above, theorists have suggested two viewpoints in how ToM may interact with either pretense or EF. The first view believes that the increase in ToM across childhood is based on domain specific shifts in understanding representations, such as appearance-reality distinctions and perspective taking, which naturally comes from pretense development. The second viewpoint posits that the transition reflects a more general cognitive maturation in that gains in EF ability in the preschool years, which significantly contributes to ToM performance and development (Hala, et al., 2003). This study proposed that the relationship between these variables may be a mix of these two viewpoints, where the domain specific growth in pretense ability is mediated by more general cognitive maturation of EF skills relating to IC and WM. Based on regression findings, the results of this study suggest that model posited (Figure 1) is at least garnering some support in that components pretend play (i.e. imagination and organization) are predictive separately of EF and ToM (Tables 7 and 8) and that, at this point developmentally, specific play skills (i.e. imaginative ability) are at a point where they are interacting with specific EF domains (i.e. working
memory) to predict ToM performance (Table 9). However, the findings suggest that EF’s role is not through mediation but rather moderation. Performance on the Digit Span Backward task did not account for *why* Imaginative ability related to ToM ability, but rather *when*. Specifically, it appears as though an interaction of both pretend play, as measured by imagination ability, and EF skill, as measured by digit span backward, is predictive of a child’s ability to infer other’s mental states. Children who are higher in working memory ability at this age seem to also show better imagination skills in play, and this combination seems to be predicting better performance on a ToM task (Figure 2). It is also important to note that, in this study, the predictive construct in EF seems to be working memory (WM) and not a combination of inhibitory control (IC) and WM, as has been found in other studies. It may be that given the average age of the sample size, more complex skill of inhibitory control was not fully developed and thus did not drive the interaction with pretend play as strongly as working memory ability. Further, this study showed that imagination, versus any other component or skill in play, is most related to ToM and working memory performance. This finding suggests that specific aspects of play (i.e. symbolic, object transformation or substitution ability) may be important areas to measure in subsequent studies and target in future intervention research, given that skill in this domain may impact performance in other areas related to social and emotional development. Relatedly, Hoffmann and Russ (2016) showed that a 6 session intervention targeting aspects of imagination in play did result in increases in this domain, and positive changes were more prominent in children who were lower players at baseline assessment. The findings of this study suggest that it may be
feasible to increase imagination and symbolic ability in play, which then may impact other important areas of development.

Taken together, the findings of this study are the first to suggest that actual ability in pretend play, specifically surrounding imagination, may set the stage behaviorally and neurologically for EF and ToM skills to develop and be processed in the brain (Bodrova et al., 2013; Carlson et al., 2014). After the emergence of EF, perhaps specifically working memory ability in young children, pretend play and EF may have a reciprocal relationship, where each domain interacts with one another in impacting ToM development (Carlson et al., 2014; Lillard, 1993; Lillard & Kavanaugh, 2014). This novel finding suggests that play as construct can also be used as a modality to help children practice other important skill sets, which then may interact with one another to help propel development forward. Practically, the act of playing can then be viewed as a developmental booster, which gives the child another avenue to practice important skills relating to cognitive and social development. It also seems as though those children who did not take part in a higher level of play, as measured by time in functional play, did have impacted EF and ToM performance. Thus, providing intervention to children who struggle reaching a higher level of play ability may have positive impacts on executive functioning skills, such as short term and working memory, and understanding the mental states of others. Although the findings here are cross-sectional and correlational, it is the first study to show how the actual act of playing relates to other cognitive and socioemotional domains and that, at this age, specific domains within pretend play and EF seem to be interacting with one another in predicting a child’s ToM ability.

**Limitations of the Current Study**
Although this study was the first to evaluate how the act of pretend play relates to EF and ToM and how all three constructs overlap with each other, certain limitations should be noted. First, the study is limited by its small sample size and reliance on correlational research. Given this methodology, the current study is not able to speak to causality or specific timing of the variables being study. Further, the smaller battery of EF and ToM measures that were given, in comparison to the standard given across other studies (Carlson & Moses, 2001; Carlson et al., 2002, 2014), may have limited this study’s ability to look within larger constructs (such as specific EF subdomains) and across various false belief understanding ability (location versus content tasks). In relation to the measures used in the current study, a potential limiting factor in generalizing these findings to other populations may be the reliance of the APS-P on expressive language ability. Children may score higher in some domains if they are able to verbalize what they are playing. However, it is important to note, that within a typically-developing sample, high play scores are not contingent on talking while playing and factor more into the child’s comfort during play, than measures of imagination, organization, or affect expression. A last important limitation to note is that the author was also the sole examiner in the current study. The author both administered and scored each assessment for every participant, which could allow for potential bias in scoring based on observing a participant’s skill in different domains. However, care was taken to ensure that scoring and coding happened once all data was de-identified and time had passed since the data collection date. Further, interrater reliability is currently being established on the data set, which will buffer against any instances of rater bias. Outside of these potential limitations, this study does provide at least initial evidence that there is
important overlap across these domains that may follow a developmental trajectory. An understanding of this overlap may help bolster skills related to these domains across early childhood.

**Practical Implications**

As outlined in the introduction, skills relating to pretend play, EF, and ToM are extremely important in almost all domains of child development. They impact a child’s ability to regulate emotions, cognitions, and behaviors and they allow children to better understand others, which increases social skills and interpersonal relationship abilities. A key tenant in child development is that no area or skill develops in isolation from others. In this way, delineating the interactions between the domains tested in this study aids in informing the scientific community’s understanding of typical development and normative trajectories. Overall this research provides a better understanding of how each construct overlaps with the others and how this information can be used in bolstering these skills within a classroom setting or in daily life.

Outside of informing typical development, a host of disorders, such as schizophrenia, attention deficit hyperactive disorder (ADHD), and autism spectrum disorders (ASD), are characterized by deficits in areas relating to pretense, EF, and ToM (Abu-Akel, 2003B; Bodrova et al., 2013; Greene et al., 2008). Understanding how these areas overlap could lead to more successful intervention and more global increases in skill ability. For example, ASD is actually characterized by deficits in all three domains (Bodrova et al., 2013; Greene et al., 2008; Kimhi et al., 2014). These children would highly benefit from intervention that targeted any one of the three skill sets, however, research has shown that these are difficult abilities to bolster within this population and
current attempts do not seem successful, nor have the ability to generalize to every day behaviors and situations (Kimhi et al., 2014).

From the theory postulated in this paper and the results obtained, the ability to increase these skills in ASD may be most successful when pretend play is used as a vehicle for intervention delivery (Bodrova et al., 2013; Lillard, 1993). First, EF skills could be targeted through playing out stories that focus on regulation (behavioral and emotional), impulse control, and integrating information. For example, a child could play through a story of when “Suzie didn’t get to go to the party and felt angry. What could Suzie do to feel better?” The building of EF skills would also naturally build pretend play and pretense skills. The next step would then be to target ToM after EF and pretense abilities have been built up. Again, pretend play would be used as a platform to work on ToM abilities (such as playing with multiple characters in a story and sharing different viewpoints). This progression and more global approach to teaching skill sets versus specific tasks (i.e. Sally-Ann task) may result in more generalized abilities and higher overall functioning in the various domains.

**Future Directions**

This study was the first step in providing evidence of the overlap of EF, pretend play abilities, and ToM. Findings suggest that, at this young age, skills relating to play, basic understanding of others’ mental states, and working memory ability are developing and do interact with one another. Further research should work to continue delineating the relationship between these constructs through experimental manipulations so that direction of causality in development can be better understood. Specifically, longitudinal studies investigating how pretend play predicts later EF or ToM ability would be
extremely beneficial in delineating developmental trajectories and causality. The ability to use larger batteries of EF and ToM may help delineate at what ages specific skills are developing and presenting behaviorally in children. The inclusion of expressive language measures in future research may also be beneficial in helping to better understand the role of language in relation to these constructs and stages of development. Another area of potential future research lies in better measuring the hypothesized neural pathways involved in these constructs and how they may potentially overlap through the use of neuroimaging techniques such as functional magnetic resonance imaging (fMRI) or electroencephalogram (EEG) recordings.
## Table 1: Participant Demographics

<table>
<thead>
<tr>
<th>School Site</th>
<th>Age (Mean ± SD)</th>
<th>IQ (Mean ± SD)</th>
<th>Gender (Percentage Male)</th>
<th>Race (Percentage Caucasian)</th>
<th>F(2, 47) = 2.48</th>
<th>Gender, F(2, 47) = 0.73</th>
<th>Race, F(2, 47) = 0.50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Site 1</td>
<td>4.14 (0.86)</td>
<td>103.29 (10.63)</td>
<td>28.6%</td>
<td>78.6%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site 2</td>
<td>4.07 (0.76)</td>
<td>108.38 (7.35)</td>
<td>30.8%</td>
<td>92.3%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site 3</td>
<td>3.87 (0.69)</td>
<td>101.04 (9.87)</td>
<td>43.5%</td>
<td>60.9%</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total (N = 50)</td>
<td>4.00 (0.76)</td>
<td>103.58 (9.80)</td>
<td>36% (n = 18)</td>
<td>76% (n = 38)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Percent male; percent Caucasian. No significant difference between school sites across variables.
Table 2: Correlations within Pretend Play Task

<table>
<thead>
<tr>
<th></th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
<th>13</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.01</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. IQ</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.02</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Imagination</td>
<td></td>
<td></td>
<td>0.73**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Comfort</td>
<td></td>
<td></td>
<td></td>
<td>0.75**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Organization</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.75**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Affect Frequency</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.63**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Affect Categories</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.73**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. No Play (%time)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.75**</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Functional Play (%time)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.68**</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Symbolic Play (%time)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.77**</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Imagination-Affect (LA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.70**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Organization-Affect (OA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.74**</td>
<td></td>
</tr>
<tr>
<td>13. Imagining-Organize-Affect (IOA)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.73**</td>
</tr>
</tbody>
</table>

All tests two-tailed. N = 50. †p < 0.10; *p < 0.05; **p < 0.01.
<table>
<thead>
<tr>
<th>Age</th>
<th>IQ</th>
<th>Band-Add Task</th>
<th>Hinting Task</th>
<th>AgE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.23</td>
<td>0.09</td>
<td>0.23</td>
<td>0.14</td>
<td>0.01</td>
</tr>
<tr>
<td>0.15</td>
<td>0.15</td>
<td>0.09</td>
<td>0.14</td>
<td>0.01</td>
</tr>
<tr>
<td>0.15</td>
<td>0.15</td>
<td>0.09</td>
<td>0.14</td>
<td>0.01</td>
</tr>
</tbody>
</table>

Table 3: Correlations within Theory of Mind Tasks

All tests two-tailed. N = 50. †p < 0.10; *p < 0.05; **p < 0.01.
Table 4: Correlations within Executive Function Tasks

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.01</td>
<td>0.28*</td>
<td>0.45**</td>
<td>0.23</td>
<td>0.03</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>0.03</td>
<td>0.21</td>
<td></td>
<td>0.58**</td>
<td>0.22</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>0.14</td>
<td>0.38</td>
<td>0.80**</td>
<td>0.43**</td>
<td>0.36</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0.21</td>
<td>0.03</td>
<td>0.30</td>
<td>0.12</td>
<td>0.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>0.03</td>
<td>0.23</td>
<td>0.58**</td>
<td>0.28**</td>
<td>0.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>0.65</td>
<td>0.55</td>
</tr>
</tbody>
</table>

All tests two-tailed. N = 50. *p < 0.10; **p < 0.05; *p < 0.01.
<table>
<thead>
<tr>
<th>Age (n)</th>
<th>Age 3</th>
<th>Age 4</th>
<th>Age 5</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>76.1 ± 4.9 (7)</td>
<td>69.6 ± 1.4 (6)</td>
<td>72.7 ± 4.3 (2)</td>
<td>72.7 ± 2.0 (4)</td>
</tr>
<tr>
<td></td>
<td>7.6 ± 1.4 (6)</td>
<td>7.4 ± 2.2 (9)</td>
<td>2.4 ± 2.3 (9)</td>
<td>2.9 ± 2.0 (9)</td>
</tr>
<tr>
<td></td>
<td>0.24 ± 1.0 (6)</td>
<td>1.4 ± 1.8 (6)</td>
<td>0.27 ± 1.2 (9)</td>
<td>0.18 ± 1.0 (9)</td>
</tr>
<tr>
<td></td>
<td>5.6 ± 1.3 (6)</td>
<td>5.2 ± 1.0 (9)</td>
<td>5.1 ± 1.0 (9)</td>
<td>5.0 ± 1.1 (9)</td>
</tr>
</tbody>
</table>

**Table 5:** Mean Scores on Pretend Play, ToM, and EF tasks as a function of age.
Table 6: Correlations across Pretend Play, ToM, and EF Measures

<table>
<thead>
<tr>
<th>Theory of Mind</th>
<th>Executive Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pretend Play Composite</td>
<td></td>
</tr>
<tr>
<td>PPT Play (%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretend Affect (IA)</td>
<td></td>
</tr>
<tr>
<td>Pretend Play (%time)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>No Play (%time)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Affect Categories</td>
<td></td>
</tr>
<tr>
<td>Affect Frequency</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Imagery</td>
<td></td>
</tr>
<tr>
<td>Organization</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Exec Function</td>
<td></td>
</tr>
</tbody>
</table>

Partial Correlations controlling for Age and IQ are shown in parentheses. All tests two-tailed. N = 50. *p < 0.05; **p < 0.01; †p < 0.10.
Table 9: Simultaneous Multiple Regression for predicting Hinting Task Scores from Pretend Play and EF Performance

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>S.E.</th>
<th>B</th>
<th>Beta</th>
<th>t-value</th>
<th>F-value</th>
<th>R²</th>
<th>Adjusted R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imagination</td>
<td>0.461</td>
<td>0.222</td>
<td>0.282</td>
<td>2.077</td>
<td>*</td>
<td>4.482</td>
<td>0.160</td>
<td>0.124</td>
</tr>
<tr>
<td>Digit Span</td>
<td>0.264</td>
<td>0.152</td>
<td>0.236</td>
<td>1.738</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Organization</td>
<td>0.764</td>
<td>0.298</td>
<td>0.314</td>
<td>2.567</td>
<td>*</td>
<td>10.021</td>
<td>0.299</td>
<td>0.255</td>
</tr>
<tr>
<td>IQ</td>
<td>0.135</td>
<td>0.037</td>
<td>0.441</td>
<td>3.610</td>
<td>**</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 7: Simultaneous Multiple Regression for predicting Digit Span Backward Scores from Pretend Play Performance

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>S.E.</th>
<th>B</th>
<th>Beta</th>
<th>t-value</th>
<th>F-value</th>
<th>R²</th>
<th>Adjusted R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imagination</td>
<td>0.395</td>
<td>0.211</td>
<td>0.242</td>
<td>1.876</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>1.073</td>
<td>0.352</td>
<td>0.393</td>
<td>3.046</td>
<td>**</td>
<td>7.985</td>
<td>0.254</td>
<td>0.222</td>
</tr>
</tbody>
</table>

Table 8: Simultaneous Multiple Regression for predicting Hinting Task Scores from Pretend Play Performance

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>S.E.</th>
<th>B</th>
<th>Beta</th>
<th>t-value</th>
<th>F-value</th>
<th>R²</th>
<th>Adjusted R²</th>
</tr>
</thead>
<tbody>
<tr>
<td>Imagination</td>
<td>0.100</td>
<td>0.052</td>
<td>0.041</td>
<td>0.377</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pretend</td>
<td>0.074</td>
<td>0.036</td>
<td>0.214</td>
<td>0.347</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
It is hypothesized that the relationship between pretend play and ToM ability may change the relationship between the variables of interest. It is predicted that as age and IQ increase, EF may account for more variance in the model above.
The results of this study found that the relationship between the three constructs of interest was best described as a moderation model, where ability on Pretend Play and EF tasks significantly interacted with one another to predict ability on the Hinting Task (black line above). Further, Age and IQ were implicated in the relationship between EF and ToM ability (red line above).
References


http://doi.org/10.1002/cd.23219800908


