The Influence of Adult- Versus Child-Directed Television Programs on Distractibility in Preschoolers

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LOYOLA UNIVERSITY CHICAGO

THE INFLUENCE OF ADULT- VERSUS CHILD-DIRECTED TELEVISION
PROGRAMS ON DISTRACTIBILITY IN PRESCHOOLERS

A THESIS SUBMITTED TO
THE FACULTY OF THE GRADUATE SCHOOL
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PROGRAM IN DEVELOPMENTAL PSYCHOLOGY

BY

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# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACKNOWLEDGMENTS</td>
<td>iii</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>v</td>
</tr>
<tr>
<td>INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>CHAPTER ONE: THE DEVELOPMENT OF ATTENTION</td>
<td>3</td>
</tr>
<tr>
<td>CHAPTER TWO: ATTENTIONAL INERTIA</td>
<td>15</td>
</tr>
<tr>
<td>CHAPTER THREE: ATTENTION AND TELEVISION</td>
<td>17</td>
</tr>
<tr>
<td>CHAPTER FOUR: THE CURRENT PROJECT</td>
<td>35</td>
</tr>
<tr>
<td>CHAPTER FIVE: METHOD</td>
<td>42</td>
</tr>
<tr>
<td>CHAPTER SIX: RESULTS</td>
<td>57</td>
</tr>
<tr>
<td>CHAPTER SEVEN: DISCUSSION</td>
<td>66</td>
</tr>
<tr>
<td>APPENDIX A: FORMAL FEATURES OF TELEVISION</td>
<td>79</td>
</tr>
<tr>
<td>APPENDIX B: “SESAME STREET” COMPREHENSION QUESTIONS</td>
<td>90</td>
</tr>
<tr>
<td>APPENDIX C: “WHEEL OF FORTUNE” COMPREHENSION QUESTIONS</td>
<td>92</td>
</tr>
<tr>
<td>APPENDIX D: PERCENTAGE AND TIME OF FORMAL FEATURES</td>
<td>94</td>
</tr>
<tr>
<td>APPENDIX E: FREQUENCY OF FORMAL FEATURES</td>
<td>96</td>
</tr>
<tr>
<td>APPENDIX F: UNSTANDARDIZED MEANS, STANDARDIZED MEANS, AND STANDARD ERRORS FOR TASK SCORES</td>
<td>98</td>
</tr>
<tr>
<td>APPENDIX G: MEANS AND STANDARD ERROR FOR THE PERFORMANCE SCORES, ATTENTION MEASURES, DISTRACTIBILITY MEASURES, AND COMPREHENSION QUESTIONS ACROSS CONDITIONS</td>
<td>100</td>
</tr>
<tr>
<td>REFERENCE LIST</td>
<td>102</td>
</tr>
<tr>
<td>VITA</td>
<td>111</td>
</tr>
</tbody>
</table>
ABSTRACT

Research in the field on children’s attention to television has suggested that discerning between two different types of programming is crucial for understanding how children attend to TV. Child-directed television consists of programs designed with the purpose that children are the intended viewers. In contrast, adult-directed television is not designed for children; these programs are directed toward an older audience. The current study investigated how children divided their attention between cognitive tasks and a distractor. The distractor was either an adult-directed TV program, a child-directed TV program, or there was no distractor. The results revealed that the both distractors reduced children’s ability to sustain attention to the tasks compared with no distractor. The child-directed distractor significantly held children’s total attention away from the tasks longer than the adult-directed distractor or no distractor. These results have implications for how television should be monitored in the home and preschool environments.
INTRODUCTION

Research on attention and television viewing spans quite a sizable spectrum regarding comprehensibility, viewing patterns, and learning, from infancy through adulthood. In the infancy and early childhood sphere of work, researchers have utilized television programs as (1) distractors (Kannass & Colombo, 2007), (2) stimuli for understanding TV content (Anderson & Pempek, 2005; Richards, 2010), and (3) teaching tools or to encourage imitation (Barr, 2010; Strouse & Troseth, 2008; Troseth, 2010). Additionally, how children pay attention to television has also received much study (Anderson, Choi, & Lorch, 1987; Anderson & Lorch, 1983; Alwitt, Anderson, Lorch, & Levin, 1980; Anderson & Levin, 1976; Richards & Anderson, 2004) only to reveal looking patterns are influenced by a host of factors. The purpose of this paper and the current project is to expand the research concerning how two unique types of television programming differentially influence attention and distractibility in preschoolers as they work on cognitive tasks. Specifically there are three goals associated with the current project. The first goal is to understand how the content of the distractor television program differentially influences task performance and attention to the task. The second goal is to understand how the content of the distractor program differentially influences distractibility or looking to the television. Subsumed within these first two goals is a secondary goal, and this is to understand how attention (looking to the task) and distractibility (looking to the television) change over the course of the session. The third
goal is to understand how children monitor a distracting event. This paper contains four distinct sections: the literature review, a description of the current project, the results of the project, and a discussion that closes with implications of the project. The purpose of the literature review is to provide background information about attention. It begins by describing how attention develops over the course of infancy and early childhood, with a particular emphasis on how endogenous attention arises. It then proceeds with a detailed account of how attention is measured and quantified in the field. Next, it describes the specific visual pattern that all infants, toddlers, and adults demonstrate while watching television (i.e. attentional inertia). Finally, it depicts how the research on attention to television has progressed over the past few decades, specifically emphasizing how TV is utilized as a distractor. Following the literature review is a detailed description of the current project followed by the methodology, results, and a discussion of the results as well as limitations, future directions, and implications. Overall, the current thesis project seeks to advance the field of attention and television. Specifically the goal is to understand how preschoolers inhibit a distractor (child- versus adult-directed) television program while engaging in cognitive tasks.
CHAPTER ONE

THE DEVELOPMENT OF ATTENTION

In order to understand how preschool children inhibit their attention to a distracting program when playing games or performing tasks, it is crucial to understand how attention develops. We do not develop in a world free from disruptions, interruptions, and diversions. As young children’s cognitive capacities mature through toy play, they must be able to develop an ability to tune out external disruption from the noises produced by the phone ringing, siblings quarreling, and the television that has been left on by others in the household. It is evident that the television is a source of distraction and background noise in the home. This notion has been empirically investigated through research collected by Rideout and Hamel (2006) as part of an initiative set by the Kaiser Family Foundation in order to obtain more information on television viewing. In addition to survey distribution, they conducted focus groups. From the surveys, they gathered that 83% of children ages 6-months-old to 6-years-old use some form of screen media daily. Additionally, 56% of those under the age of 1 year, 81% of 2- to 3-year-olds, and 79% of 4- to 6-year-olds do watch television daily. Of the oldest group (4-6 years), 46% spend greater than 2 hours watching television daily. It is clear that young children are watching television (Rideout & Hamel, 2006). In addition to being consumers of television, young children are also susceptible to television as disruptive source of noise in the home. One third (32%) of children under 6
years of age live in a home in which the television is on all or most of the time. Also, in 30% of homes, the television is on during meal times. Parents seem to leave television on when they are not watching it because of a personal preference [e.g., “I just have it on to keep me company’ says a mother of a 1- to 3-year-old” (Rideout & Hamel, 2006, 11). Moreover, as children get older, they can state their preferences to turn the TV off, [e.g., “We are trying to cut back. My 7-year-old is always asking to have family time and talk” (Rideout & Hamel, 2006, 11)]. However, young children are not likely to ask to turn the TV off; their parents have to understand that background television is disruptive. Parents need to be responsible for turning the TV off. Unmistakably, these data reveal that television has a significant presence in the typical home; therefore, in addition to the sizable degree of work that has been done on children’s active watching of television, it is also crucial to understand how background television has an impact on cognitive development as well. Before revealing research related to attention and television, it is important to describe the major tenets of attention and research on the development of attention. The following sections discuss the components of visual attention, endogenous attention, visual preferences, and measuring the quality of attention.

**Components of Visual Attention**

Visual attention consists of four separate components: alertness, spatial orienting, object attention, and endogenous attention (Colombo, 2001). These four processes are governed by separate mechanisms, as different neural substrates are responsible for the abilities associated with each. The first process, alertness, is used to prepare the organism to be in a state that allows him or her to take in information, and this is primarily
controlled by the brainstem. The noradrenergic, cholinergic, serotonergic, and dopaminergic pathways all participate in this cognitive function. The second process, spatial orienting, is related to engaging, disengaging, and shifting attention to a location in space, and this is controlled by the posterior attention system (see Posner & Petersen, 1990 for a review). The third process, attending to objects, is considered to be the “what” system (opposed to the “where” system of spatial orienting just described). This component of attention is concerned with the processing of visual object features, including part-whole processing, color identification, and shape and form recognition. Finally, endogenous attention reflects the increasing ability to hold or allocate one’s attention in a volitional manner to a particular task. The following section will go into greater detail on endogenous attention as the current project sought to examine how this type of attention inhibited preschool children from becoming distracted by a television show that played in their periphery.

**Endogenous Attention**

Endogenous attention is conceptualized as attention span, vigilance, and perseverance (Colombo & Cheatham, 2007). In infancy and early childhood, it is frequently measured in tests of distractibility (Ruff & Capozzoli, 2003) and multiple-object free play tasks (Kannass, Colombo, & Carlson, 2009; Kannass & Oakes, 2008; Ruff, Capozzoli, & Saltarelli, 1996). Colombo and Cheatham (2007) describe the manifestation of endogenous attention. The core of their assertion is that endogenous attention emerges in its basic form during the end of the first year of life and improves throughout the second year during toddlerhood. Attention is typically measured by look
duration. Look duration refers to how long an infant or toddler visually attends to a specified stimuli (e.g., a screen shot, a toy, etc.). However, look duration in the first half of the first year of life does not reflect endogenous attention. When examining a pattern of look duration from several sources across the first year of development, it is evident that it does not follow a linear course. Specifically, Colombo, Harlan, and Mitchell (1999) propose a triphasic course of look development (as cited in Colombo, 2001). Between birth to 8- to 10-weeks-old, look duration increases, followed by a decrease in look duration between 3- to 6-months-old, and finally, look duration begins to increase again during the second half of the first year of life, steadily increasing into toddlerhood and the preschool years (Colombo & Cheatham, 2007, 295, Fig. 4). In general, infants who demonstrate shorter look durations are thought to process information quicker (i.e., they are referred to as short-lookers) than those who process it more slowly (i.e., long-lookers) (Colombo, 2001). If this premise is applied to the triphasic look model, one would assume infants become better at encoding information from 3- to 6-months-old, but once they reach their 6-month-old birthday, they gradually become poorer encoders as evident from the model’s increasing look durations; this is unlikely the case. Instead, a qualitative shift in the mechanism responsible for look duration is proposed (Colombo & Cheatham, 2007). That is, beginning in the second half of the first year of life, increases in look duration reflect the beginning stages of the emergence of endogenous attention.

Look Duration

Other studies (Courage, Reynolds, & Richards, 2006; Richards, 2010; Ruff & Rothbart, 1996) support the emergence of a similar attentional system. During the first
six months of an infant’s life, s/he is more influenced by the novelty of targets (e.g., their favorite toy, a moving car, a pair of keys). In other words, the exogenous factors of an event or object elicit attention. However, the second system, endogenous attention comes online later during development, in which the top-down processes become responsible for maintaining attention to a task. Therefore, look duration in the first system is driven by something different than the second system. In the first system looking reflects children’s orienting to new objects based on the object’s properties (e.g., novelty), while in the second system, looking reflects attention span (i.e., children volitionally attend to an object).

Recently, researchers have become interested in how look duration may differ if what the child looks at is altered. Specifically, using look duration as the sole dependent measure of attention has fallen under scrutiny because the triphasic model of look duration was created from attention to simple, static stimuli. To clarify the results of look duration studies, researchers altered the complexity of stimuli presented to infants between 3- to 12-months of age (Courage et al., 2006). Look durations were greatest to the most dynamic presentations (e.g., Sesame Street). In fact, looking patterns to Sesame Street and faces mimicked the general triphasic model proposed by Colombo et al., (1999); additionally, this was supported both behaviorally via peak look length and physiologically using heart rate. It is important to keep in mind that with age, attention to simple stimuli develops differently than attention to complex, dynamic stimuli (Courage et al., 2006; Richards, 2010). Static, simple stimuli may consist of the presentation of shapes or colored screens blinking on a screen. Television programs are an example of
dynamic, complex stimuli, which are associated with increases in looking over the course of the first year of life (Richards & Cronise, 2000). With dynamic stimuli, there are multiple shapes, colors, and patterns to attend to and such entities are consistently moving about the screen in a kinetically active manner. More specifically, in the current study, the stimuli that were used as distractors consisted of complex, dynamic, multi-modal stimuli in the forms of both adult- and child-directed television programs.

Visual Preference

A separate component of visual attention concerns discerning between separate visual preferences in infancy (Cohen, 1972). As aforementioned, attention encompasses many components, and Cohen (1972) revealed how two components of attention are elicited depending on the stimuli presented to infants. These two components are attention-getting and attention-holding. Specifically, he revealed that when infants fixated on a light, their latency to turn to a checkerboard pattern differed as a function of the size of the checks. Additionally, the amount of time infants spent looking at the checkerboard differed as a function of the number of checks. He suggested that the size of the checks influenced attention-getting and the number of checks influenced attention-holding. These are two unique mechanisms responsible for attention. Attention-getting reflects orienting to a stimulus, and attention-holding reflects how long one will engage with that stimulus. In the current project, both types of attention were measured.

Measuring the Quality of Attention

While look duration reflects information processing and gives quantitative data on attention, researchers have devised other methods to ensure they are qualitatively
measuring attention to objects, television, and people. This is described as attentional state. Attentional state refers to the notion that the depth of concentration and degree of information processing will vary within a particular look (Oakes & Tellinghuisen, 1994). There are two primary methods (heart rate and behavioral coding) used in the field to measure attentional state, which thoroughly are explained in the following two sections.

Heart Rate

Heart rate measures of attention have revealed that as infants become more engaged and attentive to stimuli, their heart rate declines (Richards, 1987). This method is used in conjunction with behavioral measures (Richards, 2008, 2009, 2010; Courage et al., 2006; Frick & Richards, 2001; Richards & Casey, 1991) and electroencephalograms (Reynolds & Richards, 2005) and in studies of television viewing (Richards & Turner, 2001). In order to gauge a psychophysiological measure of attention, many researchers have opted to use the electrocardiogram (ECG). In these research paradigms, surface electrodes are placed on the participant’s body to measure the R-waves, which yield the interbeat interval (IBI) or the inverse of heart rate (Richards, 2008). Because of the parasympathetic vagal influence on heart rate, it is a justifiable measure of attention during infancy, childhood, and adulthood. It works particularly well during the early years of life as attention is developing at a variable rate (e.g., Richards & Casey, 1991). Richards has proposed a model that portraits how attention is related to heart rate (see also Richards, 2008).

Following the onset of a particular stimulus, the heart rate will accelerate, remain stable, or decelerate depending on how the infant attends to the stimulus. The phases
include: pre-attention, stimulus orienting, sustained attention, pre-attention termination, and attention termination. At the pre-attention phase, the stimulus has not been shown, so the heart rate is at base rate. During stimulus orienting, the participant becomes more concentrated with the stimulus, and his or her heart rate begins to steadily decrease. Sustained attention is defined as the period when the heart rate reaches its lowest level (or highest IBI) and remains below the prestimulus level. Cognitively, this phase is associated with top-down processing of information; the participant volitionally controls his/her attention to the stimuli. This is evidence for more engaged processing of information as demonstrated by two important results from studies by Richards and colleagues. First, the subject is behaviorally more focused and less susceptible to distraction (Lansink & Richards, 1997). When infants are presented with a toy, they are least susceptible to an audio-visual distractor when overt behavioral measures and heart rate measures of attention are congruent; that is, infants who demonstrate concentrated, focused attention also are engaged in sustained attention as measured by a heightened IBI. Additionally, sustained attention is also associated with enhanced recognition memory (Frick & Richards, 2001). Young infants, who are presented with visual stimuli when in a state of sustained attention (i.e., lowest heart rate), later recognize the same stimulus in paired-comparisons paradigm. Alternatively, recognition memory for stimuli presented when attention is not yet engaged or is beginning to terminate is less superior. Following an episode of sustained attention are the pre-attention termination and attention termination phases. In the pre-attention termination phase, the heart rate has yet to reach its pre-stimulus heartbeat level, but it is beginning to return to baseline. In
attention termination, the heart rate returns back to its pre-stimulus level. This is behaviorally accompanied by heightened inattentiveness despite the fact the infant remains fixated on the object. During this phase, the infant is much more susceptible to distraction as they are not as engaged with the target task. A discussion regarding how heart rate measures of attention appear in preschool-age children and its relation to attentional inertia will follow in a subsequent section. The next section discusses another method to measure the quality of attention.

Behavioral Coding: Casual versus Focused Attention

In addition to the heart rate method, examining the attentional state of infants via their overt behavior is another way to measure the quality of attention. This method primarily arose from the objective to understand how and why an infant manipulates an object in a particular manner (Ruff, 1984; 1986). Before deeming attention as “focused” or “casual,” Ruff (1986) noticed that concentration and inspection of an object was accompanied by focused looking and manipulating the object by either fingering or rotating it. Additionally, mouthing or banging the object was coded separately, as it indicates a lower quality of attention. Currently, these two separate types of attention are defined as focused and casual attention, respectively.

The characteristics that distinguish focused versus casual attention in infants and young children are akin to those behaviorally manifested in adulthood, especially facial expression. Infants and young children do express focused and casual attention, and so it is important to familiarize oneself with an infant prior to the coding process (Oakes, Kannass, & Shaddy, 2002). Coding requires two independent observers to judge the state
of the infant or young child, so they must use the same criteria in making their judgments (Ruff & Lawson, 1990). Focused (concentrated) attention consists of examining the object by rotating it or fingering it in a careful or purposeful manner. Deliberate and slowed manipulations of an object also resemble more focused attention. It is also important to look at the facial expression of the infant, toddler or the child—pursed lips, a furrowed brow, and eye contact with the object all are indicative of focused attention. Generally, the infant appears to be learning about the object when in a state of focused attention (Oakes, Madole, & Cohen, 1991; Oakes & Tellinghuisen, 1994). In contrast, casual attention is construed of as more general attention to the object of interest; this includes smiling and/or laughing, banging the object, repetitively hitting the object, or just starring at the object without any overt signs of concentration. Babbling while manipulating the object is considered to be more casual than focused. Typically, the reported inter-rater reliability is good to almost perfect (e.g., Kappa = .97 in Ruff & Lawson; Kappa = .89 in Ruff, Capozzoli, & Weissberg, 1998; and Kappa = .86 in Oakes et al., 2002).

General guidelines concerning focused and casual attention coding are important to follow. While children do not look physically the same at all ages, Ruff and Lawson (1990) consider that effortful attention can be judged the same at any age. However, the amount of focused attention changes with age (Ruff & Lawson, 1990; Oakes et al., 2002; Ruff, Capozzoli, & Saltarelli, 2003). Older infants are more often judged to be in states of focused attention, and they are less likely to be distracted (Oakes & Tellinghuisen, 1994). Other changes with age, such as the emergence of endogenous attention (Colombo, 2001;
Colombo & Cheatham, 2007), and improvements on executive functioning tasks like inhibitory control tests (Zelazo, Carlson, & Kesek, 2008), also parallel increasing focused attention.

Research utilizing this method has revealed some important findings with respect to how focused attention and casual attention are differentially influenced as well as how these different states of attention operate during distraction from a main task. Oakes and Tellinghuisen (1994) first investigated examining in infancy, thus revealing: (a) younger infants examine more than older infants, (b) infants examine complex objects more than simple ones, and (c) infants examine novel objects more than familiar objects. Furthermore, in the presence of a distractor, infants judged to be in a state of examination, are less distractible. Visual attention is therefore reflective of active information processing only some of the time (see also Oakes et al., 1991). When infants examine objects, their intake of new information is enhanced. Additionally, infants turn to a higher proportion of distractors and turn quicker to distractors when casually attending to toy, especially when the distractor is presented in audio-visual format versus solely auditory or visual (Tellinghuisen & Oakes, 1997). Finally, attentional state can act as a moderator. The characteristics of a stimulus will determine how much a young infant will divide his/her attention between the toy and the distractor. There are two possibilities. The first is that focused attention makes the target task seem more relevant, and therefore, the infant increases his or her engagement with it (i.e., a bias for the toy). Second, focused attention to complex stimuli increases cognitive engagement, but casual
attention or attention allocated to a simple toy simply does not require as much effort (i.e. attention lies on a continuum) (Oakes, Tellinghuisen, & Tjebkes, 2000).

While heart rate and behavioral coding measures of attention utilize different methods to acquire data on attentional engagement (focused/sustained versus causal/terminated attention), it is important to note there is consistency between behavioral indicators of attention and heart rate measures of attention (Lansink & Richards, 1997; Lansink, Mintz, & Richards, 2000). In the current project, focused attention and casual attention were not measured. However, it is important to understand how these two behaviors differ, especially since attentional engagement, which is a component of focused attention, was reflected in one of the measures utilized in the current project.
CHAPTER TWO
ATTENTIONAL INERTIA

In order to understand how attention is maintained to a task, it is crucial to understand how look duration influences the length of a look to an object or event. Attentional inertia refers to progressive maintenance of attention to an object, stimuli, or television as a look is sustained; attentional engagement is likely to persist the longer one remains attentive to something (Richards & Anderson, 2004). In order to quantify attentional inertia, Anderson et al. (1987) calculated the conditional survival probability of a look, which required calculating the proportion of looks that last across a given time interval, but this is given only if the look has already survived to the beginning of that interval. In doing so, they found looks lasting longer than 15 seconds have a greater probability of surviving henceforth, and looks for shorter periods have a greater chance of abrupt termination and increased chances of distractibility (Anderson et al., 1987).

Richards and Anderson (2004) put forth a model of attentional inertia based on extended looking to television. A fundamental concept that this “model of looking” has revealed is associated with the continuity in look patterns through development, especially to television (Richards, 2010). Infants, toddlers, children, and adults all attend to television as well as other objects of interest in the same manner. The majority of looks consist of brief, typically less than one second, looks, yet there are some looks, albeit only a few, that last a long duration. Based on aggregate looking data from 3-months-olds
through adults, the authors determined that there is a skewed distribution of looks to screen media, which is best described by the lognormal function. The skewness in looks is related to the hazard function—given short interval looks (i.e., short look duration) it is likely that one will look away, but given long interval looks (i.e., longer look duration), the probability of looking away is diminished. It is important to consider the influence of attentional inertia for two reasons. First, both attentional inertia and attentional state are related to measuring attentional engagement. Infants are most engaged (i.e. resistant to distraction) when judged to be in a state of focused attention, and when they have been looking at the target for long periods of time (Oakes, Ross-Sheehy, & Kannass, 2004). Second, the comprehensibility of the stimuli will affect how infants look toward it. Compared with comprehensible stimuli, looks to incomprehensible stimuli are relatively shorter (Anderson et al., 1981). There are also significantly more middle-range looks (15-60 s.) and long looks (> 120 s.) toward comprehensible stimuli (Richards & Anderson, 2004). Although attentional inertia was not calculated in the current project, preschooler’s average length of individual looks to the task and total looking to the distractor were measured. Having background knowledge about how attentional inertia and state reflect engagement was important when interpreting average and total looks because longer average looks reflect deeper attentional engagement and longer total looking reflects the amount of attention the participants devoted to the distractor.
CHAPTER THREE
ATTENTION AND TELEVISION

Television is a ubiquitous medium, as it exists all around us whether we choose to engage with it or not. Television is played in the home, at the airport, as a supplement to educational lessons, and even in restaurants. It is an inescapable component of our lives, which is why understanding how it beneficially serves us as well as causes potential harm to our cognitive development is essential. Moreover, understanding how television viewing influences development can reveal potential information with regard to the development of attention in infancy, toddlerhood, and during the preschool years. This section reviews the research on attention and screen media, particularly, television.

Recall that much of the infant and early childhood research has focused on attention to simple stimuli such as objects, pictures, and simple patterns. In a related field, research began to emerge in the mid-1970s concerning attention to television (e.g., Anderson, Alwitt, Lorch, & Levin, 1979; Anderson & Levin, 1976; Huston & Wright, 1983). Research in this field initially involved with what captured and held attention to a program similar to how the research on attention began with discerning attention-getting from attention-holding properties (Cohen, 1972). Television properties will be discussed in detail in a later section, but the main point is that the two initial hypotheses on the topic of attending to television differed with regard to what controlled and held attention.
One perspective proposes that children attend to television only when they can comprehend the material (Anderson et al., 1981) or if the material contains attributes that are indicative of age-appropriate material (Alwitt, Anderson, Lorch, & Levin, 1980). An alternative perspective proposes children attend to TV because they are attracted by the formal features of the program (i.e. action, pace, visual techniques, verbal and nonverbal auditory events) (Huston & Wright, 1983). Anderson and Kirkorian (2006) concisely review the research that suggests both formal features and program comprehensibility elicit attention.

The subsequent sections will integrate the aforementioned concepts and other relevant research in the field. Specifically, the subsequent sections describe important areas in the field of attention and television. The first section describes the use of television as distractor. It describes how a televised distractor is differentially distracting depending on the material or content of the distractor and the age of the participant. Specifically, research that utilizes a distractibility paradigm during the infancy, toddlerhood, and preschool years will be discussed. The second section discusses the influences of television viewing. Specifically, it clarifies the different theories associated with how children view TV (i.e., formal features, experience, and comprehensibility).

**Television as a Distractor**

Research on attention during infancy has revealed that attention is dually influenced by infant’s own attentional state to a stimulus as well as the characteristics of a distracting event (Oakes et al., 2000). Infants become more sophisticated in their allocation of attention, especially after 6 months of age when endogenous attention
begins to surface and as the prefrontal cortex and brainstem develop (Colombo, 2001; Colombo & Cheatham, 2007). Based on Colombo’s triphasic model of look duration, it is reasonable to examine how attention develops in slightly older infants as well as preschoolers. Endogenous attention begins to emerge and develops over the course of infancy, toddlerhood, and the preschool years, which suggests that older children should be better at attentional tasks than younger infants (Colombo, 2001). Furthermore, evidence of continuity or change in the development of attention in both free-play tasks and distractibility paradigms reveals information pertinent to correlations between: (a) attention and general cognitive capacities (Bornstein, 1990), (b) attention and intelligence (Colombo & Frick, 1999), (c) attention and language development (Kannass & Oakes, 2008), and (d) attention and maternal ratings of hyperactivity and behavior (Ruff, Lawson, Perinello, & Weissberg, 1990). In this section, research pertaining to how the characteristics of a television influence attention and distractibility during infancy, toddlerhood, and the preschool years is discussed. Specifically, it reflects how background television can impair specific variables (e.g. parent-child interaction, attention span, toy play, etc.).

Infancy

Courage, Murphy, Goulding, and Setliff (2010) have investigated the influence of background television on toy play and parental interaction. They found that 6- and 18-month-old infants, who were presented with toys during a 20 minute free play period while with their parent, engaged with the toys the majority of the time. However, when the TV was turned on during the 10-minute period (either for the first or second half of
the session depending on condition), it did significantly diminish their looks to their toys. Even when the TV was turned off (for those infants who viewed it during the second half), looks to the TV continued to distract from toy play. The 6-month-old infants’ looks to the toys nearly doubled when the TV was off as opposed to on (i.e., 7.47 s to 15.72 s, respectively). Parental interaction was also impaired by the presence of the TV program. Parents of 6-month-olds significantly looked and talked to their baby more when the TV was off compared to when it was on. Parents of 18-month-olds vocalized and initiated play more with their infant when the TV was off compared to when it was on. Courage et al. (2010) conclude that parents play a passive role when their young infant is viewing television; moreover, their findings were not the only study to support this claim. An earlier study has demonstrated decreased parent interaction during the presence of a background television has been demonstrated with 1-, 2-, and 3-year-old children (Kirkorian, Pempek, Murphy, Schmidt, & Anderson, 2009).

**Toddlerhood**

Kannass and Colombo (under review) longitudinally examined how competitive versus non-competitive contexts affect attention between 12- and 18-months-old. When children were 12- and 18-months-old, they were presented with three different tasks. The two competitive tasks, a multiple-object free play task and a distraction paradigm, were designed to measure attention in a competitive context. The distraction paradigm is typical of those used in the field and creates competition between a focal task and a TV program (a distractor). The multiple-object free play task is also competitive because a child has to allocate attention between the various toys presented. The non-competitive
task is a single-object free play task, in which the child is only presented with one toy to manipulate, and therefore, there are no distracting components (e.g. others toys, a TV program). Both attention and inattention were measured, and the scores for the 12-month-olds were compared with their 18-month performance. They found differences in age: the younger 12-month-olds looked longer when there was no competition for their attention, but when the children were 18-month-olds, they looked for a similar amount of time in both contexts. The authors suggest that the 12-month-olds need more time to process the toy versus when they were older, as was the case for 13-month-olds compared with 16-month-olds in a categorization task (see Oakes, Plumert, Lansink, & Merryman, 1996). Furthermore, they additionally suggest the emergence of endogenous attention plays a role in the 18-month-old’s ability to maintain attention in competitive contexts, as 18-month-olds were less inattentive than 12-month-olds in the multiple object free play task (competitive context). This paper demonstrates the enhanced performance of toddlers above and beyond infants in their ability to control attentional process in a more sophisticated, top-down manner.

Schmidt, Pempek, Kirkorian, Lund, & Anderson (2008) tested a hypothesis based on Anderson and Pempek’s (2005) review that asserts background TV is disruptive to children’s attention and toy play. They examined how 12-, 24-, and 36-month-olds would be affected by a distracting condition in which an adult-directed program (Jeopardy!) played in the background. An adult-directed program is one that is designed for an adult viewer; it is not intended for a child viewer. Importantly, the ages of the participants in the study bridges the gap between infancy, toddlerhood, and the early preschool years.
The 1-, 2-, and 3-year-olds played in a child-friendly room for 1 hour during which the TV was on for 30 minutes and then off for 30 minutes, counterbalanced. To measure the influence background TV had on children’s play, the authors examined play maturity, play episode length, and focused attention. They found that looks at the TV were short and they decreased with age, which is typical in a distraction paradigm. They also found that background television significantly decreased play episode length by 30 s on average, and the mean length of focused attention to the toy decreased by 5 s as compared to when the TV was off. Altogether, there was less play overall, shorter play episodes, and shorter bouts of focused attention in the presence of background TV. Furthermore, when the children were interrupted by the television, they had a much harder time re-engaging themselves in what they were doing prior to disruption. Background TV may cause refocusing of attention and also tax a child’s limited cognitive resources. While there were small effects in this study, the cumulative effects in the real world may be detrimental. Research in this area with adults have also supported that background television is harmful when one is attempting to encode information through reading (Armstrong & Chung, 2000). Taken together, these studies reveal that children younger than 3 years of age struggle to hold their attention to toys when there is competition for attention in the form of a televised distractor. The following two studies explain how attention at the preschool level operates. Such information is relevant as the current project assessed attention and distractibility in 4-year-olds using a distractibility paradigm.
The Preschool Years

The effects of distractor content on attention allocation have classically been explored at the infant level (e.g., dynamic versus static stimuli in Hicks & Richards, 1998; differences between visual, auditory, and audio-visual stimuli in Ruff & Capozzoli, 2003; unimodal versus bimodal in Oakes & Tellinghuisen, 1997). Recently, the type and/or content of the distracting event have been investigated during the preschool years.

Kannass and Colombo (2007) highlight the importance of studying the characteristics of the distractor because some studies have found a facilitative effect (Ruff & Capozzoli, 2003; Ruff et al., 1996) of an intermittently presented distractor while others reveal distractors do hinder performance to a central task (Oakes et al. 2002; Oakes & Tellinghuisen, 1994). The preschool period is also an important point in development to investigate distractibility as children become better equipped to focus on a central task and ignore distractors with age (Ruff & Capozzoli, 2003; Ruff, Capozzoli, & Weissberg, 1998; Ruff & Lawson, 1990), yet this is not always true [e.g. 3- and 5-year-olds are not differentially distracted when the target and distracting stimuli are both dynamic presentations, as was found in Anderson et al. (1987)].

Kannass and Colombo (2007) investigated the influence of no distraction, intermittently presented distraction, and continuous distraction on attention of 3.5- and 4-year-old children as they completed cognitive tasks. Although children worked independently on all tasks, they were explicitly instructed to perform a task. The 3.5-year-olds performed best in the no distraction condition—above and beyond those of the intermittent and continuous conditions. Four-year-olds, on the other hand, performed
worst during the continuous condition, suggesting the adverse effects of distraction are more salient at 3.5-years of age than at 4 years of age. The older children were better able to tune out intermittent distractors as compared with the younger children. These age differences are consistent with the theory on the emergence of endogenous attention. While both intermittent and continuous distractors were incomprehensible to the child in this study, it does reveal that children have a harder time tuning out continuous distraction, and they are better able to work on cognitive tasks when distraction only occurs occasionally and randomly. This is contrary to the research on adult distraction (Britton & Delay, 1989), which reveals adults are more likely to be distracted by intermittent distraction. This is relevant because the current study attempted to clarify how the nature of a distractor affected the competition of attention between a focal task and a distractor. It was hypothesized that a more meaningful distractor program would have been more distracting to a child (i.e., child-directed) than one that contains less meaningful information (i.e., adult-directed). All the distractors in the current study were presented in a continuous manner to mimic how television is typically viewed in typical contexts (e.g. the home, at school, at a friend’s house, etc.). In Kannass and Colombo (2007), participants looked less to the distractor over time when it was intermittent but not when it was continuous. However, if children are thought to be influenced by the content of the program as Anderson and colleagues purport, then in the current project, there should have been decreases in looking to the television over time when it was an adult-directed program but not when it was a child-directed program.
Other research from Kannass and colleagues explored how instruction influences task performance. Kannass, Colombo, and Wyss (2010) emphasize the importance of providing children with explicit instructions when they are expected to perform a task in the presence of either an incomprehensible or comprehensible distracting television program. Three- and four-year-old children were either given no instruction, moderate instruction, or frequent instruction when asked to complete a task. The results reveal that when an incomprehensible TV program is presented in their periphery, children benefit from any type of instruction to stay on task; however, when a comprehensible program is available, children need much more frequent and explicit instruction to stay on task. Additionally, the 4-year-olds were generally better at resisting turning toward and watching the television program than the 3-year-olds. Therefore, in the current project, it was crucial to keep the directions the same for each child and not vary the amount of instruction.

In addition to differences in distractibility due to distractor content and age, preschool children are aware of the factors that could impair attention. Specifically, 3- and 4-year-old children believe that noise can detrimentally affect attention (Miller & Zalenski, 1982). Preschoolers recognize noise as a disturbance because when noise is the only variable in question, children who are given a model room and asked to remove the objects that would be more distracting, they significantly choose noisy objects (e.g., a TV, vacuum cleaner, etc.) over a quiet object (e.g., a lamp, a camera). In addition to being disruptive, there is a negative correlation between background television exposure and executive functioning. Barr et al. (2010) found that both (1) viewing of adult-directed
programming at 1 and 4 years of age and (2) viewing of high levels of household
television at age 4 are associated with poor executive functioning skills, as rated by their parents.

The role of television on attention and distractibility has produced some variable results. Nevertheless, there are a few clear points: (1) young children do pay attention to comprehensible distractors, (2) television not intended for children (i.e., adult-directed TV) is indeed disruptive to toy play when played in the background, and (3) children can identify factors that may lead to distracting situations. The purpose of the current project was to determine the attentional behavior of 4-year-old children when they worked on a task alone, without parental involvement. There was yet to be a study that directly compares how adult- versus child-directed television programming influenced attention and distractibility in preschoolers.

**Influences on Television Viewing**

This section reviews the literature on the influences of television viewing in young children. Specifically, the formal features of television (Huston & Wright, 1983), experience with the medium with age (Anderson & Levin, 1976), and the ability to comprehend the program (Anderson et al., 1981) all have an impact on how children watch television. Importantly, the influences these factors have on television watching are not homogenous in that they do not tap the same mechanisms, but the overt behavior (i.e., watching TV) is the same. For example, 1-year-olds were more likely to pay attention to an animated segment, with more formal features, compared to a narrative animated segment (i.e., less formal features), but the opposite effect was found for 3-
year-olds (Takahashi, 1991 as cited by Anderson & Hansen, 2010). That is, the formal features likely elicit an orienting response and hold attention in the younger group, whereas the ability to understand the material will hold an older child’s attention to the medium. In other words, the exogenous features of the program elicit and hold attention at younger ages, but when children become more skilled at endogenously maintaining their attention, they have the opportunity to learn about the content of the program, and so the story or content becomes more relevant. To reiterate, the following sections describe how formal features, experience, and comprehensibly influence attention.

Formal Features

Huston and Wright (1983) contend that the perceptually salient formal features (e.g., pace, visual-auditory features, intensity, movement, contrast, change, novelty, and incongruity) elicit and hold attention to television programs, but these do not convey anything informative to the child. The formal features of a television program are a packaged form of auditory noises and visual images; together, this is what creates the backbone for a program. The formal features of television, which include the action, pace, visual techniques, verbal and nonverbal auditory events, are responsible for eliciting attention. Furthermore, these are independent of content. Unlike the perspective of Anderson et al. (1981), the formal features hypothesis proposes that children will become familiarized with the formal features of television with age and TV watching experience, so they then begin to attend to the informative aspects. While Huston and Wright (1983) advocate that the perceptual salience of formal features influences attention to television, they also acknowledge that television provides (1) a flow of
content (e.g., how the scenes progress: rapidly, fast cuts, slowly, etc), (2) signifying content to indicate who the show is made for (e.g., women and children’s voices are signals of a child’s television show), and (3) modes of mental representations (i.e., the television provides a picture of what a view might imagine). Collectively, these features signal that a program will be comprehensible and appropriate for a particular audience. This content-based perspective parallels Anderson and colleague’s notion that ability to comprehend the content of a program has an impact on children’s attention. Unlike Anderson’s perspective, Huston and Wright (1983) argue that comprehensibility does not influence attention in young children; therefore, it is the older children and more experienced viewers, who are affected by comprehensibility and rely on content material. Given the discrepancy between Anderson and Huston and Wright, it was important to investigate how children’s ability to comprehend the program influenced their attention.

Research attempting to quantify how formal features influence attention, such as pacing, is difficult, as it is difficult to hold the content constant (e.g., two dissimilar programs may differ in comprehensibility but they may also differ in pacing, speed, and language; these formal features ought to be held constant to determine effects of content). In order to ascertain that comprehensibility is the driving force behind differential patterns of attention, it is important to control for the formal features (e.g., pace, language, and speed) by manipulating the video or choosing programs similar in these features. One study that succeeded in doing so utilized the same version of Sesame Street, but edited the program to create a rapidly paced version and a slowly paced version. Anderson, Levin, and Lorch (1977) examined the short-term effects of program (Sesame
Street) pacing on children’s later play behavior. Specifically, they observed children playing a matching test, working on a puzzle, and engaging in free play (coded for active, directed, and undirected play) after they viewed the program. Overall, attention did not differ significantly across conditions, suggesting program pace does not have a negative influence on attentional engagement.

The current project juxtaposed two different types of television content, which were hypothesized to differentially influence distraction. The formal features of both of the programs were hypothesized to elicit an orienting response from participants in both conditions; however, it was expected that the content in the child-directed program would hold attention longer than the content in the adult-directed program because the child’s program was more comprehensible to preschoolers. Although subsequent free play behavior was not measured after viewing in this study, future research should discern how content of two different types of TV programming affects later behaviors while keeping the formal features similar.

Experience with Television

Two important questions about the role of experience have been raised. First, is it the age of the child that influences how he or she watches television? Second, is it the experience with a particular program that enhances their viewing and thus sets up a style of viewing television? Crawley et al., (2002) were the first to examine how preschooler’s experience with the popular program Blue’s Clues affected their comprehensibility and applicability of learned rules and lessons to other shows. In study 1, they found that experienced viewers of Blue’s Clues did indeed overtly interact with a novel episode of a
Blue’s Clues more—the show itself is interactive in nature, and the authors suggest that these experienced viewers knew overt interaction with the main character and his dog, “Blue” were acceptable behaviors. Conversely, those who had never seen the show before did not interact as much. They also found that experienced viewers looked less at the show. In study 2, they compared inexperienced viewers with experienced viewers on the same dependent variables as study 1, but they used a new show, *Big Bag*, which is also an interactive program. Again, the experienced *Blue’s Clues* viewers looked less but overtly interacted more. This study suggests that experience with a particular program’s style fosters certain skills that can be transferred to novel episodes of the same show as well as completely new programs. However, there was no learning general information and the main lesson (i.e., far transfer) from the program was not significant, as indicated by measures of comprehensibility.

Comprehensibility

The comprehensibility perspective asserts that children pay (or do not pay) attention to television programs because they can (or cannot) understand the material presented in the show. Anderson et al. (1981) directly manipulated TV program comprehensibility to determine how children would respond. In their first study, they examined dialogue in a *Sesame Street* show so that in their analysis they looked at children’s responses to either (1) immediate, concrete situations or (2) dialogue that referred to something at a different time and place; the former is much more comprehensible to a preschooler because it refers to a present state while the latter requires more cognitive effort (e.g. holding something in mind while thinking about
another point in time). Since attention was significantly greatest to immediate dialogue (versus non-immediate and absence of dialogue), they concluded that the comprehensibility of the program shaped the preschoolers’ visual attention. In their second study, they experimentally manipulated the comprehensibility of the program by altering the formal features in three separate ways: (1) scene rearrangement (2) foreign language substitution and (3) backward speech. The manipulations of the dialogue (backward speech and foreign language) significantly influenced the amount of time children viewed the program; both caused children to look at the program much less than the scene rearrangement condition. In sum, they contend that preschoolers use formal features only because they are predictive of information to be learned from the medium; within the context of a TV program, there is something they can actively extract and use, which is why attention is substantially reduced in the presence of an incomprehensible television. Other studies support this view as children as young as 18- and 24-month-olds can differentiate between comprehensible and incomprehensible televised material (Pempek, Kirkorian, Richards, Anderson, Lund, & Stevens, 2010; Richards and Cronise, 2000).

Anderson and Lorch (1983) assert that young children are active viewers of TV because they choose programs that they can comprehend. Children’s prior knowledge, the program form and content, and the environment all influence how they watch it (Kirkorian & Anderson, 2008). Moreover, preschool children have devised strategies to divide their attention between toy play and viewing a television program (Anderson et al., 1979), which requires a cognitive strategy unlike anything they have used up until this
point in their rapidly developing lives. Overall, television watching is not a passive experience, which may help explain (1) why children do learn from television once they recognize it as a symbol (Troseth, 2010), (2) why it may predict long-term academic achievement (Anderson, Huston, Schmitt, Linebarger, and Wright, 2001) and (3) why there is so little research on the transfer of learning from media to real-life situations (Crawley, et al 2002).

Comprehensibility of the program also affects how children attend to secondary tasks. Lorch and Castle (1997) presented 5-year-old children with a one of two adaptations of a 35-minute video of Sesame Street. The show was either presented normally or with the segments created to be incomprehensible to the child. Incomprehensibility was altered in one of three ways: reordering the scenes, dubbing a Greek-language soundtrack over the normal audio (foreign language semantics were identical to original English script), or creating backward speech. Note that the language dubbing segments were collapsed in analysis because both versions were equally incomprehensible. Participants were told to press a button whenever they heard a particular auditory noise (i.e. a secondary reaction time test) while simultaneously watching one version of the show (between-subjects design). Since the children were encouraged by the experimenters to watch the show, viewing the program was the main task. Replicating Anderson et al.’s (1981) work, the children paid significantly less attention to the language-dubbed portions as compared with the normal or reordered portions. When children were not watching the television, reaction times to the secondary task were statistically identical for normal, reordered, and language-dubbed segments.
However, when children were cognitively engaged with the television program, reaction times were longer when the program was played normally as compared with language-dubbed. The lack of difference between reaction times during normal segments versus reordered segments can be explained by comprehensibility: scenes within a reordered segment could be understood as the language was normal and edit points were sliced at 12 second intervals. In other words, the reordering of the segments did not significantly hinder the children’s ability to understand the program because the scene splices were not frequent enough and occurred at natural breaking points. This made it much easier for the children to follow than a language-dubbed version.

Another study that altered comprehensibility was conducted by Pempek et al. (2010) in order to determine the youngest age at which comprehensibility influences viewing. Young children were shown two versions of the same program. One version was played normally, while the other version was distorted either by (a) dubbing backward speech over the visual portion of the show or (b) altering it so the program contained a scrambled mix of visual shots. While the 6- and 12-month-olds did not differ in their looking to the normal versus distorted segments of the show, the 18- and 24-month-olds did; their looks to the comprehensible version of the program were longer than the incomprehensible version. Moreover, heart rate change, in which decreases are indicative of sustained attention (see Richards, 2008), were greatest in the oldest group of children, suggesting they paid most attention to the televised programming. Pempek et al. (2010) suggest that with age, children become sensitive to the comprehensible components of a television program. By 2 years of age children prefer to view an episode
of an age-appropriate show that makes temporal and audible sense to them versus one that is distorted and thus, unintelligible and meaningless. To a smaller extent, this finding also held true for the 18-month-olds. If 2-year-olds are sensitive to the meaningfulness of a show when watching TV is the target task in an experiment, then it is reasonable to suggest that 4-year-olds, who are sophisticated enough to understand content, will also pay different amounts attention to a television program that is either meant for them or meant for an adult viewer.

The current study sought to understand how 4-year-olds maintained engagement to a variety of cognitive tasks when competition for their attention constantly played in their periphery. The main manipulation of this study was the distractor television program. To a 4-year-old, the adult program was constituted as incomprehensible, while the child program was comprehensible. The adult-directed program was expected not hold attention away from the target task as much as the child-directed program, as it was meaningless to the child. Therefore, children exposed to the adult program were hypothesized to be more resistant to distraction. A child-directed program was expected to engage children because the program appealed to this age group.
CHAPTER FOUR

THE CURRENT PROJECT

Although the attention and television literature investigates how infants and young children pay attention and are distracted by different types of television, it is unknown how program content and age-appropriateness affects preschoolers’ attention and distractibility. There are unanswered questions related to how adult-directed versus child-directed programming differentially distract children from a focal task. Some of these questions were investigated in the current project as they were associated with goals of understanding how children divided their attention between a focal task and a distracting event. Specifically, there were three goals for this current project.

The first primary goal was to determine how the content of the distractor, whether it was an adult-directed (*Wheel of Fortune*) or a child-directed (*Sesame Street*) television program, influenced 4-year-old children’s task performance and attention to a focal task. Task performance reveals how much work children can complete in a given period of time and is reflective of children’s ability to divide their attention between a task and a distracting event. Attention is an indicator of the level of endogenous control 4-year-old children exert while working on a task. Measures of task performance complement measures of attention to signify children’s persistence toward completing a goal in the midst of distraction. Previous research on the development of attention during the preschool years have utilized how much work children complete as a measure of task
performance and how much time children spend looking to the task as a measure of attention (Kannass et al., 2010). Both task performance and attention have been shown to be detrimentally influenced by presence of distractors (Kannass & Colombo, 2007; Kannass et al., 2010; Kannass, Wyss, O’Toole, & Griner, 2011). In the current project, children had to become engaged with the material if they wanted to complete the task (e.g., they had to construct a building or match pictures together). Children needed to put forth all their attention toward the task in order to complete it correctly. For example, children could place marbles in a bucket while distracted; however, they could not construct a Lego™ building to match a model building while distracted. The latter task is an example of one of the tasks used in the current study. In sum, the first goal was to determine if attention and task performance differed as a function of condition.

The second primary goal was to understand how distractibility differed as a function of the distraction condition. Research on how children watch television, when it is the focal task, has revealed that children look at programs differently depending on if it is designed for an adult or a child. Adult-directed programs are less comprehensible to children, and so they should spend less time looking at them compared with child-directed programs because children prefer to look at comprehensible more than incomprehensible material (Anderson et al., 1981). Children are selective television viewers because they choose what they want to watch based on their knowledge about television and their experience with the medium (Anderson & Lorch, 1983). Attention to television is influenced by the program features associated with age-appropriate content (e.g., women, children, and puppets all signal that the program contains informative and
comprehensible content for a 3- or 4-year-old) (Alwitt et al., 1980). In the current project, the focal task was to complete a task in the midst of a distracting event. It was not to watch a television program, but research on how children watch TV has important implications for how they will be distracted by it. Therefore, measuring how children’s looking to the distractor differed as a function of distractor content would support the idea that distractibility was driven by their ability to comprehend the content. Both the total duration of time children spent looking at the distractor and how often they turned to the distractor were measured. These two measures reflect two unique properties of attention, as described below.

Looking to the distractor involves both attention-getting (as measured by the frequency of turns to the distractor) and attention-holding (as measured by the total amount of time spent looking at the distractor) properties (Cohen, 1972). In the current project, a distractor that was more comprehensible to children, because it was child-directed, was thought to be better at getting and holding children’s attention to the distractor. Prior work suggests that a comprehensible distractor is more distractible than an incompressible distractor. Specifically, Kannass et al. (2010) revealed that English-speaking preschool children were more distracted by an English version of Sesame Street than a Spanish version (i.e., the former is comprehensible and the latter is incomprehensible). If children’s ability to comprehend the distractor was responsible for looking to the distractor, then the results of the current project should resemble the main effect of condition evident in Kannass et al. (2010). That is, children in the child-directed distractor condition would be more distractible than children in the adult-directed...
condition. Moreover, previous research on television viewing also suggests that comprehensibility of the program influences looking. Anderson et al. (1981) revealed that 2-, 3.5-, and 5-year-olds looked less to a distorted version of *Sesame Street* (e.g., backward speech, foreign language, scrambled scenes) than to a normally played program. Although Anderson et al.’s (1981) study used television viewing as the focal task, it has important implications for distractibility research, especially in the current study. In sum, the second goal examined how distractor type influenced both the frequency and duration of looking to the distractor.

Investigating both the first and second goals were important because together, they revealed how competition for children’s attention differed as a function of distractor. To further investigate how the comprehensibility of a distractor influenced both on task attention and distractibility, it was important to analyze: (1) how children attended to the tasks over time and (2) how children looked at the distractor over time. Prior research utilizing similar methodology suggests that attention and distractibility change over time. Kannass et al. (2010) found the nature of the distractor, whether it was comprehensible or incomprehensible, differentially influenced attention to the target tasks and looking to the distractor over time. When the distractor was comprehensible, preschoolers attended to the task for similar amounts of time over the course of the session, but they looked to the distractor more over time. When the distractor was incomprehensible, preschoolers attended to the task more over time, and they looked to the distractor less over time. They suggested a comprehensible distractor was more salient than an incomprehensible distractor, and thus more challenging to ignore. The incomprehensible distractor was not
interesting to the children, so they became more attentive to the task and more resistant to distraction. On the other hand, children were less resistant to the more salient, comprehensible distractor over time. The secondary goal of the current project is to replicate the results of Kannass et al. (2010) because a child-directed distractor was more comprehensible to 4-year-olds, while an adult-directed distractor was less comprehensible. In the child-directed distraction condition, children were hypothesized to look at the distractor more over the course of the session because it was salient and interesting to them. On the other hand, in the adult-directed distraction condition, it was predicted that children would become more engaged with the task and less interested in the distractor (i.e., evidence of “tuning out” the distractor).

The third primary goal of the project was to gain a better understanding of how preschool children monitor a distracting event. Monitoring the distractor includes overt and covert attention. Overt attention is when individuals shift, orient, and look to an object in their environment. Attention is directed toward the object of interest (Wright & Ward, 2008), and so children look at what they want to attend to. Covert attention occurs when attention is directed at a stimulus without the typically accompanied body and eye shift that is evident in overt attention (Posner, 1978). This has implications for distractibility because children can monitor the distracting event using a variety of modalities (i.e., visually, audibly, or both). Television research reveals children are better able to comprehend television when they both watch and listen to it as opposed to simply listening (Lorch, Anderson, & Levin, 1979), but little is known about how children
monitor a distractor. The current project sought to expand this area by examining how children monitored the information presented by distractor.

An effective way to measure how much information the children gained from the distractor was to ask them questions about the content of the program. This project was the first to utilize a question-asking procedure to measure what information children learned when monitoring a distracting event. Crawley et al. (2002) used a question-asking procedure to understand how much children learned from television when TV viewing was the focal task. They examined how 3- to 5-year-old children answered questions after the viewing a television program. Although this previous work revealed older children answered more questions correctly than younger children, adapting a methodology similar to the content questions portion of the Crawley et al. (2002) study would be appropriate for 4-year-olds. For example, content questions were those that the children could answer correctly only if they had watched the specific episode the question referred to. For example, most 4-year-olds know who Elmo is, and so asking the child, “Who is small, red, and Zoe’s best friend on Sesame Street?” would not measure the child’s knowledge of a particular episode. Children may have this knowledge already stored in their memory. Asking the child, “What do Elmo and Zoe hide underneath the flower pot?” would be episode-specific, and thus a content question. Their answers to content questions, as opposed to their answers to general program questions, more accurately reflected how children monitored the distractor in the current project.

After children completed all four tasks, the experimenter asked children the questions. Children who paid more overt attention to the distractor (i.e., more distractible)
were expected to answer more questions correctly. While children who looked less to the distractor were expected to answer fewer questions correctly. If this pattern of results was found, it would mean that overt attention is the only form of monitoring. However, if the ability to answer questions did not differ as a function of looking to the distractor, then children were obtaining information about the distractors just by listening. This would suggest that children do not need to be visually distracted to learn about it. Therefore, even if children are not overtly attending to a distractor, it could still be harmful because they might be cognitively monitoring their environment, leaving less capacity to work on the focal task.
CHAPTER FIVE

METHOD

Participants

Forty-six participants were initially recruited for this study. Two participants were excluded due to equipment failure. Three participants were excluded because of experimenter error. One participant was excluded because he refused to play the games. Four participants were excluded because they were not between 4-years and 4-years and 4-months-old (i.e., they were too old). Thirty-six participants were used in the final analyses. Children were randomly assigned to one of three conditions: the child-directed distraction condition \( n = 12 \), the adult-directed distraction condition \( n = 12 \), or a no distraction condition (control) \( n = 12 \). Participants were recruited by mailing letters to families who have young children and live in the Chicagoland area. One week after the letters were sent, the families received phone calls asking if they received the letter and if they were willing to participate. Only healthy, typically developing children were eligible for the study.

The majority of the research on attention and television has focused on the early childhood ages. The age of 4-years-old was selected for three specific reasons. First, TV viewing begins around 2.5-years-old, and so it was important to ensure that the children in this study had some familiarity with television programs. Although this was not a study on how children watched television, the main goal was to understand how the
comprehensibility of the distractor influenced task performance, attention, and distractibility. It was crucial that children were old enough to know what television is and how the formal features operate to tell a story. Four-year-old children are sophisticated enough to interpret transitions on TV and understand points-of-view of different characters, and they use these features to understand the program (Anderson & Hansen, 2010). Second, prior research on attention and distractibility has revealed that a distractor of a continuous nature is challenging for 4-year-olds to inhibit turning to and watching (Kannass & Colombo, 2007). In the current study, it was important that both distractors created a challenging environment for the participant. Third, Kannass et al. (2010) established that 4-year-old children are more distracted by a comprehensible distractor than an incomprehensible distractor. Overall, the age of 4 was selected because it would expand upon previous work in the field regarding how the characteristics of distractor competed for presholder’s attention as they engaged in cognitive tasks.

**Apparatus**

The sessions were recorded using a Panasonic camcorder that was positioned surreptitiously behind a black curtain, 100 cm away from the child. The participant was seated at a child-sized table, facing the camcorder. The recordings were copied from a JVC digital video recorder hard drive onto a DVDs, so coders could reliably code for behaviors. A microphone was attached to the camcorder to gather any verbalizations or audio data, which aided in the attention and distractibility coding.
Stimuli

Task Descriptions and Instructions

The following cognitive tasks were used because they were similar to stimuli used in previous research on attention and distractibility (e.g., Kannass & Colombo, 2007; Kannass et al., 2010). These tasks were age-appropriate so that preschoolers could successfully complete them, yet they were challenging enough to maintain their interest. The four tasks were (1) “color by dot” (similar to color by number), (2) completing a puzzle, (3) constructing a Lego™ building, and (4) matching cards together. The details of the tasks are described below.

Coloring

For the coloring task, the participant was given a coloring sheet with a singular image that contained 3-7 spaces. Each space contained one of four colored dots (red, blue, green, yellow) to indicate which color the child should color in the space.

Instructions were given for each page; for example, the experimenter said, “See this picture. There are special colored dots inside these spaces. What color is this? [child identifies colors for each space]. Good. For this game I want you to color the space the same color as the dot inside. Let me show you [experimenter colors in one space to show the child can color outside the lines a little bit]. Can you color each space the same color as the dot inside the space? When you are all done with this page, I’ll give you a new one.” The child was then given the coloring page and an assortment of colored crayons. If the child completed the page before 3 minutes had elapsed, the child was given a new sheet along with the direction, “Can you color the spaces with the same color as the dot
on the inside?” The new pictures included a house, a dragonfly, a baseball hat, a flower, a stocking cap, a beach ball, a kite, a soccer ball, and a rocket ship.

**Puzzles**

In the puzzle task, the child received a wooden puzzle with nine different pieces that varied in shape and size (e.g., the first puzzle was a firefighter puzzle with pieces shaped like a hydrant, Dalmatian, fire truck, etc.). The experimenter instructed the child to complete the puzzle by saying, “For the puzzle game, I am going to take the pieces out, and I want you to put them back. When you are all done with this puzzle, I will give you a new one? Can you put the pieces back?” The child was then given the first puzzle board with the pieces scattered around the edges of the puzzle. If the child completed the puzzle before 3 minutes had elapsed, the child was given a new puzzle and corresponding pieces along with the direction, “Can you put the pieces back?” The new puzzles were a dinosaur puzzle, a handprint puzzle, a map of the United States puzzle, and two different alphabet puzzles.

**Lego™ Building**

In the Lego™ building task, the child was given a pre-constructed Lego™ building made from 4-8 Lego™ blocks and the corresponding Lego™ blocks to replicate the model building. The experimenter showed the child the model building, but refrained from giving him or her the Lego pieces during the instruction period. The experimenter said, “For the Lego™ game, I am going to give you some pieces, and I want you to make your building look just like mine. Your building should look the same as mine. Your building should match my building. When you are all done with this one, I will give you
some more blocks and another building.” If the child completed the Lego™ building before 3 minutes had elapsed, the child was given a new model building and a corresponding set of blocks along with the directions, “Here’s my building, and here are some more blocks for you. Can you make your blocks look just like my building?” There were 7 additional model Lego™ buildings and corresponding block sets used to replace the previous building.

**Matching**

In the matching task, the child was given an assortment of 10-20 cards with pictures on them (e.g., fruits, vehicles, animals, toys, etc). Some of the cards in the deck had a corresponding matching card, while the remaining cards were foils (i.e., they did not have a match). The child’s job was to match the duplicate cards together while leaving foils on the table. The experimenter presented the child with two matching cards and said, “Let me show you how to play the matching game. What’s this [picture of banana]?” The experimenter pointed to the card and waited for the child to say “banana.” After the child correctly stated it was a banana, the experimenter pointed to the duplicate card and asked, “What’s this [picture of duplicate banana]?” After the child correctly identified the duplicate as being a banana, the experimenter said, “Good. These two pictures look the same, don’t they? For this game, I want you to put the pictures that look the same together just like this [experimenter stacked the matching banana cards on top of one another], okay?” Then, the child was given four cards to ensure s/he understood the rules of the game. For this practice portion, two of the cards matched and two did not (e.g. two strawberry pictures, one sock picture, and one boat picture). The child was
praised after matching them together correctly, and the experimenter ended the
instruction period with, “Here are some more pictures. I want you to find the ones that
look the same and put them together, and for the ones that are different, I just want you to
leave them on the table. When you are all done with these pictures, I’ll give you some
more.” After the child completed matching a set of cards, the experimenter replaced the
old set with a new set of cards.

Distractors

The distractor DVDs were played on an 81.28 cm (32 in) wide LG television
monitor, which was located 91 m (3 ft) to the participant’s right and positioned at a 90°
angle. Children were randomly assigned to one of three conditions: the child-directed
distraction condition, the adult-directed distraction condition, or a no distraction
condition (control). In both distractor conditions, participants received target tasks to
complete with simple directions and then completed these tasks while a distractor played
continuously in their periphery. Participants in the child-directed distraction condition
were exposed to a child-directed TV program (*Sesame Street*) at suitable listening volume
(ranging between 58-62 dB). Participants in the adult-directed distraction condition were
exposed to an adult-directed game show (*Wheel of Fortune*) at the same volume (ranging
between 58-62 dB). In general, TV programs do not have a constant volume and typically
vary when they appear on television. In the control condition, there was no volume to
measure because there was no distractor. Children in the no distraction condition received
the same tasks as those children in the child- and adult-directed distraction conditions.
During the distraction conditions, the distractor ran continuously during each trial.
The use of a visually and audibly comprehensible but not age-appropriate distractor was necessary to isolate how adult-directed content was differentially distracting to preschool children than child-directed content. The adult-directed distractor was less comprehensible to children, but it was not incomprehensible in the sense that it was not a series of rearranged scenes or dubbed with backward speech (Anderson et al., 1981) or in a foreign language (Kannass, et al., 2010) as it has been utilized in previous research. Until recently, researchers have rarely differentiated between child-directed and adult-directed programming in research concerned with television (Anderson & Evans, 2001; Anderson & Pempek, 2005). Specifically, there is a lack of this distinction in research (a) when television viewing is the main activity, (b) when surveys about television viewing are given to parents, and (c) when television serves as a distractor, as in the current project. Past research has juxtaposed incomprehensible distractors with comprehensible distractors (e.g., Kannass et al., 2010); however, a limiting factor was that both distractors were child-directed, and so they contained features indicative of a child program. This was the first study to compare how two contextually different distractors affected how children divided their attention between a focal task and a distracting event. Additionally, the distractors played similarly (i.e., in a continuous fashion). Although both were comprehensible to an adult viewer, the essential point was that the adult-directed distractor would be less comprehensible to 4-year-old children. The television shows differed with respect to their target audiences, and they were suitable distractors to use in the same project because their formal features were similar.
Children use the formal features of a program to recognize it as being interesting and directed toward them (Huston & Wright, 1983). Formal features are part of television’s symbolic systems that vary in terms of their modes of representing different types of information (Huston & Wright, 1983; Salomon, 1979). For example, camera cuts are a formal feature. They do not convey any explicit information, but they help convey meaning about the on-screen action to the viewer. In the current project, the distractors were similar in terms of their formal features. Appendix A describes these similarities. The table located in Appendix D reveals how the percent of character movement, music, and speech were similar between the distractor, and the table in Appendix E reveals how the frequency of sound effects, set changes, camera features and effects were similar between the distractors. Any differences in these features would not affect total look duration or frequency of turns.

**Procedures**

The session consisted of one approximately 16 minute session with 4 trials per session, each 3 minutes long (it took approximately 1 to 1.5 minutes to switch tasks and explain the focal task instructions between each trial). After the informed consent process, the child was escorted into the room along with the parent, who was seated slightly behind and to the child’s left. The parent was previously instructed not to interact with the child. If the child asked for help, the parent responded to the child, “You’re doing great. Let’s see how you can do it by yourself.” The experimenter introduced the room and briefly explained the study to the child (e.g., “We’re going to play some fun games today”). The experimenter began the session by explaining one of four tasks to the
child. Recall, the four tasks included (1) coloring by dot (similar to color by number), (2) completing a puzzle, (3) constructing a Lego™ building and (4) matching cards together, and these were presented in a counterbalanced order. All four tasks involved a goal-directed pursuit, in which the child was shown or told what to do (e.g., “Can you put the puzzle pieces back where they belong?”). These types of tasks have been used in previous research in which a distractor competes for attention (e.g., Kannass & Colombo, 2007; Kannass et al., 2010). After the experimenter gave the instructions, the child was allowed to engage with the toys while a distractor simultaneously played in the child’s periphery (except in the no distraction condition). After the four tasks were completed, participants in the distraction conditions were asked eight questions about the distractor content to determine how much the child comprehended from the child-directed distractor (Appendix B) or adult-directed distractor (Appendix C), respectively. The questions were not inductive, but specific to the content played on the distractor. For example, the experimenter asked, “How many lady participants are in the game?” Children might have some knowledge about game shows if the family watches game shows regularly. However, general game show knowledge would not aid in children’s ability to answer the specific questions. Asking questions specific to the distractor’s content ensured children’s answers were based on their ability to monitor the distractor and not prior knowledge.
Coding and Measures

Three separate coding schemes were used to generate specific measures related to the goals of this study: task scores, measures of attention, measures of distractibility, and monitoring the distractor.

Task Scores

In order to measure how the distractor influenced task performance, task scores were calculated. For the coloring game, the task score was the sum of the correctly colored spaces in all the pictures. For the puzzle game, the task score was the sum of the correctly placed puzzle pieces. For the Lego™ game, the task score was the sum of the correctly placed individual Lego pieces when compared with the model Lego™ building. For the matching game, the task score was the number of correctly matched pairs of cards. The four scores from the tasks were summed to create a composite task performance score as in other research (Kannass & Colombo, 2007; Kannass et al., 2010). The composite score was used in the analysis to understand how the distraction condition influenced how much work the participant could complete in the allotted time.

Attention and Distractibility Coding

Using a reliable method from previous research on attention and distractibility (Kannass and Colombo, 2007; Kannass, et al., 2010) two types of behaviors were coded: looking to the task (i.e., attentive behavior) and looking to the distractor (i.e., distractibility). A coder simultaneously watched a DVD of the session and pressed a button on a Macintosh computer using a program called Habit to record the duration of behaviors (Cohen, Atkinson, & Chaput, 2004). Coding for behaviors were conducted
separately (i.e., reliable coders would only code for either attention or distractibility). Looks that were less than 1 s in duration did not count as a complete look. When these brief looks interrupted a look to either the focal task or distractor, the looks before and after the brief look were combined and scored as one look. For example, if a child looked to the task for 3 s, briefly looked away for 0.4 s, and returned to look at the toy for another 3 s, then the look was recorded as 6 s in duration and not two separate looks because the brief look away from the task was less than 1 s. However, if the look away was longer than 1 s, then the looks were not combined. In other words, when the child looked away and looked back quickly (i.e. less than 1 s) looks were combined and counted as just one look.

Attention and distractibility coding generated the duration and frequency of individual looks. Using these scores, both the duration of total looking and average length of individual looks were calculated. The duration of total looking to the task revealed how much time the child spent with the task overall. It reflected where children allotted their attention in the midst of distraction. Previous research has utilized total look duration (Kannass et al., 2010; Kannass & Colombo, 2007) and play duration (Anderson & Choi, 1991) as measures of attention. Greater total look duration reflects more attention allocation to the task. Children would look between the task and the distractor, and total look duration is a measure of the total time the child spent looking at the task. The average length of individual looks reflects, on average, how long the child looked at the task for a specific period of time before looking to the distractor. Children’s bouts of attention to the task varied throughout the session, and so the average length of these
individual looks was utilized in the analyses. The average length of the individual looks to the task revealed how long the child held or sustained his attention to the task before disengaging. Longer periods of sustained attention reflect deeper levels of attentional engagement (Richards & Anderson, 2004). In the current project, longer average individual looks would reflect more engagement with the task. In terms of distractibility, the total number head turns reflected the attention-getting properties of the distractor, and the total duration of looking reflected the attention-holding properties of the distractor. Previous research has used total duration of looking to the distractor to measure distractibility in preschoolers (Kannass et al., 2010). Together, frequency and duration of looking revealed how distractibility might differ between the conditions. Children who would turn to the distractor several times but would not look to it for a long duration of time were attracted by the attention-getting properties, whereas children who turned to the distracter very few times but looked for a greater duration were influenced by the attention-holding properties.

**Reliabilities**

The reliability for each behavior (attention and distractibility) was calculated by correlating the duration of attention (i.e., looking to the task) and distractibility (i.e., looking to the TV) from two coders. For attention coding, two coders recorded on task behavior for 25% of the sample. The average inter-observer reliability for the duration of individual looks to the task was 98.8% (mean difference = 0.68 s). For distractibility coding, two coders recorded distractor looking behavior for 25% of the sample. The
average inter-observer reliability for the duration of individual looks to the distractor was 98.8% (mean difference = 0.46 s).

Monitoring the Distracting Event

Children were asked a series of eight questions related to the distractor that played in their periphery. The questions reflected material that could only be known by watching and listening to the specific program. Children were not told it was a quiz, but rather, they heard, “While you were playing with the games, a TV program came on next to you. I have a few questions about the program I would like you to answer. The first question is…” The questions were repeated if children did not understand it; however, the experimenter did not repeat the question more than twice. Based on the work of Crawley and colleagues (Crawley et al., 1999; Crawley et al., 2002), the questions would resemble those considered to be “content” or “unique” questions; far transfer questions would be omitted from this study as transferring knowledge was not a primary goal. That is, the questions referred to things that were present on the screen and did not have to be inferred. For example, one of the players in Wheel of Fortune was from the Bay Islands of Honduras. A far transfer questions would be, “How did Debbie get to the Wheel of Fortune studio?” Not only would this question be too difficult, but also the child would have to infer that Debbie took an airplane, even though they did not talk about this on the show.

At the end of the task session, participants were asked eight questions about the distractor they were exposed to. Scores were calculated out of 16 points. Each question was worth 2 points; children could get partial credit for answering questions. The reason...
for granting partial credit was because components of their answers were correct. For example, one of the questions used in the child-directed distraction condition was “How much time does Mac give Telly to decide about the iPogo?” The correct answer was “10 seconds.” If the participant said 10 seconds, the question would be scored as completely correct (2 points). However, if the participant responded with “10 minutes,” the question would be scored as partially correct (1 point) because the participant knew that 10 was the correct answer but did not have the correct units. One of the questions used in adult-directed distraction condition was “How many of the game show players are women?” The correct answer was two. If the participant said “two,” the question would be scored as completely correct (2 points). If the participant responded with “three,” the question would be scored as partially correct (1 point). This was due to the fact that Vanna White, who turns the letters on the board, is a woman, and she is involved with the game show. Because of her role in the program, it appears as if she could be playing the game. The purpose of using full and partial credit is a more valid scoring method because it better captures children’s monitoring of the distractors.

The number of points obtained from the comprehension questions was compared with both (a) condition and (b) duration of distractibility. Comparing comprehension scores with both these variables revealed a better conceptualization of how children allocated their attention. Analyzing by duration of distractibility would reveal what modalities children use to monitor distractors. If a child did not spend a lot of time looking at the distractor but correctly answered the majority of questions, then he or she was mainly listening to comprehend the distractor. In their study on how children watch
television, Anderson and colleagues (1981) propose that children pay more attention to programs they can comprehend versus programs they cannot comprehend. This is relevant to the current project because children were hypothesized to both visually attend to and listen to the child-directed distractor more than the adult-directed distractor. If they looked at the child-directed distractor more, they had more opportunities to become engaged with it. It was therefore important to examine how both condition and duration of distractibility were related to comprehension scores.
CHAPTER SIX

RESULTS

The effect of the independent variable, condition (adult-directed distractor vs. child-directed distractor vs. no distractor) was examined using a variety of measures and analyses. All coded variables (task performance, attention, distractibility, turns to distractor, and correctly answered questions) were utilized in the subsequent analyses.

Preliminary Analyses

Preliminary analyses were conducted prior aforementioned analyses. Specifically, these preliminary analyses were conducted on two separate variables: (1) children’s viewing and exposure to television at home and (2) the effect of condition and gender on standardized task scores.

Children’s TV Viewing and Exposure at Home

Prior to the study, parents were asked to fill out a questionnaire about their children’s television viewing habits in the home. Preliminary analyses were conducted on children’s foreground television viewing (i.e., the number of hours per week children watch television) and the amount of time the television is on the home (i.e., when the child watches television and when the television is on). This latter measure captures both children’s foreground television viewing and background television. On average, preschoolers who participated in the current project watched 11.68 hours of TV per week ($SD = 7.65$, range 1 – 36). In terms of how often the TV is on, on average, preschoolers
live in environments in which the television is on 27.01 hours per week ($SD = 19.5$, range $1–84$). The second preliminary analysis was conducted on tasks scores.

**Task Scores**

Preliminary analyses were also conducted to ensure that the independent variables of condition similarly affected performance on each of the tasks, as in Kannass and Colombo (2007). To establish if there were differences between the task scores as a function of task, condition, or gender a Task (4: coloring, puzzles, Lego$^\text{TM}$, matching; within subjects) x Condition (3: no distraction, adult-directed distraction, child-directed distraction) x Gender (2: male, female) mixed model Analysis of Variance (ANOVA) was conducted on task scores. First, scores were computed to z scores for each participant’s performance score per task in order to compare the standardized units. The z scores were then used in the ANOVA. The analysis revealed no main effect of task, $F(3, 28) = 0.18$ ns (see table in Appendix F for raw scores, z scores, and their standard errors). Children performed similarly in the different tasks. There was also no main effect of condition, $F(2, 30) = 1.87$, ns. Task performance did not differ between the no distraction condition ($M = .33$, $SE = .19$), adult-directed distraction condition ($M = .03$, $SE = .18$), and child-directed distraction condition ($M = -.17$, $SE = .18$). There was a main effect of gender $F(1, 30) = 5.56$, $p < .05$. Females ($M = .31$, $SE = .13$) had higher scores than did males ($M = -.19$, $SE = .17$). None of the interactions were significant, $F < 2.21$. Overall, the preliminary analysis suggests that task performance was similar across all four tasks and between conditions, but female participants outperformed male participants on the tasks.
Goals and Analyses

Recall there were three primary goals associated with the current project. The first primary goal was to examine how condition influenced overall task performance and attention to the task. The second primary goal was to examine how condition influenced total duration of distractibility (total looking to the distractor) and frequency of distractibility (number of head turns to the distractor). A secondary goal of the project was to understand how looking to the task and looking to the distractor changed over the course of the session. Therefore, the subsequent analyses also included how attention and distractibility changed over time. Finally, the third primary goal was to examine how children monitored the distracting event. Means and standard deviations for the subsequent analyses can be found in the table in Appendix G.

Task Performance

Part of the first goal was to determine how the content of the distractor (adult-directed vs. child-directed vs. control) influenced overall task performance. A Condition (3: no distraction, adult-directed distraction, child-directed distraction) x Gender (2: male, female) ANOVA was conducted on total task performance. As a reminder, the total task performance was the sum of the coloring game (i.e., total number of sections correctly colored), puzzle game (i.e., the total number of correctly placed pieces), Lego™ game (i.e., the number of correctly placed Lego pieces by size compared with a matching building) and the matching game (i.e., the number of correctly matched pairs) for each participant. The Condition x Gender ANOVA on total task performance revealed no main effect of condition, $F(2, 30) = 1.51, ns$. The total task performance scores did not differ
whether the child was in the no distraction condition \( (M = 58.63, SE = 3.34) \), the adult-directed distraction condition \( (M = 53.57, SE = 3.19) \), or the child-directed distraction condition \( (M = 50.69, SE = 3.19) \). The analysis did reveal a main effect of gender, \( F(1, 30) = 4.14, p = .05, \eta^2 = .12 \). As in the preliminary analysis, the female participants \( (M = 58.1, SE = 2.93) \) had higher total task performance scores than the male participants \( (M = 50.49, SE = 2.33) \). The interaction was not significant, \( F(2, 30) = 1.06, ns \).

Attention

The second part of the first goal was to determine how the distraction condition influenced measures of attention. Both the duration of total looking to the task and average length of individual looks to the task were analyzed separately. Additionally, both types of looking (i.e., total duration and average length of individual looks) were divided into blocks of time. Previous research has divided the session into blocks to examine how on-task attention and distractibility change over the course of a session (i.e., from the first half to the second half) as a function of distractor properties (Kannass & Colombo, 2007; Kannass et al., 2010). Furthermore, research on infant distractibility has revealed infants habituate to distractors over time (Oakes & Tellinghuisen, 1994). In the current project, the session was divided into two blocks (i.e., in half); so that block 1 consisted of trial 1 and trial 2 and block 2 consisted of trial 3 and trial 4. The subsequent analyses included block as a within-subjects variable.

First, the total duration of looking to the task by block was analyzed. Recall that total duration of looking reflected the total amount of time the children devoted to the task over the course of the session. The Condition (3: no distraction, adult-directed
distraction, child-directed distraction) x Gender (2: male, female) x Block (2: block 1, block 2) mixed model ANOVA on total duration of looking to the task by block revealed a main effect of condition, $F(2, 30) = 9.47, \ p < .01, \ \eta^2_p = .39$. LSD post hoc analyses revealed that participants’ total duration of looking to the task in the child-directed distraction condition ($M = 204.37, SE = 10.53$) was significantly less than participants’ total duration of looking to the task in the adult-directed distraction condition ($M = 249.85, SE = 10.53, \ p < .01$) and in the no distraction condition ($M = 268.30, SE = 11.01, \ p < .001$). There were no differences in total duration of looking to task between participants in the adult-directed distraction condition and no distraction condition ($p = .21$). The analysis also revealed a marginally significant effect of block on total duration of looking to the task, $F(1, 30) = 4.00, \ p < .06, \ \eta^2_p = .12$. Participants tended to look less in first half of the session ($M = 230.78, SE = 8.11$) than in the second half of the session ($M = 250.89, SE = 7.81$). There were no gender differences in total duration of looking to the task, $F(1, 30) = .06, \ ns$. None of the interactions were significant, $F < .66$.

Next, the average length of individual looks to the task by block was analyzed. Recall that the average length of individual looks to the task reflected how long children could sustain their attention before disengaging. The Condition (3: no distraction, adult-directed distraction, child-directed distraction) x Gender (2: male, female) x Block (2: block 1, block 2) mixed model ANOVA on the average length of individual looks to the task revealed a main effect of condition, $F(2, 30) = 5.17, \ p < .05, \ \eta^2_p = .26$. LSD post hoc analyses revealed that participants’ average length of individual looks to the task in the no distraction condition ($M = 24.86, SE = 2.39$) were longer than participants’ average
length of individual looks to the task in the adult-directed distraction condition ($M = 17.87, SE = 2.29, p < .05$) and in the child-directed distraction condition ($M = 14.38, SE = 2.29, p < .01$). There were no differences in the average individual looks to the task between participants in the adult-directed distraction condition and child-directed distraction condition ($p = .38$). The analysis also revealed a significant main effect of block, $F(1, 30) = 12.46, p < .01, \eta^2_p = .29$. Participants average length of individual looks to the task in the first half of the session ($M = 15.95, SE = 1.67$) were shorter than their average length of individual looks to the task in the second half of the session ($M = 22.12, SE = 1.85$). There were also no gender differences in average length of individual looks to the task, $F(1, 30) = 1.04, ns$. None of the interactions were significant, $F < .82$.

**Distractibility**

The second goal of the project was to examine how distractibility differed as a function of condition, block, and gender. Distractibility was measured as (1) the total duration of looking to the distractor and (2) the number of head turns to the distractor. Specifically, the total duration of looking reflected the attention-holding properties of the distractor and the number of head turns reflected the attention-getting properties of the distractor. Similar to the prior analyses on attention, the distractibility data (i.e., total duration of looking and frequency of looks) were also analyzed with block as the within-subjects variable. Recall that block 1 consisted of trials 1 and 2, or the first half of the distractibility session. Block 2 consisted of trials 3 and 4, or the latter half of the distractibility session. Participants in the no distraction condition were excluded from the analyses because they did not have a distractor presented in their periphery, and thus, did
not look or turn to it. The Condition (2: adult-directed distraction, child-directed distraction) x Gender (2: male, female) x Block (2: block 1, block 2) mixed model ANOVA on the total duration of looking to the distractor revealed a main effect of condition, $F(1, 20) = 5.08, p < .05, \eta^2_p = .20$. Participant’s total duration of looking to the distractor was significantly less in the adult-directed distraction condition ($M = 42.33, SE = 14.79$) than in the child-directed distraction condition ($M = 89.49, SE = 14.79$). There was no main effect of block, $F(1, 20) = 1.34, ns$ or gender $F(1, 20) = .11, ns$. There were no interaction effects, $F < 1.8$.

The number of turns to the distractor was also analyzed by block. Again, participants in the no distraction condition were not included in the analysis. The Condition (2: adult-directed distraction, child-directed distraction) x Gender (2: male, female) x Block (2: block 1, block 2) mixed model ANOVA on the number of turns to the distractor revealed a marginal effect of condition $F(1, 20) = 3.20, p < .09, \eta^2_p = .14$. Participants in the adult-directed distraction condition ($M = 6.32, SE = 1.66$) tended to turn to the distractor less often over the course of the session than participants in the child-directed distraction condition ($M = 10.53, SE = 1.66$). There was also a main effect of block, $F(1, 20) = 4.92, p < .05, \eta^2_p = .20$. Collapsed across condition, participants turned to the distractor more in block 1 ($M = 9.41, SE = 1.33$) than in block 2 ($M = 7.44, SE = 1.18$). There was no main effect of gender, $F(1, 20) = .01, ns$, and there were no interaction effects, $F < .42$. 
Monitoring the Distractor

The third goal was to measure how children monitored the distractor as they completed a focal task. The analyses examined how condition and distractibility influenced children’s ability to answer questions about the content of the distractor that played in their periphery as they worked on tasks. As in the distractibility analyses, the no distraction condition was excluded from the monitoring analyses. A Condition (2: adult-directed distraction, child-directed distraction) x Gender (2: male, female) between-subjects ANOVA on correctly answered questions revealed no significant effects of condition, $F(1, 20) = 1.29, ns$ or gender, $F(1, 20) = 0.01, ns$. Children in the adult-directed distraction condition ($M = 1.39, SE = .72$) answered the same number of questions correctly as those in the child-directed distraction condition ($M = 2.54, SE = .72$). Overall, children answered few questions correctly. There interaction was not significant, $F(1, 20) = .19, ns$.

Additionally, it may have been that participants who looked at the distractor more would have answered more questions correctly. A median split on total duration of distractor looking was calculated to divide children into two groups, “more distractible” and “less distractible.” Presumably those who were “more distractible” would answer more questions correctly than those who were “less distractible.” Moreover, it was hypothesized that participants who were both “more distractible” and in the child-directed distraction condition would answer the most questions correctly. Instead of conducting the analysis on four separate groups (i.e., “more distractible” in the child-directed distraction condition, “less distractible” in the child-directed distraction
condition, “more distractible” in the adult-directed distraction condition, and “less distractible” in the adult-directed distraction condition), only two groups were used (more vs. less distractible). The reason for collapsing across conditions was twofold. First, the Condition x Gender ANOVA on correctly answered questions revealed there was not a main effect of condition, suggesting that participants in the adult-directed distraction condition answered the same number of questions correctly as participants in the child-directed distraction condition. Second, the sample size for the analysis consisted of 24 participants. Dividing the sample size into four subgroups would yield a very small number of children in each group ($n = 6$). Therefore, a distractibility median split was used as the between-subjects factor to analyze if distractibility contributed to children’s ability to answer questions correctly. The Distractibility Split (2: more distractible, less distractible) x Gender (2: male, female) between-subjects ANOVA did not reveal a main effect of distractibility, $F(1, 20) = 1.27, n.s$ or gender, $F(1, 20) = .01$ on correctly answered questions. Children who were “more distractible” ($M = 2.58, SE = .70$) answered the same number of questions correctly as those who were “less distractible” ($M = 1.44, SE = .65$). The interaction was not significant, $F(1, 20) = .52, n.s$. Potential limitations and reasons for why no effects were found for distractor monitoring are described in the discussion.
CHAPTER SEVEN
DISCUSSION

The current project has revealed important findings about attention and distractibility in the context of different types of television program content. First, task performance did not differ as a function of condition, which suggests children performed the same on the tasks regardless of distractor type. There was a gender difference in task performance, as girls outscored boys on total task performance. Second, total duration of looking to the task decreased when the distractor was child-directed but not when it was adult-directed or when there was no distractor present. However, the average length of individual looks to the task was shorter in both distraction conditions than in the no distraction condition. On task attention in all conditions increased over the course of the session. Together, the results from the attention measures have implications for how distractor content differentially influences on task attention. Third, distractibility was greater in the child-directed condition in terms of the number of head turns to the distractor and the total duration of looking at the distractor. Across distraction conditions, children turned less to the distractor over the course of the session, but their total duration of looking at the distractor did not decrease over the course of the session. Finally, children’s monitoring of the distractor did not differ as a function of condition or as function of their distractibility.
First, it is interesting that children’s task performance scores did not differ as a function of condition. Even though children looked to the task less in the child-directed distraction condition, it did not significantly impair their ability to complete the task. This conflicts with previous research that suggests distraction impedes task performance (e.g., Kannass & Colombo, 2007) and that comprehensible distractors are significantly more impeding on task performance than incomprehensible distractors (Kannass et al., 2010). However, it is consistent with previous research that suggests 3.5-year-olds are more focused in the presence of distractors (Ruff & Capozzoli, 2003). Although the current project did not measure focused attention, it is possible that the distractors facilitated more focused attention allowing for task completion. This interpretation, however, is unlikely because children showed less attention to the task in the child-directed condition.

It is likely that differences in task performance would have emerged with a larger sample of participants. In the current project, only 12 participants were in each condition. It is likely with a larger sample size that significant effects of distraction on task performance would emerge. The mean task score values reflect the trend that the child-directed distraction condition ($M = 50.68$) impedes task performance more than the adult-directed distraction condition ($M = 53.57$) and the no distraction condition ($M = 58.63$). Moreover, this trend suggests any type of distraction impedes task performance, which is consistent with prior research (Kannass & Colombo, 2007). Although these mean differences are not significant with a sample size of 36, it does reveal that it is trending in the hypothesized direction.
Task performance scores also revealed a main effect of gender in that girls outperformed boys on task completion. In the literature on attention and distractibility, there are no reported gender differences in infancy (Oakes et al., 2000; Ruff et al., 1996), toddlerhood (Wyss, Kannass, & Haden, in press), and the preschool years (Kannass & Colombo, 2007, Kannass et al., 2010, Kannass et al., 2011). The results of the current project were likely due to a spurious effect of gender because of the small sample size and an unequal distribution between boys and girls. More boys ($n = 22$) participated in the study than girls ($n = 14$). Since the sample size was so small, the difference of 8 participants between the gender groups could yield significant differences in any of the dependent variables, as was the case for task performance. There is more variability in the boy’s scores, which could explain why their performance scores were lower.

The second major finding was that total duration of looking to the task significantly differed between the child-directed distraction condition and both the adult-directed distraction condition and the no distraction condition. Overall, children spent less total time looking at the task when a child-directed distractor played in their periphery. This result is consistent with previous research that has used comprehensible and incomprehensible television programs as a distractor. Specifically, Kannass et al. (2010) found that 3- and 4-year-old children’s total looking to the task was less when the distractor was in English (comprehensible condition) than when the distractor in a foreign language (incomprehensible condition). In the current project, children’s total looking to the task was less when the distractor was a program made for children than when the distractor was made for adults. This finding also is consistent with research on children’s
television viewing. Anderson et al. (1981) found that young children’s ability to understand a television program is a strong predictor of their viewing because children’s total looking to a comprehensible version of *Sesame Street* is significantly longer than their looking to an incomprehensible version (e.g. backwards language dubbing, foreign language dubbing).

The analyses on the average length of individual looks to the task revealed a somewhat different pattern. Specifically, the average length of individual looks to the task were similar for children in the adult-directed distraction condition and the child-directed distraction condition, but the average length of individual looks to the task in the no distraction condition were longer than those in both distraction conditions. This suggests that when there is no distraction, children’s attentional engagement is deeper than when there is any type of distraction present. In other words, they can focus on the task for longer bouts of time. However, when there is any type of distraction present, it impairs children’s ability to become as engaged with the task as their average individual looks are shorter. On the other hand, the child-directed distractor was more detrimental to children’s total looking to the task, which reflects the total amount of time children devote to the task. These differences have implications for how the content of a distracting event might differentially impair attentional processes. Specifically, any type of distraction impairs preschooler’s ability to become engaged with a task, but when the content of a distractor is made for children, they devote less time to the task, overall.

There was a strong trend for total duration of looking to the task to increase over the course of the session in all three conditions. This indicates that children spent more
total time looking to the task in the second half of the session than the first half, suggesting they became more resistant to distraction in the distraction conditions and more engaged with the task in the no distraction condition. This finding is consistent with the pattern of total looking to the task over the course of the session in Kannass et al. (2010) for those who were exposed to an incomprehensible distractor (i.e. foreign language). That is, 3- and 4-year-olds looked at the task longer in the second half of the session than the first half of the session. However, when the distractor was comprehensible, children’s total looking to the task was the same in the first half of the session as the second half. Data are still being collected in the current project, and it is likely that this trend for total duration of looking to the task to be longer in the second half than the first half of the session will become significant, but not for the children in the child-directed condition. Their total looking to the task will remain same.

The third major finding also revealed that a more comprehensible and age-appropriate distractor was more distracting when children worked on cognitive tasks. Children looked to the distractor more when it was child-directed (Sesame Street) than when it was adult-directed (Wheel of Fortune). This is also consistent with how children watch television when TV viewing is the focal task (Anderson et al., 1981). That is, children attend to material they understand. In the current project, the child-directed distractor may have been easier for children to understand than the adult-directed distractor. There was also a trend for children to turn more to the distractor when it was child-directed than when it was adult-directed. This suggests that the child-directed distractor possessed greater attention-getting and attention-holding properties than the
adult-directed distractor. Because children may have comprehended the content presented on distractor in the child-directed condition better, it attracted and held their attention more than the content presented on the distractor in the adult-directed condition. Overall, a child-directed program was more distracting than an adult-directed program.

Distractibility over the course of the session also revealed some interesting findings. Children’s total looking to the distractor did not decrease over the course of the session, but they did turn to the distractor less in the second half of the session than the first half of the session. Because children’s total looking to the distractor did not change over the session it suggests that any continuously playing distractor is hard for preschoolers to inhibit watching. This suggests that although a child-directed distractor is better at holding 4-year-old’s attention, any type of continuously playing distractor can hold children’s attention for at least a twelve minute period. Television, as a distractor, has strong attention-holding properties, regardless of content. This finding is similar to Kannass and Colombo (2007) who also found that 3.5- and 4-year-olds do not look less to a continuous distractor over the course of a session. The number of head turns to the distractor over the course of the session revealed a different pattern. There were more head turns in first half of the session to both distractors, which was likely driven by the novelty of a distractor in the room. As children worked on the tasks, the attention-getting properties of the distractor became less salient, and so children did not look over as frequently in the second half of the session. Overall, the distractibility analyses revealed that children were more distracted by a child-directed distractor than an adult-directed distractor. However, both types of distractors held children’s attention throughout the
course of the session, suggesting that attention-holding properties may be driven by a different mechanism than attention-getting processes.

Finally, children’s ability to monitor the distractor was not evident in the current project. There was a floor effect of the number of questions the children answered across both groups. On average, children only received 2 points out of a total of 16 points ($M = 1.96, SE = .72$). Because of the floor effect and consequently, low variability in the scores, it was unlikely that any significant effects would emerge. Thus, participants in the adult-directed condition did not show more evidence of monitoring the distractor than participants in the child-directed condition. Also, children who looked at the distractor more (i.e. “more distractible”) did not answer more questions correctly than children who did not look at the distractor very often (i.e. “less distractible”). There are three reasons as to why this floor effect occurred. First, as aforementioned, the sample size of the current project was small. However, among the twenty-four participants in the distraction conditions, the average score should be greater than 2 points if (1) the questions were easier or (2) children were actually monitoring the distractor for content. Specifically, the second possibility as to why the floor effect occurred is because the questions could have been too hard for the children to answer. The question itself could have been difficult. That is, the information the questions tried to elicit from the children was above their ability, especially in this context when TV viewing was not the focal task. Simpler questions, such as, “What is Telly Monster wearing on his head, a hat or a helmet?” or “What do the game show players guess, letters or numbers?” are easier because these questions alleviate the cognitive burden that the recall questions place on memory.
The third explanation for the floor effect is that 4-year-olds are not monitoring the distractor for its content. When television serves as a distractor it is disruptive, but children do not become engaged with the content to learn much from it. While distracted, children do not necessarily watch and learn from it and ignore the main task. If this was the case, it was a positive finding that children did not answer the majority of the questions. They were able to inhibit the content of the program and focus on the main task. The television program did disrupt their ability to sustain attention to the task, but the information from the distractor program did not displace information the children needed to complete the task. Cognitively, preschool children cannot handle as much information as adults, and in the current project, they allocated those resources to completing the task instead of learning the information provided by the program. It is likely that both the second and third explanation best capture why children scored low on the question portion of the project. The questions were likely too cognitively burdensome, and children did not monitor the content, although it was disruptive to their attentional engagement.

Taken collectively, the results from the current project suggest that any television programming is distracting to 4-year-olds, but it is especially distracting when the programming is designed for young children. The presence of a child’s program reduces preschoolers’ total duration of attention and their ability to sustain attention to the task, and it increases their total duration of looking to the distractor. When the program is not designed for children, it is also disruptive because it compromises their ability to sustain attention to the task. Although preschoolers are more distracted by a program designed
for young children than a program designed for adults, it does not mean an adult program is not distracting. Specifically, children do not look less to either program over time. Therefore, both types of television programming are distracting, but in different ways. Additionally, although it appears 4-year-old children possess the cognitive ability to not let a distracting event impair their task performance, it is likely that this finding was due to the small sample size, which was a significant limitation of the current project. The following section discusses the limitations of the current project.

**Limitations and Future Directions**

One limitation of the current study was the small sample size. This limited the potential of the data to yield significant effects across all variables. First, it limited the effects of condition on task performance. The mean differences revealed a trend in the hypothesized direction, but it did not reach significance. Previous research has revealed that task performance is negatively influenced by the presence of a distractor (Kannass & Colombo, 2007; Kannass et al., 2010; Kannass et al., 2011). It is likely that if the sample size were greater, the trends between the task scores would have been significantly different between conditions.

The small sample size also limited the effects of duration of total looking to the task between the no distraction condition and the adult-directed condition. As in previous research with 4-year-olds, the presence of a continuous distractor is more disruptive to total looking to the task than no distractor at all (Kannass & Colombo, 2007). Moreover, children’s ability to sustain attention, as reflected in the length of individual looks to the task was impaired in both distraction conditions. It is likely with a greater sample size,
children’s total looking to the task will be shorter in the adult-directed distraction condition than the no distraction condition, but it will not be significantly less than total looking to the task in the child-directed distraction condition.

Additionally, a second limitation is the absence of a younger or older comparison group. It does not allow conclusions to be drawn about the development of attention in this context. Currently, data are being collected with 3-year-old children. It is expected that 3-year-old children will not reveal the same attentional patterns as the 4-year-olds. Specifically, it is expected that patterns will emerge suggesting that 3-year-olds do not discern between the two distractors as well as 4-year-olds did, and thus it will interfere with their total looking to the task. Recall in the current project, total duration of looking to the task was longer in the child-directed condition compared with the adult-directed and no distraction conditions. This pattern is not expected to emerge with the 3-year-old children. Instead, it is predicted 3-year-olds will show longer total duration of looking to the task in both distraction conditions than in the no distraction condition. Four-year-old children have more experience with television, so their total looking to the task was only impaired by a program that was created for young children (i.e., the content was relevant). The 3-year-olds do not have as much experience with the medium and thus do not comprehend it as well as the 4-year-olds nor is their ability to endogenously control their attention allocation as advanced (Colombo, 2001); therefore, their total looking to the task is predicted to be significantly impaired by both distractors.

A third limitation of the current project is the presence of a floor effect due to children’s low scores on the questions. This was likely due to the fact that the questions
were too difficult, and children did not monitor the distractor content. The reasons for this are twofold. As previously mentioned, the sample size was too small to compare those who were “more distractible” than “less distractible” in each condition on the number of correctly answered questions. There would only have been 6 participants per subgroup. A larger sample size would have likely yielded a significant effect of distractibility by condition interaction, in that more distractible preschoolers in the child-directed condition would answer the most questions correctly if the questions were modified. Specifically, the use of a combination of the current recall questions and some easier recognition questions would create a measure that was of medium difficulty. The reason for using a combination would ensure that the questions were not too easy and that children were not obtaining points purely by guessing.

Implications

Both types of television programming are disruptive to 4-year-old children when they engage in tasks. This has important implications for the home and classroom setting. During the preschool years, the majority of learning takes place in the home through play, as children do not yet go to school full time. Children’s ability to learn from educational toys is compromised when ambient noise is present. In particular, the television serves as a source of both visual and auditory distraction, and it is disruptive to preschool children’s attention despite their ability to understand the content of the program. Although a child might appear content working on a game or playing with a toy while an adult watches a game show episode, on average he or she is unable to engage with the task for as long a period of time as when no television program is on. The same is true for
when a child’s television program is on the television, but the effect is exacerbated. In this case, the child would allocate less attention to the task overall and become less engaged with the task, as attention is being devoted to looking to the TV screen. For example, two siblings might be in the same room, and while one is watching *Sesame Street*, the other might be working on a puzzle. Because the program is comprehensible to the child, it would be more disruptive than a program that is made for an adult. The child’s attention to the puzzle would be interrupted. The longer children are uninterrupted, the greater the likelihood they engage with the toy or game, which is a necessity for learning.

Additionally, children’s ability to monitor television that is being played in their periphery reveals that although children are not learning much from the television, it is still disruptive to their on task attention. Although educational television viewing in the preschool years is associated with higher grades, reading more books, and greater creativity in the adolescent years, especially for boys after controlling for socioeconomic status (Anderson et al., 2001), the best tools for young children’s learning are books and toys. A home with several toys, books, and games creates an enriching environment for preschoolers, but if the activities are not separated from the television set, then they are not as effective. Rather, it creates too chaotic of an environment for the child to learn. When in the presence of a child’s program, the current study revealed that a child would spend less playing with the toys because they would be watching the program. Even though it may be an educational program, children do not learn from it. Overall, toy play is superior to television viewing in terms of cognitive development. Moreover, even
though children do not look more to the task in the adult-directed distraction condition versus no distraction condition, it still disrupts their ability to sustain attention to their toy play. Generally speaking, the 4-year-old child does not yet possess the attentional skills to focus on one task, so even if it appears they are ignoring the television because they are not watching it; it is still detrimentally influencing their toy play.

The current project drives home the point that television viewing should be a separate activity for young children. When it comes to monitoring their children’s viewing, most parents are concerned about the appropriateness (e.g., violence, sexual situations, crude language) of a television show. Undoubtedly, this is a good thing, but the current project adds another component that parents may not recognize as readily. That is, even age-appropriate programming is disruptive to children’s learning when a program is on in the same room in which a child is working or playing. However, when television viewing is the main activity, it can be a beneficial supplement if it is an educational program like Sesame Street (Schmidt & Anderson, 2007). When it is not the main activity, it has deleterious effects on children’s attention to toy play and thus, their learning and cognitive development.
APPENDIX A

FORMAL FEATURES OF TELEVISION
Formal Features of Television

Learning how to watch television presents a challenging task akin to how humans learn how to use words. In written and verbal language, we use syntax, morphology, and inflection to understand the message of either text or another speaker. Television also has its own “grammar” and rules that children must understand before they can learn from this representational medium. Formal features convey the information that viewers need in order to comprehend the interplay between characters and between characters in their environment. Houston and Wright (1983) contend that formal features contain general categories related to the visual, auditory, and molar components of the program. In the current study, formal features outlined by Houston and Wright (1983) were measured to ensure that these aspects of the television programs were not driving the differences in task scores, attention to the task or distractibility by the television.

Specifically, Houston and Wright (1983) consider that visual images include the camera change perspective, zooming, and panning. Auditory components include the sound track and character speech. Specifically, the sound track of a program includes the music, the sound effects, laughing, and other auditory events. Speech can be either dialogue between two characters or narration of events that occur on screen. Finally, the molar level characteristics include the pacing, variation, and levels of action. Additionally, Huston and Wright (1983) also provided specific definitions that helped in the creation of the current project’s coding scheme. Rapid pace includes “frequent changes of scene and characters” (42). Overall perceptually salient cues include dimensions of intensity, movement, contrast, change, novelty, and incongruity in the
program. Salience refers to the physical activity of characters, program pace, variation of scenes, special effects, music, sound effects, and voices. Dialogue is considered a non-salient feature but dialogue between children maintains the children’s attention. Although pace was originally considered to be a formal feature, research has revealed that a fast paced program does not hold attention to television any longer than a slow paced program (Anderson, Levin, & Lorch, 1977; Huston & Wright, 1983). Children are initially driven to watch TV because of the formal features of the program, but with time and experience with the medium, children learn that formal features may signal content that is appropriate for them. Therefore, the formal features may initially elicit attention, but eventually children pay attention to cuts or scene changes not because of their attention-getting properties, but because they are important for comprehending the message of the program. Anderson and Lorch (1983) also suggest that cuts, scene changes, and other perceptually salient features elicit children’s attention because they convey information needed to understand the nature of the scene.

Using the formal features put forth by Huston and Wright (1983), specific features were coded for in the child-directed distractor, Sesame Street, and the adult-directed distractor, Wheel of Fortune. Both programs have been used separately in the television literature but for different purposes. Sesame Street is typically used with the intention a child will be watching the show (e.g. Anderson & Levin, 1976) or as a distractor (Kannass et al., 2010). Therefore, Sesame Street was selected as the child-directed distractor for the current project. A game show has been used as a background television program to investigate how it disrupts toy play in infants and young children.
(e.g. *Jeopardy!*). (Schmidt et al., 2008) *Wheel of Fortune* was selected as the adult-directed distractor for the current project instead of *Jeopardy!* because it contains features more akin to a child’s show than an adult’s show. The use of music, a variety of colors, and sound effects in *Wheel of Fortune* would attract attention similarly to how a child’s show would attract attention, yet it is designed for adult-viewers. That is, the content is not very comprehensible to a 4-year-old, but the formal features are similar. Little work has been done comparing child- versus adult-directed television programming as a distractor, and so it was essential to draw on the literature from both television viewing and distractibility to determine what programs were best for the current project.

In the current project, seven general categories of formal features were used to code the distractor programs: character movement/action, music, speech type, sound effects, set changes, character changes, and camera features and effects. The child was exposed to each program for a maximum of 12 minutes, and therefore, the entire 12 minutes of the program was coded for each formal feature to ensure the greatest accuracy. The subsequent sections describe how each feature was operationalized as well as the results from the coding. The results are reported as both percentages and frequencies depending on the operationalization of the feature. For percentage results, time in seconds is also reported. Note that the program time for both television shows is 12 minutes in duration. See Appendices D and E for a summary of the results.

**Character Movements and Action**

First, movement and action of the characters were coded. This was defined as the percent of character movement. This included both active movement and moderate
movement. Active movement included any rapid movement like running, exercise, or jumping. Moderate movement included walking, stepping over things, or talking using gestures. In general, active movement is more exaggerated and requires greater energy output than moderate, everyday movement. In the child-directed distractor, active movement occurred during 2.5% (18.2 s) of the program and moderate movement occurred during 10.3% (74.1 s) of the program for a total of 12.8% (92.3 s). In the adult-directed distractor, active movement did not occur and moderate movement occurred during 14% (100.8 s) of the program for a total of 14% (100.8 s). Therefore, the proportion of character movement was very similar in both distractors.

**Music**

The second formal feature coded for was music. Music was present in both programs, as either lively foreground music or as music in the background. Lively foreground music is when the music is the main feature of that scene, and no one is talking above the music. Background music is often played when characters are talking or thinking as a way to enhance the scene beyond the dialogue itself. In the child-directed distractor, lively foreground music played during 6.8% (48.9 s) of the program and background music played during 7% (50.3 s) of the program for a total of 13.8% (99.2 s). In the adult-directed distractor, lively foreground music was not played and background music played during 22.9% (165.1 s) of the program for a total of 22.9% (165.1 s). There was slightly more music in the adult-directed distractor; however, this feature is more closely associated with children’s television show. If formal features are what drive
the looking in 4-year-olds, then participants in the current project would look to the adult-directed distractor more, even if they did not comprehend it.

**Speech Type**

The third formal feature coded was speech type or the presence of speaking by characters. Speech type was either coded as dialogue or narration. Dialogue is continuous conversation between two or more characters. On the other hand, narration is speech from one character, who is usually describing some aspect of the setting, environment, or background information. Additionally, the type of speech for dialogue and narration was discerned as to whether it was male, female, child, or adult. In the child-directed distractor, dialogue occurred during 73.3% (528 s) of the program and narration occurred during 0.4% (3.4 s) of the program for a total of 73.8% (531.4 s). The dialogue between characters is entirely male voices (100%), with the majority of the speech coming from an adult voice (71.6%) and the remaining speech coming from a child (28.3%). A male child spoke the brief period of narration. In the adult-directed distractor, dialogue occurred during 54.5% of the program and narration occurred during 3.8% of the program (27.2 s) for a total of 58.3% of the program (419.8 s). The dialogue between characters is entirely adult voices (100%), with the majority of speech coming from a male (82.7%) and the remaining speech coming from a female (17.3%). An adult male spoke for the narration period. There was more dialogue in the child-directed program than the adult-directed distractor; however, Huston and Wright (1983) assert that dialogue in general would not suggest a more child- or adult-oriented program. Rather, it is the type of dialogue. Male voices have been shown to lose children’s attention to TV
but female voices and child voices maintain children’s attention (Alwitt et al., 1980). All of the characters in the child-directed distractor were male voices, and the majority of speech from the adult-directed distractor was male. Moreover, there were elements of child-directed distractor in both programs. Approximately a quarter of the speech in the child-directed distractor came from a child, while a slightly smaller proportion of speech in the adult-directed distractor came from a woman. In both programs, the main character was an adult male. Therefore, the speech type in the programs was not drastically different, and so speech alone cannot account for differences in attention between the two conditions.

**Sound Effects**

The fourth formal feature, sound effects, was calculated as a frequency. Sound effects are shorter in duration than background music. Their fleeting nature is used to draw attention to a particular occurrence on screen or enhance a character’s affective state. Although they can be used for a variety of reasons, they are briefer than a musical score in duration. In the child-directed distractor, there were 43 sound effects during the program. In the adult-directed distractor, there were 51 sound effects during the program. Overall, the sound effects were balanced between the two programs.

**Set Changes**

The number of times the set changed was the fifth formal feature examined in this project. In most television programs or movies the set changes, which suggests the storyline moves to another location or another point in time. The set includes the background and area in which the actors and actresses are playing their roles. In both the
child-directed and adult-directed distractors, there was only one set. The characters remain in the same location during the entirety of the program albeit they move and the camera changes its angle, which will be discussed in a later section.

Character Changes

The sixth formal feature was the number of characters in the program. The actors and actresses were considered characters if they were on the camera long enough to discern their facial and bodily features. For example, if the camera panned over the audience, these individual would not be considered characters because their presence on camera was not long enough to distinguish them. In the child-directed distractor, there were six characters in the program. In the adult-directed distractor, there were eight characters in the program. Therefore, there were a similar number of characters in both distractors. One difference between the programs is the nature of the characters. In *Sesame Street*, there are live adults and puppets (note the puppets are live and not created by animation); however, in *Wheel of Fortune*, there are only live human adults.

Camera Features and Effects

Finally, camera features and effects were coded as a formal feature. There were four unique types of camera features than could distort the visual imagery of the program. These were cuts, pans, zooming, and dissolves. Camera cuts were defined as number of changes in camera angle or changes in camera location. These were measured in terms of frequency. In the child-directed distractor, there were 126 camera cuts. In the adult-directed TV distractor, there were 140 camera cuts. Camera pans were defined as the camera moving across a scene; this is done to capture a larger amount of screen and
character than is available in one still shot. For example, the camera can pan the audience to get a sense of how many individuals are in the audience without taking multiple shots. In the child-directed distractor, there were 9 camera pans. In the adult-directed distractor, there were 5 camera pans. Zooming occurs when the camera moves either toward or away from a scene. In the child-directed distractor, there was 1 camera zoom effect. In the adult-directed distractor, there were 7 camera zoom effects. Finally, dissolve is a fading away process by which the camera gradually changes from one scene to another. In the child-directed distractor, there was no evidence of camera dissolving effects. In the adult-directed TV distractor, there were 4 dissolving effects.

**Plot**

Although Huston and Wright (1983) do not consider plot as one of their key formal features, it is important in the context of the current project. The programs are used as distractors, so it is important that their storylines are of similar nature. In other words, the programs had to be equally engaging when considered for their target audience (although the child-directed distractor would be more engaging to the participants in the current project). Specifically, neither of the programs have a distinct plot as most television programs do. Almost all adult-directed programs, with the exception of the news and game shows, contain a plot sequence. This is done purposely in order to keep the viewer entertained. Moreover, in many children’s television shows, there is also a distinct plot (e.g. in *Dora the Explorer*, the characters typically go on a quest to find something). The fact that *Sesame Street* and a game show distractors in the current project do not have distinct plots is very appealing to the study because the
television was turned off at 3-minute intervals in order to change the task and explain the new directions. The plots of the *Sesame Street* program and *Wheel of Fortune* distractors had loose plots in which the end goal is general (e.g. to learn about the letter of the day or to win some money). There is a general sense of what is being accomplished by all actors and actresses, but these programs are more accessible to a viewer because one could turn on the program in the middle of an episode and could watch it the rest of the way through. That is, unlike adult plot-based storylines (e.g. *Law and Order*) and child plot-based storylines (e.g. *Finding Nemo*), both *Sesame Street* and *Wheel of Fortune* do not require a viewer to watch from the beginning to understand the nature of the program. It is important that this concept is held constant in both conditions, thus justifying another reason why these two programs were appropriate to serve as the distractor stimuli.

Overall, there are differences between an adult-directed television program and a child-directed television program. It has been accepted that these are what trigger children to watch child TV programs and not adult TV programs (Alwitt et al., 1980). However, music, sound effects, and character movement, which can all signal child-directed programming, were all very similar between the two episodes. Additionally, the child-directed program did have child speech, but the majority of the program was adult voices (71.3%), specifically male adult voices. Male voices signal adult-directed content. Female voices only occurred in the adult-directed program. Therefore, the stereotypic formal features associated with child TV versus adult TV was either balanced between the two programs, or they were only present in the adult-directed distractor. It is
important to keep this in mind when interpreting the results, as the differences in attention and distractibility cannot be attributed to the formal features of the shows.
APPENDIX B

“SESAME STREET” COMPREHENSION QUESTIONS
“Sesame Street” Comprehension Questions

*Sesame Street: “There’s an App for That!”*

1. What trick does Telly Monster want to do?

2. What toy is Telly playing with?

3. What does Mac give Telly? Follow-up prompt: And what is it called?

4. How much time does Mac give Telly to decide about the iPogo?

5. What shape does Telly need to press to boing on his iPogo?

6. What does Telly say to make the iPogo speed up?

7. What does the rectangle button allow Telly to do?

8. What is the new iPogo called?
APPENDIX C

“WHEEL OF FORTUNE” COMPREHENSION QUESTIONS
“Wheel of Fortune” Comprehension Questions

*January 3, 2011 America’s Game (Episode #5346)*

1. What holiday is it on the TV show?

2. Debbie solves the first puzzle correctly. What bird does she guess?

3. Where was Debbie married?

4. How many of the game show players are women?

5. Vanna turns the letters on the board. What color is her dress?

6. What is in the background behind the players?

7. Victor Trey solves the puzzle with “Hula dancing on the beach.” He is right! Where does he win a trip to?

8. What is the name of the person who goes to the bonus round?
APPENDIX D

PERCENTAGE AND TIME OF FORMAL FEATURES:

CHARACTER MOVEMENT, MUSIC, AND SPEECH TYPE
Percentage and Time of Formal Features:
Character Movement, Music, and Speech Type

<table>
<thead>
<tr>
<th>Formal Feature</th>
<th>Adult-directed Distractor</th>
<th>Child-Directed Distractor</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Percentage</td>
<td>Seconds</td>
</tr>
<tr>
<td><strong>Character Movement</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Active Movement</td>
<td>0%</td>
<td>0 s</td>
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<tr>
<td>Moderate Movement</td>
<td>14%</td>
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<tr>
<td>Overall Movement</td>
<td>14%</td>
<td>100.8 s</td>
</tr>
<tr>
<td><strong>Music</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Foreground Music</td>
<td>0</td>
<td>0 s</td>
</tr>
<tr>
<td>Background Music</td>
<td>22.9%</td>
<td>165.1 s</td>
</tr>
<tr>
<td>Overall Music</td>
<td>22.9%</td>
<td>165.1 s</td>
</tr>
<tr>
<td><strong>Speech Type</strong></td>
<td></td>
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<tr>
<td>Narration</td>
<td>3.8%</td>
<td>27.2 s</td>
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<tr>
<td>Dialogue</td>
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<td>392.6 s</td>
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<tr>
<td><strong>Percent of Dialogue</strong></td>
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<td></td>
</tr>
<tr>
<td>Adult Speech</td>
<td>100%</td>
<td></td>
</tr>
<tr>
<td>Child Speech</td>
<td>0%</td>
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</tr>
<tr>
<td>Male Speech</td>
<td>82.7%</td>
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<tr>
<td>Female Speech</td>
<td>17.3%</td>
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APPENDIX E

FREQUENCY OF FORMAL FEATURES:
SOUND EFFECTS, SET CHANGES, CAMERA FEATURES AND EFFECTS
Frequency of Formal Features:
Sound Effects, Set Changes, Camera Features and Effects

<table>
<thead>
<tr>
<th>Formal Feature</th>
<th>Frequency</th>
<th>Frequency</th>
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<tbody>
<tr>
<td><strong>Sound Effects</strong></td>
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<td><strong>Set Changes</strong></td>
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<td>1</td>
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<td><strong>Character Changes</strong></td>
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<td>6</td>
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<tr>
<td><strong>Camera Features and Effects</strong></td>
<td></td>
<td></td>
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<tr>
<td>Cuts</td>
<td>140</td>
<td>126</td>
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<tr>
<td>Pans</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Zooms</td>
<td>7</td>
<td>1</td>
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<tr>
<td>Dissolves</td>
<td>4</td>
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APPENDIX F

UNSTANDARDIZED MEANS, STANDARDIZED MEANS, AND

STANDARD ERRORS FOR TASK SCORES

COLLAPSED ACROSS CONDITION
### Unstandardized Means, Standardized Means, and Standard Errors for Task Scores Collapsed Across Condition

<table>
<thead>
<tr>
<th>Task</th>
<th>Unstandardized Raw Scores</th>
<th>Standardized Z-Scores</th>
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<tbody>
<tr>
<td></td>
<td>Means</td>
<td>SE</td>
</tr>
<tr>
<td>Coloring</td>
<td>5.89</td>
<td>.67</td>
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<tr>
<td>Puzzles</td>
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<td>.62</td>
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<td>Legos™</td>
<td>19.33</td>
<td>.99</td>
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<td>Matching</td>
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<td>.67</td>
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APPENDIX G

MEANS AND STANDARD ERROR FOR THE PERFORMANCE SCORES, ATTENTION MEASURES, DISTRACTIBILITY MEASURES, AND COMPREHENSION QUESTIONS ACROSS CONDITIONS
Means and Standard Error for the Performance Scores, Attention Measures, Distractibility Measures, and Comprehension Questions Across Conditions

<table>
<thead>
<tr>
<th>Measure</th>
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<th>Adult-directed Distractor</th>
<th>Child-directed Distractor</th>
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<tr>
<td></td>
<td>Mean</td>
<td>SE</td>
<td>Mean</td>
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<tr>
<td>Task Performance</td>
<td>58.63</td>
<td>3.34</td>
<td>53.57</td>
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<tr>
<td>Total Task Looking</td>
<td>268.30</td>
<td>11.01</td>
<td>249.84</td>
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<td>Task Average Look Length</td>
<td>23.69</td>
<td>2.15</td>
<td>17.24</td>
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<tr>
<td>Total TV Looking</td>
<td>--</td>
<td>--</td>
<td>84.66</td>
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<tr>
<td>Frequency of Looks to TV</td>
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<td>12.64</td>
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<tr>
<td>Comprehension Questions Points</td>
<td>--</td>
<td>--</td>
<td>1.44</td>
</tr>
</tbody>
</table>
REFERENCE LIST


VITA

Kathryn O’Toole is currently pursuing her doctoral degree in developmental psychology at Loyola University. She first became interested in cognitive development while working at the Infant Cognition Laboratory at University of Illinois at Urbana-Champaign under the supervision of Dr. Renee Baillargeon. After graduating with her bachelor’s degree in psychology, Kathryn pursued her interest in cognitive development at Loyola University Chicago where she is presently working with Dr. Kathleen Kannass. Her specific interests fall within the realm of cognitive development, and she is particularly interested in how infants and young children pay attention to and learn from television and other forms of electronic media. She plans to pursue her interests in the field, and specifically wants to focus on how infants and young toddlers attend to and learn from touch screen media.