

IMPROVING PRESCHOOLERS' THEORY OF MIND SKILLS WITH DIGITAL  
GAMES: A TRAINING STUDY

by

Mariya Nikolayev  
A Dissertation  
Submitted to the  
Graduate Faculty  
of  
George Mason University  
in Partial Fulfillment of  
The Requirements for the Degree  
of  
Doctor of Philosophy  
Education

Committee:

\_\_\_\_\_ Chair

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_ Program Director

\_\_\_\_\_ Dean, College of Education and Human  
Development

\_\_\_\_\_ Fall Semester 2015  
George Mason University  
Fairfax, VA

Improving Preschoolers' Theory Of Mind Skills With Digital Games: A Training Study

A Dissertation submitted in partial fulfillment of the requirements for the degree of  
Doctor of Philosophy at George Mason University

by

Mariya Nikolayev  
Master of Arts  
University of California, Irvine, 2010  
Bachelor of Arts  
Rutgers University, 2005

Director: Kevin Clark, Professor  
College of Education and Human Development

Fall Semester 2015  
George Mason University  
Fairfax, VA



This work is licensed under a [creative commons attribution-noncommercial 3.0 unported license](https://creativecommons.org/licenses/by-nc/3.0/).

## Acknowledgements

I owe a very special thank you to my committee chair and advisor, Dr. Kevin Clark. His invaluable mentorship, patience, and continual support have enabled me to not only to complete this thesis, but also get my feet wet in the field of children's educational media. I would also like to thank my committee members, Dr. Anya Evmenova and Dr. M. Susan Burns, without whom this dissertation would not be complete. I thank Anya for her encouragement, feedback, advice, optimistic outlook, and willingness to offer help whenever I needed it. I am grateful to Susan for providing her time, expertise, and insightful input. I am also incredibly fortunate to have Dr. Stephanie Reich from UC Irvine as my mentor, to collaborate with her, and to learn from her throughout the years.

My heartfelt appreciation goes out to all the amazing staff and teachers at the participants' preschool. For the 6 weeks of data collection they made me feel like a part of the preschool's community. I was fascinated by their passion for child education, warmth, generosity, and enthusiasm about preschool's mission. My gratitude also goes to all the incredibly adorable participants of this study; I wish I could acknowledge each of them personally for their contributions to this project. I looked forward to seeing them and laughing with them every day of the data collection. I am extremely appreciative of my volunteer research assistants who helped with the development and validation of the materials for the study and data collection, specifically of interrater reliability and procedural reliability data.

I am very lucky to have met many amazing people through this experience who were invaluable in my completion of my graduate studies. I specifically want to thank Sophia Godkin, Lindsay Cameron, Elizabeth Rush, Dana Garfin, and Brittany Liu for their friendship, advice, and moral support.

Finally, I could not have completed graduate school without the constant support and help from my amazing family. In fact, I feel like we all went to graduate school together. I am extremely lucky to have my husband Lenik always be there by my side, providing tireless support and encouragement, and my wonderful son Daniel, who always makes me smile and is ready to "play experiment." I am grateful to my parents, Alexander and Marina Sumaroka, and my brother Dmitry, for believing in me, supporting me, and doing everything they could to further my progress.

This project was supported by the Ph.D. in Education program of George Mason University Dissertation Research Fellowship Award.

## Table of Contents

	Page
List of Tables .....	viii
List of Figures .....	ix
List of Abbreviations .....	x
Abstract .....	xi
Chapter One .....	1
Background of the Problem.....	1
Digital Media as an Educational Tool .....	2
Media for Social Good and Education .....	3
Social-Emotional Learning and Media.....	4
Theory of Mind and Media.....	5
Research-Based Educational Media .....	6
Statement of the Problem and Research Questions.....	7
Definition of Terms.....	10
Chapter Two.....	12
Media and Child Development .....	12
Learning from Digital Games.....	14
Factors that Contribute to Learning form Media.....	15
Demands of Cognitive Resources/Capacity Theory.....	18
Learning Material: ToM in Digital Media.....	21
Summary.....	22
Social-Emotional Development .....	23
Theory of Mind.....	24
Developmental Progression and Measurement .....	26
Individual Differences .....	29
Language .....	30

Training Studies.....	38
Summary.....	40
Language Practices to Inform Game Design.....	41
Elaborate Reminiscing.....	41
Syntax .....	42
Learning Mental-State Language Understanding from Exposure.....	43
Storybook Reading, Mental State Verbs, and Causal Talk .....	45
Examples .....	45
Conclusion.....	46
Chapter Three.....	48
Participants .....	48
Participant Selection Process, Protection of Human Participants, and Informed Consent .....	48
Final Sample .....	49
Study Site .....	53
Research Design.....	54
Multiple-baseline Design.....	55
Measures.....	58
Theory of Mind Developmental Scale.....	58
Measures in the Current Study .....	61
Materials.....	62
Games .....	62
Voice-overs.....	64
Independent Variable .....	65
Design of the Original Voice-overs Independent Variable .....	65
Validation of the Original Voice-overs Independent Variable.....	66
Modified Independent Variable .....	66
Procedures .....	67
Data Collection Procedures .....	68
Baseline Procedures.....	68
Voice-over Training Procedures.....	68
Voice-overs and Discussion Training Procedures.....	69
Reliability and Scoring.....	69

Procedural Reliability .....	69
Interrater Agreement.....	70
Social Validity .....	72
Data Analysis .....	72
Visual Inspection .....	73
Nonoverlap of All Pairs.....	74
Chapter Four .....	75
Diverse Desires, Diverse Beliefs, Knowledge Access Skills.....	76
Mia.....	78
Isabella.....	78
Paula .....	79
Sienna .....	80
Camilla.....	80
Emily .....	81
False Belief.....	82
Mia.....	84
Isabella.....	85
Paula .....	86
Sienna .....	86
Camilla.....	87
Emily .....	88
Social Validity.....	88
Chapter Five.....	90
Summary of the Findings .....	91
Explanation of Findings from the Perspective of ToM Development .....	92
Finding One .....	92
Finding Two .....	95
Finding Three .....	98
Explanation of Findings from the Perspective of Learning from Digital Games .....	103
Limitations .....	108
Implications and Future Directions .....	111
Appendix A. English and Spanish Recruitment Letters and Consent Forms .....	116

Appendix B. Voice-Overs (Game Scripts) .....	124
Appendix C. Description of Tasks Used in The Procedures .....	137
Appendix D. Procedural Reliability Checklists .....	141
Appendix E. Social Validity Interview Questions .....	145
References .....	147



## List of Tables

Table	Page
<i>Table 1.</i> Description of Participants.....	50
<i>Table 2.</i> Overall Means and Standard Deviations for Individual Participants .....	76

## List of Figures

Figure	Page
<i>Figure 1.</i> Logic model. ....	9
<i>Figure 2.</i> Accuracy of responses to the three tasks in DBK measure by participants across the research phases.....	77
<i>Figure 3.</i> Accuracy of responses to the two tasks in False Belief measure by participants across the research phases.....	84

## **List of Abbreviations**

Diverse Desires, Beliefs, Knowledge .....	DBK
Ecological Systems Theory.....	EST
False Belief .....	FB
NonOverlap of All Pairs .....	NAP
Socioeconomic Status .....	SES
Theory of Mind .....	ToM
Typically Developing.....	TD
Voice-overs combined with Discussion.....	VAD

## **Abstract**

### **IMPROVING PRESCHOOLERS' THEORY OF MIND SKILLS WITH DIGITAL GAMES: A TRAINING STUDY**

Mariya Nikolayev, Ph.D.

George Mason University, 2015

Dissertation Director: Dr. Kevin Clark

This single-subject research study examined functional relation between digital games enriched with voice-overs and theory of mind (ToM) when game play was either followed or not followed by a discussion focused on the game's content. The study employed multiple baseline design across participants to evaluate the effects of games with mental state language voice-overs as well as games with mental state language voice-overs combined with a follow-up discussion of children's ToM skills. ToM was assessed with two measures based on a continuous ToM assessment scale; the first measure included three tasks and targeted earlier-developing ToM skills (diverse desires, diverse beliefs, and knowledge access) and the other measure included 2 tasks that assessed later-developing ToM competency, false belief understanding. The voice-overs for the games were created based on results of research studies examining language conducive to ToM development and validated by a group of early childhood educators.

The participants were 6 typically developing children between the ages of 46 and 52 months enrolled in a preschool center serving working-class families in a suburban area of a large Mid-Atlantic state. Data were collected on children's performance in each of the three phases of the study. In baseline, children played games without voice-overs and underwent ToM assessment procedures; in the original treatment phase, participants played games with embedded voice-overs and then underwent ToM assessment procedures; finally, in the modified treatment phase, participants first played games with embedded voice-overs, then participated in the researcher-led discussion, and concluded sessions with the assessment procedures. Data analyses included visual inspection of data and calculations of NonOverlap of All Pairs (NAP).

The main findings included:

1. There was no evidence of functional relation between children's understanding that people have different desires, beliefs, and knowledge access and the mental state language voice-overs in digital games, however only 2 children showed some improvement in ToM.
2. No evidence of functional relation between children's false belief understanding and mental state language voice-overs in digital games was observed.
3. A strong evidence of functional relation between children's understanding that people have different desires, beliefs, and knowledge access and mental state language voice-overs in digital games was observed when the game play was followed by a discussion about the games. All participants earned maximum

scores in their answers regarding diverse desires, beliefs, and knowledge access questions during that phase.

4. No evidence of functional relation between children's false belief understanding and mental state language voice-overs in digital games was observed when the game play with voice-overs was followed by a discussion about the games. However, 2 children showed improvement in false belief understanding during the last treatment phase of the study.

Social validity interviews were conducted with participants, a teacher, and a social worker to determine participants' perceptions regarding usefulness and effectiveness of ToM-promoting digital games. Findings are discussed with respect to the fields of ToM development and learning from technology, study limitations, and implications and recommendations for both practical implementation and future research. Overall, results of this study indicate that the incorporation of ToM-conducive language in digital games can be beneficial for improving ToM, as it can prompt parents or teachers to engage in conversations about mental states by leaning and expanding on voice-overs found in the games.

## **Chapter One**

This study examined the functional relation between ToM skills and digital games adapted to contain ToM-enhancing voiceovers when or when not followed by a discussion about the games. The study attempted to explore how to design digital content for social-emotional learning using research literature from the field of child development.

### **Background of the Problem**

Children today are growing up in a world that is saturated with electronic media; almost three quarters of children under age 8 have used some sort of smart phone or mobile device. Many children use these devices on a daily basis, with some leading complex digital lives starting in preschool (Ito, 2009; Levine & Vaala, 2013; Rideout, 2013). Additionally, the time spent using media is increasing; children between ages 2 and 4 spend about 2 hours every day engaged with some type of digital media (Rideout, 2013). Many studies have shown that digital media permeates and shapes the contexts of a child's development in myriad ways, from contributing to cognitive, social-emotional, and physical development to influencing family dynamics and cultural values (e.g., Brooks-Gunn & Donahue, 2008; Takeuchi & Levine, 2014). Because of the ubiquity of digital media, digital media developers have the responsibility and opportunity to create

digital media around children's needs; parents and teachers must then use the media in socially responsible ways, with children's interests in mind (Radich, 2013).

### **Digital Media as an Educational Tool**

With increasing access to digital media and with new forms of digital media continually emerging, there is a growing need for designing effective educational content for different platforms. Whereas an abundance of research exists on children's engagement and learning from older forms of educational media, such as television programming and movies (M. Cohen, 2012; Kirkorian, Wartella, & Anderson, 2008; Richert, Robb, & Smith, 2011), much less is known about what factors in the newer digital platforms—such as online games, and smartphone and tablet apps—contribute to children's learning (Brooks-Gunn & Donahue, 2008; Levine & Vaala, 2013). Because digital games are extremely popular among children of all ages, researchers, educators, and policy makers (M. Cohen, 2012; Levine & Vaala, 2013) have been especially concerned with the effects of digital games on children's development. Concerns range from the limited educational value of games to potentially harmful effects, such as aggression and fear (Blumberg & Fisch, 2013; M. Cohen, 2012; Levine & Vaala, 2013). Although studies lend credence to some of the aforementioned concerns, researchers point out that digital technology is not homogeneous, and most often it is content rather than media platform that matters in learning outcomes (Glaubke, 2007; Jordan & Romer, 2014; Levine & Vaala, 2013). For example, although violent game exposure and play were found to be associated with aggressive behaviors and attention problems in children and adolescents (Anderson et al., 2010; Hastings et al., 2009), mounting evidence



suggests that game play benefits cognitive, social-emotional development, and academic skills (e.g., Bavelier, Green, & Seidenberg, 2013; Fisch, Lesh, Motoki, Crespo, & Melfi, 2011; Mares & Woodard, 2005). Although digital games may appear to be a promising platform for education, designing effective games for learning has proven difficult. The biggest challenge is to find ways to capitalize on the instructional potential of digital games without losing the engaging entertainment value, as well as to ensure commercial success, creativity, and innovation (M. Cohen, 2012; Levine & Vaala, 2013; Radich, 2013). Another challenge is to ensure that content and curriculum are age appropriate and that the skills being taught are transferrable (Blumberg, Altschuler, Almonte, & Mileaf, 2013; Jordan & Romer, 2014). Finally, there is a challenge to identify the interactions between different media platforms and children's learning and to tailor the content to fit the game medium (Radich, 2013).

### **Media for Social Good and Education**

Media have been used to address a variety of needs of children in vulnerable circumstances for many years. To date, the leader in such initiatives is Sesame Workshop, which continuously researches ways to improve children's lives across the globe (Lemish, 2014). For example, among its many programs, Sesame Workshop created a special series aimed at bringing together Israeli and Palestinian preschoolers, Catholic and Protestant children of Northern Ireland, and multiethnic children of Macedonia. In addition, it also recently implemented a large media-based program to help children from military families cope with their unique challenges and stressors (D. Cohen, Betancourt, & Kotler, 2014; Lemish, 2014). Although many of the initiatives

have tackled broad social issues, similar interventions can be conducted for smaller, more closely defined problems, for example, helping low-socioeconomic status (SES) children improve specific skill areas, such as language development or social-emotional learning. Results of such interventions can then be incorporated into larger programs or used in individual games that target specific skills. At this point, many game and app designers are guided by their own, often flawed, understanding of how children learn from media, and only few use research-based approach (Hirsh-Pasek et al., 2015).

### **Social-Emotional Learning and Media**

Currently, social-emotional learning is a prime target of many educational media-based programs, including large networks, such as PBS (Wilson, 2008), in addition to hundreds of independent mobile apps producers. Although developmental psychologists and media researchers have studied young children's social-emotional learning from television, albeit not extensively, there is some evidence that preschoolers can improve in emotional knowledge from watching Sesame Street (Calvert & Kotler, 2003; Weiss & Wilson, 1996; Wilson, 2008), develop emotional attachment and relationships with favorite media characters (Calvert & Richards, 2014), and learn prosocial behaviors from prosocial programs (Mares & Woodard, 2005; Sprafkin, Liebert, & Poulos, 1975).

At the same time, the extent of the opportunity for children to learn social-emotional skills from digital games is unclear. A recent content analysis indicated that although online games for preschoolers teach skills from the domain of social-emotional development, they tend to focus on a limited number of skills and overlook others (Nikolayev, Clark, & Reich, 2015). Even when the skills are targeted, whether children

actually learn them is often unclear as games are seldom evaluated by researchers (Wartella & Lauricella, 2014).

### **Theory of Mind and Media**

Among the skills from the social-emotional domain rarely included in educational games for preschoolers is theory of mind (ToM; Nikolayev et al., 2015), which refers to the ability to understand mental states of self and others (Wellman, Cross, & Watson, 2001). The majority of typically developing (TD) children acquire false belief understanding (an important indicator of ToM understanding) around 5 years of age primarily through specific socio-linguistic experiences (e.g., Slaughter, Peterson, & Mackintosh, 2007). Some children, however, such as preschoolers from low-income backgrounds, often lack exposure to situations and language promoting ToM and consequently develop ToM skills later than their peers (e.g., Dessen & de Hollanda Souza, 2014). Lack of age-appropriate ToM skills often contributes to various negative developmental outcomes, such as lack of friendships (Fink, Begeer, Peterson, Slaughter, & Rosnay, 2015) and poor academic achievement (Blair & Razza, 2007). Researchers have shown that ToM can be trained by introducing children to the language conducive to ToM development; however, almost all of the training and intervention studies to date were delivered via live instruction (e.g., Melot & Angeard, 2003; Ornaghi, Brockmeier, & Gavazzi, 2011; Slaughter & Gopnik, 1996). Considering the widespread accessibility of digital media devices in everyday life, adapting existing ToM training programs to be used in educational digital games for TD children might help support ToM skills development in preschool children.

## **Research-Based Educational Media**

In the past decade, empirical and theoretical research in the areas of cognitive, physical, and social-emotional development of young children has increased society's understanding of how children learn, gain social-emotional skills, and construct knowledge (M. Cohen, 2012). These advances, which have transformed early childhood education, are in the initial phases of being translated and applied to media development, including game design (M. Cohen, 2012; Hirsh-Pasek et al., 2015). Although research in developmental psychology offers many insights into the changing needs and demands of a child's development (Blumberg & Fisch, 2013; Revelle, 2013), to date, this resource has received limited attention from digital game creators (Revelle, 2013).

Recently, in an effort to ensure quality research-based media development, the Fred Rogers Foundation hosted roundtable discussions that involved experts across a broad range of fields, including child development researchers, media producers, educators, and child advocates. Together they outlined recommendations of ways to recognize and create quality media. These recommendations were grounded in the principles of early child development and education and were designed for parents, educators, and media producers. According to discussion participants, more work needs to be done to identify the educational affordances of different media platforms and how they interact with learning (Fred Rogers Center for Early Learning and Children's Media at Saint Vincent College, 2012).

Sesame Workshop's Cycle of Content Model is widely recognized as the epitome of successful collaboration between educators, researchers, and producers. Under the

Cycle of Content Model, program development begins via advisory meetings of experts in the fields of child development, early childhood education, and mental health with producers, content developers, game and designers. Once educational or intervention goals have been clarified and established, content design begins, followed by formative research, where drafts of various materials are presented to target groups for their response. Material is then revised based on the responses of target groups, and production is concluded with summative research on the effectiveness of the program (D. Cohen et al., 2014; Lemish, 2014). Although it is often difficult to evaluate the effectiveness of the programs due to limited resources and the large scale of the initiatives, those programs that have been evaluated provide insight into media's vast benefits (Lemish, 2014).

Unfortunately, at this point, many game and app designers are guided by their own, limited understanding of how children learn from media, and very few of them use research-based approaches to content development (Hirsh-Pasek et al., 2015). Therefore, it is not surprising that most of children's media products on the market demonstrate very modest if any impact on learning (Hirsh-Pasek et al., 2015; Robb, Richert, & Wartella, 2009). Potentially, if provided with concrete applied recommendations, designers would be more likely to incorporate results from research studies on children's learning and thus increase the likelihood of children's effective learning from games.

### **Statement of the Problem and Research Questions**

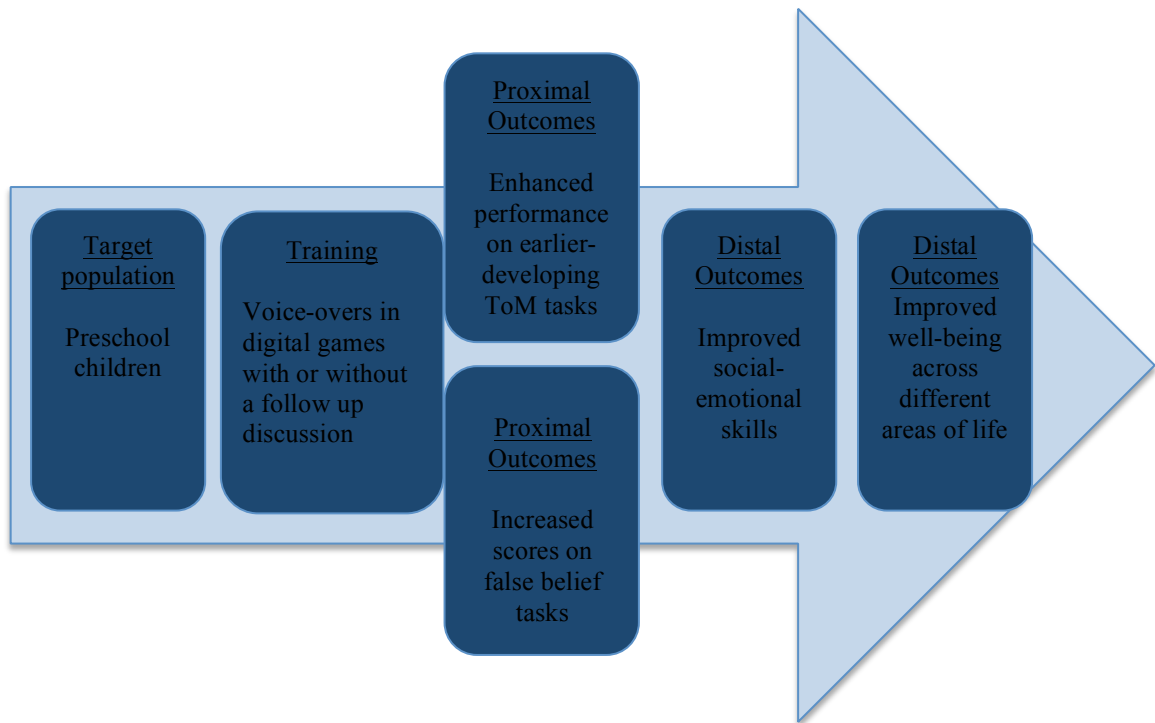
Despite the growing access to high-speed Internet, mobile devices, and screen media across SES backgrounds, young children's social-emotional learning from new

media, especially digital games, remains poorly understood. Although research demonstrates that preschoolers can improve social-emotional skills from watching well-crafted, developmentally appropriate TV programs and films, such as Sesame Street, little information exists on how effective games are at teaching ToM skills and what factors contribute to the successful design of such games.

The need for research-based design of games as well as further research into the effectiveness of educational games that target specific skills of various populations clearly exists. In the current study, the researcher used the results of peer-reviewed training and correlational studies on language and TD children's ToM skills to create voice-overs for several existing games. These voice-overs, which targeted language-related ToM skills, were added to existing games for preschoolers. Preschool children were studied as they played these games, and any changes in their ToM skills were evaluated using a single-subject research design. In consideration of the growing body of literature highlighting benefits of parental co-engagement for learning from digital games, a portion of all treatment sessions were also followed up by a researcher-led discussions that focused on the mental-states and behaviors presented in the games.

The rationale for the study is depicted in the logic model (Figure 1), which describes the target population (preschoolers), original and modified treatment phases ([a] voice-overs created with ToM-promoting language in digital games and [b] the voice-overs created with ToM-promoting language in digital games followed by a discussion about games); proximal outcomes (enhanced performance on earlier-developing ToM tasks and increased scores on false belief tasks), and distal outcomes

(improved social-emotional skills and overall well-being) that guided the design of this study. The main goal of the study was to explore whether there is a functional relation between children's understanding that people have different desires, beliefs, and knowledge (early-developing ToM skills) as well as false belief (higher-level ToM skills) and mental states-focused voice-overs in digital games when game play is either combined or not with a follow-up discussion.



*Figure 1.* Logic model.

The study attempted to answer the following questions:

RQ1: Is there a functional relation between children's understanding that people have different desires, beliefs, and knowledge sources and voice-overs in digital games?

RQ1a: Does children's understanding that people have different desires, beliefs, and knowledge sources increase when the digital games with voice-overs are followed by a discussion about the games?

RQ2: Is there a functional relation between children's false belief understanding and voice-overs in digital games?

RQ 2a: Does children's false belief understanding increase when digital games with voice-overs are followed by discussion about the games?

### **Definition of Terms**

*Digital Games* – In this study, this term is used to refer to any digital game, regardless of the media platform, for example, a computer; website; a console, such as an Xbox; or an app on a screen device, such as a tablet, phablet, or smartphone. All digital games used in the experiment were app games downloaded from the app store.

*Developmental Science* – This area of psychology studies mechanisms, correlates, and processes of human development. In this study, Developmental Science is used interchangeably with Child Development and Developmental Psychology.

*Preschoolers* – In this study, the term refers to children between the ages of 3 and 5 who have not yet started school.



*Social-Emotional Development or Social-Emotional Learning* – These interchangeable terms both refer to a multidimensional construct that includes a number of inter- and intra-personal processes related to the acquisition of fundamental social-emotional competencies, such as the ability to understand, recognize, and label one's own and others' emotions; express, control, and regulate one's own feelings and behaviors appropriately; establish, maintain, and manage social relationships effectively; and make responsible choices and decisions (Hoffman, 2009).

*Voice-overs:* In this study voice-overs refer to the verbal input in game narration, feedback regarding participants' actions, or conversations between game characters. Voice-overs for this study were created using previous research findings on different linguistic elements known to promote ToM skills.

## **Chapter Two**

This chapter is divided into three sections. The first section presents an overview of the literature on the effects of media on child development as well as individual, media-specific, and contextual factors that contribute to children's effective learning from digital games. The second section presents an overview of the literature on social-emotional development, and specifically on ToM development and its correlates. Studies discussed in those sections shed light on different linguistic factors that contribute to ToM development. The third and final section relates research on language-based ToM interventions to digital game design.

### **Media and Child Development**

Omnipresence of digital media in everyday life changes childhood experiences in many ways (Jordan & Romer, 2014) and shapes children's developmental trajectories. Thus, the study of digital media use is critical to understanding the impacts of digital media on development, and informs design of digital technology for positive development.

Takeuchi and Levine (2014) examined changes caused by media in children's environmental contexts through the lens of Urie Bronfenbrenner's ecological systems theory (EST). Per this framework, a child's development happens within five interrelated, nested environmental contexts. Takeuchi and Levine described how the effects of media

use on developmental trajectories are mediated by specific factors within each context. The chronosystem refers to historical context for development, and for current children this context is the digital age. Inside the microsystem, i.e., the child's immediate environment, parents determine media access and practices, make digital media purchases, and model media use, whereas teachers decide whether to introduce media in curriculum. Depending on these decisions, children's online gaming can promote discussions on online activities and foster connections among children, parents, siblings, and relatives (Reich, Korobkova, Black, & Sumaroka, 2012). Conversely, it may hinder family relations to have family members engage in excessive media use and multitasking (Takeuchi & Levine, 2014). Among exosystem (the context in which child is not involved directly, such as parental workplace) factors, family income and social class determine children's access to different forms of digital media (Rideout, 2013), and often shape parental beliefs about appropriate media practices for children (Klopfer, Osterweil, & Salen, 2009). The macrosystem (societal and cultural context) includes factors that form the public's attitude toward media use, such as news stories and policies that promote (or do not promote) technology use in schools (Takeuchi & Levine, 2014). The mesosystem describes various interactions among children's environments, and its factors determine how much the beneficial and harmful effects of media exposure would carry over to other settings. Recognition of the roles of different environments on media use can help identify the roles of different factors in learning from media and inform effective media design.

## **Learning from Digital Games**

As the proliferation of digital game continues, so does educational game production; interest in educational gaming surged in the 2000s (Sherry, 2013a), resulting in thousands of games and apps claiming educational benefits (Wartella, 2015). Emergence of new technology comes with promises and high expectations of benefits for learning and development (Wartella & Robb, 2007). For example, the Global Child Development Steering Group (Engle et al., 2011) named educational media a promising method to promote early child development and address at-risk populations, and school districts across the country have invested millions of dollars into new technologies (Blackwell, Lauricella, & Wartella, 2014). Additionally, game apps for toddlers and preschools attract huge interest from parents (Hirsh-Pasek et al., 2015). The appeal of digital games for education is clear; they are engaging and interactive, can be adapted to different skill levels, and can be used for individual study through repetition and discovery (Sherry, 2013a). Yet, for the most part, children's learning from digital games, including which skills are enhanced by game play and which types of learning are happening during game play (Blumberg, 2014), is not well understood. In addition to digital games being relatively new and, thus, understudied (Subrahmanyam & Smahel, 2010), the majority of existing research on learning from digital games focuses on older teenagers and young adults (Blumberg, 2014). That said, although there are unique challenges in understanding learning from playing, researchers find that much of the existing research on children's use of older media (e.g., television), as well as general learning principles derived from the relevant disciplines (Wartella, 2015), such as child

development or cognitive science, is applicable to educational game design. Hirsh-Pasek et al. (2005), for example, argued that educational effectiveness of children's apps can be informed by the science of learning (an interdisciplinary field that draws from the fields of child development, linguistics, neuroscience, and others).

### **Factors that Contribute to Learning from Media**

Guernsey's (2007) frequently employed model for studying media's effects on children considers the three Cs: content, context, and child. By accounting for various needs and different environments of children, this approach allows for the evaluation and design of quality digital media, including games. The following sections offer descriptions of content, context, and child-specific factors that are known to mediate learning from media. As much as possible, examples are provided from research on children and games, and when these are not available, examples from television are used.

**Child.** Among child-specific factors that contribute to the design and evaluation of media are gender, developmental stage, SES, individual abilities and needs, aptitudes, and interests (Radich, 2013). The same game may not appeal to all children or affect all children in the same way (Takeuchi & Levine, 2014). For example, younger children are less interested in and capable of understanding games with complex storylines and character attributes than adolescents (Greenberg, Sherry, Lachlan, Lucas, & Holmstrom, 2010), girls prefer more realistic game features whereas boys do not have such a preference (Kafai, 1994), and children from low-income families are more attracted to action-based games than middle-class children (Andrews, 2008) and tend to experience

more negative effects of media exposure than their peers from middle-class families (Duch et al., 2013; Lerner & Barr, 2014).

**Context.** As described by Takeuchi and Levine (2014), effects of media on children are mediated by factors of multiple interrelated environments. Much of what children learn from media is interpreted through immediate contexts, both formal (e.g., school) and informal (e.g., playground or adults at home; Hirsh-Pasek et al., 2015). Researchers consider that environments most beneficial to children's learning are those that are flexible and provide scaffolding and opportunities for exploration (Darling-Hammond, 2008). Meaningful parental engagement in children's media use is one of the contexts conducive to effective learning.

**Child-parent media co-engagement.** Mounting evidence has documented that young children's learning from media is enhanced by parental involvement (Nathanson, 2001; Reiser, Tessmer, & Phelps, 1984; Takeuchi & Stevens, 2011). For example, parents were found to help toddlers transfer learning from digital devices to real life by scaffolding children's symbolic thinking skills during joint engagement with touchscreen devices (Zack, 2010). In low-income immigrant communities, maternal verbal interactions with infants during TV exposure were found to mitigate negative cognitive and language outcomes in toddlerhood (Mendelsohn et al., 2010). Judging by the numbers in national surveys, joint parent-child media engagement is not widespread, especially in families with young children. For example, in a nationally representative survey, only 34% of parents of children between 2 and 5 years old indicated that they co-view television with their children; 36% join in when children are using a computer or

smartphone to reach internet content, and 26% use iPads or similar touchscreen devices along with their children (Wartella, Rideout, Lauricella & Connell, 2013). However, exact activities reported during joint media engagement are unknown, thus it is hard to conclude whether all types of co-viewing or co-playing are indeed beneficial. Even less is known about how to encourage or support parents' co-viewing/co-playing. Information is needed regarding the type of content that attracts the most parental involvement, whether parents interact with children during joint media engagement, and, if so, what type of interactions occur between parents and children (Rideout, 2014). Additionally, most research to date on media co-engagement examines co-viewing of television, but not joint gaming (Takeuchi & Levine, 2014) or the role parents have in children's learning from games. Judging by parental reports of children between 2-5 years of age, 41% of those who own a mobile device report using it to occupy children when they are doing chores or eating at a restaurant (Wartella et al., 2013). Thus, it appears that co-engagement with smart device is not routine, but rather an occasional activity.

**Content.** The nature of content is paramount to the study of media effects on children, more so than frequency or duration of media exposure. For example, curriculum-based educational programming promotes children's development and school performance, whereas violent and pure entertainment content is associated with poor cognitive and academic achievement (Kirkorian et al., 2008). The effects of child-directed media content extends to health and physical development; specifically, different types content were found to mediate the association between preschoolers' media use and sleep problems (Garrison & Christakis, 2012), as well as relationships between media use

and subsequent attention problems (Zimmerman & Christakis, 2007). Simple substitution of educational programs for entertaining and violent ones in the homes of preschoolers was found to decrease the number of sleep problems in the experimental group of children as compared to the control group (Garrison & Christakis, 2012). Despite unanimous recognition of the critical role of content in child-media interactions among researchers, the need remains to further examine which elements of content are beneficial for children's well-being and which are not, and which specific aspects are responsible for learning different types of educational material (e.g., literacy, mathematics, physical, and social-emotional development). Since ToM skills from digital games are the focus of this study, research pertaining to this type of content is discussed in addition to research on different features of content beneficial to learning.

### **Demands of Cognitive Resources/Capacity Theory**

The capacity theory proposed by Fisch (2000) describes how children comprehend educational content in television programs and allows for maximizing educational benefits. It postulates that people's—and, in the case of educational television for preschoolers, children's—working memory capacity necessary for processing information is limited, and excessive demands on cognitive resources impede content comprehension. Educational television requires children to distribute cognitive resources between two simultaneous components: narrative and educational content. When these components are closely interwoven, they draw on the same resources and strengthen comprehension of educational content. However, when these two components are tangential, they compete for the working memory resources and impair



comprehension of educational content. Although Fisch (2000) designed his theory for educational television, it can potentially be extended to digital games. For example, better learning is known to occur when children's attention is on the task, and they are actively engaged in the task. If, simultaneously, children are exposed to other game features unrelated to the task or story, such as music, their attention drifts and inhibits learning (Hirsh-Pasek et al., 2015).

**Repetition.** To keep children engaged, some educational content designers include different features, changes in scenes and screens, and tasks. However, this is counterproductive and inhibits learning, as young children need repeated exposure to the same content for maximum comprehension, preferably embedded in different contexts (Hirsh-Pasek et al., 2015). This need for repetition stems from young children's limited processing abilities and underdeveloped symbolic understanding. When presented with information through media rather than real-life, children have trouble applying the information seen on the screen to the real world, an effect known as transfer-deficit (Lerner & Barr, 2014). Researchers, however, find that repeated exposure to the same screen content mitigates transfer-deficit and increases comprehension in children between ages 1-5 years (Kirkorian et al., 2008; Lerner & Barr, 2014). Specifically, children who repeatedly see the same actions on videos or read about them in books are more likely to imitate those actions, and as a result, comprehend the material (Lerner & Barr, 2014). For example, in one experiment, a group of children watched a single episode of "Blues Clues" once, while another group watched the same episode five times. Children who watched the episode five times demonstrated better comprehension of the show content

than children who watched it once (Crawley, Anderson, Wilder, Williams, & Santomero, 1999). In a similar study, researchers showed one group of preschoolers an animated film *101 Dalmatians*: 2 once, as opposed to five times to another group of preschoolers. Interestingly, in comparison to the group that watched the film once, children in the repeated exposure group demonstrated better comprehension only of the explicit content, but not implicit information that had to be inferred from multiple scenes (Skouteris et al., 2007).

**Interactivity.** Children learn best when they are engaged with learning material in a meaningful, mind-on fashion and can interact socially with others about the content (Christakis, 2014; Hirsh-Pasek et al., 2015; Ornaghi et al., 2011). It appears that interactive features of digital games allow for such engagement (Lauricella, Pempek, Barr, & Calvert, 2010) and indeed, the more actively children interact with media, the greater their learning (Lerner & Barr, 2014). Interactivity can take different forms. Feedback provided by a digital game or a character addressing the player directly or content that requires parental participation all promote social engagement. Interactive features that require meaningful action, such as tapping on a screen or shaking a tablet in response to a task, are known to foster meaningful engagement. Manipulation of symbolic material helps children to stay focused on the task and be engaged mentally (Hirsh-Pasek et al., 2015). It appears, however, that there is an optimal amount of interactivity. Too much social engagement by a video character distracts children from educational content and impedes learning (Nussenbaum & Amso, 2015) and so do interactive content features unrelated to the learning goal (Hirsh-Pasek et al., 2015).

## **Learning Material: ToM in Digital Media**

Whereas many digital games and tablet and phone applications claim to teach children social-emotional skills, the educational effectiveness is never really, if ever, assessed. What is known is that in teaching social-emotional skills, designers often do not capitalize on beneficial interactive features of games, choosing instead to model social skills similar to television programming. Additionally, some skills appear to be very popular across different games, whereas others are systematically overlooked (Nikolayev et al., 2015). Interestingly, ToM-related skills are among those that are rarely targeted. It could be that designers are not equipped with knowledge on ways to incorporate ToM tasks in game content. Relationships between digital media and ToM appear to be understudied across platforms; the few existing studies focus on associations between video content and ToM skills, and no studies (to the researcher's knowledge) examined digital game content in relation to ToM development. Furthermore, the two existing studies yielded conflicting results. Nathanson, Sharp, Aladé, Rasmussen and Christy (2013), for example, found a negative association between background television exposure and having a TV in a child's bedroom and ToM skills; however, purposeful watching that involved parent-child discussion about the content was positively correlated with children's performance on ToM tasks. In a different study, Mar, Tackett, and Moore (2010), found that children who had more exposure to storybooks and films (as measured by recognition tests completed by parents) performed better on ToM tasks than those exposed to children's TV programming. Potentially, consistent with other research, joint child-parent involvement is the driving factor of these results; films and

books are media that promote joint parent-child engagement and provide many opportunities for discussions of mental states, whereas children's TV watching is often a solitary activity that does not allow for such communication (Mar et al., 2010; Nathanson & Fries, 2014). Conversely, other research indicates that even in the absence of parental involvement, child-directed videos can provide opportunities for children to improve ToM (Gola, 2012), and other social-emotional outcomes (Coates, Pusser, & Goodman, 1976). Therefore, it could be that films present more opportunities for characters to discuss mental states and include language necessary for ToM development than TV programs do. Both explanations may help with the design of games that teach ToM skills; the designers might want to capitalize on interactivity features promoting social engagement and enrich games with different types of mental-state language.

## **Summary**

As the proliferation of online educational games, apps, and devices continues, a need arises for high quality educational content. Taken together, the literature demonstrates that many different factors—such as immediate and distant environments, parental contribution, type of content, and child's characteristics—as well as interactions between them, need to be considered in order to understand children's experiences and learning from digital media. It appears that when research on child development is used, it has successfully informed the design of effective educational television for young children. Now that this connection has been supported, it can be extended to newer technologies like digital games. Evidently, features of digital games, if used properly, provide a number of opportunities for effective integration of educational content. For

example, there are affordances for social engagement, such as feedback (which makes children active agents of the game), engaging nature (which promotes frequency of play and staying on-task), and potential to adapt content to different needs and abilities. The next step is to use these opportunities to incorporate material that targets specific learning needs. The following section will identify and describe such material by reviewing research on children's social-emotional development and specifically the development of ToM abilities.

### **Social-Emotional Development**

Social-emotional development refers to a number of inter- and intra-personal processes that contribute to children's emerging capabilities to experience, recognize, express, and regulate various emotions; build and maintain relationships with peers and adults; and explore and learn from their environment and various social experiences (D. Cohen, Onunaku, Clothier, & Poppe, 2005; Hoffman, 2009). Early social-emotional learning can be an indicator of short-term and long-term achievements and problems, as it underlies and contributes to individuals' behaviors and interactions with the world throughout the course of their lives (D. Cohen et al., 2005). For example, children's positive representations of self, enhanced emotional knowledge, and regulatory abilities predict successful child-teacher interactions and peer inclusion (Denham, McKinley, Couchoud, & Holt, 1990; Zins, Bloodworth, Weissberg, & Walberg, 2007); advanced social-emotional skills at the beginning of kindergarten are related to faster adjustment to the new environment, positive assessment of school experiences, and high academic achievement (Blair, Denham, Kochanoff, & Whipple, 2004). Moreover, children's social-

emotional skills at the age of 8 have been found to predict quality and intactness of marriage at the age of 36 years (Kinnunen & Pulkkinen, 2003). In contrast, children who are low in emotional knowledge are often aggressive towards peers and are less liked by them (Arsenio, Cooperman, & Lover, 2000; Denham et al., 2002). Young children's deficits in social-emotional knowledge also can contribute to a lack of literacy achievement (Miles & Stipek, 2006), which is correlated with a risk for psychopathology (Carter, Briggs-Gowan, & Davis, 2004) and delinquency (Haapasalo & Tremblay, 1994) later in life.

### **Theory of Mind**

Theory of Mind (ToM), one of the components of social-emotional and cognitive development, is considered to be paramount for navigating everyday social relationships (Hughes & Leekam, 2004). ToM is a multidimensional concept; overall, it refers to children's developing abilities to attribute mental states to self and others (Astington, 2003). More specifically, ToM enables children to recognize feelings, intentions, beliefs, and desires, which allows them to understand, predict, and explain the behaviors of the self and others (Astington, 2003; Keenan, 2003). Some researchers refer to ToM skills as *mindreading* (e.g., Apperly, 2010; Southgate, 2013), understanding the psychological world (e.g., Wellman, 2002), or mentalistic understanding (e.g., Flavell, 2004).

The development of ToM skills correlates with children's performance and abilities in other areas and underlies children's social behaviors and functioning across different areas of life. Young children with a better understanding of mental states begin to understand humor and sarcasm earlier than peers (e.g., De Groot, Kaplan, Rosenblatt,

Dews, & Winner, 1995), show higher sensitivity to criticism (Cutting & Dunn, 2002), perform better on emotional understanding measures (Weimer & Guajardo, 2005), and engage in more sophisticated pretend play than their peers (Astington & Jenkins, 1995; Taylor & Carlson, 1997). Understanding humor could make children more likable, sociable, and skillful in social situations, whereas sensitivity to criticism could help them to adapt and modify their behavior, and sophisticated pretend play could allow for rehearsing a variety of social situations. In comparison to children with less advanced skills, children with better ToM skills are more socially adept (Jenkins & Astington, 2000), better at social interactions and developing higher quality friendships (Maguire & Dunn, 1997), more popular with peers (Slaughter, Dennis, & Pritchard, 2002), and more favorably perceived by teachers, as indicated by teachers' ratings on social competence (Watson, Nixon, Wilson, & Capage, 1999; Weimer & Guajardo, 2005). In contrast, delays in ToM skills development often negatively affect the quality of children's social functioning because children with less advanced skills often misunderstand intentions and social cues and also fail to predict and accurately interpret the behavior of others (Seidenfeld, Johnson, Cavadel, & Izard, 2014).

Individual differences in ToM skills appear to be sustained over time as demonstrated by a series of longitudinal studies on young children's ToM skills and later social school adjustment and academic achievement. A study by Caputi, Lecce, Pagnin, and Banerjee (2012) followed a cohort of children starting at ages 5 through 7 years old. Each year, researchers assessed children's ToM skills, prosocial behaviors, and language ability, as well as children's popularity among peers at ages 6 and 7 years. Study findings

revealed that individual differences in children's ToM at age 5 predicted later prosocial behaviors. In turn, children's prosocial behaviors at age 6 significantly predicted later peer relationships. Thus, children with better ToM skills at age 5 were more popular among peers at age 7. In a similar longitudinal study, children who had poor ToM understanding at the age of 5 had trouble making and sustaining friends and remained friendless at the age of 7 (Fink et al., 2015). Early ToM also indirectly contributes to long-term school achievement; children's ToM skills at age 5 were associated with their sensitivity to teachers' criticism, which in turn, predicted academic achievement at age 10 (Lecce, Caputi, & Pagnin, 2014).

### **Developmental Progression and Measurement**

People begin learning to understand the intentions, desires, thoughts, and hopes of others from birth and continue doing so well into adolescence (Wellman & Peterson, 2013). In learning about mental states of others, TD children across the world follow a common sequence of skills acquisition, with early abilities serving as precursors for later skills (Sabbagh, Xu, Carlson, Moses, & Lee, 2006; Wellman & Liu, 2004). Although it is impossible to establish a specific age of emergence of ToM skills, a large body of research indicates an approximate timeline of ToM development.

ToM skills begin to emerge with infants seeing others as intentional agents and by showing joint attention behaviors (Astington, 2001; Pyers & De Villiers, 2013). By 18 months old, toddlers perceive behaviors as being goal-oriented, and use their observation of behaviors and goals to learn about people and environments (Meltzoff, 1995; Woodward, 2005). By age 2, children recognize their own desires and link them with



their behaviors, and they recognize that people's behaviors are driven by desires (Wellman, 1993). The most rapid gains in ToM skills happen between ages 3 and 5. At approximately age 3, children clearly distinguish between the mental and physical world (Astington, 2001; Baron-Cohen, 2001) and use *mental verbs* to describe different states of mind. Most children also understand that the brain allows mental activities, such as dreaming or thinking, and some may know that the brain is responsible for executing physical activities (Wellman & Estes, 1987). At that age, children are also able to grasp the *seeing-leads-to-knowing* concept and begin to understand and experiment with deception (Baron-Cohen, 2001). Finally, at around 4 years of age, children begin to understand that people's actions are guided by invisible mental states, such as beliefs and perceptions, regardless of whether these beliefs and perceptions are correct (Wellman et al., 2001). By age 5, the vast majority of TD children demonstrate false-belief understanding, that is, the idea that someone may have a misconception based on his/her limited knowledge and the realization that thoughts may be false (Astington, 2001; Repacholi & Gopnik, 1997). False-belief understanding marks mastery of first-order (i.e., as they involve a single person's mental states) ToM skills (Baron-Cohen, 2001). The development of ToM does not stop at age 5; second-order ToM abilities are acquired in kindergarten and involve understanding a person's belief about another's belief about reality (e.g., holding a belief about what Tim thinks Johnny knows) and third-order ToM (e.g., holding a belief about what Tim thinks Johnny knows about what Anna thinks about reality).

For many years the key measure of ToM mastery was the false belief task, which assesses children's ability to attribute a mistaken belief to an agent. First developed by Wimmer and Perner (1983) and modified by Baron-Cohen, Leslie, and Frith (1985), the task is also known as the Sally-Anne test. In the classic version of the test, a researcher presents a child with a short scenario in which a doll, Sally, hides an object (e.g., a marble) in a basket and leaves the room. In her absence, another doll, Annie, takes the marble and places it in her box. Sally then returns to the scene, and the child is asked to predict where she will look for the marble. To pass the test, children must understand that someone may have a misconception based on his/her limited knowledge and infer that Sally would look for the marble in the basket. Most children between 4 and 5 years of age are able to pass this task.

Although false belief understanding is still considered to be fundamental for children's abilities to navigate the social world, it appears that the broad implementation of the false belief test in early research limited the scope of studies to investigating primarily higher-complexity ToM skills (Hughes & Leekam, 2004). As a result, earlier-developing ToM components and developmental progression in ToM were understudied (Bloom & German, 2000; Hughes & Leekam, 2004). Currently, most researchers in the field adhere to a broader conceptual model of ToM that embodies the multi-component nature of the ability that unfolds over time as a child matures (Hughes & Leekam, 2004).

In 2004, Wellman and Liu developed and validated a comprehensive measure of ToM development that closely maps common developmental progression of ToM skills. In this measure, tasks are sequenced in order of increasing conceptual complexity. In the

first task, Diverse Desires, children must demonstrate an understanding that people might have different desires regarding the same object or situation. In the second task, Diverse Beliefs, children must demonstrate the understanding that people can hold different beliefs about the same thing or event. In the third task, Knowledge Access, children must correctly judge the knowledge of people who did not have access to the same information available to the children. Finally, the two last tasks assess false belief understanding. These tasks are of a similar order of complexity; in the Contents False Belief children must judge another person's false belief and in the fifth and final task, the Explicit False Belief task, children must predict agent actions given the agent's incorrect belief. Comprehensive data from different studies (Wellman, Fang, & Peterson, 2011) provide insights into average ages at which typically-developing children in Western societies correctly answer each question in the progression: diverse desires at 44 months (3.66 years); diverse beliefs at 46 months (3.84 years); knowledge access at 53.4 months (4.45 years) ; and false belief at 57 months (4.77).

### **Individual Differences**

Although most TD children go through the same sequence of acquiring ToM skills, demonstrating roughly the same level of false belief understanding by the end of preschool (Wellman & Peterson, 2013), the timing and rate of development, conceptual elaboration, and the degree to which children apply the skills in social situations vary among individuals (Cutting & Dunn, 1999; Keenan, 2003; Wellman et al., 2001). Both contextual and cognitive factors were found to contribute to individual differences in ToM skills. Among cognitive factors are executive function and especially inhibitory

control (e.g., Carlson & Moses, 2001; Hughes, 1998; Perner, Lang, & Kloo, 2002), security of attachment to primary caregiver (e.g., Meins, Fernyhough, Russell, & Clark-Carter, 1998), working memory (e.g., Keenan, Olson, & Marini, 1998), and children's own language competence (e.g., De Villiers & Pyers, 2002). Among primary social factors contributing to children's ToM development are family characteristics, such as family structure; number of siblings and their constellation (e.g. McAlister & Peterson, 2007); family demographics, especially SES (e.g., Cole & Mitchell, 2000; Pears & Moses, 2003); maternal language; and values of individualistic or collectivistic cultures (Shahaeian, Peterson, Slaughter, & Wellman, 2011).

Since this study was designed to incorporate findings from ToM research into digital games, a larger focus is given to the associations between ToM skills and factors that can be adapted to be used with digital games. Thus, literature on contributions of different linguistic elements and social contexts is reviewed in more detail than other factors that are not relevant to learning from digital games.

## **Language**

One of the major predictor of children's ToM development is language. Since language by itself is a very broad term, researchers distinguish between two interrelated concepts: socio-linguistic environment and a child's own linguistic abilities (Astington & Baird, 2005a). The concept of socio-linguistic environment is based on the notion that language needed for ToM is facilitated by a child's social experiences, such as the content of conversations between parents and children, books that are read to children, frequency of conversations that include utterances shown to promote ToM skills, and

content of conversations overheard by children (Astington & Baird, 2005a; Ruffman, 2014). The socio-linguistic environment is interwoven with other contextual factors, such as family structure and demographics. A child's own abilities and knowledge refer to mastery of specific language components, e.g., vocabulary, syntax, and pragmatics. The socio-linguistic environment and children's own language are closely related, and contribute both jointly and independently to ToM development (Astington & Baird, 2005a).

**Social contexts and ToM.** Family is one of the major social contexts for young children. Thus, it is not surprising that a number of factors pertaining to family characteristics contribute to children's ToM development. First is family size; it appears that being surrounded by other people greatly benefits children's ToM development (Carpendale & Lewis, 2004; Jenkins & Astington, 1996). Researchers find that children who have extended family members or several generations of family members living in the same household demonstrate accelerated development of ToM skills (Lewis, Freeman, Kyriakidou, Maridaki-Kassotaki, & Berridge 1996). This may be due to the fact that children get to participate in or observe more social interactions that involve false belief situations or conversations loaded with mental state verbs (e.g., Jenkins & Astington, 1996; McAlister & Peterson, 2007).

Not only family size but also family structure affect ToM skills; across different studies, children with older siblings consistently performed better on false belief tasks than children without siblings (Hughes & Ensor, 2005; Jenkins & Astington, 1996; McAlister & Peterson, 2012; Perner, Ruffman, & Leekam, 1994). According to

McAlister and Peterson (2007), siblings, especially those close in age, often provide a more developmentally appropriate, child-like context in which there are more instances of false beliefs that need to be addressed, conflict negotiations that require perspective taking and mentalistic explanations, and pretend play that requires role taking. Ruffman (2014) suggested that both parents and siblings promote children's implicit and explicit learning about mental states by turning children's attention to patterns of behaviors, introducing mental state vocabulary, and explaining connections between mental states and underlying behaviors.

Family demographics are another important environmental factor in children's ToM. Studies consistently find that children from low-income families lag behind their peers from middle-class families in the acquisition of ToM skills (e.g., Cole & Mitchell, 1998; Cutting & Dunn, 1999; Holmes-Lonergan, 2003; Weimer & Guajardo, 2005), as do working-class children of low-educated parents working at low-prestige jobs (Dunn, Brown, Slomkowski, & Youngblade, 1991; Pears & Moses, 2003). African-American children enrolled in Head Start on average begin to pass false belief tasks 6 months later (Holmes, Black, & Miller, 1996; Seidenfeld et al., 2014) than the average age estimated by Wellman et al.'s (2001) meta-analysis (Curenton, 2004). African-American children from low-income families also score lower on false belief assessments than low-income Caucasian children (Curenton, 2003). Among the mechanisms underlying the relationships between SES, ethnic background, and ToM development, researchers name socioeconomic and cultural mechanisms. For example, affluent parents of Western European background tend to use more mentalistic language to explain behaviors than do

low-income minority parents (Cutting & Dunn, 1999; Seidenfeld et al., 2014).

Additionally, the positive associations between the number of siblings and ToM skills typical for middle- and high-income families were not observed in low-income populations (e.g., Cutting & Dunn, 1999; Weimer & Guajardo, 2005) and low-income mothers were found to talk less to children (Brooks-Gunn & Markman, 2005).

The necessity of the appropriate social environments for ToM development is exemplified by studies of children that have experienced early social deprivation; post-institutionalized children, maltreated children in foster care, and orphans in institutions all fare poorly on false belief task performance (Pears & Fisher, 2005; Yagmurcu, Berument, & Celimi, 2005). A study by Tarullo, Bruce, and Gunnar (2007) compared three groups of children with exposure to different early social environments: post-institutionalized children adopted from abroad into U.S. families, post-foster care children from abroad adopted into U.S. families, and TD children born into families. The post-institutionalized group performed significantly worse on the false belief assessment than the other two groups, followed by children who were adopted from foster care, and then the TD group (Tarullo et al., 2007). The effects of early social deprivation on ToM is sustained across cultures; when Turkish researchers assessed the false belief understanding of orphaned children living in a boarding home and their TD counterparts, those living in institutions performed significantly worse than children living in families. Although the institutionalized children live in large groups and are surrounded by many other people of the same age, there are few caregivers available to introduce children to the language needed to acquire ToM skills through books or conversations. Additionally,

institutionalized children are often not seen as individuals but as a part of a group, which can make it harder for the children to learn differentiate among their own beliefs and those of others. Moreover, these children's conflicts are not mediated by adults who can teach that it is possible to have discrepant views or desires (Yagmurlu et al., 2005).

**Socio-linguistic input.** There is considerable interest among researchers in the mechanisms underlying associations between children's social interactions and linguistic environments and their understanding of mind (Rosnay & Hughes, 2006). To distinguish particular components of social interactions predicting children's ToM development, many studies have closely examined the content of maternal linguistic input in conversations between mothers and their children.

The overall conclusion of many studies is that maternal mental-state language in conversations with children promotes ToM development (e.g., Ruffman, Slade, & Crowe, 2002; Taumoepeau & Ruffman, 2006). Mental-state language encompasses references to emotional states (e.g., happy, sad, excited), mental processes (e.g., know, think, remember, understand, feel), desires (e.g., want, wish, hope), and modulations of assertion (e.g., guess, maybe, perhaps; Ruffman et al., 2002).

The frequency of mental-state utterances in mothers' language was found to be predictive of children's later mental-state understanding at the time of conversation and long-term. For example, in a study by Taumoepeau and Ruffman (2006), 15-month-old children of mothers who used more references to desires when asked to describe pictures in wordless books demonstrated a larger mental-state vocabulary and better emotional-situation understanding at 24 months of age than children of mothers who used fewer



mental state utterances. In a subsequent study, a positive association was found between maternal talk about emotions, desires, and thoughts or knowledge at 24 months and children's social understanding and mental-state language at 33 months of age (Taumoepeau, & Ruffman 2008). Notably, as children grow, the content of mothers' mentalistic talk changes; when children are 15 to 24 months of age, mothers mostly refer to desires and emotions, whereas at 33 months the most common references are to mental processes terms, such as *think* and *know*. Researchers hypothesize that the change in the content of mother-child conversations helps children to transition from desire-based to belief-based reasoning (Taumoepeau & Ruffman, 2008).

Further, studies demonstrate that it is not frequency of exposure alone that matters for ToM development but also the context in which mental-state language is used and the function and form of utterances. For example, Slaughter et al. (2007) provided mothers of two groups of TD preschoolers—the younger with  $M = 3.9$  years and the older with  $M = 4.7$  years—with wordless books and asked them to have story time sessions with their children. The mothers' narrations were subsequently analyzed for mental-state language and the children's utterances were assessed for ToM skills. Both younger and older children who performed better than their peers on ToM assessment tasks had mothers whose narrations included three types of cognition clarification, that is, instances when mothers elaborated on a cognitive term used previously. Three types narration were used: (a) explanatory talk: expansions that explicitly state the invisible contents of a protagonist's mind in the manner of a pictorial thought bubble; (b) causal talk: explanations of protagonist's sources of knowledge; and (c) contrastive expressions to

demonstrate inconsistencies between one's mental state and physical reality or between different people's mental states.

Additionally, when Howard, Mayeux, and Naigles (2008) analyzed the content of conversations between mothers and their preschool-age children and assessed mental-state understanding of the latter, they discovered that maternal use of mental verbs in questions and single-clause statements referring to children's mental states were positively associated with children's false-belief understanding. Finally, with mental-state language being central to conversations about the past, mother-child reminiscing about the past was found to be beneficial to children's understanding of the mind (e.g., Fivush, Haden, & Reese, 2006; Reese & Cleveland, 2006; Rudek & Haden, 2005). Specifically, a highly elaborative style of maternal reminiscing that involves abundance of detail, mental-state references, and open-ended questions helps children understand that mental states exist and influence behavior over time, create and connect previous mental states to current behaviors, and learn to describe present and past mental states of self and others (Reese & Cleveland, 2006)

Although most of the studies on socio-linguistic input examined the content of caregivers' child-directed talk, children can benefit from socio-linguistic input from other people as well, for example, from conversation with friends (Hughes & Dunn, 1998), older siblings (Dunn et al., 1991), and even researchers, as demonstrated by a number of successful interventions described subsequently. Moreover, although children's participation in conversations, explanations of mental states, and the ability to receive feedback is beneficial for ToM learning (e.g., Lohmann, Tomasello, & Meyer, 2005), it

appears that children can improve their false-belief understanding by simply observing others' conversations, including videotaped conversations (Gola, 2013).

**Child's own language abilities.** In addition to the socio-linguistic environment, children's own language abilities are uniquely associated with ToM development (e.g., Cutting & Dunn, 1999; Ruffman, Slade, Rowlandson, Rumsey, & Garnham, 2003; Watson, Painter, & Bornstein, 2002). The relationship is believed to be causal; in a study by Astington and Jenkins (1999), children's verbal abilities predicted later performance on ToM assessments, but ToM did not predict later language abilities. Specific roles and contributions of different linguistic aspects are still being debated. Some researchers believe that the primary predictor of ToM skills in preschoolers is the mastery of syntax, not semantics (e.g., De Villiers & De Villiers, 2000; Smith, Apperly, & White, 2003), whereas others argue that general language ability as expressed by independent and joint contribution of semantic, syntactic, and general aspects of language predict ToM skills (Antonietti, Sempio, & Marchetti, 2006; Slade & Ruffman, 2005). A meta-analysis by Milligan, Astington, and Dack (2007) demonstrated the importance of each linguistic feature in the development of false belief understanding.

The role of semantics, that is, lexical knowledge and aspects of meaning that go beyond the word level (Milligan et al., 2007), in the development of ToM is demonstrated by positive associations between children's performance on receptive vocabulary measures and ToM tasks (e.g., Astington & Jenkins, 1999; Meins, Fernyhough, Johnson, & Lidstone, 2006) and the development of children's mental-state vocabulary knowledge, which aids in understanding of mental states (Ruffman et al.,

2002). Children's mastery of syntax is also predictive of ToM development. Specifically, researchers have found that that command of a sentence structure, a *mental or communication verb along with sentential complements*, is an important predictor of successfully passing a false-belief task. In other words, children have attained a certain facility of language to structure sentences in a way that allows discussions of false beliefs (De Villiers & Pyers, 2002; Milligan et al., 2007). An example of the relevant sentence structure is demonstrated in the following sentence "Bobby thought the clouds were sweet." In this sentence, "thought" is a mental-state verb, and "the clouds were sweet" is a sentential complement. Mastery of this linguistic structure allows for discussion of false beliefs because the verb in the sentence refers to verifiable reality whereas the complements may or may not be true. Thus, complements enable children to discuss discrepancies between mental states and reality (De Villiers & Pyers, 2002).

### **Training Studies**

Since many of the studies of mother-child interactions and children's mental-state understanding are correlational, it is often unclear whether caregivers' linguistic input fosters children's ToM development, or whether it is children's developmental gains in ToM that cause parents to increase mental-state language (Gola, 2013). Training studies provide insights into the causal nature of the relationships, and suggest the importance of each aspect of maternal language (syntactic, semantic, or pragmatic) in contributing to children's ToM understanding.

A number of successful training studies of ToM have demonstrated that false-belief understanding can be taught. Importantly, the results of such studies are not

explained by developmental maturation. The natural course of ToM development is slow — children’s false belief performance improves only slightly between the ages of 3.5 and 4 (Amsterlaw & Wellman, 2006)—whereas many experimental studies successfully trained children to pass false-belief tasks in as short a time frame as 2 weeks (e.g., Hale & Tager-Flusberg, 2003; Slaughter & Gopnik, 1996), with one training succeeding over 1 day (Pillow, Mash, Aloian, & Hill, 2002).

A recent analysis of training studies by Mori and Cigala (2015) included ToM trainings that were conducted in the past 18 years and targeted TD children between ages 3 and 5. All of the ToM training programs were face-to-face in nature, meaning that children were instructed by a researcher, teacher, parents, or different combinations of these adults. A number of different intervention instruments were employed; in some studies researchers made children complete a number of false-belief tasks, with each attempt being followed by an evidence-based or corrective feedback and explanations (e.g., Amsterlaw & Wellman, 2006; Clements, Rustin, & McCallum, 2000; Slaughter & Gopnik, 1996). Other studies exposed children to syntactic and semantic elements embedded in the training content (Gola, 2012; Lohmann & Tomasello, 2003; Peskin & Astington, 2004), while some other studies employed a pragmatic approach, engaging children in various conversational language game activities or discussions containing mentalistic language (e.g., Ornaghi et al., 2011). Other studies incorporated a number of approaches, for example, exposure to mental language followed by a discussion. Ornaghi et al. (2011) and Mori and Cigala (2015) concluded that the most effective interventions were: (a) the ones that made the child an active agent by providing the child with

explanatory feedback (Hale & Tager-Flusberg, 2003), engaging in discussions of mental states (e.g., Knoll & Charman, 2000), or making children self-explain their false beliefs (e.g., Guajardo, Petersen, & Marshall, 2013); (b) the ones that occurred in children's familiar environments, such as homes and classrooms and used methods known to them, such as conversations or book readings; and (c) those that happened frequently and routinely through interactions with familiar adults.

### **Summary**

ToM abilities are a critical part of children's social-emotional and cognitive development. Although skills improve as children grow and mature, variations in individual trajectories of ToM development suggest the importance of contextual and individual factors. Taken together, research on various contributing factors and on ToM suggests the importance of language for ToM acquisition. Social interactions with family members, peers, and siblings; involvement and exposure to elaborative conversations rich in mental-state language; and the explanation of mental states and how they link to behavior likely provide important input to developing socio-linguistic capacities. Extrapolating from these observations that socio-linguistic input fosters ToM skills, this study explored the hypothesis that early interaction with and around digital games supplemented with appropriate ToM-enhancing language may also improve ToM skills.

The next section of this literature review considers language-based training studies designed to enhance children's ToM abilities. The findings of these studies can inform design of digital games for preschoolers.

## **Language Practices to Inform Game Design**

Reviewed subsequently are training studies whose findings are adaptable for digital games. The findings from these studies informed the design of the verbal components of the games. Observational studies (Slaughter et al., 2007) or general recommendations of researchers based on a body of studies (Taumoepeau & Ruffman, 2008) will inform the design of the verbal utterances. Lego Duplo app games were used as media for the verbal component of this intervention. Interactive features of these games allow for social engagement known to promote mental-state language learning and social-emotional learning (Coates et al., 1976; Hirsh-Pasek et al., 2015); content features allow users to meaningfully manipulate symbolic material, thus making players sustain attention on the game and learn (Hirsh-Pasek et al., 2015); and finally the games' storylines can be enhanced by verbal component containing language conducive to ToM development. Finally, the language was built in to accompany the original storyline, thus educational content did not compete with the storyline, and according to the Capacity theory (Fisch, 2000) would not distract from learning.

### **Elaborate Reminiscing**

In an experimental training study, Taumoepeau and Reese (2013) examined the effects of maternal elaborative reminiscing on children's understanding of minds. Participants were mother-child dyads, where children were on average 19 months old. Toddlers' language development was assessed pre-test at 19 months, and their performance on ToM tasks was assessed at 44 months of age. Mothers were randomly divided into training and control groups, wherein the former group of mothers received

training on elaborate reminiscing at three times when their children were 21, 25, and 29 months of age, and the latter group of mothers did not receive any instructions. Specifically, mothers were instructed to ask a lot of *what*, *when*, *who*, and *where* questions about a past event, and if the child did not respond, to provide a new piece of information. After the intervention, children of the training group who had low levels of expressive vocabulary at 19 months were shown to benefit from the maternal training program, and at 44 months of age had similar ToM abilities as children with initially better language skills. In contrast, at 44 months of age, control group children with initially low levels of expressive vocabulary lagged behind their peers in the quality of ToM skills. The questions used in this study can be used as a social interactivity feature by making a character or narrator address a child with a question or model elaborative reminiscing by making characters talk about a past event that happened earlier in the game.

### **Syntax**

Several training studies have demonstrated unique causal contribution of children's syntax abilities to ToM development (e.g., Hale & Tager-Flusberg, 2003; Lohmann & Tomasello, 2003). For example, teaching young children syntactic and semantic properties of sentential complements was shown to promote development of ToM, regardless of inclusion of mental-state language (Hale & Tager-Flusberg, 2003). For example, Hale and Tager-Flusberg (2003) included only communication verbs (i.e., describing how a subject communicates), such as *said*, in their training program, but not mental-state verbs to control for mental-state language's individual contribution to ToM



development. For example, “Anna said that John went to the movies,” has a communication verb (said) followed by a sentential complement (John went to the movies). Three groups of children—one trained on false-belief task performance, another trained communication verb and on sentential complement sentence use, and a control group, which did not undergo any training—attended two training sessions conducted 1 week apart. All the training sessions included specific tasks and corrective feedback. Analysis showed that whereas the control group did not show any changes in performance, both the group trained in sentential complements and the group trained in the false-belief task improved on the false-belief assessment; however, children in the group trained in the use of syntax structure improved their verbal abilities in addition to false-belief understanding.

### **Learning Mental-State Language Understanding from Exposure**

Many researchers argue the importance of pragmatics, i.e., more directed or involving more active or participatory language development on the part of the child, in training programs of false belief understanding. That is, these researchers believe that ToM is not improved by passive mental-state language exposure but by children having to use mentalistic language in conversations (e.g., Ornaghi et al, 2011). However, Gola’s (2013) training study provided evidence for the possibility that ToM skills can be enhanced in the absence of an advantageous social context. Specifically, the study demonstrated that watching a video enriched with mental verb utterances can improve understanding of mental states, with the effectiveness of the training being dependent on the form of mental-state verb presentation. In the study, preschoolers were randomly

assigned to four groups. Each group watched videos that involved the same plot and characters, but differed in how mental-state verbs were presented. Specifically, presentations differed in the form (statement or question), the referent (first person or other person), and interaction style (overheard or interactive). Each video contained 16 *think* verbs, 14 *know* verbs, and two *remember* verbs (these mental-state verbs were selected by the author based on correlational research on mother-child interactions). In each video, two characters discussed the mental state of another character. The differences between the conditions were in the presentation of the mental verbs: statement or question, the first person or other person, and overheard or interactive. The children who demonstrated significant improvement in ToM skills as indicated by their scores on false belief assessment were exposed to videos where mental states of someone else were discussed in statement or question form. Specific beneficial forms of mental verb presentation included (as taken from the manuscript):

- *Overheard Other Person Statement Interactive*, for example, Freddy (to child): “Hey kids, you know what golf is,” and Spot (to child): “Yeah kids, you know what golf is.”
- *Overheard Other Person Question*: Freddy (to Spot): “Do you know what golf is?” Spot (to Bessie): “Do you know what golf is?”
- *Other Person Statement*: Bessie (to Spot): “You know just what everyone will like.” Spot (to Bessie): “You know just what everyone will like.”

This study is also notable for the demonstration that the effects of maternal language in naturalistic studies (e.g., Howard et al., 2008) carry over to video presentation.

## **Storybook Reading, Mental State Verbs, and Causal Talk**

Another example of successful incorporation of naturalistic studies' results was offered by Esteban, Sidera, Serrano, Amadó, and Rostan (2010). They examined whether reading preschool-aged children storybooks enriched with mental-state language improved children's false-belief understanding. Researchers added sentential complement sentences and causal and contrastive talk about mental states (desires, beliefs, and emotions) to a familiar story (Little Red Riding Hood), and trained teachers on the appropriate presentation of the story. Teachers were also trained to initiate discussion throughout the story. Children and teachers were randomly assigned to experimental and control groups. At the end of the study children in the experimental group showed improvements in false-belief understanding, but only in one type of false-belief task, *Location Change*. This study provides examples of how different forms of mentalistic language from maternal talk found to be positively associated with children's understanding of mental can be adapted for use in an existing familiar story.

### **Examples**

The following are examples of language constructed for the three Lego Duplo games using research findings listed previously. Specific rules for the verbal component design along with references to specific studies are outlined in the Methods section (scripts for each game can be found in Appendix B).

1. *Hey Kid, remember the Lion didn't see Giffy and Rabbit getting the package. It means he does not know they have it.* This statement is an *Other-Person-Statement-Interactive* type of sentence, where someone else's state of mind is

described and causal talk is used to describe the mental states of others.

Additionally, the sentence includes the mental-state verbs *remember* and *know* and uses elements of elaborative reminiscing.

2. *What a great boat! Bunny and Teddy like it so much, they have decided to swim far far away.* In this feedback, game narrator explains the protagonist's state of mind, using the mental-state verb of desire *like* and explains the mental state underlying the behavior.
3. *Bunny and Teddy think there is a green rock, but click on it — it is really a turtle!* This line uses contrastive utterances of mental and physical realities and the mental verb *think*.
4. *Everyone in the audience thinks that the acrobat may fall down from the swing, but she knows she won't.* This sentence contains the *mental verb (think) along with sentential complements* structure, modulations of assertion verb *know*, and contrastive utterances of different people's mental states.
5. *Giffy, I think the Lion does not know about the package and were happy if we bring it to him at the Zoo.* This is an *Overheard-Other-Person-Statement* sentence that uses mental verb along with sentential complements structure, includes mental-state verbs *know* and *think* and uses causal talk to explain the protagonist's mental state.

### **Conclusion**

Digital games present a promising medium for teaching various skills to preschoolers, including social-emotional ones. Yet, in designing content, not only

technological possibilities but also child-specific factors and factors in children's environments should be considered as they greatly moderate effects of media on children's learning.

Despite the body of literature indicating that ToM contributes greatly to various aspects of preschoolers' lives, educational media rarely if ever targets ToM and ToM-related skills. This paucity of ToM-related content may be due to the lack of knowledge about whether mechanisms underlying ToM development can be incorporated in educational digital content. No research to date has examined the role of specific language in children's digital media for ToM development, and whether face-to-face training and naturalistic studies can be successfully adapted to be used in digital interactive form.

This study sought to purposively incorporate research findings on the role of language in ToM development from face-to-face interventions and naturalistic studies into existing digital games. The study then examined the effectiveness of young children's ToM learning from playing these games as well as talking about these games. The results shed light on children's ToM learning from digital games and provide game designers with concrete tools to be used in the development of social-emotional curriculum.

## **Chapter Three**

This chapter presents the methods for this research study, which examined the functional relation between adapted digital games and children's ToM skills when game play is either followed or not followed by a discussion. The descriptions of the overall design, implementation, and analysis of the current project are discussed in this chapter.

### **Participants**

The participants for this study were selected from a larger pool of all preschool students from a single preschool that serves low-income families in a Mid-Atlantic metropolitan area. Screening procedures, which are described subsequently, yielded six study participants.

### **Participant Selection Process, Protection of Human Participants, and Informed Consent**

Prior to granting approval for this study, the Institutional Review Board (IRB) at George Mason University (GMU) reviewed all the methods and procedures in order to ensure the rights and welfare of the study participants. Permission was also obtained from the principal of the preschool.

In order to maintain confidentiality of the participants in this study, each participant was assigned a unique pseudonym and all student identifying information was

deleted. Potentially revealing information about the preschool in which the study was conducted was purposefully eliminated from the descriptions in this section.

For the preliminary selection, director and classroom teachers were asked to identify typically developing children who were (a) fluent in English and (b) between the ages of 3 and 5. These criteria were used to ensure that the children could comprehend the language in the games and face-to-face communications with the researcher, and that they could navigate through games designed for preschool-age players. Once the initial pool of potential participants was identified, the school provided each student's parents with two forms. One was an information/recruitment letter, and the other was a consent form (Appendix A). Children whose parents returned a signed consent form participated in the screening process.

To finalize the sample for the study, all children selected for the first screening played one of the five games without voice-overs and were administered the Theory of Mind (ToM) assessment. A detailed description of the selection criteria and assessment is provided in the Measures section. Children who failed three or more of the five tasks in the two measures of the ToM assessment were selected to participate in this training study.

### **Final Sample**

Six participants, all girls, were selected from a single preschool that serves low-income families in a Mid-Atlantic metropolitan area. The sample consisted of typically developing children all between 42 and 54 months (Table 1). As follows from Table 1, all children in the sample came from families where another language was spoken in

addition to or instead of English. Importantly, not all children were speakers of a different native language than English; whereas some talked to their parents exclusively in their home language, others were merely exposed to another language, but did not speak or understand it.

Table 1

*Description of Participants*

Name	Gender	Ethnicity	Age (in months)	Second Language
Mia	Female	African-American	49.5	Shona
Isabella	Female	Caucasian	51.5	Spanish
Sienna	Female	Hispanic	46	Spanish
Paula	Female	Hispanic	48.5	Spanish
Camilla	Female	Hispanic	46	Spanish
Emily	Female	Asian	48	Korean

*Note.* In this study second language refers to any language other than English that children are exposed to on an everyday basis. Some participants exclusively spoke another language at home, whereas others only occasionally heard parents speaking another language.

**Mia.** Mia was an African-American girl who was 49.5 months old at the beginning of the study. Social workers and teachers described her as social and talkative, able to explain her feelings, although with some challenges in interpersonal communications. Specifically, Mia seemed to be led by a friend who would not let her play with other children. Mia was an only child. At home she spoke mostly English, although she was exposed to Shona, which was spoken by her parents. During the initial assessment Mia correctly answered only one question, the most basic one, from the assessment. Mia enthusiastically participated in all sessions, often initiated conversations



about characters' feelings during the discussion part of the sessions, and eagerly offered responses to the assessment scenarios.

**Isabella.** Isabella was a Caucasian girl who was 51.5 months old at the beginning of the study. She came from a large Spanish-speaking, multigenerational family where she was “the baby” of the family. Teachers reported that Isabella appeared to be skilled in having relationships with adults but had trouble making and sustaining friendships with peers. With children, she often attempted to be the leader, bossed them around, and started fights when children disobeyed her commands. During the initial assessment, Isabella answered only the two most basic questions correctly. She actively participated in all sessions, although often initiated conversations unrelated to the study procedures.

**Sienna.** Sienna was a Hispanic girl who was 46 months old at the beginning of the study. Sienna was a very energetic, happy, and assertive girl. She was an only child of a single mother. Sienna and her mother spoke Spanish exclusively when together. During the study, Sienna and Camilla transferred to a classroom for older children and, according to the teachers, adjusted well. During the assessment, Sienna answered two most basic questions correctly. Sienna clearly enjoyed participating in the study, liked find humor in false-belief situations, and often attempted role-play during the assessment portion of the sessions.

**Paula.** Paula was a Hispanic girl who was 48.5 months old at the beginning of the study. She had an older sister, and her family spoke both English and Spanish. Teachers described Paula as a well-liked girl who was very calm and patient, but was consistently

tired. Paula had a best friend, Camilla (also in the study), who was in a different class. Paula was not close to any children in particular in her own class. In the initial session, Paula answered two questions correctly. Initially, she was very shy and reluctant in her responses but she warmed up after the first session and remained engaged in the sessions, providing answers quickly.

**Camilla.** Camilla was a Hispanic girl who was 46 months old at the beginning of the study. Camilla came from a Spanish-speaking family and had an older brother. She was a friendly child who played well with others and made friends easily. She could be often observed engaged in group play. During the study, Camilla transferred to a classroom for older children along with Sienna, and adjusted well. Camilla was very focused and engaged during the sessions, eagerly played games and participated in the procedures.

**Emily.** Emily was an Asian-American girl who turned 48 months old at the beginning of the study. Teachers described her as quiet and reserved, but friendly. In class, Emily usually played with one friend, also a very quiet girl, who was beginning to learn English. Emily was the youngest of five children and the only girl in her family. Her family spoke Korean at home. During the initial assessment, Emily answered only a single, most basic, question correctly. Emily was quiet, but not shy during the sessions and gave her answers with confidence.

### **Study Site**

Participants were students at a preschool located in a middle-class suburb of a large city on the East Coast of the United States. The preschool primarily served working families receiving childcare subsidies; more than 70% of the children in the school came from low-income families, and almost 60% of the children came from single-parent households. The school had a diverse student body; in 2015, students represented 12 nationalities, and 66% of students were Spanish-speaking. According to the school website, the school's mission was to provide quality care and help children become kindergarten-ready.

All sessions in the study took place either in the library or resource room. The library had bookshelves along the walls filled with books, toys, educational materials, and board games; a large round table in the middle of the room surrounded with chairs; and a cart with a TV and videotapes next to the door. When sessions were held in the library, the children and the researcher sat across from each other at the round table, with the camera on the tripod located behind the researcher and assessment materials located on the chair next to the researcher. The resource room had storage boxes along the walls filled with various equipment, such as toys, educational materials, and musical instruments. In the middle of the resource room were desks arranged in a U-shape layout with chairs pushed under the desks on the side that was near the wall. There was a computer desk with a desktop computer in one corner of the room, and a sink in another corner of the room. When sessions were held in the resource room, the children and the researcher sat across from each other along the two long sides of the last desk of the U-

shape layout nearest to the wall. The tripod with the camera was connected to the outlet in the wall and situated near the short side of the desk.

### **Research Design**

Single-subject research originated in the 1950s (Gast, 2010; Neuman & McCormick, 1995) and since then has continued to inform theory and practice in many fields, including special education (Horner et al., 2005); applied, clinical, and school psychology (Kazdin, 2011; Kratochwill & Levin, 2014; Sheridan, 2014); literacy education; medical studies; and social work (Gast, 2010; Neuman & McCormick, 1995). The main goal of single-subject research design (SSR) is to demonstrate a consistent effect of the independent variable (the intervention) on an individual (Neuman & McCormick, 1995); that is, to establish that there is a functional relation between the independent and dependent variables. Although SSR is based on established theoretical frameworks of behavioral psychology, such as operant conditioning and social learning theory, it can be applied to evaluate interventions based on other theoretical models (Gast, 2010).

Despite the resemblance of some aspects of SSR to aspects of qualitative and experimental group designs, many features make SSR unique (Neuman & McCormick, 1995). Some of the unique features of SSR are as follows:

1. In SSR, the unit of intervention is a single subject. The subject can be one individual participant or several participants (Kratochwill et al., 2010).

Regardless of the number of participants in a study, each individual's data are

analyzed separately, thereby placing the focus on the process rather than the number of individuals.

2. There is no control group, as the subject serves as its own control. To assess change, post-intervention outcomes are compared with the pre-intervention measurements.
3. The independent variable is repeatedly measured within and across conditions, which are also known as *phases* (Kratochwill et al., 2010).

To this researcher's knowledge, no studies have used SSR to investigate ToM development, especially in typically developing (TD) children. Yet, several microgenetic studies—which, like SSR use multiple closely spaced assessment procedures—have explored the changes in children's ToM performance under different treatment conditions (Amsterlaw & Wellman, 2006; Flynn, O'Malley, & Wood, 2004; Guajardo et al., 2013; Rhodes & Wellman; 2013). Amsterlaw and Wellman (2006) argued that microgenetic methods yield rich data on developmental changes in performance across various domains, and in ToM specifically. Specifically, these methods can shed light on mechanisms underlying children's transition to false belief understanding and factors contributing to children's variability in ToM development (Wellman, 2012).

### **Multiple-baseline Design**

In this study SSR was used to establish whether the intervention was effective and to track developmental changes in individual children's ToM skills. Specifically, a single subject, multiple-baseline design across participants was implemented to investigate

whether a functional relation exists between adapted with voice-overs digital games and ToM skills in preschoolers.

One advantage of multiple-baseline design is that it allows for analysis within the set of repeated measurements of individual participants' responses (or data series) as well as between the data series (also known as tiers in reference to their positioning on a graph). The effectiveness of the independent variable is determined by its influence on the same dependent measure across functionally similar behaviors of several different individuals (Gast, Lloyd, & Ledford, 2010). Thus, in order to ensure that the introduction of the independent variable does not affect other tiers and to allow for replication of the intervention, dependent variables must be functionally independent but functionally similar (Gast et al., 2010; Kratochwill & Levin, 2014).

Pre-intervention, baseline data are collected simultaneously across participants. Once baseline data are stable, the intervention is introduced in a tiered way over time across participants; that is, the first participant starts receiving treatment while the other participants are still in the baseline condition; then, after a set amount of time, the second participant begins to receive treatment, followed by the third participant, and so on (Ferron & Levin, 2014; Gast et al., 2010).

To meet evidence standards, a study using multiple-baseline design should adhere to the following set of criteria outlined by Kratochwill et al. (2010):

- “The independent variable (i.e., the intervention) must be systematically manipulated, with the researcher determining when and how the independent variable conditions change.” (p. 14).

- “Each outcome variable must be measured systematically over time by more than one assessor, and the study needs to collect inter-assessor agreement in each phase and on at least 20 percent of the data points in each condition (e.g., baseline, intervention) and the inter-assessor agreement must meet minimal thresholds.” (p.15).
- “Include at least three attempts to demonstrate an intervention effect” (p. 15), that is, have at least six phases (three or more tiers).
- Have at least five data points per phase in order for a phase to qualify as an attempt to demonstrate an effect.

The present study met these criteria in that there were three different conditions in the study (Baseline, Voice-overs, and Voice-overs followed by discussion); the inter-rater agreement data were collected on 33-35% of data points in each session and, in most instances, the design standard for inter-rater agreement was met; there were six tiers in the study, each containing three different phases; and each phase had a minimum of five data points.

In this study, a multiple-baseline design was used for several reasons: (a) it is assumed that ToM skills are irreversible, thus withdrawal is not possible; (b) the design makes it possible to measure target responses to multiple assessments (Gast, 2010; for example, in this study, one measure focuses on diverse desires, beliefs, and knowledge, and another measure targets false belief understanding); (c) the design makes it possible to control for developmental maturation, since children are known to improve in terms of ToM skills with age. There were three phases (conditions) in this design in the sequence

of A—B—B+C, where A was the Baseline phase, B was Voice-overs treatment phase, and B+C was Voice-overs combined with Discussion (VAD) modified treatment phase. The baselines were tiered across six participants and consisted of six to nine sessions. The different times of staggered introduction of treatment was used to ensure that changes in the data series were due to the introduction of the treatment and did not have alternative explanations such as the multiple exposures to the assessment procedures or maturation.

### **Measures**

In each session of the study, including the screening session, children were administered variations of tasks found in Wellman and Liu's (2004) developmental scale. Throughout the study, in some sessions original scenarios developed by Wellman and Liu as well as by Wimmer and Perner (1983) were used. In other sessions similar scenarios were employed, but the props and scenarios were changed (Appendix C). Data from the screening session counted for the first baseline session.

### **Theory of Mind Developmental Scale**

Each child's ToM was measured using two sets of tasks adapted from the Wellman and Liu (2004) developmental scale and from Wimmer and Perner's (1983) Location Change task. The Wellman and Liu (2004) scale is composed of five components that parallel developmental sequence of ToM tasks acquisition: (a) Diverse Desires, (b) Diverse Beliefs, (c) Knowledge Access, (d) Contents False Beliefs, and (e) Explicit False Belief. In the Diverse Desires task, the child must demonstrate an understanding that someone might have a different desire about the same object. The



child is presented with a doll named Mr. Jones and pictures of two different snacks. The researcher asks for the child's preference of snack and subsequently states that the doll wants a different snack than the one selected by the child. The child is then asked which snack the doll would choose, since it can only choose one snack. To pass this task, the child must provide an answer to the target question that is opposite from what they desire.

In the Diverse Beliefs tasks, the child must demonstrate an understanding that someone might hold a different belief about the same thing. The child is shown a doll named Linda and pictures of a garage and bushes. The child is told that Linda is looking for her cat; the researcher then asks the child where he/she thinks the cat is, in the bushes or in the garage. The researcher then says that Linda believes her cat is in a different location than indicated by the child and asks the child where Linda would look for her cat. To demonstrate the targeted understanding, the child must say the opposite of his/her belief.

In the Knowledge Access (Seeing-Knowing) task, the child must correctly judge the knowledge of another person who does not have access to the information available to the child. The child is presented with a small box and asked what he/she thinks is in the box. After the child guesses or says that he/she does not know, the researcher lets the child open the box to see the contents (a Lego piece). The researcher then introduces a doll named Polly and says that Polly has never seen inside the box, and asks whether Polly knows what's inside the box. The child must say "No" to be correct.

In the Contents False Belief task, the child must reason how another person might misjudge. The child is provided with a familiar, easily identifiable container (e.g., a box

of crayons) and is asked to guess what the contents are. After the child answers, “crayons,” the box is opened and a small wooden hippopotamus is revealed. The child can handle the hippopotamus for a short time, and then the researcher puts the toy back into the box and closes the lid. A doll named Linda then appears, and the researcher states that Linda has not seen inside the box and asks the child what Linda thinks is in the box. The correct response to the question is “crayons.”

In the Explicit False Belief task, the child must decide where an agent would look for an object given the agent’s incorrect belief. The child is presented with a doll named Scott and two pictures, one of a backpack and another of a closet. The researcher then explains that Scott is looking for his mittens that are really in his backpack, but Scott thinks they are in his closet. The researcher then asks where Scott is going to look for his mittens. The correct response is that Scott would look for his mittens in the closet.

The Location Change Task was developed by Wimmer and Perner (1983) and is commonly used to assess children’s Explicit False Belief understanding. The task is based on a story of character A, who places an object (e.g., a book) in a specific location (e.g., a cabinet) and then leaves. Meanwhile, unbeknownst to character A, character B moves the object to a different location (e.g., a bookshelf), and character A then reappears. The child’s task is to answer, Where will character A look for the object first? To be correct, the child must answer that character A will look in the original location (before the move).

## **Measures in the Current Study**

**Theory of Mind.** ToM was assessed using variations of tasks from the five-item developmental scale created by Wellman and Liu (2004) and Location Change task developed by Wimmer and Perner (1983). Following the Gola's (2012) study, tasks were grouped into two categories. In the first category, three tasks assessed children's understanding that people can have diverse desires, beliefs, and knowledge about the same thing; and in the second category, two tasks assessed False Belief understanding. All tasks corresponded to a progression of milestones in children's development of ToM (the two False Belief Tasks are of similar difficulty), thus, the first category contained conceptually easier tasks than the second one. In the study these categories were used as two separate measures:

***Measure 1: Desires, Beliefs, Knowledge (DBK).*** Three tasks (task numbers 1, 2, and 3 in the Wellman and Liu [2004] developmental scale) assessed children's understanding that people can have different desires, beliefs, and knowledge access. Across all sessions, scenarios were similar to the original ones, but characters and settings were different. Children received 1 point for each correct answer and could receive 0-3 points overall.

***Measure 2: False Belief (FB).*** Three tasks (task numbers 4 and 5 in the Wellman and Liu [2004] developmental scale), Unexpected Contents False Belief and Explicit False Belief, and Location Change task (Wimmer & Perner, 1983) were used to measure children's false belief understanding, with two different tasks used per session. Children received 1 point for each correct answer and could receive 0-2 points overall. As

described in the Measures section, Unexpected Contents False Belief tasks involve children finding unexpected contents in a familiar container. To avoid children's expectation of being tricked, the researcher included a task where a container has appropriate content in half of the assessment sessions along with the Unexpected Contents task. For the same reason, instead of one specific scenario for the second False Belief task, two types of scenarios were used; the first one is Explicit False Belief task developed by Wellman and Liu (2004), and the second is a Location Change Task (Wimmer & Perner, 1983).

According to meta-analyses by Wellman and Liu (2001), children's performance on False Belief tasks remains consistent across different task presentation formats and different types of tasks. To keep children engaged in the assessment procedures, half of the tasks were presented in a digital storybook format (these were created with several iPad drawing apps) and the other half were acted out with props (Appendix C). Presentation order was counterbalanced across sessions for task type and format. This decision along with some of the task scenarios was modeled after Amsterlaw and Wellman's (2006) microgenetic study.

## **Materials**

### **Games**

During the baseline condition, children played one of five game apps produced by the Lego group. According to the description of the games on the developer's website, all five games were designed around an educational curriculum for preschoolers. Among developmental goals of the games, producers listed "sense of accomplishment,

understanding the nature of friendship, and creative play that simulates grown-up activities” (“Duplo Apps,” n.d., para. 1).

As covered in Chapter Two, certain game design features are known to enhance children’s learning of educational content. Some of these features were originally present in the Lego games used in the study (e.g., interactivity) and other features were implemented along with the design of voice-overs (repeated exposure to research-based voice-overs, alignment of the voice-overs, and game narrative). The role of these factors was not investigated in this study.

**Game 1: LEGO® DUPLO® Circus.** Game 1, Circus, lets children manage a circus by making different choices. The game opens with circus-goers lined up at the marquee. Children have to sell tickets to the circus-goers, announce the performers, and decide what tricks the audience will see. The game has background music and sounds, but no verbal component.

**Game 2: LEGO® DUPLO® Ice Cream.** Game 2, Ice Cream, lets children help a bunny and a teddy bear on their quest for ice cream. Children have to complete several mini-games that focus on characters interacting, helping, and sharing. The game has background music and sound effects, but no verbal input.

**Game 3: LEGO® DUPLO® ZOO.** In Game 3, Zoo, characters actively provide, seek, and receive help, and interact with other characters in positive ways. Children playing the game help the characters Rabbit and Giraffe deliver a gift to the character Lion by successfully navigating through a series of obstacles. The game has background music and sound effects, but no language.

**Game 4: LEGO® DUPLO® FOREST.** Game 4, Forest, shows Rabbit and Giraffe visiting Bear on his birthday. During the road trip, Rabbit and Giraffe help different animals, build, camp, and celebrate with friends. As with other Lego Duplo games, this game has background music and sound effects, but no verbal component.

**Game 5: LEGO® DUPLO® FOOD.** Game 5, Food, lets a player open a food shop and “cook” food for customers. The game allows players to interact with customers, design meals according to food orders, and make decisions regarding different aspects of the business. There is no verbal input, only background music and sound effects.

### **Voice-overs**

During this treatment condition, children played one of the five games described in the baseline condition; however, unlike in the baseline, the children heard voice-overs provided through headphones connected to the researcher’s computer. Although different voice-overs were created for different games in the study, each individual utterance for voice-overs was constructed using the same guidelines described in the Independent Variable section. Using the audio editor Audacity, which is “a free, easy-to-use, multi-track audio editor and recorder for Windows, Mac OS X, GNU/Linux and other operating systems” (“Audacity,” n.d., para. 1), the researcher created audio files for each line and modified the pitch, depending on the game character. A presentation slide show was then put together, in which each slide corresponded to a different screen in the game. It contained audio files with transcribed lines underneath the files. A slide with

hyperlinks to other slides was created for the occasions where the sequence of events in the game depends on a player's choice, which cannot be predicted.

### **Independent Variable**

The original independent variable in this study was presence of voice-overs in the games (the game could either include or not include voice-overs).

### **Design of the Original Voice-overs Independent Variable**

Voice-overs for the games were constructed using results of peer-reviewed training and correlational studies on linguistic input and children's ToM performance. Vocabulary, semantics, and conversational elements found to be predictive of enhanced performance on ToM assessments were incorporated into voice-overs. Therefore, voice-overs for the games included the following elements: (a) explanatory, causal, and contrastive talk about mental states; (b) an abundance of mental verbs, specifically verbs referring to mental processes (e.g., think, know, and remember) that scaffold preschoolers' transition to belief-based thinking, and verbs of desire (e.g., like, want) to accommodate younger children who are still transitioning from desire-based to belief-based explanations of behaviors; (c) mental state verbs along with embedded sentential complements structures; (d) explanations of mental states underlying characters' behaviors; (e) references to events that occurred earlier in the game; and (f) mental-state verbs directed toward players were incorporated into statements, whereas utterances directed to other characters in the video were incorporated into questions.

The game voice-over scripts underwent a validation process by three expert reviewers with unique strengths and expertise in related fields of study. All three expert-

reviewers were Early Childhood specialists working on their Master's degrees in Early Childhood Education. The first expert was an early childhood Special Education preschool teacher working with 4-year-old special needs children. The second reviewer was an elementary school teacher with specialization in English for Speakers of Other Languages. The third expert was a preschool Special Education teacher working with children ages 3-4 years with Autism Spectrum Disorders.

### **Validation of the Original Voice-overs Independent Variable**

To validate the videos, the three expert reviewers familiarized themselves with the research study and literature review, independently read existing scripts, and played all games. They checked each statement for the presence and types of outlined rules, provided feedback on the development-appropriateness of utterances (e.g., sentence structure, vocabulary) and appropriateness of specific voice-overs on the context of games. Their feedback was used to make changes to the scripts.

### **Modified Independent Variable**

Due to limited behavior changes in response to the original independent variable, a modified independent variable was introduced. The Voice-overs and Discussion (VAD) variable consisted of the voice-overs described previously and a follow-up discussion. Although discussions were structured around the game narrative, discussions were different for each child so that the interaction between student and researcher resembled a natural conversation between a child and caregiver after a game play. The researcher asked questions to help the child reconstruct narrative plots of the games, highlighted and repeated episodes that contained mental-state references and exchanges between



characters, and engaged the child in a discussion of episodes of deception and false beliefs. For example, in one session after the child played the Circus game, the researcher began with the introductory question, asking the child to recall that the circus came to town in the game, then asked about the characters' expectations about the show and performers and whether these expectations came true. Next, the researcher asked the child about the mental states underlying the character's behaviors (e.g., "Why did the clown run away? Could it be because he did not expect to be chased by the tiger?"), and finally prompted the child to describe the audience members' thoughts. When children injected their experiences into the conversation, the researcher supported them, and then returned to discussing the events in the game.

### **Procedures**

Children were visited three to five times a week over the course of 5 weeks, for a total of 19-20 sessions. All children were trained and tested individually in a private room at the preschool. Prior to the beginning of the study, researcher asked teachers to provide the class schedule, and participants' drop-off and pick up times. Based on that information, researcher created and followed a schedule of testing sessions. Researcher picked up children at their classroom, gym, or playground and brought them to research room. Once the child entered the room, researcher briefly went over the procedures and invited the child to take a seat at the table. All sessions were video recorded. Once the child was done with the session, researcher brought them back to the room and picked

### **Data Collection Procedures**

Each session, including baseline condition and both types of treatment conditions (original and modified), started with each child playing a game on an iPad and concluded with face-to face assessment procedures. Across all phases the researcher was available to explain the rules or help solve problems. At the end of every session, each child received a prize, such as a sticker or hand stamp.

### **Baseline Procedures**

Baseline procedures began with participants playing one of the five games on the iPad. During game play, participants wore headphones connected to the researcher's computer to maintain consistency of procedures across baseline and training sessions. Unlike the in the treatment phases, however, the computer volume was muted, and no sounds other than those from the iPad were played for the participants. The researcher sat across the child and was available for help with the games, but did not initiate or support discussions about the game plot.

### **Voice-over Training Procedures**

During the voice-over training procedures, the participant and researcher sat next to each other so that the researcher could see the participant's game actions and provide relevant voice-overs. The researcher and the participant wore headphones connected to the researcher's computer to hear the verbal component. The researcher started audio files at specific times, but if the child missed a step or an audio file malfunctioned, the researcher skipped the accompanied utterance and introduced the next one at the appropriate time. It is worth mentioning that such incidents happened only twice over the

course of the whole study. The game's original music and sounds were not muted so that the game play would feel more natural.

### **Voice-overs and Discussion Training Procedures**

The VAD training procedures were identical to the voice-over treatment procedures, with one exception; right after the game play and before the assessment activities, the researcher engaged the child in a semi-structured discussion about the game. Depending on the child, each discussion lasted between 3-7 minutes. Children usually sat on the chair during the discussion, although some wiggled on the chair or stood near the table. After the discussion was over, the researcher started the assessment procedures.

### **Reliability and Scoring**

This section presents information on reliability during data collection (procedural reliability), reliability of scoring procedures (interrater agreement) on the two dependent measures (DBK and FB), and social validity.

#### **Procedural Reliability**

Procedural reliability assesses the integrity of the independent variable and ensures that the results are due to the specific procedures outlined in the method section (Neuman & McCormick, 1995). To collect procedural reliability data, an independent observer monitored session activities and compared them against a preplanned checklist of expected activities that were based on criteria for the design and implementation of the study. At the time of the study, three slightly different versions of procedural reliability checklists existed, with one designed for each phase (see Appendices for complete

procedural reliability checklists). A checklist for the baseline procedures included 11 items (Appendix D), with such sample items as “Ensures that the child plays the game from the beginning to the end” and “Provides playing instructions, but no other verbal input.” The procedural reliability checklist for the voice-over condition included 14 items (Appendix D), such as, “Does not help the child to answer the question correctly” and “Announces that they will play games together.” Finally, the procedural reliability checklist for the VAD procedures contained 17 items (Appendix D), including “Leads the discussion, but gives time for the participant to respond.”

The independent observer was an assistant teacher at the research site preschool who holds a bachelor’s degree in Early Childhood Education. Prior to the procedural reliability data collection, the researcher trained the observer on the procedure. First, the observer familiarized himself with the checklist; second, the observer underwent a sample training procedure himself as a participant while the researcher commented on her actions and pointed out corresponding items in the procedural reliability checklist; and third, the observer practiced monitoring one session and then discussed his choices with the researcher. Procedural reliability data were collected for 30% of the data for all participants across all three conditions (baseline, Voice-overs, VAD). The number of correct actions was then divided by the number of incorrect actions and multiplied by 100%, yielding procedural reliability of 100%.

### **Interrater Agreement**

To ensure scoring reliability, an independent observer scored 30% of the assessment sessions. The independent observer was a child development professional

with a bachelor's degree in Human Development and a master's degree in Social Work. She also had extensive experience working with preschoolers as well as training in experimental research. Prior to the scoring, the researcher introduced the observer to the dependent measure and familiarized the observer with the assessment scale. The researcher and observer then watched several videos from the sample, discussing the participants' responses. Finally, the observer practiced scoring several videos independently, discussing each one with the researcher after the procedure. Once the observer was trained, videos of several sessions from each condition for each individual participant were selected at random and distributed to the observer to be scored.

Inter-observer agreement was assessed for 33-35% of the observations of DBK scores and FB scores in the baseline, Voice-overs, and VAD phases. The Total Agreement formula was used to calculate interrater agreement; a smaller total of correct answers recorded by each observer was divided by the larger total and multiplied by 100% (Kennedy, 2005). The mean inter-observer coefficient of agreement for DBK was calculated to be 92% (range: 87% - 100%) for all participants: Mia ( $M = 94\%$ ), Isabella ( $M = 92\%$ ), Sienna ( $M = 100\%$ ), Paula ( $M = 88\%$ ), Camilla ( $M = 87\%$ ), Emily ( $M = 94\%$ ). The average percent of agreement for FB was calculated to be 96% (range: 75 - 100%) for all participants: Mia ( $M = 100\%$ ), Isabella ( $M = 100\%$ ), Sienna ( $M = 100\%$ ), Paula ( $M = 75\%$ ), Camilla ( $M = 100\%$ ), Emily ( $M = 100\%$ ). The inter-rater agreement for Paula was calculated below 80% because one observer recorded three correct FB responses while the other observer recorded four. Since the variety of FB answers was very small, retraining was not conducive to this situation. Thus, in most

individual instances as well as in the group averages, the design standard for inter-rater agreement was met (Kratochwill et al., 2010).

### **Social Validity**

Social validity—which is the applicability, importance, and difference that intervention can make in the real world—is determined through the assessment of significance of the goals of intervention, social appropriateness of the procedures, and social importance of the effects (Wolf, 1978). Social validity of this training program was assessed through open-ended interviews with the participants, the lead teacher, and the preschool's social worker (Appendix E).

After the last session, participants were asked whether they liked playing digital games, discussing the games, and participating in the assessment procedures; whether they liked playing games with or without voice-overs; what would they recommend to change in the sessions; and whether they would do it again. The social worker and lead teacher were asked whether they believe teaching children social skills through digital games is important, whether they thought the study procedures were appropriate for the children, whether they observed changes in children's social skills, and what recommendations, if any, they would give the researcher. The social validity interview questions are available in Appendix E.

### **Data Analysis**

Visual inspection of graphed data was used to examine the level of functional relation between voice-overs in the games, combination of VAD, and changes in participants' performance on DBK and FB. Specifically, changes in level, trend, data

variability, immediacy of effect, and an index of improvement between phases, NonOverlap of All Pairs (NAP; Parker & Vannest, 2009), were analyzed for each participant's DBK and FB data. NAP was also used to calculate the percentage of data that improved across participants for each measure.

### **Visual Inspection**

SSR employs visual inspection of graphs, constructed by plotting the data collected throughout the study, to draw inferences about the presence and types of relations between the independent and dependent variables (Kratochwill et al., 2010; Neuman & McCormick, 1995). The essence of visual analysis is the comparison of graphical representation of baseline behaviors with graphical representation of intervention behaviors, and sometimes comparison between different intervention behaviors (Neuman & McCormick, 1995). Changes in the mean performance across conditions are represented in the level of data points (i.e., mean score in each phase); time-dependent effects of the training are demonstrated by trend, which refers to slope and direction of a best-fit line overlaid on the data in each phase (Kratochwill & Levin, 2014); fluctuations in participants' responses within individual condition are assessed through variability of data points around the mean or slope (Horner et al., 2005); immediacy of change is observed through the differences between the last three data points in one condition and the first three data points in the next one; and overlap indicates the proportion of data in one phase of the same value as the proportion of data in another phase (Kennedy, 2005). NAP index was used to assess data overlap for this study.

### **Nonoverlap of All Pairs**

Though different indices of overlap exist, several studies (Manolov, Solanas, Sierra, & Evans, 2011; Parker, Vannest, & Davis, 2011) demonstrate an advantage of a recently introduced NAP index. It is derived from a nonparametric assessment procedure that involves individual comparison of all A to B data points and provides a percentage of all non-overlapping data points. NAP is appropriate for many different data types and distributions and is less susceptible to outliers than some other indices of data overlap (Parker & Vannest, 2009). Parker and Vannest (2009) suggested the following guidelines for assessing training effects: NAP of 0-.65 indicates weak effects, NAP of .66-.92 signifies medium effects, and NAP higher than .92 shows large or strong effects. Although NAP calculations can be done by hand, they are often cumbersome and time-consuming. For this study an online NAP calculator was used ([Single Case Research, n.d.](#)).



## **Chapter Four**

This chapter presents the results of a single-subject research (SSR) study that explored the presence of a functional relation between children's ToM understanding and exposure to voice-overs in digital games (Voice-overs training) with or without game-based discussion following the game-play (VAD training). As described in the Methods section, six children participated in the study. All participants followed through the same three phases of the study. In baseline, children played games without voice-overs and underwent assessment procedures; in the original treatment phase, Voice-overs, participants played games with embedded voice-overs and then underwent assessment procedures; in the modified treatment phase, VAD, participants first played games with voice-overs, then participated in the researcher-led discussion, and concluded each session by undergoing the assessment procedure. Children's performance was assessed with two measures derived from a continuous ToM assessment scale (Wellman & Liu, 2004); earlier-developing skills were grouped into DBK measure and false belief skills were assessed by FB.

As can be seen from the overall scores (across both DBK and FB measures) in Table 2, three children improved their ToM performance after playing games with voice-overs, and all six children improved after playing games with voice-overs followed by a discussion.

Table 2

*Overall Means and Standard Deviations for Individual Participants*

	Baseline	Voice-overs	VAD
Mia	1.5 (.55)	2.2 (1.1)	2.7 (.86)
Isabella	2.2 (.75)	2.4 (.55)	3.4 (1.0)
Sienna	2.1 (.37)	2.2 (.45)	3.3 (1.6)
Paula	2.3 (.48)	2.2 (.45)	3.1 (.38)
Camilla	0.9 (.64)	2.8 (.45)	2.8 (.41)
Emily	1.9 (.35)	3.0 (.71)	3.1 (.64)

*Note.* Overall means refer to the average of combined DBK and FB scores (the range could be 0-5).

### **Diverse Desires, Diverse Beliefs, Knowledge Access Skills**

These three skills were measured via the corresponding tasks from Wellman and Liu's (2004) assessment scale. The answers were judged as either correct or not; each correct answer was given a score of 1, and incorrect answers were scored 0. The scores were then added together for the DBK, with the total score ranging from 0-3. During the Voice-over phase, two out of six participants increased their DBK scores as compared to the Baseline, and during the VAD phase all participants increased their scores as compared to Baseline (Figure 2). The visual analysis of DBK data demonstrated no evidence of the functional relation between Voice-overs training and improvements in DBK skills (Kratochwill et al., 2010) and strong evidence of the functional relation between VAD treatment and improvements in DBK skills development. Mean Nonoverlap of All Pairs (NAP) across participants was calculated to be .66 for Voice-overs phase and .87 for VAD phase. Individual DBK results for both treatments are described subsequently.

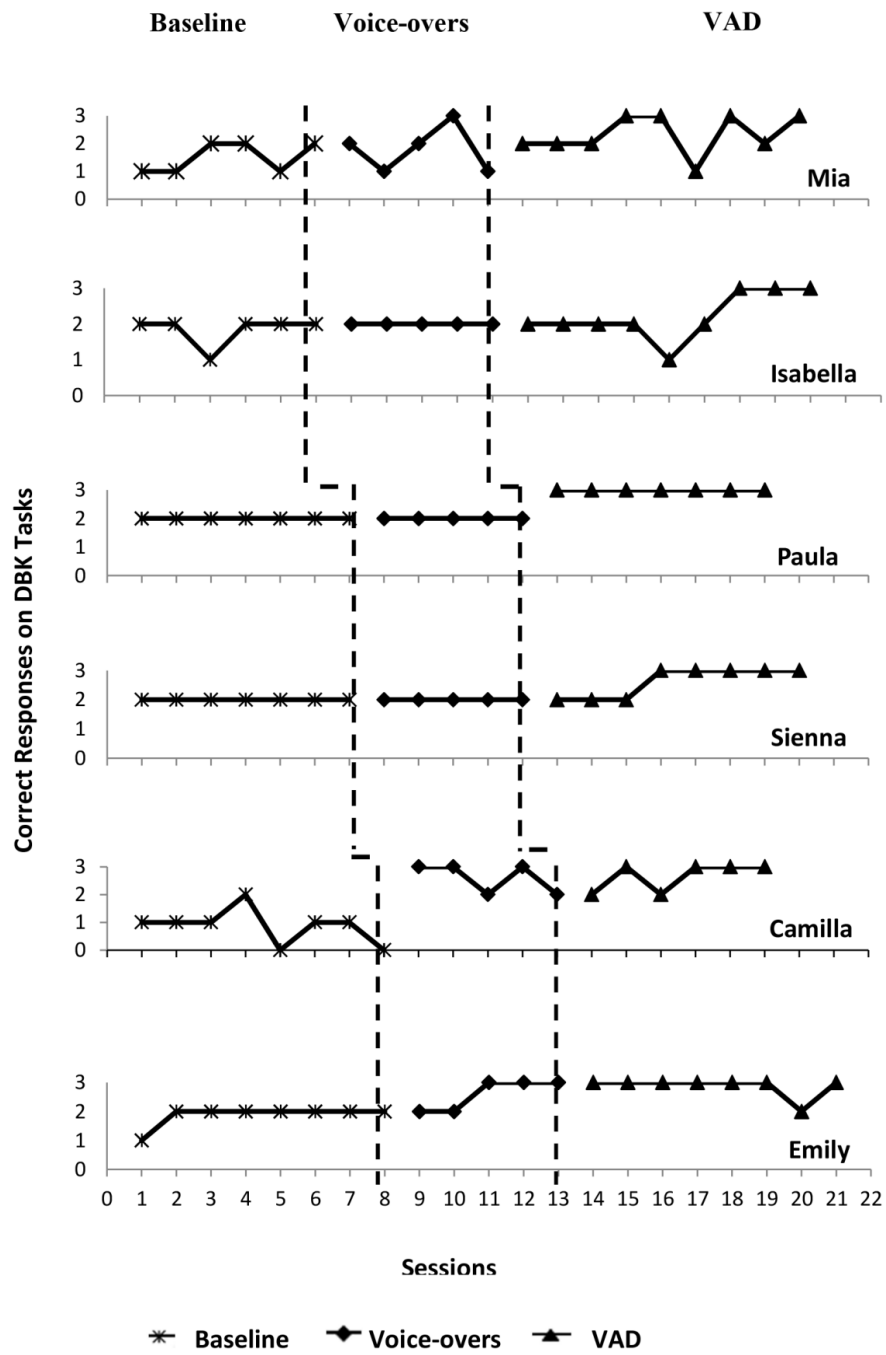


Figure 2. Accuracy of responses to the three tasks in DBK measure by participants across the research phases.

## **Mia**

Overall, across the six sessions in baseline, Mia's data demonstrated low level ( $M = 1.5$ ,  $SD = .54$ ), accelerating trend, and moderate levels of variability (Figure 2). Mia consistently answered correctly in the diverse desires and diverse beliefs tasks, but demonstrated no mastery of the knowledge access task.

Upon introduction of the Voice-overs training, Mia's data demonstrated a small increase in level (from Baseline  $M = 1.5$ ,  $SD = .54$  to Voice-overs Training  $M = 1.8$ ,  $SD = .83$ ), no immediacy of effect, a flat trend, and high variability of data (Figure 2). NAP for Mia's DBK data was calculated to be .60 from Baseline to Voice-overs phase.

In response to VAD modified treatment condition, Mia's data level increased from Baseline ( $M = 1.5$ ,  $SD = .55$ ) to VAD ( $M = 2.33$ ,  $SD = .71$ ), with almost half of the answers being at the ceiling level (Figure 2). DBK data in the VAD phase had an upward trend, high variability, and no immediacy of effect. There was also an increase in level and change in trend: from the Voice-overs phase level ( $M = 1.8$ ,  $SD = .83$ ) to VAD phase level ( $M = 2.33$ ,  $SD = .7$ ), and from the flat trend in Voice-overs to an upward trend in the VAD. NAP for Mia's data was calculated to be .81 from Baseline to VAD phase.

## **Isabella**

Across the six baseline sessions, Isabella had mid-range scores ( $M = 1.83$ ,  $SD = .4$ ), with a flat trend and low variability of data. With the implementation of the Voice-overs training, Isabella's DBK data showed a small change in level from baseline ( $M = 1.83$ ,  $SD = .4$ ) to Voice-overs phase ( $M = 2$ ,  $SD = 0$ ), no immediacy of effect, flat

trend, and absence of variability (Figure 2). A NAP of .58 was calculated for Isabella's data from baseline to Voice-overs treatment phase.

In the VAD modified treatment phase, Isabella showed above-baseline performance with level increase from baseline ( $M = 1.83$ ,  $SD = .4$ ) to VAD ( $M = 2.33$ ,  $SD = .66$ ), an accelerating trend, and moderate variability of data (Figure 2). Isabella's level increased only slightly from the Voice-overs phase (from Voice-overs phase  $M = 2$ ,  $SD = 0$  to VAD phase  $M = 2.33$ ,  $SD = .66$ ), showed no immediacy of effect, and the greatest amount of change was observed in the trend direction that improved from being flat in the Voice-overs phase to accelerating in the VAD phase. A NAP of .67 from Baseline to VAD treatment phase was calculated for Isabella's DBK data.

### **Paula**

In the seven baseline sessions, Paula consistently answered two of the three DBK questions correctly (Figure 2), answered diverse desires and diverse beliefs tasks correctly, but did not answer the knowledge access questions correctly. Her data showed medium level ( $M = 2$ ,  $SD = 0$ ), no variability, and flat trend.

There was no change in Paula's data (Figure 2) in response to the implementation of Voice-overs phase: level remained the same ( $M = 2$ ,  $SD = 0$ ), no immediacy of effect was observed, there was absence of variability and a flat trend also remained. A DBK NAP of .50 from baseline to Voice-overs treatment phase was calculated.

Upon implementation of VAD training, Paula's data (Figure 2) demonstrated a rise in level from Baseline ( $M = 2$ ,  $SD = 0$ ) to VAD ( $M = 3$ ,  $SD = 0$ ), immediacy of effect, flat trend, and no variability of data. In other words, Paula immediately reached ceiling

in her responses and remained there for all seven VAD training sessions. An NAP of 1 from Baseline to VAD modified treatment phase was calculated for Paula's DBK data.

### **Sienna**

During the seven baseline sessions, Sienna consistently answered two questions correctly (diverse desires and diverse beliefs; Figure 2), thus showing mid-level scores ( $M = 2$ ,  $SD = 0$ ), flat trend, and no variability. Sienna never answered the knowledge access questions correctly.

Sienna's DBK data showed no change in response to the implementation of Voice-overs phase: level remained the same ( $M = 2$ ,  $SD = 0$ ), as did absence of variability, and a flat trend. An NAP of .50 from Baseline to Voice-overs treatment phase was calculated for DBK data.

In the VAD treatment phase, Sienna's data (Figure 2) had a rise in level from Baseline ( $M = 2$ ,  $SD = 0$ ) to VAD ( $M = 2.63$ ,  $SD = .51$ ), no immediacy of effect, a steep accelerating trend, and a moderate variability of data. Since Sienna's performance on DBK measure was identical during the Baseline and Voice-overs phases, the same changes in level, trend, and data variability were observed from baseline to VAD phases and from Voice-overs to VAD phases. An NAP .81 from Baseline to VAD modified treatment phase was calculated on Sienna's DBK measure.

### **Camilla**

Throughout the eight baseline sessions, Camilla had low scores ( $M = .88$ ,  $SD = .64$ ), with data showing a downward trend and moderate variability. Upon the introduction of the Voice-overs phase, Camilla's data (Figure 2) demonstrated a rise in

level: from baseline ( $M = 1.87$ ,  $SD = .35$ ) to Voice-overs Training ( $M = 2.6$ ,  $SD = .55$ ), immediacy of effect, downward trend, and moderate variability. NAP of .97 was calculated for Camilla's DBK data from baseline phase to Voice-overs treatment phase.

In response to the VAD training, Camilla performed at above-baseline levels (level changed from Baseline [ $M = .88$ ,  $SD = .64$ ] to VAD modified treatment phase [ $M = 2.66$ ,  $SD = .51$ ]), data showed an upward trend, and moderate variability (Figure 2). In most of the VAD phase sessions Camilla performed at ceiling levels on the DBK measure, answering all three questions correctly. Only minor changes in Camilla's VAD data were observed in comparison to the Voice-overs phase. There was almost no increase in level (from Voice-overs phase  $M = 2.6$ ,  $SD = .54$  to VAD phase  $M = 2$ ,  $SD = .35$ ), no immediacy of effect, change in the trend from downward to upward, and less data variability. NAP of .98 from Baseline to VAD phase was calculated for Camilla's performance.

### **Emily**

During the eight baseline sessions, Emily's DBK data (Figure 2), were consistently mid-level ( $M = 1.87$ ,  $SD = .35$ ), demonstrated low variability, and a slightly upward trend. Specifically, Emily consistently responded correctly to two questions on diverse desires and diverse beliefs, but not the knowledge access task.

Upon introduction of Voice-overs phase, Emily's DBK data (Figure 2) demonstrated rise in level: from Baseline ( $M = 1.87$ ,  $SD = .35$ ) to Voice-overs Training ( $M = 2.6$ ,  $SD = .54$ ), no immediacy of effect, steep accelerating trend, and moderate

variability of data. NAP of .82 was calculated for Emily's data on DBK measure from Baseline to Voice-overs Training.

During the VAD modified treatment phase, Emily's DBK data (Figure 2) demonstrated a rise in level from baseline ( $M = 1.87$ ,  $SD = .35$ ) to VAD ( $M = 2.87$ ,  $SD = .35$ ), no immediacy of effect, slightly downward trend driven by an outlier, and low variability. Emily almost always responded correctly to all three questions, with the exception of one session. Only minor changes in data were observed from the Voice-overs phase. In comparison to the Voice-overs phase, there was an increase in level from Voice-over phase ( $M = 2.6$ ,  $SD = .54$ ) to VAD phase ( $M = 2.87$ ,  $SD = .35$ ), less variability of data in VAD phase, and change in the trend from steep upward to slightly downward.

### **False Belief**

False belief understanding is a higher-order ToM competency often considered to be the indicator of ToM mastery. In this study it was assessed by two false belief tasks per session from a FB measure. One task, Unexpected Content, was always based on Wellman and Liu's (2004) assessment, and another task was either based on the Explicit False Belief task (Wellman & Liu, 2004) or Location Change (Wimmer & Perner, 1983) task. The answers were judged as either correct or not; each correct answer was given a score of 1, and incorrect answers were scored 0. None of the six participants demonstrated improvement in false belief understanding in the Voice-overs phase. Visual analysis of FB data found no evidence of the functional relation between Voice-overs training and children's false belief skills, and mean NAP across participants was



calculated to be .57 for Voice-overs phase. Only two participants showed improvement in VAD phase. Thus, visual analysis indicated no evidence of the functional relation between VAD treatment and early ToM skills development, and mean NAP across participants was calculated to be .63 for VAD phase (Kratochwill et al., 2010).

Individual FB results for both treatment phases are described subsequently (see Figure 3).

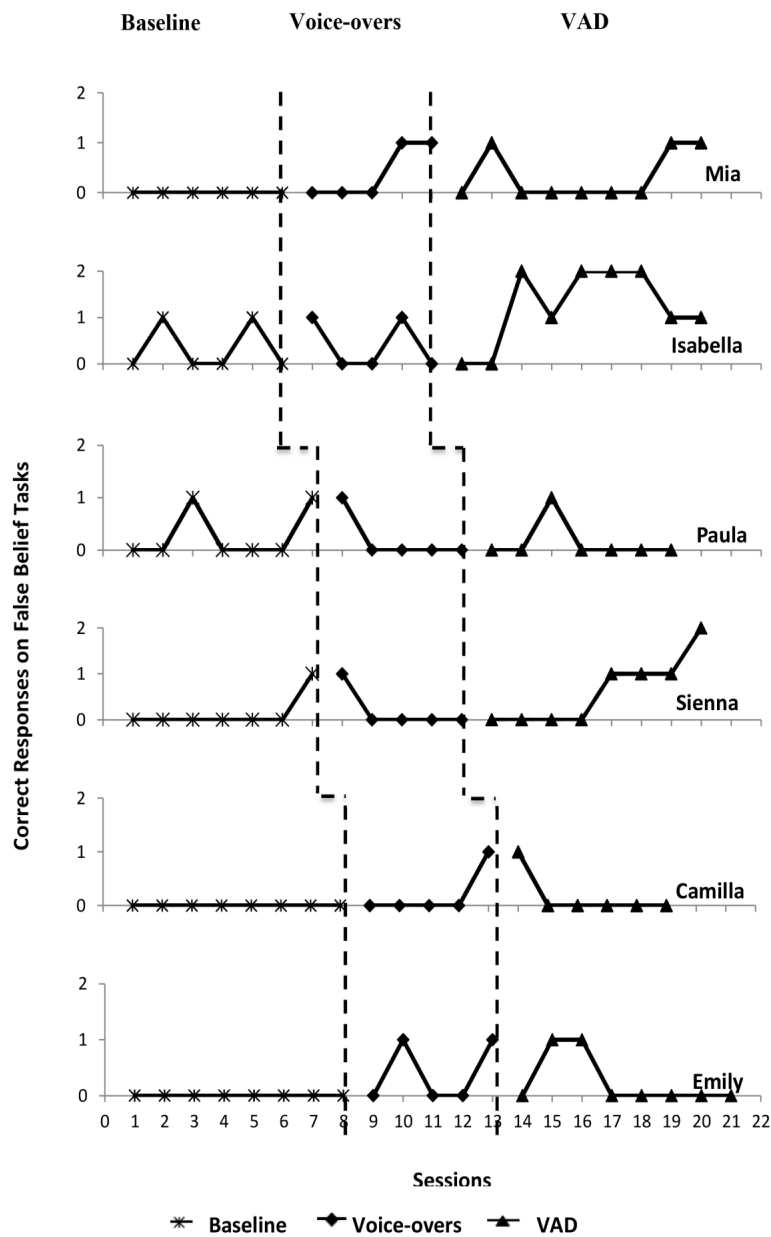


Figure 3. Accuracy of responses to the two tasks in False Belief measure by participants across the research phases.

## Mia

Mia scored 0 on all False Beliefs tasks in Baseline, indicating no conceptual understanding of false belief (Figure 3). Upon introduction of Voice-overs treatment,

Mia's data demonstrated some increase in level from  $M = 0$ ,  $SD = 0$  to  $M = .4$ ,  $SD = 0.55$ , emergence of steep upward trend, moderate variability of data, and no immediacy of effect. NAP .70 was calculated for Mia's FB data from Baseline to Voice-overs Phase.

Visual analysis did not indicate a considerable change in Mia's FB performance in the VAD phase (Figure 3) from the Baseline performance. There was a small increase in level as opposed to Baseline phase ( $M = 0$ ,  $SD = 0$ ) to VAD ( $M = .33$ ,  $SD = 0.5$ ); there was no immediacy of effect, no obvious trend emerged in the VAD phase, and data showed moderate variability. In comparison to the Voice-overs phase, there was a small drop in level (from Voice-overs phase  $M = .4$ ,  $SD = .55$  to VAD phase  $M = .33$ ,  $SD = 0.5$ ), a change in the trend from upward to flat. Mia's NAP for FB was .66

### **Isabella**

Isabella's FB data (Figure 3) was at a low level with a mean of .3 ( $SD = .5$ ), showed no distinct trend, and had moderate variability. During the Voice-overs phase, Isabella's FB performance data remained at the low level ( $M = .4$ ,  $SD = .54$ ), showed no immediacy of effect, had no pronounced trend, and showed moderate variability of data. An NAP of .58 was calculated for Isabella's FB data from Baseline to Voice-overs treatment phase.

In the VAD phase, Isabella's FB data (Figure 3) showed a rise in level from Baseline ( $M = .33$ ,  $SD = .52$ ) to VAD ( $M = 1.2$ ,  $SD = .74$ ), no immediacy of effect, steep accelerating trend, and high variability. In a similar fashion, Isabella's FB data showed a rise in level from the Voice-overs phase ( $M = .4$ ,  $SD = .54$ ) to VAD ( $M = 1.2$ ,  $SD = .74$ )

and an emergence of upward trend. A FB NAP of .80 from Baseline to VAD modified treatment phase was calculated for Isabella's FB data.

### **Paula**

During the baseline, Paula's FB data (Figure 3) was at a low level ( $M = .29$ ,  $SD = .49$ ) across the seven sessions, and had no distinct trend, as most of Paula's FB scores were 0 with two spikes, when she correctly answered to one of the two False Belief tasks. In the Voice-overs treatment phase, Paula's FB data remained at low levels ( $M = .2$ ,  $SD = .44$ ), showed no immediacy of effect, exhibited a downward trend, and had low variability. A NAP of .52 from Baseline to Voice-overs treatment phase was calculated for Paula's FB data.

Upon introduction of VAD training, Paula's FB data (Figure 3) showed no considerable change in comparison to Baseline or Voice-overs treatment phases. The data remained at low levels ( $M = .14$ ,  $SD = .38$ ), had no distinct trend, and variability stayed low. A NAP of .50 from Baseline to VAD modified treatment phase was calculated for Paula's FB data.

### **Sienna**

Sienna's FB baseline data (Figure 3) showed a low level ( $M = .14$ ,  $SD = .37$ ), a slightly upward trend, and low variability of data across the seven sessions. Similar to Baseline condition, Sienna's FB data in the Voice-overs condition was at a low level ( $M = .2$ ,  $SD = .44$ ), showed no immediacy of effect, demonstrated a slightly downward trend, and exhibited low variability. An NAP of .52 from Baseline to Voice-overs treatment phase was calculated.

Upon the introduction of VAD training, Sienna's FB data (Figure 3) showed a rise in level when comparing Baseline ( $M = .14$ ,  $SD = .37$ ) to VAD ( $M = .62$ ,  $SD = .74$ ), no immediacy of effect, steep accelerating trend, and moderate variability of data. In comparison to the Voice-overs phase, Sienna's FB data also increased in level from Baseline ( $M = .2$ ,  $SD = .44$ ) to VAD ( $M = .62$ ,  $SD = .74$ ), and trend direction changed from downward to upward. An NAP of .69 from Baseline to VAD modified treatment phase was calculated for Sienna's FB data.

### **Camilla**

Camilla showed no understanding of false belief; she scored 0 on all tasks in eight sessions of the Baseline phase (Figure 3). During the Voice-overs phase Camilla's data slightly increased in level from Baseline ( $M = 0$ ,  $SD = 0$ ) to Voice-overs Training ( $M = 0.2$ ,  $SD = .45$ ), showed no immediacy of effect, had an upward trend due to one correct answer in the last session, and demonstrated low variability. NAP of .53 was calculated for Camilla's FB data from Baseline to Voice-overs Training.

Camilla's FB data (Figure 3) showed only minor changes during the VAD phase; observed were a slight increase in level from Baseline ( $M = 0$ ,  $SD = 0$ ) to VAD ( $M = 0.16$ ,  $SD = .40$ ), no immediacy of effect, and a downward trend that was due to one correct answer in the first session of the phase and incorrect answers in all other sessions. NAP of .51 from Baseline to VAD phase was calculated for Camilla's performance on FB.

## **Emily**

Emily demonstrated no evidence of false belief understanding by scoring 0 on all False Beliefs tasks in all eight sessions of Baseline (Figure 3). During the Voice-overs phase Emily showed a slight increase in level from Baseline ( $M = 0$ ,  $SD = 0$ ) to Voice-overs Training ( $M = 0.4$ ,  $SD = .55$ ), no immediacy of effect, no distinct trend, and moderate variability of data (Figure 3). NAP of .64 was calculated for Emily from Baseline to Voice-overs Training.

Once VAD was introduced, Emily's FB data (Figure 3) showed a slight increase in level from Baseline ( $M = 0$ ,  $SD = 0$ ) to VAD ( $M = 0.25$ ,  $SD = .46$ ), no immediacy of effect, and no distinct trend. In comparison to Voice-overs phase, Emily's data showed some drop in level; from Voice-overs Training ( $M = 0.4$ ,  $SD = .55$ ) to VAD ( $M = 0.25$ ,  $SD = .46$ ) the trend changed from upward to downward. NAP of .63 from Baseline to VAD phase was calculated for Emily's FB data.

## **Social Validity**

To establish social validity of the training, all the participants, the lead teacher, and the social worker responded to the researcher's open-ended questions designed to assess the importance of the training and difference that training can make in the real world.

Participants reported liking all session activities, with playing iPad games being everyone's favorite part. Four children requested that the researcher include their friends (who did not pass the screening) in the study, two children suggested that researcher should hold sessions several times a day, and one child said she would like to be able to

choose which digital game to play each session. One child also asked to tell her mom the names of the games so she can play them at home.

The lead teacher reported that children enjoyed the study and were excited to participate every time the researcher came to class. The teacher considered procedures to be age-appropriate and engaging for her students. She believed the study mission to be important, as the development of the social skills is an essential part of the preschool curriculum, and added that having support from technology would benefit her students in developing social skills. The teacher expressed concerns that as technology becomes widespread in homes and classrooms, the teachers often lack appropriate training to use technology to teach children. She appreciated the idea that parents and teachers can use games' content to initiate discussions and promote children's social skills.

In his interview, the social worker also acknowledged the importance of the development of social-emotional skills, especially for the population of children from low-income homes. He mentioned that at first he was concerned that children might get bored with the assessment procedures, but was pleasantly surprised by children's enthusiasm throughout the study. He reported noticing some children using more mental verbs and initiating discussion of past events, but, admittedly, he did not make connections between their behaviors and participation in the study.

## **Chapter Five**

The aim of this study was to test whether children's understanding of mental states (also known as ToM) can be improved in preschool children playing digital games with embedded voice-overs conducive to ToM development when also followed or not followed by a discussion about the game. To examine this question, the following four research questions were proposed:

1. Is there a functional relation between children's understanding that people have different desires, beliefs, and knowledge access and the language used in digital games?
2. Is there a functional relation between children's false belief understanding and the language used in digital games?
3. Is there a functional relation between children's understanding that people have different desires, beliefs, and knowledge access and the language used in digital games when the game play is followed by a discussion about the game?
4. Is there a functional relation between children's false belief understanding and the language used in digital games when the game play is followed by a discussion about the game?



In the original treatment condition (Voice-overs), children played games followed by a battery of ToM assessments, whereas in the modified treatment condition (VAD), children played games and also discussed the games with the researcher.

### **Summary of the Findings**

The findings revealed that the study was effective in accelerating only the development of children's earlier-emerging ToM skills, and only under the VAD condition. The study was not effective in promoting children's false belief understanding under the Voice-overs conditions, and was marginally effective in promoting false belief understanding under the VAD condition. The results yielded the following answers to the research questions:

1. There was a modest functional relation between children's understanding that people have different desires, beliefs, and knowledge access and the mental state-based voice-overs in digital games. Only two children showed some improvement in ToM, and those improvements were not strong.
2. No functional relation between children's false belief understanding and mental state-based voice-overs in digital games was observed.
3. A strong functional relation between children's understanding that people have different desires, beliefs, and knowledge access and mental state-based voice-overs in digital games was observed when the game play mental state-based voice-overs was followed by a discussion about the game. All participants reached maximum scores in their answers to diverse desires, beliefs, and knowledge access questions during that phase.

4. A modest functional relation between children's false belief understanding and the language used in digital games was observed when the game play with mental state-based voice-overs was followed by a discussion about the game. Only two children received better scores on the false belief measure, although not consistently.

Subsequently, possible explanations for the findings from the perspectives of the two different fields of study, ToM development and learning from games are discussed. Some findings are grouped together in the interest of making the interpretation more comprehensive.

### **Explanation of Findings from the Perspective of ToM Development**

#### **Finding One**

All six children improved on DBK performance, indicating positive conceptual changes in social cognitive understanding. As mentioned in the Methods chapter, DBK measures consisted of three progressively more difficult items:

1. Diverse desires assessed children's understanding that people may have different desires for the same thing.
2. Diverse beliefs checked whether children understood that people may have different beliefs about the same situation.
3. Knowledge access evaluated children's understanding that something can be true, but another person may not know this because he/she lacks access to the information (Wellman et al., 2011; Wellman & Liu, 2004).

In the baseline condition, most of the participants consistently answered the most basic questions correctly (diverse desires and diverse beliefs), with Mia and Camilla demonstrating mastery of diverse desires only. No participant in this study showed conceptual understanding of knowledge access during the baseline phase. By the end of the study, however, all children consistently reached ceiling levels (answered three out of three questions correctly) in their performance on DBK.

The Knowledge access task is the most conceptually difficult task in DBK measure; mastery of this skill precedes the mastery of false belief in the developmental progression of conceptual achievements. Although for most participants, mastery of knowledge access would follow naturally occurring developmental progression, advances in understanding appear to be due the conceptual insights specific to the training rather than the result of participant maturation. This conclusion is due to the following reasons. First, multiple-base design allowed for the control of maturation; children started the intervention at different points, and no improvements in ToM understanding were observed prior to the training implementation (during Baseline phase) for any child. Second, as mentioned in Chapter Two, the results of several studies based on the data of 280 typically developing preschoolers in the United States and Australia allowed the researcher to estimate average ages of attainment of each skill within the ToM developmental scale (Wellman et al., 2011). Children in those studies responded correctly to the diverse desires tasks at 44 months (3.66 years), diverse beliefs tasks at 46 months (3.84 years), and knowledge access tasks at 53.4 months (4.45 years). The average age of children in the current study was 48.25 months at the beginning of the study (ranging

from 46 to 51.5 months), and their performance on baseline DBK tasks was at the lower end of the age ranges found by previous research ( $M = 1.7$ , ranging from 0-2 total correct responses per session). Wellman et al. (2011) found that in the natural course of development, typically developing children tend to master knowledge access tasks at 53.4 months of age. As follows from the numbers of the average age of achievements, it takes on average 7 months to progress from understanding diverse beliefs to understanding knowledge access tasks. In a different study, Rhodes and Wellman (2013) stated that 3-6 months are required to progress from diverse beliefs understanding to the next level, knowledge accesses understanding. By comparison, at the end of the study all children were younger than 53.4 months ( $M = 48.25$ , ranging from 47 to 52.5 months of age), and they advanced to knowledge access mastery in the period of 2-3 weeks. Similarly, Wellman et al. (2011) showed that children gain, on average, 1.38 points (or steps within the scale) in about a 13-month time span. In this study, children gained on average .92 points on the DBK measure or moved one step up within the scale in about 2-3 weeks.

Additionally, it is important to note that all participants in this sample came from low-income families. Although the Wellman and Liu (2004) assessment instrument was not scaled for low-income populations, studies consistently find that low-income children achieve false belief understanding at slower rates than children from middle-class families (Holmes-Lonergan, 2003; Seidenfeld et al., 2014; Weimer & Guajardo, 2005). Thus, it is plausible that, without this training study, children in the study sample would need even more time than indicated by Wellman et al. (2011) to accomplish knowledge access tasks.

The differences between the length of time needed to achieve each next ToM skill reported by the previous studies that followed children's natural progression in ToM development and those found in this study lend confidence that the treatment conditions in the study were indeed responsible for the accelerated progression through ToM skills observed in this sample and not due to participants' maturation.

### **Finding Two**

Two children (Camilla, and Emily) showed improvement on the DBK measure during the Voice-over condition, and four children (Isabella, Sienna Paula, and Mia) increased DBK scores during the VAD training. During the VAD intervention, Camilla, and Emily maintained and further improved their scores. In other words, all children benefited from the combination of voice-overs in the games and follow-up discussions, but only two showed some improvement from engagement with voice-overs alone. Theories on the contribution of language to the development of ToM skills along with prior intervention studies help explain these results. De Villiers and De Villiers (2014) summarized three types of theories to explain relations between ToM and language (also explained in more detail in Chapter Two). The first group of theories stresses the importance of learning vocabulary for feelings, desires, and beliefs. Often parents do this by labeling children's behaviors based on underlying mental states (e.g., when a child is reaching for a toy, a parent would say that that child *wants* that specific toy). In line with this group of theories, Gola's training (2012) demonstrated that children improve their false belief understanding by simply watching videos in which characters present mental state verbs in specific ways. Despite the fact that many voice-overs for the games in this

study were designed to be similar to the ones found in Gola's training (2012), this study failed to corroborate the results for both DBK (no improvement was observed in Gola's study), and FB (Gola found significant improvement) measures.

The second group of theories concerns the critical role of children's participation in conversations (conversational theories) in the development of ToM skills. According to conversational theories, in conversations, a child's own and other people's perspectives come to light as well as inconsistencies between a child's own and others' mental states and realities. Results of a number of intervention studies that utilized storybooks to teach children about mental states demonstrated the validity of conversational theory (Ornaghi et al., 2011; Peskin & Astington, 2004; Tompkins, 2015). In short, the studies found that children do not enhance ToM skills by listening to the stories passively, even when the latter are enriched with mental state verb and linguistic elements known to promote ToM. Rather, improvements are observed when children engage in adult-led discussions and reflections about the mental states and behaviors of characters in the stories. The most evident advancement in the current study also happened in the discussion phase. In fact, despite the differences in the training mediums, the results of this study are very similar to the results of the studies that attempted to teach children ToM by reading books enriched with mental-state content and having concurrent follow-up discussions about the book content (e.g., Guajardo & Watson, 2002; Tompkins, 2015), which further supports the effectiveness of the conversational approach in ToM development.

The third group of theories concerns children's own language production, specifically proficiency in grammatical constructs that enable children to talk about mental states of others, including mistaken beliefs. Studies that structure their training procedures around this theory usually train children to use sentential complements by engaging children in discussions and explanations of their own false beliefs (Guajardo et al., 2013; Hale & Tager-Flusberg, 2003; Lohmann & Tomasello, 2003). While the current study did not involve having children construct sentences with sentential complements, such sentences were included in the voice-overs and often referenced during the discussions. Each discussion was tailored for the individual child and was adapted every session to resemble a naturalistic conversation rather than a structured lesson. Thus, while all children were engaged in discussions, active participation in constructing sentences with sentential complements or explaining false belief of self and others varied across participants. Because some children were more engaged than others during the discussion part, their engagement may have helped them to benefit from the intervention more than the less engaged children.

The groups of theories presented previously are interrelated and capture different aspects of language development necessary for learning about the minds of others (De Villiers & De Villiers, 2014). Accordingly, it is possible that children have individual needs in terms of language development required for ToM progress. In the present study, Emily and Camilla may have required minimal support for ToM skills (DBK only) development and thus demonstrated improved performance after being exposed to mental-state vocabulary in games; however, other children, like Isabella, Sienna, Paula,

and Mia, required more support to achieve the same (and better) results, and thus benefited from game-based discussions. Furthermore, since there was no control group to test the effects of discussion without the voice-over input, it could be that Isabella, Sienna Paula, and Mia benefited from both being exposed to voice-overs and discussion together, rather than only from the discussion. It is also worth mentioning that neither Emily nor Camilla reached false belief understanding across both training modalities (Voice-overs and VAD), indicating that they may have needed minimal training to reach knowledge access understanding but might have needed different variations of training to achieve false belief understanding.

### **Finding Three**

Only two children, Isabella and Sienna, demonstrated improvement in performance on false belief tasks. Of the two, only Isabella consistently reached the ceiling (answered both false belief questions correctly). There are several possible interrelated explanations as to why the majority of children in the study did not show improvements on false belief tasks. First, in accordance with the theory of ToM development as a sequential progression of conceptual achievements (Rhodes & Wellman, 2013; Wellman & Liu, 2004), it could be necessary for children to master less sophisticated concepts first in order to achieve more complex social cognitive understanding later. Data collected from Isabella and Sienna (participants who showed improvement on ToM) demonstrate this progression; improvements on diverse desires, beliefs, and knowledge access preceded and overlapped with improvements on false belief tasks.



Results of several previous studies support the explanation that children need to have knowledge access understanding in order to develop false belief understanding under treatment conditions. Gola's (2012) ToM video training was found to be effective for the enhancement of false belief tasks, but not for diverse desires, beliefs, and knowledge tasks. According to the author, the reason for these results is the near-ceiling, pre-intervention performance of participants on the diverse desires, beliefs, and knowledge tasks; children already had the necessary foundation for false belief development and could build upon it. Benson, Sabbagh, Carlson, and Zelazo (2013) found that pre-test performance on knowledge access tasks correlated with children's improvement on false belief training. Finally, Rhodes and Wellman (2013) noticed large variability in individual scores of the participants of cross-sectional false belief training studies and examined the reasons for variation with a combination of microgenetic and scale-based methods. Results of their training program were the same as the results of the study by Benson et al. (2013); most of the children who demonstrated knowledge access understanding during pre-test progressed to consistently correct performance on false belief tasks during the training study, and almost half of those who did not have knowledge access attained it by the end of the study. Authors of the study concluded that children's initial ToM competence could both enable and constrain their learning from training programs. Whereas appropriate training programs bring most children closer to false belief understanding on the developmental scale, regardless of initial ToM competencies, children who already possess knowledge understanding skills are more likely to incorporate new conceptual information and reach false belief understanding

than those who don't yet have knowledge access understanding (Rhodes & Wellman, 2013). By extension, all participants in this study gained in intermediate understandings on the way to false belief understanding, but many may have needed more time and training to achieve false belief skills.

Second, and related to the aforementioned idea of the necessity of developing knowledge access understanding before progressing to false belief understanding, it appears that the length of the intervention may have prevented children from making the next step and advancing to false belief understanding after learning the concept of knowledge access. Although by the end of the study all participants acquired understanding of knowledge access, only two, Isabella and Sienna, moved further to improved performance on false belief tasks. Even with that, they did not reach ceiling right away on false belief tasks and demonstrated variability in their responses. Most ToM training studies are cross-sectional in design; that is, they test children's conceptual understanding only twice: pre- and post-test. Positive results of these studies can be somewhat misleading because of the impression of sudden rapid gains in participants' ToM. However, in some studies, when children were tested too soon after the training, no learning was observed, which caused researchers to conclude that children need time to accommodate new information and solidify learning received through ToM training before they can build upon the new conceptual knowledge (Kloo & Perner, 2008). Microgenetic research provided insights into the course, rates, and patterns of changes in children's ToM skills, although all of the existing studies were done on false belief understanding, but not on the earlier-developing competencies. These studies

demonstrated that false belief acquisition is a slow, gradual process of conceptual restructuring, not a sudden insight (Amsterlaw & Wellman, 2006; Flynn et al., 2004; Guajardo et al., 2013; Rhodes & Wellman, 2013). Additionally, prior to reaching consistent false belief understanding, children often go through a period of instability in responses, failing tasks they previously passed successfully (Flynn et al., 2004). The described patterns in children's understanding showed up under the intervention conditions aimed to speed up the development of ToM skills; thus, it could be that on their own children require even more time to reinforce new understanding and go through longer periods of instability. Hence, in the current study, Mia, Camilla, Paula, and Emily may have needed more time to progress to the development of false belief after achieving knowledge access, whereas Isabella and Sienna may have needed more time to establish a conceptual understanding of false belief.

Finally, it can be argued that the children's performance reflected the content of the training, which was often game specific and targeted the development of awareness of desires, beliefs, knowledge access, and false belief situations to different degrees. Researchers have found that different language input and communicative skills may contribute to different ToM competencies. For example, naturalistic studies show that young children's understanding of mental states correlates with the contents of their mothers' speech, and changes in understanding match changes in the content of conversations (Slaughter et al., 2007; Taumoepeau & Ruffman, 2006, 2008). When children are very small, mothers tend to focus conversations on the children's desires, thus scaffolding children's mental state language development and desire and belief

understanding. Once children achieve a better grasp of diverse desires and beliefs, mothers begin to include more references to the mental states of other people and more abstract use of desire and belief language (Taumoepeau & Ruffman, 2006, 2008).

Although the voice-over design for the current study was guided by relevant research findings on language and ToM development, it was somewhat constrained by the plot of the games. Thus, because of the game plot, it was not possible to distribute and counterbalance linguistic and communicative elements to target all different components of ToM equally. It could be that children received more stimulation related to the ToM components on which they showed advancement and did not show achievement on false belief because not enough false belief-specific language input was used. Esteban et al. (2010) came to a similar conclusion in their study of the effects of storybook reading on children's ToM development. The authors of the study enriched a *Little Red Riding Hood* book with sentential complement sentences, causal and contrastive talk about mental states, and prompts for teachers to initiate discussions. They found improvements to occur with only one type of false belief task. They explained these results by the content and structure of the specific story, noting that different narratives with different interactions between characters and including descriptions of different wishes, beliefs, and emotions of the characters could have promoted other ToM competencies.

Additionally, many previous studies designed ToM tasks to be similar to false belief used at pre- and post-test (e.g., Appleton & Reddy, 1996; Hale & Tager-Flusberg, 2003; Knoll & Charman, 2000), thus targeting very specific skills. All five games included in this study had very few false belief scenarios similar to the tasks included in the Wellman and

Liu (2004) developmental scale or location change task. There were, however, many scenes showing characters' needs, wants, and likes, as well as references to the characters' sources of knowledge. Therefore, it could be that, due to the game structure and content, children in the current study received enough training to improve on diverse desires, beliefs, and knowledge access understanding, but not enough training to progress in false belief understanding.

### **Explanation of Findings from the Perspective of Learning from Digital Games**

The results described previously were interpreted from the perspective of ToM development. To have a more complete picture of the results it is important to consider the contribution of the learning medium: digital games. Digital games are exciting platforms that afford interactivity, repetition, and variable content: features that may be promising in teaching social-cognitive skills to young children. From this study, however, it appears that, despite being more technologically advanced than storybooks, digital games enriched with ToM-stimulating language, when used alone, may be as ineffective in promoting social-emotional skills as storybooks when used alone (e.g., Peskin & Astington, 2004). Research from studies on children learning from digital media sheds additional light on children's performance.

Two major findings of this study in relation to children's learning ToM skills from digital games were: (s) only two children showed (very moderate) gains in ToM understanding (on the DBK measure) by playing games with ToM enhancing voice-overs, and (b) all children showed progress (on the DBK measure) when ToM-enriched game-play was accompanied by researcher-led discussions.

One of the biggest reasons for the lack of participants' progress in learning ToM skills from playing games in the voice-over condition may be the lack of the transfer effect: that is, of children's ability to apply messages from media to the real world. This ability has been linked to children's developing abstract understanding and differential reliance on the information as a veritable source of knowledge about the world (Heintz & Wartella, 2012; Richert et al., 2011). First of all, preschool children have difficulty distinguishing whether screen-based characters and events are fictional or real. When children determine that educational content cannot happen in real life, they fail to absorb and apply that content (Mares & Acosta, 2008; Mares & Sivakumar, 2014; Richert et al., 2011). Preschoolers also appear to have an especially hard time with abstract messages embedded in educational content due to their developing cognitive abilities (Richert et al., 2011). This inability makes young children oblivious to much prosocial content in children's television programs; the understanding of such content grows from ages 3-7 (Mares & Woodard, 2005).

In light of these other research findings, it appears that participants in this study may have seen narratives as too abstract and have not made connections between false belief situations, different desires, and beliefs of characters depicted in the games and those presented in ToM assessment tasks (despite half of the tasks being presented on an iPad drawing app). As a way of remedying this effect, researchers suggest showing concrete situations (Fisch, McCann Brown, & Cohen, 2001) and inserting explicit statements regarding the educational goal or moral of the game along with the applicability of the concrete situation to the real world. These explicit statements would

be akin to parental comments made during media co-engagement (Mares & Acosta, 2010). However, although the games in this study had a narrator to describe beliefs and desires of the characters, the games never explained that people could have similar desires and thoughts in real life. Additionally, as mentioned before, voice-overs were composed for the existing commercial games. Thus, it could be that references to the mental states in the game plot, along with false belief situations, were indeed too abstract for children; hypothetically, if games were designed specifically for the study with the goal of ToM improvement, more participants might improve in just the voice-over phase of the study.

As mentioned earlier, whereas only two participants showed some gains in ToM skills under the voice-over condition, all children in the study demonstrated noticeable achievements in the VAD session. These results are in agreement with a growing body of work showing the importance of joint engagement between caregivers and children through adults' active mediation of media content (e.g., Nathanson, 2001; Reiser et al., 1984; Takeuchi & Stevens, 2011). To date most research on adult mediation focuses on television co-viewing, but the findings can be extended to parent-child co-engagement with digital games as well because of several shared features between these two media. Generally speaking, the results of this study suggest that by means of scaffolding, the researcher could have helped the children in the study overcome the lack of transfer of learning demonstrated in the Voice-overs condition. Scaffolding refers to the process of an adult supporting the child's skills acquisition, providing task information of different complexity and on a various structure level until the child learns to perform skill-based

tasks independently (Pratt, Kerig, Cowan, & Cowan, 1988). Like naturally occurring scaffolding, post-game discussions about the games were tailored to each child's individual answers, thus accommodating a range of abilities.

Specifically, the researcher prompted participants to remember the content and rehearse the narrative by asking such questions as "Why was the Bunny sad?" and "What happened to Bunny to make him sad?" According to previous studies, these activities may have helped children process information and store it for later use (Strouse, O'Doherty, & Troseth, 2013). Additionally, by asking children to remember specific parts of the game, the researcher drew children's attention to the important parts of the game, potentially encouraging participants to exert more effort in understanding the material (Reiser et al., 1984). After listening to children respond, the researcher often expanded on answers (e.g., "Right, he was sad because he really wanted an ice cream, and thought that the Ice Cream Lady would sell him some Ice Cream. Then he realized that the Ice Cream Lady ran out of ice cream and got upset."), thus exposing the child to the vocabulary presented in the games once again and providing context for children to better understand the story plot. These types of explanations could have made abstract situations more concrete and helped children understand the situational precursors to mental states and connect behaviors to underlying mental states (Mares & Acosta, 2010). Finally, a discussion with the researcher could have helped the child overcome fiction-reality confusion and see how the situations found in the game are applicable to real life (Strouse et al., 2013).



Children's characteristics, game features, and the interplay of these two factors can also help explain the results of this study, specifically the variability in individual performance and the overall pattern of responses. First, it is important to consider that all people, including children, are differentially susceptible to media effects. According to Valkenburg and Peter (2013), this means that person-specific factors (such as age, cognitive, and social development) as well as contextual factors (such as SES and family composition) determine how much that person can benefit from or be harmed by interactions with media. That is, each child's learning patterns are dependent on his/her individual cognitive abilities. For example, it is possible that Emily and Camilla were cognitively ready to transfer information from screen and learn mental-state understanding from the games alone, but other participants were not. It is also possible that children's similarity in age and SES status contributed to the patterns of learning observed for the sample in each phase of the study. Additionally, game-specific factors could have contributed to the degree to which children learned information. The apparent effectiveness of the follow-up discussion this study in enhancing children's performance adds to the number of studies that demonstrate that social interactivity is crucial for children's learning from digital media (e.g., Tamis-LeMonda, Kuchirko, & Song, 2014; Troseth, Saylor, & Archer, 2006). In contrast, the ineffectiveness of the Voice-overs treatment phase may also indicate that perhaps the games themselves did not have an optimal level of social interactivity (Nussenbaum & Amso, 2015) to promote learning in the current sample of children.

## **Limitations**

This study was not without limitations. Although the functional relation was established in some cases, these results cannot be generalized to larger populations due to the nature of SSR (Gast, 2010). Additionally, the design of the current study did not allow for detecting and quantifying of unique contributions of different linguistic elements in the voice-overs, as well as separate contribution of discussion to children's performance. Finally, whereas single-subject design does not require a control group because of the use of a baseline condition for each participant, the study could have benefited from a number of participants who did not undergo any training. Doing so would further demonstrate the absence of the maturation effect in children's performance. More research is warranted as some of these questions would best be examined in the context of a group study.

Among the threats to internal validity was variability of assessment materials. As mentioned previously, the assessment scenarios were modeled on the Wellman and Liu (2004) developmental assessment scale and Change of Location task (Wimmer & Perner, 1983). Twenty variations of the same scenario were created. Whereas all scenarios were deemed age-appropriate by the panel of preschool teachers, there were several times when children did not know the intended content for the container in the Unexpected Content task. Specifically, one child did not know the watering can has water in it, another child did not know what the appropriate contents of a tissue box were, and two children did not recognize a glue stick. In these cases, the researcher had to explicitly state the content of the container and then say that a doll or character in the assessment

scenarios “really likes to use water can to water flowers,” or “really likes to use glue sticks to glue things together” before asking the target question, such as, “What does the doll think is in the watering can, water or candy?” However, based on the consistently incorrect answers to these and other Unexpected Contents assessment scenarios, additional information in these specific cases did not interfere with children’s performance.

Among the external threats to validity were time constraints and setting constraints. Although the preschool administration and staff were extremely accommodating, the preschool is a busy place, with a lot of activities, a set schedule, and an academic curriculum. Therefore, data collection occurred during the summer months before the beginning of the academic year. Thus, even though each phase of the study met the single-subject evidence standards (Kratochwill et al., 2010), more time would have allowed for more training sessions, better examination of children’s progress under each condition, and, potentially, the detection of emergence of false belief understanding in more participants. Further, time constraints did not allow for implementation of the maintenance phase, which is limiting because the maintenance of children’s knowledge gains remains unknown. Additionally, a longer data collection period could have allowed children to have more control of the procedures, such as to choose which games to play or play several games per session. Letting children be in control of procedures would more closely resemble real life game play and could potentially allow children improve more on ToM skills through repeated exposure to voice-over enriched games. Finally, the timing for children’s participation during the day depended on the children’s schedules,

so some children participated only in the mornings before nap, and others who were usually picked up in the evening participated after naptime. It is unclear whether those schedules were optimal for children's learning.

As mentioned earlier, preschool is a busy place, so it was hard to reserve a stable place to carry out all sessions. Thus, sessions happened in one of two rooms: the library or in the resource room. The schedule was unpredictable; for example, the resource room was under renovation at the last week of the study and could not be used at all, while the library was often used for staff meetings or educational workshops. Although usually it was possible to adapt to the changes in the room schedule, there were times when a participant's session had to be rearranged or cancelled to accommodate school activities. On the one hand, whereas both rooms were quiet and comfortable, it is possible that setting and timing inconsistency negatively impacted children's learning. On the other hand, in everyday life, children's game play (especially on mobile devices) is not tied to one location and thus the results of the study may actually more relatable to real-life learning processes.

There are also limitations in the ability to make conclusions concerning the advantages in using games to promote ToM skills. Since this study did not directly compare Voice-over and VAD methods with other strategies for facilitating ToM development, it cannot be concluded that one of these two methods is superior to the other methods. Rather, it can be established that VAD could be an effective option available for parents and teachers to promote mental state understanding in children or

content designers developing educational games with the goal of teaching ToM skills.

The ability to generalize the effectiveness of these results requires further investigation.

### **Implications and Future Directions**

This study examined whether children could improve their ToM understanding by playing commercial digital games enriched with mental-state-based voice-overs and followed or not followed by a discussion with a researcher. By bridging gaps in existing knowledge regarding learning from digital games and preschoolers' ToM development, the current study makes a number of novel contributions to the literature that may have important implications for educational game design professionals. Although additional research is necessary to extend and adapt presented findings, the current study offers a necessary step toward understanding the potential for digital technology to improve children's ToM development.

First, the study partially replicated findings of earlier training programs (e.g., Peskin & Astington, 2004) and showed that being passively exposed to training material on mental states understanding is less effective than discussing that material. The replication is partial because this study found improvement in the knowledge access ability, but not in false belief understanding. The findings of this study, although not new, add to a very small body of knowledge on children's learning ToM from digital games. The majority of previous studies used picture- and storybooks to introduce mental-state language (Ornaghi et al., 2011; Peskin & Astington, 2004; Tompkins, 2015); a few used short films (Appleton & Reddy, 1996; Gola, 2012), but no one, to this researcher's knowledge, used digital games. Most of the children in this study performed similarly to

participants in studies that utilized storybooks whether accompanied by follow-up discussions or not. Although it is disappointing that game design alone did not enhance most children's ToM skills, the study can inform content design by highlighting the important role of social interaction in educational games. An interesting result is that two children showed some improvement in earlier-developing ToM skills while only playing games, before the discussion was introduced. This improvement suggests the existence of individual differences in learning from the games. Because of previous research (Gola, 2012) reporting improvements in children ToM after watching characters interact in a film, it could be that single-subject design prevented the detection of differently nuanced relations between different game features and children's learning. An important avenue for future research would be to examine individual contributions and interactions between participants' characteristics and game design features in children's learning ToM skills from digital games. Among characteristics to examine would be participants' SES (perhaps children from different backgrounds learn differently from games), content (whether content designed specifically around ToM is more effective than content designed for existing commercial games), and social interactivity levels (e.g., whether a *conversation* where a character asks a player about false belief situations and the player points at the answers is more effective than the player walking characters through a set of obstacles and observing the characters communicating).

The association between children's preexisting knowledge access understanding and progress in false belief understanding under appropriate treatment conditions was also replicated in this study. However, whereas earlier research used either a correlational

design (Guajardo et al., 2013) or a combination of approaches (Rhodes & Wellman, 2012) to examine this relation, this study is the first one to capture developmental change of earlier-developing ToM competencies and how this development precedes and underlies the development of false belief understanding. Additionally, this study was one of the very few (if any) to employ single-subject design in the training study of ToM. The unique features of the study allowed for the examination of patterns of progress over time within and across different treatment phases, without any training at baseline and under different variations of treatment conditions. Finally, while microgenetic studies that examine trajectories of children's ToM development (Amsterlaw & Wellman, 2006; Flynn et al., 2004; Guajardo et al., 2013; Rhodes & Wellman, 2013) have been done and other studies have examined the timeline of false belief understanding in low-income children (e.g., Curenton, 2003; Cutting & Dunn, 1999; Dessen & de Hollanda Souza, 2014), this study is one of the first to look at process and patterns of ToM development through extended, closely spaced, longitudinal assessments in low-income children. Future studies may find it worthwhile to compare longitudinal trajectories of ToM development between samples of children from different SES backgrounds.

This study also highlighted the importance of child-adult joint-media engagement for children's learning. However, while digital media's potential to promote learning through joint engagement between caregivers and children is widely recognized by researchers, this potential is rarely used. According to a recent report by PlayScience and the Casual Games Association (2015), 70% of children ages 6-12 play their favorite app alone, and only 25% of children believe the ability to play the game with someone else is

an important feature for an app to have. Additionally, a content analysis of apps claiming to promote literacy in young children (Vaala & Ly, as cited in Guernsey & Levine, 2015) found a significant lack of opportunities for parents and children to share learning from game apps and to have meaningful interactions around the apps.

Thus, while results of this study do indicate that co-engagement is a crucial part of learning ToM skills from digital games, more work is needed to examine how to facilitate parental co-engagement with games. In designing content for children's games with parents in mind, it is important to take into account the fact that parents may not be aware of the benefits of early ToM understanding and may be unfamiliar with the ways to promote ToM skills (e.g., explanatory, causal, and contrastive talk about mental states; detailed discussions of past events; mental state verbs along with embedded sentential complements structures). One approach to bridging this gap is to provide ideas for parent-child discussion by modeling teaching strategies in the games themselves, for example, in character interactions or in the notes for parents, as in PBS Parents Play & Learn App©. Results of this study may also extend to e-book content development. Like the games in this sample, e-books have a plot and some level of interactivity, but they also have features missing in the games that may be advantageous for teaching understanding of mental states; for example, parents are more likely to co-engage with books than with games. Therefore, built-in discussion prompts focused on mental-states may be a promising feature in e-books with an aim to enhance ToM development.

Overall, results of this study indicate that the incorporation of ToM conducive language in digital games can be beneficial for ToM improvements as it can prompt



parents or teachers to engage in conversations about mental-states by leaning and expanding on voice-overs found in the games. Although all TD children master ToM skills with time, there are advantages to achieving conceptual understanding sooner rather than later because this understanding can contribute to children's social-emotional development and short- and long-term development. Some populations of children, such as children from low-income families, may particularly benefit from additional help in promoting ToM. Since digital technology is commonplace in the everyday lives of preschoolers (Neumann & Neumann, 2014; Schneider et al., 2012), an effort to design evidenced-based educational games to enhance mental state understanding in preschoolers will benefit all children.

## Appendix A

### English and Spanish Recruitment Letters and Consent Forms

#### College of Education and Human Development



Dear Parent,

Dr. Anna Evmenova and his doctoral student Mariya Nikolayev want to let you know about exciting opportunities for you and your children! At College of Education and Human Development on the campus of George Mason University, we study children's learning from educational games by conducting studies with children. We visit children at their preschools at times most convenient for parents, teachers and children. Children get to play games, talk to researchers, and complete computer tasks while we learn important information about their development.

Currently, we are seeking children who just turned four (or will soon turn four years old within the next few months) and who might like to help with our ongoing study about children's learning from game play. Please take a consent form home, read it carefully, sign, and return to the center if you'd like your child to participate in this study.

We are looking forward to meeting you and your children!

Sincerely,

**GEORGE MASON UNIVERSITY  
CONSENT TO ACT AS A HUMAN RESEARCH SUBJECT**

Children's Learning from Digital Games

Your child is being asked to participate in a research study. Participation is completely voluntary. Please read the information below and ask about anything that you do not understand before deciding if you want your child to participate. If you have questions, contact any of the researchers listed next.

**RESEARCH TEAM**

**Lead Researcher:**

Anna Evmenova, Assistant Professor,  
College of Education and Human Development, GMU  
Helen Kellar Institute for Human disAbilities  
(703) 993-3670; FAX: (703) 993-3681  
Email: [aevmenov@gmu.edu](mailto:aevmenov@gmu.edu)

**Lead Researcher:**

Kevin Clark, Professor, Division of Learning Technologies  
College of Education and Human Development at George Mason University  
Phone: (703) 993-3669 Fax: (703) 993-2722  
Email: [kclark6@gmu.edu](mailto:kclark6@gmu.edu)

**Researcher:**

Mariya Nikolayev, doctoral student, College of Education and Human Development, GMU  
Email: [msumarok@gmu.edu](mailto:msumarok@gmu.edu)

**Study Location(s):** Main Street Child Development Center

**PURPOSE OF STUDY**

The purpose of this research study is to investigate children's learning from educational digital games, including when this learning is effective and how effectiveness depends on different game features.

**SUBJECTS**

***Inclusion Requirements***

Your child is eligible to participate in this study if she/he just turned 4 (or will soon turn 4 years old within the next few months).

***Time Commitment***

This study will involve up to 18 sessions of 30 minutes each over one to two months. Playing the digital game will take about 7 minutes, whereas the rest of the time will be occupied by answering questions about the game, completing scenarios, and playing games that include labeling objects

**PROCEDURES**

The following procedures will occur: Children will be observed individually in location in the school that is quiet and minimally distracting. Meetings will not interfere with important classroom activities and will be done at times most convenient for teachers and children. Children will be invited to take part in the session. If they agree, during each session, children will be administered tasks that include playing an age-appropriate education children's game on iPad, answering questions, labeling objects, and completing stories. All tasks are developmentally appropriate and involve brief question-answer sessions with the researcher. Sessions are videotaped to ensure that the individual working with children can devote full attention to the children and not have to document responses during the interaction.

**RISKS AND DISCOMFORTS**

This study involves no more than minimal risk. There are no known harms or discomforts associated with this study beyond those encountered in daily life. Any child who appears uncomfortable will be reassured and returned to the classroom.

**BENEFITS**

Your child will not directly benefit from participation in this study. Children typically find our procedures interesting, and they feel important knowing that the information they provide is valuable and needed. Society in general will benefit from



**IRB: For Official Use Only**

Project Number: 662979-2  
Date Approved: 7/28/15  
Approval Expiration Date: 7/27/16

Page 1 of 3

the study's results. Knowledge about how children learn from games will advance developmental theory and educational game design.

#### ALTERNATIVES TO PARTICIPATION

The only alternative to participation in this study is not to participate.

#### COSTS OR REIMBURSEMENT

There are no costs associated with participation.

#### WITHDRAWAL OR TERMINATION FROM THE STUDY AND CONSEQUENCES

You are free to withdraw your child from this study at any time. **If you decide to withdraw your child from this study, please notify the researcher immediately.** Your child is also free to stop participation at anytime during a session. There are no penalties for withdrawing from a study or for stopping partway through a session. Children who wish to stop during a session will have the option to participate on another day.

#### CONFIDENTIALITY

##### **Subject Identifiable Data and Data Storage**

All information about your child is kept confidential, except as required by law. There is one exception to confidentiality. It is our legal responsibility to report situations of suspected child abuse or neglect to appropriate authorities. Although we are not seeking this type of information in this study nor will you be asked questions about these issues, we will disclose them as required under the law if discovered. All identifiable information that will be collected about your child will be removed and child's name will be replaced with a pseudonym. A list linking the code and your child's identifiable information will be kept separate from the research data. All study information will be stored in a locked cabinet in a secure building.

##### **Data Access**

The research team and authorized GMU personnel may have access to the study records to protect your and your child's safety and welfare. Any information derived from this research project that personally identifies you or your child will not be voluntarily released or disclosed by these entities without your separate consent, except as specifically required by law. Research records provided to authorized, non-GMU entities will not contain identifiable information about you or your child. Publications and/or presentations that result from this study will not include identifiable information about you. Study records will be destroyed at the end of the study.

#### IF YOU HAVE QUESTIONS

If you have any comments, concerns, or questions regarding this research, please contact Dr. Anna Evmenova at 703-993-3670 or aevmenov@gmu.edu

You may contact the George Mason University Office of Research Integrity & Assurance at 703-993-4121 if you have questions or comments regarding your rights as a participant in the research.

#### VOLUNTARY PARTICIPATION STATEMENT

You should not sign this form unless you have read it and been given a copy of it to keep. **Participation in this study is voluntary.** Your child may refuse to answer any question or discontinue involvement at any time without penalty or loss of benefits to which your child might otherwise be entitled. Your decision will not affect your future relationship with GMU. Your signature below indicates that you have read the information in this consent form and have had a chance to ask any questions that you have about the study.

*I agree to allow my child to participate in the study.*

\_\_\_\_\_  
Parent or /Guardian Signature

\_\_\_\_\_  
Date

\_\_\_\_\_  
Printed Name of Parent or Guardian



#### IRB: For Official Use Only

Project Number: 662979-2  
Date Approved: 7/28/15  
Approval Expiration Date: 7/27/16

Page 2 of 3

\_\_\_\_\_  
Researcher Signature **Date**

\_\_\_\_\_  
Researcher Printed Name **Date**

**Child's Name:** \_\_\_\_\_

**Child's Date of Birth:** \_\_\_\_\_ **Child's Sex:** Male Female

**Child's Race/Ethnicity:** \_\_\_\_\_

**Your Relationship to Child:** \_\_\_\_\_

## Facultad de Educación y Desarrollo Humano



de la Universidad George Mason

Estimados padre o madre:

La Dra. Anna Evmenova y su estudiante de doctorado Mariya Nikolayev desean informarle acerca de algunas oportunidades interesantes para usted y sus hijos. En la Facultad de Educación y Desarrollo Humano de la Universidad George Mason estudiamos el aprendizaje infantil mediante el uso de juegos educativos. Para hacerlo, llevamos a cabo estudios con niños. Visitamos a los niños en sus salas de preescolar en los horarios más convenientes para los padres, los maestros y los niños. Los niños juegan, conversan con los investigadores y realizan tareas en una computadora mientras nosotros recopilamos información importante sobre su desarrollo.

Actualmente, estamos buscando niños que tengan cuatro años recién cumplidos (o que vayan a cumplir los cuatro años de edad en los próximos meses) y que podrían estar interesados en ayudarnos con el estudio que actualmente estamos realizando acerca del aprendizaje infantil mediante el uso de juegos. Si desea que su hijo/a participe en este estudio, le solicitamos que se lleve un formulario de consentimiento a su casa, lo lea detenidamente, lo firme y lo entregue al centro.

¡Estamos ansiosos por conocerlos a usted y a sus hijos!

Atentamente,

**UNIVERSIDAD GEORGE MASON**  
**CONSENTIMIENTO PARA PARTICIPAR COMO SUJETO DE UNA INVESTIGACIÓN CON SERES HUMANOS**

El aprendizaje infantil mediante el uso de juegos digitales

Invitamos a su hijo/a a que participe en un estudio de investigación. Su participación es totalmente voluntaria. Le solicitamos que lea la siguiente información y que haga todas las preguntas que necesite sobre lo que no comprenda antes de decidir si desea que su hijo/a participe. Si tiene preguntas, comuníquese con cualquiera de los investigadores listados a continuación.

**EQUIPO DE INVESTIGACIÓN**

**Investigadora principal:**

Anna Evmenova, Profesora adjunta,  
Facultad de Educación y Desarrollo Humano, GMU  
Instituto Helen Kellar de Discapacidades Humanas  
(703) 993-3670; FAX: (703) 993-3681  
Email: [aevmenov@gmu.edu](mailto:aevmenov@gmu.edu)

**Investigador principal:**

Kevin Clark, Profesor, División de Tecnologías del Aprendizaje  
Facultad de Educación y Desarrollo Humano de la Universidad George Mason (GMU)  
Teléfono: (703) 993-3669 Fax: (703) 993-2722  
Email: [kclark6@gmu.edu](mailto:kclark6@gmu.edu)

**Investigadora:**

Mariya Nikolayev, estudiante de doctorado, Facultad de Educación y Desarrollo Humano, GMU  
Email: [msumarok@gmu.edu](mailto:msumarok@gmu.edu)

**Sitio(s) del estudio:** Centro de Desarrollo Infantil Main Street

**PROPÓSITO DEL ESTUDIO**

El propósito de este estudio de investigación es investigar el aprendizaje infantil mediante el uso de juegos digitales educativos. Entre otras cosas, se investigará en qué circunstancias este aprendizaje es efectivo y de qué manera su efectividad depende de diferentes características de los juegos.

**PARTICIPANTES**

***Requisitos de participación***

Su hijo/a podrá participar en este estudio si tiene 4 años recién cumplidos (o si va a cumplir 4 años en el transcurso de los próximos meses).

***Tiempo requerido***

El presente estudio consistirá en hasta 18 sesiones de 30 minutos cada una que tendrán lugar en el transcurso de uno a dos meses. Jugar al juego digital llevará aproximadamente 7 minutos, mientras que el resto del tiempo estará destinado a responder preguntas sobre el juego, a completar escenarios y a jugar a juegos que, entre otras cosas, consistirán en rotular objetos.

**PROCEDIMIENTOS**

Se llevarán a cabo los siguientes procedimientos: Se observará a los niños de manera individual en un sitio de la escuela que sea silencioso y que presente la menor cantidad de distracciones posible. Las reuniones no interferirán con ninguna actividad importante del salón de clases y se llevarán a cabo en los momentos que sean más convenientes para los maestros y los niños. Se invitará a los niños a participar en la sesión. Si aceptan, durante cada sesión se les asignarán a los niños diferentes tareas, entre ellas, jugar en un iPad a un juego infantil educativo adecuado para su edad, responder preguntas, rotular objetos y completar historias. Todas las tareas que se les asignen serán adecuadas a su nivel de desarrollo e incluirán breves sesiones de preguntas y respuestas con el investigador. Las sesiones serán filmadas a fin de que la persona que trabaje con los niños pueda enfocar toda su atención en los niños y no tenga que registrar respuestas durante la interacción.

**RIESGOS Y MOLESTIAS**

Este estudio no conlleva más que un riesgo mínimo. Se desconoce que existan riesgos o molestias asociados con este estudio más allá de los que se experimentan en la vida diaria. Los niños que presenten signos de molestia serán tranquilizados y regresarán al salón de clases.

**BENEFICIOS**

Su hijo/a no se beneficiará directamente de su participación en este estudio. Por lo general, los niños encuentran interesantes nuestros procedimientos, y saber que la información que brindan es valiosa y necesaria los hace sentir importantes. Los resultados de este estudio serán beneficiosos para la sociedad en general. El conocimiento acerca de la manera en la que los niños aprenden mediante el uso de juegos promoverá la teoría del desarrollo y la creación de juegos educativos.



**IRB: For Official Use Only**

Project Number: 662979-2  
Date Approved: 7/28/15  
Approval Expiration Date: 7/27/16

#### ALTERNATIVAS DE PARTICIPACIÓN

La única alternativa a participar en este estudio es no participar en el mismo.

#### COSTOS O REEMBOLSO

La participación en este estudio no tiene ningún costo.

#### INTERRUPCIÓN O FIN DE LA PARTICIPACIÓN EN EL ESTUDIO Y SUS CONSECUENCIAS

Usted es libre de retirar a su hijo/a del estudio en cualquier momento. **Si decide retirar a su hijo/a del estudio, le solicitamos que se lo notifique de inmediato al investigador.** Además, su hijo/a es libre de interrumpir su participación en cualquier momento durante la sesión. No habrá sanciones si retira a su hijo/a del estudio o si su hijo/a deja de participar en medio de una sesión. Los niños que deseen dejar de participar durante una sesión tendrán la opción de participar otro día.

#### CONFIDENCIALIDAD

##### **Datos de carácter personal del participante y Almacenamiento de datos**

Toda la información relativa a su hijo/a será tratada de manera confidencial, a menos que la ley exija lo contrario. Existe una excepción a la confidencialidad. Tenemos la responsabilidad legal de reportar ante las autoridades pertinentes cualquier situación de sospecha de abuso o negligencia infantiles. Si bien no buscamos este tipo de información en este estudio, ni le haremos a usted ninguna pregunta respecto de estos asuntos, en caso de percibirlos los reportaremos según lo requiere la ley. Toda la información de carácter personal que se recopile sobre su hijo/a será eliminada y el nombre de su hijo/a será reemplazado por un seudónimo. El código y la información personal de su hijo/a se incluirán en una lista independiente de los datos de la investigación. Toda la información pertinente al estudio será almacenada bajo llave en un armario dentro de un edificio seguro.

##### **Acceso a los datos**

El equipo de investigación y personal autorizado de la Universidad George Mason podrían tener acceso a los registros del estudio con el fin de proteger la seguridad y el bienestar suyos y de su hijo/a. Dichas entidades no entregarán ni divulgarán sin su consentimiento particular ninguna información derivada de este proyecto de investigación que pueda servir para identificarlo/a a usted o a su hijo/a, a menos que la ley específicamente exija lo contrario. Los registros de la investigación que se pongan a disposición de entidades autorizadas ajenas a la Universidad George Mason no contendrán información de carácter personal sobre usted o su hijo/a. Las publicaciones y/o presentaciones que deriven de este estudio no incluirán información de carácter personal sobre usted. Los registros del estudio serán destruidos al finalizar el estudio.

#### SI TIENE PREGUNTAS

Si tiene comentarios, inquietudes o preguntas sobre esta investigación, comuníquese con la Dra. Anna Evmenova al 703-993-3670 o envíele un correo electrónico a [aevmenov@gmu.edu](mailto:aevmenov@gmu.edu).

Si tiene preguntas o comentarios acerca de sus derechos como participante de esta investigación, puede comunicarse con la Oficina para la Integridad y el Cumplimiento en la Investigación de la Universidad George Mason al 703-993-4121.

#### DECLARACIÓN DE PARTICIPACIÓN VOLUNTARIA

No firme este formulario a menos que lo haya leído y haya recibido una copia del mismo para llevarse a su casa. **La participación en este estudio es voluntaria.** Su hijo/a puede negarse a responder cualquier pregunta o a dejar de participar en cualquier momento sin que se apliquen sanciones y sin que su hijo pierda beneficios de los cuales podría gozar en caso contrario. Su decisión no afectará futuros vínculos con la Universidad George Mason. Su firma a continuación indica que usted ha leído la información incluida en este formulario de consentimiento y que ha tenido la oportunidad de formular todas las preguntas que tuviera acerca del estudio.

*Autorizo a mi hijo/a a participar en el estudio.*

\_\_\_\_\_  
Firma del padre, madre o tutor

\_\_\_\_\_  
Fecha

\_\_\_\_\_  
Nombre del padre, madre o tutor en letras de imprenta

\_\_\_\_\_  
Firma del investigador; Nombre del investigador en letras de imprenta

\_\_\_\_\_  
Fecha

\_\_\_\_\_  
Nombre del investigador en letras de imprenta

\_\_\_\_\_  
Fecha

Nombre del niño: \_\_\_\_\_



Project Number: 662979-2  
Date Approved: 7/28/15  
Approval Expiration Date: 7/27/16

**IRB: For Official Use Only**



Fecha de nacimiento del niño: \_\_\_\_\_ Sexo del niño: Varón    Mujer

Raza/etnia del niño: \_\_\_\_\_

Su relación con el niño: \_\_\_\_\_

## **Appendix B**

### **Voice-Overs (Game Scripts)**

#### **Circus Game**

Narrator: WOW, the circus is here! Everyone knows you need to get a ticket to see the show!

Narrator: This customer would like one ticket, just for themselves.

Audience 1: If my friends see me going to the circus, they will come here too.

Audience 2: Hi Seller, do you know if there will be a lion?

Seller: Hmm. What do you think? You probably hope to see one.

Audience 3: Do you think everyone would like to see a clown?

Seller: Everyone knows they'd be so happy to see a clown!

Audience 3: My friends are so excited, because they LOVE clowns

#### **Acrobat**

##### **a) Rope**

Narrator: Everyone in the crowd thinks that the acrobat may fall down from the rope, but she knows she won't because she's been practicing.

##### **b) Horse**

Narrator: Everyone in the crowd thinks that the acrobat may fall down from the horse, but she knows she won't because she's been practicing.

c) Swing

Narrator: Everyone thinks that the acrobat may fall down from the swing, but she knows she won't because she's been practicing.

**Clown**

a) Juggler

Narrator: Clown thought everyone can juggle, but now he sees that it is a hard thing to do. Look , he's dropping his tenpins

b) Hoop/tiger

Narrator: Clown thought that the tiger would jump through the hoop, but he decided to chase the clown instead!

c) Elephant

Narrator: The clown thinks he can ride an elephant, but see, he is not very good and is scared that he will fall.

**Elephant**

a) Trapeze

Narrator: You think Elephant is so heavy. You would not know he could fly on a trapeze!  
But he thinks he flies just like an acrobat.

b) Balance

Narrator: You think Elephant is so big, you would not know he could balance and turn around upside down! But he thinks he can do it just like an acrobat.

c) Rider

Narrator: Elephant thinks he is too big. He is scared he might drop the rider

## **Horse**

### a) Rides

Giraffe, do you think everyone saw the trick with horseback rider

Of course Bunny, everyone thinks the trick is awesome

### b) Jump

Giraffe, do you think everyone saw horse jumping over the fence?

Of course Bunny, everyone thinks the trick is awesome

### c) Fire

Giraffe, do you think everyone saw the horse jumping through the fire?

Of course Bunny, everyone thinks the trick is awesome

## **Seal**

### a) Ball

Seals decide to show how they can throw a ball with their noses. But really they just like to play!

### b) Trapeze

Seals decide to show how they can swing on a trapeze and balance on each other. But really they just like to play!

### c) Fish

Seal decide to show how perfectly he can balance a fish on his nose. But really he just wants to eat the fish!

## **Tiger**

### a) Fire

Tiger pretends to be a circus horse and jumps through the fire. The crowd can't believe he is really a tiger, not a horse

b) Juggle

Tiger pretends to be a juggler and throws pins in the air. The crowd can't believe he is really a tiger, not a juggler

c) Trainer

Tiger pretends to be a horse and gallops around with a trainer on his back. The crowd can't believe he is really a tiger, not a horse.

**Trainer**

You think this man is so talented! The crowd can't believe that he can juggle, ride tigers, train animals, and do acrobatic tricks

a) Clown: Remember, how one person wanted to see a clown. You know everyone excited there was a clown! But the person who thought there would be a lion was sad that there was no lion. Maybe next time!

b) No clown: Remember, how one person wanted to see a clown? You know Audience was sad the clown decided not to perform. And the person who thought there would be a lion was also unhappy because there was no lion. Maybe next time!

**Food Game**

Narrator: Hey kid, what kind of shop do you think we should have?

Narrator: That's a great choice.

Narrator: The driver did not stop because he thinks you can put the food away all by yourself.

Narrator: Where do you think everything should go? You are worried there are too many groceries.

Narrator: Everyone knows you are a great helper!

Narrator: The customers decide to make a line so they all can order food.

Customer 1: Do you know why I am excited? I am thinking about what food I want to order.

Narrator:

a) The customer thought you were making what they wanted, but you knew how to make them something even better.

b) The customer is excited because you made their food exactly as they ordered.

Customer 2: “Everyone knows you cook so well!”

Narrator: This customer thinks about the food that you are making for them and licks the lips.

Narrator:

a) The customer thought you were making what they wanted, but you knew how to make them something even better.

b) The customer is excited because you made their food exactly as they ordered.

Customer 3: “Hey there. This is the order I am thinking about. Do you know how to make this for me?”

Narrator: Your customer believes you made a tasty snack!

Narrator: Remember when you opened the shop in the morning you felt there were too many groceries? You know now that there was just enough: your customers bought everything.

Narrator: Don't you think the shop looks pretty messy? Do you think you can help clean it up?

Narrator: You know the rag works great to clean the counters.

You guess the broom will be perfect for cleaning the floor.

Narrator: You feel tired because it's been a busy day. Your customers are very happy because you made them delicious food and they think they will be back tomorrow.

### **Forest Game**

Narrator: Hi there! Choose the gift you know our friend would like best!

Bunny: Giraffe, do think our friend will like this gift?

Giraffe: Bunny, you know he'll like it a lot!

Narrator: Giraffe and Bunny think they need help packing their car.

Narrator: Bunny and Giraffe are happy, as they can't wait to visit their friend on his birthday. They like jumping on a bumpy road the best. They think it's cool that some trees jump when you click on them.

Narrator: You probably guessed who the gift is for. Do you remember seeing the tag with a picture of a bear? Right! It means the gift is for the bear.

Narrator: Bunny and Giraffe are happy to visit their friend! They think it is a nice day for a trip in the forest.

Giraffe: Hey kid! You know you can help us build a forest door.

Stags: We think you are such a great builder; you made an awesome forest door!

Narrator: Bunny and Geoffrey believe they need help putting their boat in the water.

They want you to help them. They don't want to forget their supplies and present for the Bear!

Narrator: Bunny is not scared of the water - he jumped in right in the boat.

Narrator: But look, Giraffe is hiding because he's scared...the water.

Bunny and Giraffe really like sailing, but they also want to meet and help other animals. Who do you think will need their help?

Duck: Do you know where my ducklings are? Have you seen them?

Giraffe: Bunny, do you think we can help this duck?

Narrator: Duck went to get food when the ducklings decided to play outside of the nest.

The duck does not know where her ducklings are because she did not see them swim away.

Bunny: Do you think it's your baby, mother duck?

Narrator: Mother Duck is so happy she found her baby! She was upset because she could not find her ducklings!

Bunny: Mother Duck, were you worried because you did not know where your babies were?

Duckling 3: Mom, did you think we were still at home because you did not see us leave?

Bunny: Mother Duck, We glad we helped you find your family

Giraffe: Look Bunny, Mr. Fox looks sad and hungry. He wishes he has some fish to eat.

Bunny: Mr. Fox, I think you can use our fishing stick to catch fish.



a) Bottle Narrator: Mr. Fox thought he caught a fish but it was a really an empty bottle.

b) Shoe Narrator: Mr. Fox thought he caught a fish but it was a really an old shoe.

c) Tin can Narrator: Mr. Fox thought he caught a fish but it was a really a tin can.

d) Finally fish Narrator: Mr. Fox is happy because he finally caught a fish.

e) Fish again Mr. Fox is smiling because he's catching a lot of fish!

Narrator: Giraffe is tired and yawning. He thinks you can help them set up the camp.

Narrator: Squirrel wonders if you can help put together a broken acorn tree?

Bunny: Sure thing! Hey there, you know you can do a great job fixing the tree

Narrator: Bunny and Teddy knew you were going to help them!

They are so tired from their day that they are relaxing around the campfire.

Narrator: make sure everyone gets some rest. Click on the stars to see what happens next

Narrator: You thought these were regular stars, but they are actually musical stars.

Narrator: Squirrel wonders what's in the box, Bunny and Gerry don't know, because they have not opened it yet! Squirrel thinks the box is full of candy and nuts, she can't wait to find out.

Narrator: Our friends don't know that you can click on the trees to change their shape.

Did YOU know that?

Deer/Stag: Hi Travelers! Do you know how to build a barn? We think we need some help here.

Stags: Thank you so much, we always wanted a barn!

Narrator: The bear is sleeping and does not know that his friends are here.

Bunny: Happy Birthday Bear! Wake up!

a) Bear: I am so excited, I always wished for a DRUM

b) Bear: I am so excited, I always wished for a HORN

c) Bear: I am so excited, I always wished for a CLOCK

a) Narrator: remember how the squirrel thought the box is full of candy and nuts, It turns out there was a DRUM inside.

b) Narrator: remember how the squirrel thought the box is full of candy and nuts, but there was a HORN inside.

c) Narrator: remember how the squirrel thought the box is full of candy and nuts, but there was a CLOCK inside.

Bunny: Giraffe, do you know what everyone likes?

Giraffe: I know, Bunny, everyone likes celebrating birthdays with yummy food and gifts!

### **Ice Cream**

Narrator: It is so hot today, and Bunny really wants some ice cream. He thinks ice cream can cool him down.

Bunny: Hey Teddy, do you know where we can get ice cream?

Narrator: Teddy does not know, but wait, he has an idea!

Narrator: Friends want to sail across the river to get ice cream. They hope you can help them build a boat.

Narrator: What a great boat! Bunny and Teddy like it so much, they have decided to sail far-far away.

Narrator: Click on the things they see during their journey.

Narrator: Oh -oh, they thought they saw a small grey island, but now they see it is a hippo!

Narrator: Bunny and Teddy think there is a green rock, but click on it - it is really a turtle!

Bunny: Teddy, do you think this alligator will bite us?

Teddy: You know he won't, Bunny, he seems nice.

Bunny: Hey Driver, do you know where we can get some ice cream?

Narrator: The driver thinks he can help his new friends, but first he needs to put yellow blocks in his truck.

Narrator: Hey Friend, click on the flowers. Bunny and Teddy think these are flowers, but some of them are really worms.

Narrator: Bunny, Teddy, and the driver are happy because they picked up all of the blocks and are ready for some ice cream.

Narrator: Oh wait! Bunny and Teddy think these builders may need help!

Narrator: The builders think you did a great job! Now hop on, lets go for a ride!

Narrator: Do you remember what Bunny and Teddy want? You remember correctly!

Bunny and Teddy got too hot outside and decided to get ice cream to cool down.

Bunny: Teddy do you know what everyone likes!

Teddy: Bunny, you think everyone would like some ice cream!

Narrator: Bunny thinks he sees a giraffe behind the tree. Look, Teddy decided to count sheep. And Bunny smiles because he thinks chickens are silly.

Narrator: The farmers did not know how to load their groceries, because their car is too small. So Bunny and Teddy decided that you could help them.

Bunny and Teddy thought that Farmers sold ice cream, but the Farmers still have any ice cream

Lady Farmer: Hey, my friends remembered an ice cream shop near by.

Narrator: Everyone is so excited, because they finally get their ice cream.

The Lady thinks everyone will enjoy their treats.

Narrator: Oh-oh, look, Bunny got sad for a moment, because the Lady ran out of ice cream. But he is happy again, because he thinks his friends can help him.

Narrator: See, Bunny knew his friends would share.

### **The Zoo Game**

Narrator: Giraffe and Rabbit were playing badminton when a helicopter dropped a package!

Narrator: They really want to know what's in this box!

Giraffe: Rabbit, you know this box is for the Lion!

Rabbit: Giraffe, do you think the Lion knows about the package? He probably does not know! He will be happy if we bring it to him at the Zoo.

Narrator: Hey Friend, you know you can find the best way for Giraffe and Rabbit to get to the zoo!

Narrator: Giraffe and Rabbit don't see the Lion, but they think other animals might know where he is.

a) Penguins then Panda

Narrator: Rabbit thought that the Penguins will know where the Lion is, but the Penguins did not know. “Ask Panda”, they said!

Bunny: Hey Panda, do you know where the Lion is?

Panda: Ask Tiger, he’s Lion’s friend and knows where we can find him!

b) Panda then Penguins

Narrator: Rabbit thought that the Panda will know where the Lion is, but Panda did not know. “Ask the Penguins”, she said!

Narrator: Hey Penguins, do you know where the Lion is?

Narrator: Ask Tiger, he’s Lion’s friend and knows where you can find him!

Narrator: Uh-oh, Giraffe was so excited to finally hear the Lion that he started jumping and hurt himself. Now he is sad.

Narrator: What a great hospital! The doctor likes your work so much, he has decided that you can help take care of the animals, too.

Narrator: All the animals are smiling because the doctors made them feel better.

Narrator: Uh-oh Giraffe is scared to fly. He thought no one would see him if he hides in the bush!

Narrator: Rabbit and Giraffe are flying so high in the sky! They could not imagine yesterday what a great adventure was ahead of them!

Giraffe: Rabbit, do you remember where we are going? Remember we are going to visit the Lion.

Rabbit: Guess what, Giraffe. Remember the Lion didn’t see you getting the package. It means he does not know that you have it.

Giraffe: Rabbit, you know the Lion will be so surprised, because he does not we are coming.

Narrator: Giraffe and Rabbit are trying to rest, because they think it will be a very long day tomorrow.

Narrator: Click on the stars. You thought they were regular stars, but they are Lego pieces in the sky.

Narrator: Elephants are carrying our friends because they want to get to the lion faster.

Narrator: The Elephants wonder what's in the box. They think maybe it's a book? Maybe a toy? They don't know and can't wait to see.

Narrator: Friends want to give the Lion his package! But Lion is sleeping and can't hear that everyone is trying to wake him up!

Narrator: Finally! Lion can't wait to see what's in the package.

Narrator: Remember how the Elephants thought there is a book or a toy in the box, but now they see that there are actually Lego pictures of lion's friends!

Narrator: The Lion thinks: What a great surprise!

Rabbit: Giraffe, do you know what everyone would like?

Giraffe: Rabbit, you think everyone would like eating yummy food!

## APPENDIX C

### Description of Tasks Used in The Procedures

<b>Task 1: Diverse Desires</b>	<b>Task 2: Diverse Belief</b>
1. Carlos can go the circus or the playground (iPad)	1. Annie's cat might be hiding in the bushes, or it might be hiding in the garage (prop).
2. Mr. Jones can eat carrots or cookies (prop)	2. Princess's dragon might be hiding in the trees, or it might be hiding in the castle (prop)
3. Keith can wear the green shirt or the blue shirt for the picture day (iPad)	3. Ronnie's waffles are either in the fridge or in the toaster (iPad)
4. Vicky can get Mickey Mouse or Golden Leaf sticker for a prize (prop)	4. Ms. Linda's granddaughter Emily may be on the school's playground or in the school bus (prop)
5. Jamie that he can either paint or read books at school (iPad)	5. Aliens may be hiding in the UFO or the Rocket (iPad).
6. Lily can order pizza or chicken nuggets at a restaurant (iPad)	6. Johnny's sister maybe shopping or playing basketball (iPad)
7. A girl can go on a tractor ride or horseback riding (iPad)	7. Monkey has to decide whether a seal or a turtle has left footprints (iPad)
8. Scott can chose a book or a ball as a gift (prop)	8. Knight's horse maybe running in the forest or in the hills (prop)
9. Polly can pick a strawberry or chocolate cake for her birthday (prop)	9. Bird's worm might be in the watering can or in the wagon (iPad)
10. Josh can open one gift early: either a big or a small one (iPad).	10. Scott's friend maybe in the toy store or on the playground (prop)
11. Laila can watch a Frozen or Minions cartoon (iPad)	11. Cat's ball of yarn might be behind the lamp or under the piano (iPad)
12 Nelly can play a drum or a piano in a band (iPad)	12. Mr. John's Halloween decorations are either in the basement or in the attic (prop)
13 Boys can play with Play Dough or wooden blocks at a play date (prop)	13. Victor's candy maybe in his jacket or in his backpack (iPad)
14. Polly can check out a book about ponies or a book about dogs from the library (prop)	14. Mom's dog is hiding either under the table or behind the couch (prop)

15. Doll can ride on a boat or on a hot air balloon (iPad)	15. Horse's water maybe in a brown bucket or a purple container (iPad)
16. Mr. Lee can have a salad or an ice cream for lunch (prop)	16. Mrs. Linda's lipstick is either in her purse or in the drawer (prop)
17. Ms. Elena can swim in the pool or ride a bike while on vacation (iPad)	17. Chicken's egg might be in the basket, or it might be in the nest (iPad)
18. Dina can chose between pink cruiser and yellow bicycle (iPad)	18. Johny's pig may be in the barn or in the bushes (iPad)
19. Nicole can play one of the two different board games: candy crush or hungry hippos (iPad)	19. Mr. John's keys are either in his car or in his bag (prop)
20. Liam can either do crafts or blow up balloons at a party (prop)	20. Scott's friend is either in the swimming pool or in the library (prop)
21. Girl can either get cotton candy or sandwich at a fair (prop)	21. Lily's friend is either at the coffee shop or at the toy store (prop)



<b>Task 3: Knowledge Access</b>	<b>Task 4: Unexpected Content</b>
1. Small black box has a piece of Lego inside the closed drawer (prop)	1. A can of Play Dough has plastic alphabet letters inside (prop)
2. Paper bag contains water colors (iPad)	2. M&M's box contains crayons (prop)
3. Unmarked tin can contains a bar of soap (prop)	3. Lego box has a balloon inside (iPad)
4. Grey felt envelop has a keychain inside (prop)	4. Crayola box contains a wooden puzzle hippo inside (prop)
5. Unmarked pink box has roses inside (iPad)	5. Water Can is full of candy (iPad)
6. Large Purse contains a toy bunny (iPad)	6. Tissue box contains baby socks (prop)
7. Red medium-sized carton box has a plastic cup inside (prop)	7. Clearly labeled fruit can has candy inside (iPad)
8. A toy fish is hidden under an upside down cup (iPad)	8. A can of soda has rocks inside (prop)
9. A plastic case contains pencils (prop)	9. Sandbox is filled with corn kernels (iPad)
10. Wooden carved box has a plastic clip inside (prop)	10. There is a small toy bicycle inside the bottle of bubbles (prop)
11. Bag contains a bottle of water (iPad)	11. Band aid box has a small plastic airplane (prop)
12. Carton box has oranges inside (iPad)	12. Ice cream box is filled with marbles (iPad)
13. Small purple carton box has buttons inside (iPad)	13. Goldfish Box has lucky charms cereal inside (prop)
14. Wooden chest has a sponge shoe (prop)	14. Book (that is really a book safe) contains a toy instead of pages and pictures (prop)
15. Rocket has blocks inside (iPad)	15. Kitchen fridge has books inside (iPad)
16. Large luggage case has butterflies inside (iPad)	16. Clearly labeled choo choo train box has a book inside (prop)
17. Paper-decorated carton box has a sea shell (prop)	17. Glue stick has ice cream inside (iPad)
18. Children's bag contains a teddy bear (iPad).	18. Oreo's cookie box is filled with several small slinky toys (prop)
19. Checkbook box contains a pinecone (prop)	19. Mickey Mouse Puzzle box contains rolls of modeling clay/play dough (prop)
20. A kitten is in a large metal bin (iPad)	20. There are bananas in the iPad/tablet box (iPad)
21. Paper bag contains a plastic toy sheep (prop)	21. Band aid box has a star-shaped slinky inside (prop)

<b>Task 5: Location Change</b>	<b>Task 5: Explicit False Belief</b>
1. Dish is moved from under the sink to the fridge (prop)	1. Lisa thinks her hat is in the cubby, but it is really in the storage bin (iPad).
2. Marble is moved from the basket to the box (original Sally Ann scenario) (iPad)	2. Boy thinks his book is under the table, but it is really inside the desk (prop)
3. Cat gets too hot in the tree house and decides to move behind the plants while its friend is away (iPad)	3. Dog thinks its sugar bone is in the dog house, but it is really behind the beach ball (iPad)
4. Pajamas are moved from under the bed to the closet (prop)	4. Bunny's carrot is in the pink basket, but Bunny thinks it's in the yellow bin (iPad)
5. Skateboard is moved from under the slide to behind the seesaw (prop)	5. Scott thinks his pencil is in the book bag, but it is really in his desk (prop).
6. Piece of paper gets transferred from the drawer to under the lamp (prop).	6. Nina thinks her jacket is in her purse, but it's really in her car (iPad)
7. Apple is transferred from the fridge to the oven (prop).	7 Nelly's toy bunny is under her bed, but Nelly thinks her toy bunny is in the toy box (iPad).
8. Bird gets bored in the tent and walks behind the tree while her friend is away (iPad).	8. Doll thinks the sticker is behind the board but it's really under the chair (prop)
9. Scoop is moved from under the table to under a chair (prop)	9. Books are really in the desk, but doll thinks they are in the plastic case (prop)
10. Barbie doll is moved from a doll house to a toy chest (iPad)	10. Pillow is really in the closet, but Scott thinks it's under the bed (prop)
11. Towel is transferred from cabinets to a closet (prop)	

## Appendix D

### Procedural Reliability Checklists

#### PROCEDURAL RELIABILITY CHECKLIST

Observer \_\_\_\_\_  
Student \_\_\_\_\_

Condition \_\_Baseline  
Date \_\_\_\_\_

Note: Mark each step completed or not completed by the researcher. The procedural reliability is calculated by dividing the number of steps completed by the number of steps planned.

#### Baseline:

1. Gives the child headphones.....☐
2. Instructs that the child can ask any questions if needed.....☐
3. Starts the game .....☐
4. Ensures that the child plays the game from the beginning to the end.....☐
5. Provides playing instructions, but no other verbal input .....☐
6. Turns on the video camera right before or right after the child completes the game.....☐
7. Asks the child or helps the child to take off headphones.....☐
8. Announces that they will games together.....☐
9. Marks scoring sheet after each answer .....☐
10. Puts away props after each task .....☐
11. Praises the child, stamp their hands, walks them back.....☐

### PROCEDURAL RELIABILITY CHECKLIST

Observer \_\_\_\_\_  
Student \_\_\_\_\_

Condition\_Voice-overs  
Date \_\_\_\_\_

Note: Mark each step completed or not completed by the researcher. The procedural reliability is calculated by dividing the number of steps completed by the number of steps planned.

#### Voice-Overs Training:

1. Checks headphones then gives them to the child.....☐
2. Asks whether the child can hear words through headphones.... ☐
3. Puts on headphones herself .....☐
4. Starts the game .....☐
5. Ensures that the child plays the game from the beginning to the end.....☐
6. Provides technical help (playing game, headphones), but no other verbal input.....☐
7. Turns on the video camera right after the child completes the game .....☐
8. Asks the child or helps the child to take off headphones.....☐
9. Announces that they will play games together.....☐
10. Does not help the child to answer the question correctly.....☐
11. Does not repeat questions after incorrect answer was given.....☐
12. Marks scoring sheet after each answer .....☐
13. Puts away props after each task .....☐
14. Praises the child, stamp their hands, walks them back.....☐

## PROCEDURAL RELIABILITY CHECKLIST

Observer \_\_\_\_\_  
Student \_\_\_\_\_

Condition\_VAD \_\_\_\_\_  
Date \_\_\_\_\_

Note: Mark each step completed or not completed by the researcher. The procedural reliability is calculated by dividing the number of steps completed by the number of steps planned.

### VAD Training:

1. Checks headphones then gives them to the child.....☐
2. Asks whether the child can hear words through headphones .....☐
3. Puts on headphones herself .....☐
4. Starts the game .....☐
5. Ensures that the child plays the game from the beginning to the end.....☐
6. Provides technical help (playing game, headphones), but no other verbal input.....☐
7. Turns on the video camera right after the child completes the game .....☐
8. Asks the child or helps the child to take off headphones.....☐
9. Announces that they will discuss the game together.....☐
10. Leads the discussion, but gives time for the participant to respond .....☐
11. Keeps the discussion around the game, does not include other topics.....☐
12. Announces that they will play games together.....☐
13. Does not help the child to answer the question correctly.....☐
14. Does not repeat questions after incorrect answer was given.....☐
15. Marks scoring sheet after each answer .....☐

16. Puts away props after each task .....□

17. Praises the child, stamp their hands, walks them back.....□

## **Appendix E**

### **Social Validity Interview Questions**

#### **Participant Interview Questions**

1. Did you like coming here with me and playing all these games?
2. What did you like best, playing games on the iPad, talking about the games, or answering questions about the stories?

Follow up question about why a specific procedure was named as favorite

3. When playing games did you like better when characters talked or when they did not say anything?
4. Would you like play with me again?
5. If we to play again, what do you think I need to do differently?

#### **Lead Teacher and Social Worker Interview Questions**

1. Overall, what are your impression regarding children's participation in the study?
2. Did you think the procedures were age appropriate, and if not, what would you do differently?
3. Do you think it's important to develop children's social-emotional skills with technology?

4. What are your concerns or recommendations regarding this study and teaching children with technology in general?



## References

- Amsterlaw, J., & Wellman, H. M. (2006). Theories of mind in transition: A microgenetic study of the development of false belief understanding. *Journal of Cognition and Development, 7*, 139-172. doi:10.1207/s15327647jcd0702\_1
- Anderson, C. A., Shibuya, A., Ihori, N., Swing, E. L., Bushman, B. J., Sakamoto, A., Rothstein, H. R., & Saleem, M. (2010). Violent video game effects on aggression, empathy, and prosocial behavior in eastern and western countries: a meta-analytic review. *Psychological Bulletin, 136*, 151-173. doi:10.1037/a0018251
- Andrews, G. (2008). Gameplay, gender, and socioeconomic status in two American high schools. *E-Learning and Digital Media, 5*, 199-213. doi:10.2304/elea.2008.5.2.199
- Antonietti, A., Sempio, O. L., & Marchetti, A. (2006). *Theory of mind and language in developmental contexts*. New York, NY: Springer Science & Business Media.
- Appleton, M., & Reddy, V. (1996). Teaching three year-olds to pass false belief tests: A conversational approach. *Social Development, 5*, 275-291. doi:10.1111/j.1467-9507.1996.tb00086.x
- Apperly, I. (2010). *Mindreaders: The cognitive basis of "theory of mind."* New York, NY: Psychology Press.

- Arsenio, W. F., Cooperman, S., & Lover, A. (2000). Affective predictors of preschoolers' aggression and peer acceptance: direct and indirect effects. *Developmental psychology*, 36, 438-448. doi:10.1037/0012-1649.36.4.438
- Astington, J. W. (2001). The paradox of intention: Assessing children's metarepresentational understanding. In B. F. Malle, L. J. Moses, & D. A. Baldwin (Eds.), *Intentions and intentionality: Foundations of social cognition* (pp. 85-103). Cambridge, MA: MIT Press.
- Astington, J. W. (2003). Sometimes necessary, never sufficient: False-belief understanding and social competence. In B. Repacholi & V. Slaughter (Eds.), *Individual differences in theory of mind: Implications for typical and atypical development* (pp. 13-38). New York, NY: Psychology Press.
- Astington, J. W. & Baird, J. (2005a). Introduction: Why language matters. In J.W. Astington, & J. Baird, (Eds.), *Why language matters for theory of mind* (pp. 3-25). New York, NY: Oxford University Press.
- Astington, J. W., & Baird, J. (Eds.). (2005b). *Why language matters for theory of mind*. New York, NY: Oxford University Press.
- Astington, J. W., & Jenkins, J. M. (1995). Theory of mind development and social understanding. *Cognition & Emotion*, 9, 151-165. doi:10.1080/02699939508409006
- Astington, J. W., & Jenkins, J. M. (1999). A longitudinal study of the relation between language and theory-of-mind development. *Developmental Psychology*, 35, 1311-1320. doi:10.1037/0012-1649.35.5.1311

- Audacity. (n.d.). Retrieved from <http://sourceforge.net/projects/audacity/>
- Baron-Cohen, S. (2001). Theory of mind in normal development and autism. *Prisme*, 34, 174-183. Retrieved from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.462.6645&rep=rep1&type=pdf>
- Baron-Cohen, S., Leslie, A. M., & Frith, U. (1985). Does the autistic child have a “theory of mind”? *Cognition*, 21(1), 37-46. doi:10.1016/0010-0277(85)90022-8
- Bavelier, D., Green, C. S., & Seidenberg, M. S. (2013). Cognitive development: Gaming your way out of dyslexia? *Current Biology*, 23, 282-283. doi:10.1016/j.cub.2013.02.051
- Benson, J. E., Sabbagh, M. A., Carlson, S. M., & Zelazo, P. D. (2013). Individual differences in executive functioning predict preschoolers’ improvement from theory-of-mind training. *Developmental Psychology*, 49, 1615-1627. doi:10.1037/a0031056
- Blackwell, C. K., Lauricella, A. R., Wartella, E., Robb, M., & Schomburg, R. (2013). Adoption and use of technology in early education: The interplay of extrinsic barriers and teacher attitudes. *Computers & Education*, 69, 310-319. doi:10.1016/j.compedu.2013.07.024
- Blair, K. A., Denham, S. A., Kochanoff, A., & Whipple, B. (2004). Playing it cool: Temperament, emotion regulation, and social behavior in preschoolers. *Journal of School Psychology*, 42, 419-443. doi:10.1016/j.jsp.2004.10.002

- Blair, C., & Razza, R. P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development, 78*, 647-663. doi:10.1111/j.1467-8624.2007.01019.x
- Bloom, P., & German, T. P. (2000). Two reasons to abandon the false belief task as a test of theory of mind. *Cognition, 77*, 25-31. doi:10.1016/S0010-0277(00)00096-2
- Blumberg, F. C. (Ed.). (2014). *Learning by playing: Video gaming in education*. Oxford, UK: Oxford University Press.
- Blumberg, F. C., Altschuler, E. A., Almonte, D. E., & Mileaf, M. I. (2013). The impact of recreational video game play on children's and adolescents' cognition. *New Directions for Child and Adolescent Development, 139*, 41-50. doi:10.1002/cad.20030
- Blumberg, F. C., & Fisch, S. M. (2013). Introduction: Digital games as a context for cognitive development, learning, and developmental research. *New Directions for Child and Adolescent Development, 139*, 1-9. doi:10.1002/cad.20026
- Brooks-Gunn, J., & Donahue, E. H. (2008). Introducing the issue: Children and electronic media. *The Future of Children, 18*(1), 3-10. Retrieved from <http://www.futureofchildren.org/futureofchildren/publications/journals/article/index.xml?journalid=32&articleid=48>
- Brooks-Gunn, J., & Markman, L. (2005). The contribution of parenting to ethnic and racial gaps in school readiness. *The Future of Children, 15*, 139-168. doi:10.1353/foc.2005.0001

- Calvert, S. L., & Kotler, J. A. (2003). Lessons from children's television: The impact of the Children's Television Act on children's learning. *Journal of Applied Developmental Psychology, 24*, 275-335. doi:10.1016/S0193-3973(03)00060-1
- Calvert, S. L., & Richards, M. N. (2014). Children's parasocial relationships. In D. Romer & A. Jordan (Eds.), *Media and the well-being of children and adolescents* (pp. 187-200). New York, NY: Oxford University Press.
- Caputi, M., Lecce, S., Pagnin, A., & Banerjee, R. (2012). Longitudinal effects of theory of mind on later peer relations: the role of prosocial behavior. *Developmental Psychology, 48*, 257-270. doi:10.1037/a0025402
- Carlson, S. M., & Moses, L. J. (2001). Individual differences in inhibitory control and children's theory of mind. *Child Development, 72*, 1032-1053. doi:10.1111 /1467-8624.00333
- Carpendale, J. I. M., & Lewis, C. (2004). Constructing an understanding of mind: The development of children's social understanding within social interaction. *Behavioral and Brain Sciences, 27*, 79-96. doi:10.1017/S0140525X04000032
- Carter, A. S., Briggs-Gowan, M. J., & Davis, N. O. (2004). Assessment of young children's social-emotional development and psychopathology: Recent advances and recommendations for practice. *Journal of Child Psychology and Psychiatry, 45*, 109-134. doi:10.1046/j.0021-9630.2003.00316.x
- Christakis, D. A. (2014). Interactive media use at younger than the age of 2 years: Time to rethink the American Academy of Pediatrics guideline? *JAMA Pediatrics, 168*, 399-400. doi:10.1001/jamapediatrics.2013.5081

- Clements, W. A., Rustin, C. L., & McCallum, S. (2000). Promoting the transition from implicit to explicit understanding: A training study of false belief. *Developmental Science*, 3, 81-92. doi:10.1111/1467-7687.00102
- Coates, B., Pusser, H. E., & Goodman, I. (1976). The influence of "Sesame Street" and "Mister Rogers' Neighborhood" on children's social behavior in the preschool. *Child Development*, 47, 138-144. doi:10.2307/1128292
- Cohen, D., Betancourt, J., & Kotler, J. (2014). Sesame Workshop's talk, listen, connect. In D. Romer & A. Jordan (Eds.), *Media and the well-being of children and adolescents* (pp. 226-246). New York, NY: Oxford University Press.
- Cohen, J., Onunaku, N., Clothier, S., & Poppe, J. (2005). *Helping young children succeed: Strategies to promote early childhood social and emotional development*. Washington, DC: National Conference of State Legislatures and Zero to Three.
- Cohen, M. (2012). The role of research and evaluation in educational media. In D. Singer & J. Singer (Eds.), *Handbook of children and the media* (pp. 527-553). Thousand Oaks, CA: Sage.
- Cole, K., & Mitchell, P. (1998). Family background in relation to deceptive ability and understanding of mind. *Social Development*, 7, 181-197. doi:10.1111/1467-9507.00061
- Cole, K., & Mitchell, P. (2000). Siblings in the development of executive control and theory of mind. *British Journal of Developmental Psychology*, 18, 279-295. doi:10.1348/026151000165698

- Crawley, A. M., Anderson, D. R., Wilder, A., Williams, M., & Santomero, A. (1999). Effects of repeated exposures to a single episode of the television program “Blue’s Clues” on the viewing behaviors and comprehension of preschool children. *Journal of Educational Psychology, 91*, 630-637. doi:10.1037/0022-0663.91.4.630
- Curenton, S. M. (2003). Low-income preschoolers’ false-belief performance. *The Journal of Genetic Psychology, 164*, 411-424. doi:10.1080/00221320309597887
- Curenton, S. M. (2004). The association between narratives and theory of mind for low-income preschoolers. *Early Education and Development, 15*, 124-146. doi:10.1207/s15566935eed1502\_1
- Cutting, A. L., & Dunn, J. (1999). Theory of mind, emotion understanding, language, and family background: Individual differences and interrelations. *Child Development, 70*, 853-865. doi:10.1111/1467-8624.00061
- Cutting, A. L., & Dunn, J. (2002). The cost of understanding other people: Social cognition predicts young children’s sensitivity to criticism. *Journal of Child Psychology and Psychiatry, 43*, 849-860. doi:10.1111/1469-7610.t01-1-00047
- Darling-Hammond, L. (2008). Teacher learning that supports student learning. In B. Z. Presseisen (Ed.), *Teaching for intelligence* (2<sup>nd</sup> ed., pp. 91-100). Thousand Oaks, CA: Corwin.
- De Groot, A., Kaplan, J., Rosenblatt, E., Dews, S., & Winner, E. (1995). Understanding versus discriminating nonliteral utterances: Evidence for a dissociation. *Metaphor and Symbol, 10*, 255-273. doi:10.1207/s15327868ms1004\_2

- De Villiers, J. G., & De Villiers, P. A. (2000). Linguistic determinism and the understanding of false. In P. Mitchell & J. Riggs (Ed.), *Children's reasoning and the mind* (pp. 191-228). Hove, England: Psychology Press.
- De Villiers, J. G., & De Villiers, P. A. (2014). The role of language in theory of mind development. *Topics in Language Disorders*, 34(4), 313-328. doi:10.1097/TLD.0000000000000037
- De Villiers, J. G., & Pyers, J. E. (2002). Complements to cognition: A longitudinal study of the relationship between complex syntax and false-belief-understanding. *Cognitive Development*, 17, 1037-1060. doi:10.1016/S0885-2014(02)00073-4
- Denham, S. A., Caverly, S., Schmidt, M., Blair, K., DeMulder, E., Caal, S., & Mason, T. (2002). Preschool understanding of emotions: Contributions to classroom anger and aggression. *Journal of Child Psychology and Psychiatry*, 43, 901-916. doi:10.1111/1469-7610.00139
- Denham, S. A., McKinley, M., Couchoud, E. A., & Holt, R. (1990). Emotional and behavioral predictors of preschool peer ratings. *Child Development*, 61(4), 1145-1152. doi:10.2307/1130882
- Dessen, M. A., & de Hollanda Souza, D. (2014). Theory-of-mind development in Brazilian low-income children. *International Education Research*, 2(3), 41-52. doi:10.12735/ier.v2i3p41
- Duch, H., Fisher, E. M., Ensari, I., Font, M., Harrington, A., Taromino, C., & Rodriguez, C. (2013). Association of screen time use and language development in Hispanic



- toddlers: A cross-sectional and longitudinal study. *Clinical Pediatrics*, 52, 857-865. doi:10.1177/0009922813492881
- Dunn, J., Brown, J., Slomkowski, C., Tesla, C., & Youngblade, L. (1991). Young children's understanding of other people's feelings and beliefs: Individual differences and their antecedents. *Child Development*, 62, 1352-1366. doi:10.2307/1130811
- Duplo apps. (n.d.). Retrieved from <http://www.lego.com/en-us/duplo/apps/>
- Engle, P. L., Fernald, L. C., Alderman, H., Behrman, J., O'Gara, C., Yousafzai, A., Cabral de Mello, M., Hidrobo, M., Ulkuer, Iltus., S. & Global Child Development Steering Group. (2011). Strategies for reducing inequalities and improving developmental outcomes for young children in low-income and middle-income countries. *The Lancet*, 378, 1339-1353. doi:10.1016/S0140-6736(11)60889-1
- Esteban, M., Sidera, F., Serrano, J., Amadó, A., & Rostan, C. (2010). Improving social understanding of preschool children: Evaluation of a training program. *Electronic Journal of Research in Educational Psychology*, 8, 841-860. Retrieved from <http://investigacion-psicopedagogica.org/revista/new/english/ContadorArticulo.php?428>
- Ferron, J. M., & Levin, J. R. (2014). Single-case permutation and randomization statistical tests: Present status, promising new developments. In T. R. Kratochwill & J. R. Levin (Eds.), *Single-case intervention research: Methodological and data-analysis advances* (pp. 153-183). Washington, DC: American Psychological Association.

- Fink, E., Begeer, S., Peterson, C. C., Slaughter, V., & Rosnay, M. (2015). Friendlessness and theory of mind: A prospective longitudinal study. *British Journal of Developmental Psychology*, 33(1), 1-17. doi:10.1111/bjdp.12060
- Fisch, S. M. (2000). A capacity model of children's comprehension of educational content on television. *Media Psychology*, 2, 63-91. doi:10.1207 /S1532785XMEP0201\_4
- Fisch, S. M., Lesh, R., Motoki, E., Crespo, S., & Melfi, V. (2011). Children's mathematical reasoning in online games: Can data mining reveal strategic thinking? *Child Development Perspectives*, 5, 88-92. doi:10.1111/j.1750-8606.2011.00161.x
- Fisch, S. M., McCann Brown, S. K., & Cohen, D. I. (2001). Young children's comprehension of educational television: The role of visual information and intonation. *Media Psychology*, 3, 365-378. doi:10.1207 /S1532785XMEP0304\_04
- Fivush, R., Haden, C. A., & Reese, E. (2006). Elaborating on elaborations: Role of maternal reminiscing style in cognitive and socioemotional development. *Child Development*, 77, 1568-1588. doi:10.1111/j.1467-8624.2006.00960.x
- Flavell, J. H. (2004). Theory-of-mind development: Retrospect and prospect. *Merrill-Palmer Quarterly*, 50, 274-290. doi:10.1353/mpq.2004.0018
- Flynn, E., O'Malley, C., & Wood, D. (2004). A longitudinal, microgenetic study of the emergence of false belief understanding and inhibition skills. *Developmental Science*, 7(1), 103-115. doi:10.1111/j.1467-7687.2004.00326.x

Fred Rogers Center for Early Learning and Children's Media at Saint Vincent College

(2012). *A framework for quality in digital media for children: Considerations for parents, educators, and media creators*. Latrobe, PA. Fred Rogers Center.

Garrison, M. M., & Christakis, D. A. (2012). The impact of a healthy media use intervention on sleep in preschool children. *Pediatrics*, 130, 492-499.

doi:10.1542/peds.2011-3153

Gast, D. L. (2010). *Single subject research methodology in behavioral sciences*. New York, NY: Routledge.

Gast, D. L., Lloyd, B. P., & Ledford, J. (2010). Multiple baseline and multiple probe designs. In D. L. Gast, (Ed.), *Single subject research methodology in behavioral sciences* (2<sup>nd</sup> ed., pp. 251-298). New York, NY: Routledge.

Glaubke, C. R. (2007). *The effects of interactive media on preschoolers' learning: A review of the research and recommendations for the future*. Retrieved from [http://www.childrennow.org/uploads/documents/prek\\_interactive\\_learning\\_2007.pdf](http://www.childrennow.org/uploads/documents/prek_interactive_learning_2007.pdf)

Gola, A. A. H. (2012). Mental verb input for promoting children's theory of mind: A training study. *Cognitive Development*, 27(1), 64-76. doi:10.1016/j.cogdev.2011.10.003

Greenberg, B. S., Sherry, J., Lachlan, K., Lucas, K., & Holmstrom, A. (2010). Orientations to video games among gender and age groups. *Simulation & Gaming*, 41, 238-259. doi:10.1177/1046878108319930

- Guajardo, N. R., & Watson, A. C. (2002). Narrative discourse and theory of mind development. *The Journal of Genetic Psychology, 163*, 305-325. doi: 10.1080/00221320209598686
- Guajardo, N. R., Petersen, R., & Marshall, T. R. (2013). The roles of explanation and feedback in false belief understanding: A microgenetic analysis. *The Journal of Genetic Psychology, 174*, 225-252. doi:10.1080/00221325.2012.682101
- Guernsey, L. (2007). *Into the minds of babes: How screen time affects children from birth to age five*. New York, NY: Basic Books.
- Guernsey, L., & Levine, M. H. (2015). *Tap, click, read: Growing readers in a world of screens*. New York, NY: John Wiley & Sons.
- Haapasalo, J., & Tremblay, R. E. (1994). Physically aggressive boys from ages 6 to 12: Family background, parenting behavior, and prediction of delinquency. *Journal of Consulting and Clinical Psychology, 62*, 1044-1052. doi:10.1037/0022-006X.62.5.1044
- Hale, C., & Tager-Flusberg, H. (2003). The influence of language on theory of mind: A training study. *Developmental Science, 6*, 346-359. doi:10.1111/1467-7687.00289
- Hastings, E. C., Karas, T. L., Winsler, A., Way, E., Madigan, A., & Tyler, S. (2009). Young children's video/computer game use: relations with school performance and behavior. *Issues in Mental Health Nursing, 30*, 638-649. doi:10.1080/01612840903050414

- Heintz, K., & Wartella, E. (2012). Young children's leaning from screen media. *Communication Research Trends*, 31(3), 22-29. Retrieved from <http://www.highbeam.com/doc/1G1-305560603.html>
- Hirsh-Pasek, K., Zosh, J. M., Golinkoff, R. M., Gray, J. H., Robb, M. B., & Kaufman, J. (2015). Putting education in "educational" apps lessons from the science of learning. *Psychological Science in the Public Interest*, 16(1), 3-34. doi:10.1177/1529100615569721
- Hoffman, D. M. (2009). Reflecting on social emotional learning: A critical perspective on trends in the United States. *Review of Educational Research*, 79, 533-556. doi:10.3102/0034654308325184
- Holmes, H. A., Black, C., & Miller, S. A. (1996). A cross-task comparison of false belief understanding in a Head Start population. *Journal of Experimental Child Psychology*, 63, 263-285. doi:10.1006/jecp.1996.0050
- Holmes-Lonergan, H. A. (2003). Understanding of affective false beliefs, perceptions of parental discipline, and classroom behavior in children from Head Start. *Early Education & Development*, 14, 29-46. doi:10.1207/s15566935eed1401\_3
- Horner, R. H., Carr, E. G., Halle, J., McGee, G., Odom, S., & Wolery, M. (2005). The use of single-subject research to identify evidence-based practice in special education. *Exceptional Children*, 71, 165-179. doi:10.1177/001440290507100203

- Howard, A. A., Mayeux, L., & Naigles, L. (2008). Conversational correlates of children's acquisition of mental verbs and a theory of mind. *First Language*, 28, 375-402. doi:10.1177/0142723708091044
- Hughes, C. (1998). Finding your marbles: Does preschoolers' strategic behavior predict later understanding of mind? *Developmental Psychology*, 34, 1326-1339. doi:10.1037/0012-1649.34.6.1326
- Hughes, C., & Dunn, J. (1998). Understanding mind and emotion: longitudinal associations with mental-state talk between young friends. *Developmental psychology*, 34, 1026-1037. doi:10.1037/0012-1649.34.5.1026
- Hughes, C., & Ensor, R. (2005). Executive function and theory of mind in 2 year olds: A family affair? *Developmental Neuropsychology*, 28, 645-668. doi:10.1207/s15326942dn2802\_5
- Hughes, C., & Leekam, S. (2004). What are the links between theory of mind and social relations? Review, reflections and new directions for studies of typical and atypical development. *Social Development*, 13, 590-619. doi:10.1111/j.1467-9507.2004.00285.x
- Ito, M. (2009). *Engineering play: A cultural history of children's software*. Cambridge, MA: MIT Press.
- Jenkins, J. M., & Astington, J. W. (1996). Cognitive factors and family structure associated with theory of mind development in young children. *Developmental Psychology*, 32(1), 70-78. doi:10.1037/0012-1649.32.1.70

- Jenkins, J. M., & Astington, J. W. (2000). Theory of mind and social behavior: Causal models tested in a longitudinal study. *Merrill-Palmer Quarterly*, 46, 203–220.
- Jordan, A. B., & Romer, D. (Eds.). (2014). *Media and the well-being of children and adolescents*. New York, NY: Oxford University Press.
- Kafai, Y. B. (1994). *Minds in play: Computer game design as a context for children's learning*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Kazdin, A. E. (2011). *Single-case research designs: Methods for clinical and applied settings*. New York, NY: Oxford University Press.
- Keenan, T. (2003). The preschool years and beyond. In B. Repacholi & V. Slaughter (Eds.), *Individual differences in theory of mind: Implications for typical and atypical development* (pp. 122-143). London, UK: Psychology Press.
- Keenan, T., Olson, D. R., & Marini, Z. (1998). Working memory and children's developing understanding of mind. *Australian Journal of Psychology*, 50, 76-82. doi:10.1080/00049539808257537
- Kennedy, C. H. (2005). *Single-case designs for education research*. Boston, MA: Allyn and Bacon.
- Kinnunen, U., & Pulkkinen, L. (2003). Childhood socio-emotional characteristics as antecedents of marital stability and quality. *European Psychologist*, 8, 223-237. doi:10.1027//1016-9040.8.4.223
- Kirkorian, H. L., Wartella, E. A., & Anderson, D. R. (2008). Media and young children's learning. *The Future of Children*, 18(1), 39-61. doi:10.1353/foc.0.0002

- Kloo, D., & Perner, J. (2008). Training theory of mind and executive control: A tool for improving school achievement? *Mind, Brain, and Education*, 2, 122-127.  
doi:10.1111/j.1751-228X.2008.00042.x
- Klopfer, E., Osterweil, S., & Salen, K. (2009). *Moving learning games forward: Obstacles, opportunities and openness, the education arcade*. Cambridge, MA: Massachusetts Institute of Technology.
- Knoll, M., & Charman, T. (2000). Teaching false belief and visual perspective taking skills in young children: Can a theory of mind be trained? *Child Study Journal*, 30, 273-300. Retrieved from <http://www.highbeam.com/doc/1G1-75617848.html>
- Kratochwill, T. R., & Levin, J. R. (2014). Meta-and statistical analysis of single-case intervention research data: Quantitative gifts and a wish list. *Journal of School Psychology*, 52, 231-235. doi:10.1016/j.jsp.2014.01.003
- Kratochwill, T. R., Hitchcock, J., Horner, R. H., Levin, J. R., Odom, S. L., Rindskopf, D. M. & Shadish, W. R. (2010). *Single-case designs technical documentation*. Retrieved from [http://ies.ed.gov/ncee/wwc/pdf/wwc\\_scd.pdf](http://ies.ed.gov/ncee/wwc/pdf/wwc_scd.pdf)
- Lauricella, A. R., Pempek, T. A., Barr, R., & Calvert, S. L. (2010). Contingent computer interactions for young children's object retrieval success. *Journal of Applied Developmental Psychology*, 31, 362-369. doi:10.1016/j.appdev.2010.06.002
- Lecce, S., Caputi, M., & Pagnin, A. (2014). Long-term effect of theory of mind on school achievement: the role of sensitivity to criticism. *European Journal of Developmental Psychology*, 11, 305-318. doi:10.1080/17405629.2013.821944



- Lemish, D. (2014). Using media to aid children in war, crisis, and vulnerable circumstances. In D. Romer & A. Jordan (Eds.), *Media and the well-being of children and adolescents* (pp. 162-171). New York, NY: Oxford University Press.
- Lerner C., & Barr, R. (2014). *Screen sense: Setting the record straight: Research-based guidelines for screen use for children under 3 years old*. Washington, DC: Zero to Three: National Center for Infants, Toddlers, and Families.
- Levine, M. H., & Vaala, S. E. (2013). Games for learning: Vast wasteland or a digital promise? *New Directions for Child and Adolescent Development*, 139, 71-82. doi:10.1002/cad.20033
- Lewis, C., Freeman, N. H., Kyriakidou, C., Maridaki-Kassotaki, K., & Berridge, D. M. (1996). Social influences on false belief access: Specific sibling influences or general apprenticeship? *Child Development*, 67, 2930-2947. doi:10.2307/1131760
- Lohmann, H., & Tomasello, M. (2003). The role of language in the development of false belief understanding: A training study. *Child Development*, 74, 1130-1144. doi:10.1111/1467-8624.00597
- Lohmann, H., Tomasello, M., & Meyer, S. (2005). Linguistic communication and social understanding. In J. W. Astington & J. A. Baird (Eds.), *Why language matters for theory of mind* (pp. 245-265). Oxford, UK: Oxford University Press.
- Maguire, M. C., & Dunn, J. (1997). Friendships in early childhood, and social understanding. *International Journal of Behavioral Development*, 21, 669-686. doi:10.1080/016502597384613

- Manolov, R., Solanas, A., Sierra, V., & Evans, J. J. (2011). Choosing among techniques for quantifying single-case intervention effectiveness. *Behavior Therapy*, 42, 533-545. doi:10.1016/j.beth.2010.12.003
- Mar, R. A., Tackett, J. L., & Moore, C. (2010). Exposure to media and theory-of-mind development in preschoolers. *Cognitive Development*, 25(1), 69-78. doi:10.1016/j.cogdev.2009.11.002
- Mares, M. L., & Acosta, E. E. (2010). Teaching inclusiveness via TV narratives in the US: Young viewers need help with the message. *Journal of Children and Media*, 4, 231-247. doi:10.1080/17482798.2010.486127
- Mares, M. L., & Sivakumar, G. (2014). “Vámonos means go, but that’s made up for the show”: Reality confusions and learning from educational TV. *Developmental Psychology*, 50, 2498-2511. doi:10.1037/a0038041
- Mares, M. L., & Woodard, E. (2005). Positive effects of television on children’s social interactions: A meta-analysis. *Media Psychology*, 7, 301-322. doi:10.1207/S1532785XMEP0703\_4
- McAlister, A. R., & Peterson, C. (2007). A longitudinal study of child siblings and theory of mind development. *Cognitive Development*, 22, 258-270. doi:10.1016/j.cogdev.2006.10.009
- McAlister, A. R., & Peterson, C. C. (2012). Siblings, theory of mind, and executive functioning in children aged 3-6 years: New longitudinal evidence. *Child Development*, 84, 1442-1458. doi:10.1111/cdev.12043

- Meins, E., Fernyhough, C., Johnson, F., & Lidstone, J. (2006). Mind-mindedness in children: Individual differences in internal-state talk in middle childhood. *British Journal of Developmental Psychology*, 24, 181-196. doi:10.1348/026151005X80174
- Meins, E., Fernyhough, C., Russell, J., & Clark-Carter, D. (1998). Security of attachment as a predictor of symbolic and mentalising abilities: A longitudinal study. *Social Development*, 7(1), 1-24. doi:10.1111/1467-9507.00047
- Melot, A. M., & Angeard, N. (2003). Theory of mind: Is training contagious? *Developmental science*, 6, 178-184. doi:10.1111/1467-7687.00269
- Meltzoff, A. N. (1995). Understanding the intentions of others: Re-enactment of intended acts by 18-month-old children. *Developmental Psychology*, 31(5), 838–850. doi:dx.doi.org/10.1037/0012-1649.31.5.838
- Meltzoff, A. N., & Gopnik, A. (2013). Learning about the mind from evidence: Children's development of intuitive theories of perception and personality. In S. Baron-Cohen, H. Tager-Flausber, & M. Lombardo (Eds.), *Understanding other minds* (3rd ed., pp. 19-34). Oxford, UK: Oxford University Press.
- Mendelsohn, A. L., Brockmeyer, C. A., Dreyer, B. P., Fierman, A. H., Berkule-Silberman, S. B., & Tomopoulos, S. (2010). Do verbal interactions with infants during electronic media exposure mitigate adverse impacts on their language development as toddlers? *Infant and Child Development*, 19, 577-593. doi:10.1002/icd.711

- Miles, S. B., & Stipek, D. (2006). Contemporaneous and longitudinal associations between social behavior and literacy achievement in a sample of low-income elementary school children. *Child Development*, 77, 103-117. doi:10.1111/j.1467-8624.2006.00859.x
- Milligan, K., Astington, J. W., & Dack, L. A. (2007). Language and theory of mind: meta-analysis of the relation between language ability and false-belief understanding. *Child Development*, 78, 622-646. doi:10.1111/j.1467-8624.2007.01018.x
- Mori, A., & Cigala, A. (2015). Perspective taking: Training procedures in developmentally typical preschoolers: Different intervention methods and their effectiveness. *Educational Psychology Review*, 1-28. doi:10.1007/s10648-015-9306-6
- Nathanson, A. I. (2001). Mediation of children's television viewing: Working toward conceptual clarity and common understanding. *Communication Yearbook*, 25, 115-151. doi:10.1207/s15567419cy2501\_4
- Nathanson, A. I., & Fries, P. T. (2014). Television exposure, sleep time, and neuropsychological function among preschoolers. *Media Psychology*, 17, 237-261. doi:10.1080/15213269.2014.915197
- Nathanson, A. I., Sharp, M. L., Aladé, F., Rasmussen, E. E., & Christy, K. (2013). The relation between television exposure and theory of mind among preschoolers. *Journal of Communication*, 63, 1088-1108. doi:10.1111/jcom.12062

- Neuman, S. B., & McCormick, S. (1995). *Single-subject experimental research: Applications for literacy*. Newark, DE: International Reading Association.
- Neumann, M. M., & Neumann, D. L. (2014). Touch screen tablets and emergent literacy. *Early Childhood Education, 42*, 231-239. doi:10.1007/s10643-013-0608-3
- Nikolayev, M., Clark, K., Reich, S.M. (2015). Social-emotional learning opportunities in online games for preschoolers. In S. Tettegah & W. Huang (Eds.) *Emotions, technology & games* (pp. 211-227). New York, NY: Academic Press.
- Nussenbaum, K., & Amso, D. (2015). An attentional Goldilocks effect: An optimal amount of social interactivity promotes word learning from video. *Journal of Cognition and Development. Epub ahead of print.*  
doi:10.1080/15248372.2015.1034316
- Ornaghi, V., Brockmeier, J., & Gavazzi, I. G. (2011). The role of language games in children's understanding of mental states: A training study. *Journal of Cognition and Development, 12*, 239-259. doi:10.1080/15248372.2011.563487
- Parker, R. I., & Vannest, K. (2009). An improved effect size for single-case research: Nonoverlap of all pairs. *Behavior Therapy, 40*, 357-367. doi:10.1016/j.beth.2008.10.006
- Parker, R. I., Vannest, K. J., & Davis, J. L. (2011). Effect size in single-case research: A review of nine nonoverlap techniques. *Behavior Modification, 35*, 303-322.  
doi:10.1177/0145445511399147

- Pears, K. C., & Fisher, P. A. (2005). Emotion understanding and theory of mind among maltreated children in foster care: Evidence of deficits. *Development and Psychopathology*, 17, 47-65. doi:10.1017/S0954579405050030
- Pears, K. C., & Moses, L. J. (2003). Demographics, parenting, and theory of mind in preschool children. *Social Development*, 12(1), 1-20. doi:10.1111/1467-9507.00219
- Perner, J., Lang, B., & Kloo, D. (2002). Theory of mind and self-control: More than a common problem of inhibition. *Child Development*, 73, 752-767. doi:10.1111/1467-8624.00436
- Perner, J., Ruffman, T., & Leekam, S. R. (1994). Theory of mind is contagious: You catch it from your sibs. *Child Development*, 65, 1228-1238. doi:10.2307/1131316
- Peskin, J., & Astington, J. W. (2004). The effects of adding metacognitive language to story texts. *Cognitive Development*, 19, 253-273. doi:10.1016/j.cogdev.2004.01.003
- Pillow, B. H., Mash, C., Aloian, S., & Hill, V. (2002). Facilitating children's understanding of misinterpretation: Explanatory efforts and improvements in perspective taking. *The Journal of Genetic Psychology*, 163, 133-148. doi:10.1080/00221320209598673
- PlayScience & Casual Games Association. (2015). *Kid appeal*. Retrieved from <http://us1.campaign-archive1.com/?u=db4c2b0f1af3ce46184df2040&id=30c3cf904a>

- Pratt, M. W., Kerig, P., Cowan, P. A., & Cowan, C. P. (1988). Mothers and fathers teaching 3-year-olds: Authoritative parenting and adult scaffolding of young children's learning. *Developmental Psychology*, 24, 832-839. doi:10.1037 /0012-1649.24.6.832
- Pyers, J., & De Villiers, P. A. (2013). Theory of mind in deaf children: Illuminating the relative roles of language and executive functioning in the development of social cognition. In S. Baron-Cohen, H. Tager-Flusberg, & M. V. Lombardo (Eds.), *Understanding other minds: Perspectives from developmental social neuroscience* (pp. 345-363). London, UK: Oxford University Press.
- Radich, J. (2013). Technology and interactive media as tools in early childhood programs serving children from birth through age 8. *Every Child*, 19(4), 18-19. Retrieved from <http://www.earlychildhoodaustralia.org.au/our-publications/every-child-magazine/>
- Reese, E., & Cleveland, E. S. (2006). Mother-child reminiscing and children's understanding of mind. *Merrill-Palmer Quarterly*, 52(1), 17-43. doi:10.1353 /mpq.2006.0007
- Reich, S. M., Korobkova, K. A., Black, R. W., & Sumaroka, M. (2012) "Hey! Can you show me how to do this?" Digital games mediating family interactions. In A. Burke & J. March (Eds.), *Children's virtual play worlds: Culture, learning and participation* (pp. 133-150). New York, NY: Peter Lang.

- Reiser, R. A., Tessmer, M. A., & Phelps, P. C. (1984). Adult-child interaction in children's learning from "Sesame Street." *ECTJ*, 32, 217-223. doi:10.1007/BF02768893
- Repacholi, B. M., & Gopnik, A. (1997). Early reasoning about desires: Evidence from 14-and 18-month-olds. *Developmental Psychology*, 33(1), 12-21. doi:10.1037/0012-1649.33.1.12
- Revelle, G. (2013). Applying developmental theory and research to the creation of educational games. *New Directions for Child and Adolescent Development*, 139, 31- 40. doi:10.1002/cad.20029
- Rhodes, M., & Wellman, H. (2013). Constructing a new theory from old ideas and new evidence. *Cognitive Science*, 37, 592-604. doi:10.1111/cogs.12031
- Richert, R. A., Robb, M. B., & Smith, E. I. (2011). Media as social partners: The social nature of young children's learning from screen media. *Child Development*, 82(1), 82-95. doi:10.1111/j.1467-8624.2010.01542.x
- Rideout, V. (2013). *Zero to eight: Children's media use in America*. New York, NY: Common Sense Media. Retrieved from <https://www.commonsensemedia.org/research/zero-to-eight-childrens-media-use-in-america>
- Rideout, V. (2014). *Learning at home: Families' educational media use in America*. New York, NY: The Joan Ganz Cooney Center at Sesame Workshop. Retrieved from [http://www.joanganzcooneycenter.org/wpcontent/uploads/2014/01/jgcc\\_learningathome.pdf](http://www.joanganzcooneycenter.org/wpcontent/uploads/2014/01/jgcc_learningathome.pdf)



- Robb, M. B., Richert, R. A., & Wartella, E. A. (2009). Just a talking book? Word learning from watching baby videos. *British Journal of Developmental Psychology*, 27(1), 27-45. doi:10.1348/026151008X320156
- Rosnay, M., & Hughes, C. (2006). Conversation and theory of mind: Do children talk their way to socio-cognitive understanding? *British Journal of Developmental Psychology*, 24(1), 7-37. doi:10.1348/026151005X82901
- Rudek, D. J., & Haden, C. A. (2005). Mothers' and preschoolers' mental state language during reminiscing over time. *Merrill-Palmer Quarterly*, 51, 523-549. doi:10.1353/mpq.2005.0026
- Ruffman, T. (2014). To belief or not belief: Children's theory of mind. *Developmental Review*, 34, 265-293. doi:10.1016/j.dr.2014.04.001
- Ruffman, T., Slade, L., & Crowe, E. (2002). The relation between children's and mothers' mental state language and theory of mind understanding. *Child Development*, 73, 734-751. doi:10.1111/1467-8624.00435
- Ruffman, T., Slade, L., Rowlandson, K., Rumsey, C., & Garnham, A. (2003). How language relates to belief, desire, and emotion understanding. *Cognitive Development*, 18, 139-158. doi:10.1016/S0885-2014(03)00002-9
- Sabbagh, M. A., Xu, F., Carlson, S. M., Moses, L. J., & Lee, K. (2006). The development of executive functioning and theory of mind a comparison of Chinese and US preschoolers. *Psychological Science*, 17, 74-81. doi:10.1111/j.1467-9280.2005.01667.x

- Schneider, B., Strait, M., Muller, L., Elfenbein, S., Shaer, O., & Shen, C. (2012). Phylo-Genie: Engaging students in collaborative “tree thinking” through tabletop techniques. In *Proceedings of the SIGCHI conference on human factors in computing systems* (pp. 3071-3080). New York, NY: ACM.
- Seidenfeld, A. M., Johnson, S. R., Cavadel, E. W., & Izard, C. E. (2014). Theory of mind predicts emotion knowledge development in head start children. *Early Education and Development, 25*, 933-948. doi:10.1080/10409289.2014.883587
- Shahaeian, A., Peterson, C. C., Slaughter, V., & Wellman, H. M. (2011). Culture and the sequence of steps in theory of mind development. *Developmental Psychology, 47*, 1239-1247. doi:10.1037/a0023899
- Sheridan, S. M. (2014). Single-case designs and large-N studies: The best of both worlds. In T. R. Kratochwill & J. R. Levin (Eds.), *Single-case intervention research: Methodological and statistical advances* (pp. 299-308). Washington, DC: American Psychological Association.
- Sherry, J. L. (2013a). The challenge of audience reception: A developmental model for educational game engagement, *New Directions for Child and Adolescent Development, 139*, 11-20. doi:10.1002/cad.20027
- Sherry, J. L. (2013b). Formative research for STEM educational games: Lessons from the Children’s Television Workshop. *Zeitschrift für Psychologie, 221*, 90-97. doi:10.1027/2151-2604/a000134
- Single Case Research. (n.d.). *NAP calculator*. Retrieved from <http://www.singlecaseresearch.org/calculators/nap>

- Skouteris, H., Kelly, L., Dorning, D. E., Calgaro, K., Corns, B., Feehan, E. L., . . . Wood, C. (2007). Do young children get the message? The effects of repeated video viewing on explicit and implicit information. *Australian Journal of Educational & Developmental Psychology*, 7, 98-107. Retrieved from [http://www.newcastle.edu.au/\\_\\_data/assets/pdf\\_file/0016/100366/v7-skouteris-et-al.pdf](http://www.newcastle.edu.au/__data/assets/pdf_file/0016/100366/v7-skouteris-et-al.pdf)
- Slade, L., & Ruffman, T. (2005). How language does (and does not) relate to theory of mind: A longitudinal study of syntax, semantics, working memory and false belief. *British Journal of Developmental Psychology*, 23, 117-141.  
doi:10.1348/026151004X21332
- Slaughter, V., Dennis, M. J., & Pritchard, M. (2002). Theory of mind and peer acceptance in preschool children. *British Journal of Developmental Psychology*, 20, 545-564.  
doi:10.1348/026151002760390945
- Slaughter, V., & Gopnik, A. (1996). Conceptual coherence in the child's theory of mind: Training children to understand belief. *Child Development*, 67, 2967-2988.  
doi:10.2307/1131762
- Slaughter, V., Peterson, C. C., & Mackintosh, E. (2007). Mind what mother says: Narrative input and theory of mind in typical children and those on the autism spectrum. *Child Development*, 78, 839-858. doi:10.1111/j.1467-8624.2007.01036.x

- Smith, M., Apperly, I., & White, V. (2003). False belief reasoning and the acquisition of relative clause sentences. *Child Development*, 74, 1709-1719. doi:10.1046/j.1467-8624.2003.00633.x
- Southgate, V. (2013). Early manifestations of mindreading. . In S. Baron-Cohen, H. Tager-Flausber, & M. Lombardo (Eds.), *Understanding other minds: Perspectives from developmental social neuroscience* (pp. 3-18). Oxford, UK: Oxford University Press.
- Sprafkin, J. N., Liebert, R. M., & Poulos, R. W. (1975). Effects of a prosocial televised example on children's helping. *Journal of Experimental Child Psychology*, 20, 119-126. doi:10.1016/0022-0965(75)90031-4
- Strouse, G. A., O'Doherty, K., & Troseth, G. L. (2013). Effective coviewing: Preschoolers' learning from video after a dialogic questioning intervention. *Developmental Psychology*, 49, 2368-2382. doi:10.1037/a0032463
- Subrahmanyam, K., & Smahel, D. (2010). *Digital youth: The role of media in development*. New York, NY: Springer Science & Business Media.
- Takeuchi, L., & Levine, M. H. (2014). Learning in a digital age: Towards a new ecology of human development. In A. Jordan & D. Romer (Eds.), *Media and the wellbeing of children and adolescents* (pp. 20-43). New York, NY: Oxford University Press.
- Takeuchi, L., & Stevens, R. (Eds.). (2011). *The new coviewing: Designing for learning through joint media engagement*. New York, NY: The Joan Ganz Cooney Center at Sesame Workshop. Retrieved from [http://www.joanganzcooneycenter.org/wp-content/uploads/2011/12/jgc\\_coviewing\\_desktop.pdf](http://www.joanganzcooneycenter.org/wp-content/uploads/2011/12/jgc_coviewing_desktop.pdf)

- Tamis-LeMonda, C. S., Kuchirko, Y., & Song, L. (2014). Why is infant language learning facilitated by parental responsiveness? *Current Directions in Psychological Science*, 23, 121-126. doi:10.1177/0963721414522813
- Tarullo, A. R., Bruce, J., & Gunnar, M. R. (2007). False belief and emotion understanding in post-institutionalized children. *Social Development*, 16(1), 57-78. doi:10.1111/j.1467-9507.2007.00372.x
- Taumoepeau, M., & Reese, E. (2013). Maternal reminiscing, elaborative talk, and children's theory of mind: An intervention study. *First Language*, 33, 388-410. doi:10.1177/0142723713493347
- Taumoepeau, M., & Ruffman, T. (2006). Mother and infant talk about mental states relates to desire language and emotion understanding. *Child Development*, 77, 465-481. doi:10.1111/j.1467-8624.2006.00882.x
- Taumoepeau, M., & Ruffman, T. (2008). Stepping stones to others' minds: Maternal talk relates to child mental state language and emotion understanding at 15, 24, and 33 months. *Child Development*, 79, 284-302. doi:10.1111/j.1467-8624.2007.01126.x
- Taylor, M., & Carlson, S. M. (1997). The relation between individual differences in fantasy and theory of mind. *Child Development*, 68, 436-455. doi:10.2307/1131670
- Tompkins, V. (2015). Improving low-income preschoolers' theory of mind: A training study. *Cognitive Development*, 36, 1-19. doi:10.1016/j.cogdev.2015.07.001

- Troseth, G., Saylor, M., & Archer, A. (2006). Young children's use of video as a source of socially relevant information. *Child Development*, 77, 786-799. doi:10.1111/j.1467-8624.2006.00903.x
- Valkenburg, P. M., & Peter, J. (2013). The differential susceptibility to media effects model. *Journal of Communication*, 63(2), 221-243. doi:10.1111/jcom.12024
- Wartella, E. (2015). Educational apps: What we do and do not know. *Psychological Science in the Public Interest*, 16(1), 1-2. doi:10.1177/1529100615578662
- Wartella, E. & Lauricella, A. (2014). Early learning, academic achievement, and children's digital media use. In A. Jordan & D. Romer (Eds.), *Media and the well-being of children and adolescents* (pp. 173-186). New York, NY: Oxford University Press.
- Wartella, E., Rideout, V., Lauricella, A., & Connell, S. (2013). *Parenting in the age of digital technology: A national survey*. Retrieved from [http://static1.1.sqspcdn.com/static/f/1083077/22839022/1370380073813/PARENTING\\_IN\\_THE\\_AGE\\_OF\\_DIGITAL\\_TECHNOLOGY.pdf?token=K0Jhb%2FVCoKzqkStZiua%2Fq8m5nIY%3D](http://static1.1.sqspcdn.com/static/f/1083077/22839022/1370380073813/PARENTING_IN_THE_AGE_OF_DIGITAL_TECHNOLOGY.pdf?token=K0Jhb%2FVCoKzqkStZiua%2Fq8m5nIY%3D)
- Wartella, E., & Robb, M. (2007). Young children, new media. *Journal of Children and Media*, 1(1), 35-44. doi:10.1080/17482790601005207
- Watson, A. C., Nixon, C. L., Wilson, A., & Capage, L. (1999). Social interaction skills and theory of mind in young children. *Developmental Psychology*, 35, 386-391. doi:10.1037/0012-1649.35.2.386

- Watson, A., Painter, K., & Bornstein, M. (2002). Longitudinal relations between 2-year-olds' language and 4-year-olds' theory of mind. *Journal of Cognition and Development, 2*, 449-457. doi:10.1207/S15327647JCD0204\_5
- Weimer, A. A., & Guajardo, N. R. (2005). False belief, emotion understanding, and social skills among Head Start and non-Head Start children. *Early Education & Development, 16*, 341-366. doi:10.1207/s15566935eed1603\_3
- Weiss, A. J., & Wilson, B. J. (1996). Emotional portrayals in family television series that are popular among children. *Journal of Broadcasting & Electronic Media, 40*(1), 1-29. doi:10.1080/08838159609364330
- Wellman, H. M. (2002). Understanding the psychological world: Developing a theory of mind. In U. Goswami (Ed.), *Blackwell handbook of childhood cognitive development* (pp. 167-187). Malden, MA: Blackwell.
- Wellman, H. M. (2012). Theory of mind: Better methods, clearer findings, more development. *European Journal of Developmental Psychology, 9*, 313-330. doi:10.1080/17405629.2012.680297
- Wellman, H. M., Cross, D., & Watson, J. (2001). Meta-analysis of theory-of-mind development: The truth about false belief. *Child Development, 72*, 655-684. doi:10.1111/1467-8624.00304
- Wellman, H. M., Fang, F., & Peterson, C. C. (2011). Sequential progressions in a theory-of-mind scale: longitudinal perspectives. *Child Development, 82*, 780-792. doi:10.1111/j.1467-8624.2011.01583.x

- Wellman, H. M., & Liu, D. (2004). Scaling of theory-of-mind tasks. *Child Development*, 75, 523-541. doi:10.1111/j.1467-8624.2004.00691.x
- Wellman, H. M., & Peterson, C. C. (2013). Theory of mind development, and deafness. In S. Baron-Cohen, M. V. Lombardo, & H. Tager-Flusberg (Eds.), *Understanding other minds: Perspectives from developmental social neuroscience* (pp. 51-71). London, UK: Oxford University Press.
- Wilson, B. J. (2008). Media and children's aggression, fear, and altruism. *The Future of Children*, 18, 87-118. doi:10.1353/foc.0.0005
- Wimmer, H., & Perner, J. (1983). Beliefs about beliefs: Representation and the containing function of wrong beliefs in young children's understanding of deception. *Cognition*, 13, 103-128. doi:10.1016/0010-0277(83)90004-5
- Wolf, M. M. (1978). Social validity: The case for subjective measurement or how applied behavior analysis is finding its heart. *Journal of Applied Behavior Analysis*, 11, 203-214. doi:10.1901/jaba.1978.11-203
- Woodward, A. L. (2005). The infant origins of intentional understanding. *Advances in Child Development and Behavior*, 33, 229-262. doi:10.1016/S0065-2407(05)80009-6
- Yagmurlu, B., Berument, S. K., & Celimi, S. (2005). The role of institution and home contexts in theory of mind development. *Journal of Applied Developmental Psychology*, 26, 521-537. doi:10.1016/j.appdev.2005.06.004



- Zack, E. A. (2010). *Infant transfer of learning across 2D/3D dimensions: A touch screen paradigm*. Unpublished doctoral dissertation. Georgetown University, Washington DC.
- Zimmerman, F. J., & Christakis, D. A. (2005). Children's television viewing and cognitive outcomes: a longitudinal analysis of national data. *Archives of Pediatrics & Adolescent Medicine*, 159, 619-625. doi:10.1001/archpedi.159.7.619
- Zimmerman, F. J., & Christakis, D. A. (2007). Associations between content types of early media exposure and subsequent attentional problems. *Pediatrics*, 120, 986-992. doi:10.1542/peds.2006-3322
- Zins, J. E., Bloodworth, M. R., Weissberg, R. P., & Walberg, H. J. (2007). The scientific base linking social-emotional learning to school success. *Journal of Educational and Psychological Consultation*, 17, 191-210. doi:10.1080 /10474410701413145

## **Biography**

Mariya Nikolayev was born and grew up in Saratov, Russia. After moving to the United States, she received her Bachelor of Arts in psychology from Rutgers University in 2005 and her Master of Arts in Social Ecology from University of California, Irvine in 2010. Mariya's research interests concerns development of media content to serve various needs of different populations of young children.