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Attention skills and looking to television in children from low income families

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ABSTRACT

Attentional skills and home environment were examined as predictors of looking patterns during television viewing by 70 48- to 91-month-old children from low income families. Looking to the television was assessed in conditions without distractors and with continuous distractors. Looking patterns during television viewing reflected attentional inertia and the expected distribution of many short looks and few long looks (i.e., lognormal distribution) in both viewing conditions. The hypothesis that core attention skills and the home environment predict individual differences in looking patterns was partially supported by multiple hierarchical regression analyses. Looking patterns were predicted by orienting attention network skills in the no-distractor condition only. Alerting attention network skills and home environment factors were not significant predictors. The current study with a sample of children from low income families supports the idea that television viewing is a complex cognitive task that requires different mechanisms depending on the viewing condition.

Questions regarding television viewing in young children have attracted considerable interest (Courage & Setliff, 2009). Television viewing has been labeled both as a cause for problems in attention development (e.g., Christakis, Zimmerman, DiGiueseppe, & McCarty, 2004) and as a complex cognitive task that requires attentional processes (e.g., Acevedo-Polakovich, Lorch, & Milich, 2007; Anderson, Choi, & Lorch, 1987; Milich & Lorch, 1994). The current study extends the analysis of television viewing to a population of children shown to be at risk for attention problems (Breznitz & Norman, 1998; Brooks-Gunn & Duncan, 1997; Mirsky, 1995; Norman & Breznitz, 1992; Pineda et al., 1999) and examines the role of core attention skills and the home environment on looking patterns.

Attentional inertia and television viewing in children

Previous research on children's television viewing describes looking patterns characterized by many looks to and away from the television. Looking patterns have typically been described as including many looks that vary in duration with most of the looks being short (e.g., 3 s) and few of the looks being long (e.g., 15 s or longer). This description is confirmed by distribution analyses that show that the duration of looks made to television fit the lognormal distribution (Richards & Anderson, 2004; Richards & Cronise, 2000). The lognormal distribution of look durations to the television show that the frequency of looks decreases with the duration of looks.

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Looking patterns to television have also been described in terms of attentional inertia. Attentional inertia is defined as a pattern in which there is an increase in the probability that a look will continue the longer it is maintained (Anderson et al., 1987; Anderson & Lorch, 1983). To confirm attentional inertia, looks are calculated according to a conditional survival probability function or the proportion of looks that survive across specific time intervals given that they were already in progress at the beginning of the interval (Anderson, Alwitt, Lorch, & Levin, 1979; Anderson et al., 1987; Burns & Anderson, 1993; Choi & Anderson, 1991). Studies have consistently shown a leveling off of the probabilities for looks 15 s and longer. These long looks are assumed to reflect deepened cognitive engagement as enhanced comprehension and memory have been shown for children and adults who spend more time in long looks (Burns & Anderson, 1993; Lorch et al., 2004; Lorch, Milich, Astrin, & Berthiaume, 2006; Richards & Anderson, 2004; Whirley, Lorch, Lemberger, & Milich, 2003). Long looks are also associated with decreased distractibility for intermittent distractors or distractors that occur on intervals (Anderson et al., 1987; Burns & Anderson, 1993; Choi & Anderson, 1991; Lorch & Castle, 1997; Lorch et al., 2006; Richards & Turner, 2001; Whirley et al., 2003). Studies that have incorporated conditions that reflect natural settings and include distractors have shown that the frequency and duration of long looks are negatively affected by the presence of continuous distractors (Kannass & Colombo, 2007; Lorch et al., 2004; Sanchez, Lorch, Milich, & Welsh, 1999). Time spent in short looks (i.e., looks less than 15 s in duration) does not appear to relate to cognitive engagement (Burns & Anderson, 1993; Lorch et al., 2004) and short looks are thought to indicate high distractibility (Richards & Cronise, 2000). Support for this explanation of the attentional inertia phenomenon has been found in studies of adults, school-age children, and children with attention deficits (Lorch et al., 2004; Richards & Anderson, 2004). No previous studies of attentional inertia have focused solely on a sample of children from low income families or families with incomes at or below poverty level.

Attention networks

Recent advances in cognitive neuroscience have identified three functionally independent attention networks that correspond to different anatomical parts of the brain—the orienting, alerting, and executive attention networks (Berger, Jones, Rothbart, & Posner, 2000; Fan, McCandliss, Sommer, Raz, & Posner, 2002; Fernandez-Dugue & Posner, 1997, 2001; Posner & Petersen, 1990; Rueda, Rothbart, McCandliss, Saccomanno, & Posner, 2005). The orienting network accounts for shifts in attention, controlling both the engagement and disengagement of attention. The orienting network has been measured using tasks that manipulate cue validity, such as the “feed the fish game” developed by Berger et al. (2000). The alerting network accounts for the ability to achieve and maintain alertness or vigilance and is mainly measured using warning tasks or continuous performance tasks. Tests using a warning signal measure how quickly a person can obtain maximum alertness. Continuous performance tasks require participants to remain alert in order to detect targets. The executive network manages goal-directed behavior, target detection, conflict resolution, task switching, the inhibition of automatic responses, and the allocation of attentional resources. Executive attention can be measured through a variety of measures, including the Stroop task, the go/no go task, and in tasks that measure spatial conflict resolution. Research has shown that the orienting network is required to select the location or object that should be fixated, thus preceding sustained or alerting attention (Fernandez-Dugue & Posner, 2001; Posner & Petersen, 1990). The specific developmental courses for the three networks differ considerably. The orienting and alerting networks generally begin to develop in infancy and the executive network begins to develop around age 2 (Gerardi-Caulton, 2000; Posner & Rothbart, 2007; Rueda et al., 2004, 2005; Ruff & Rothbart, 1996). There are periods of significant developmental growth for all three networks between ages 4 and 7 (Gerardi-Caulton, 2000; Posner & Rothbart, 2007; Rueda et al., 2004, 2005; Ruff & Rothbart, 1996).

Researchers have begun to apply the attention network framework in examinations of attentional processes and its relation to school readiness in children from low income families. Mezzacappa (2004) found that children from low income families had slower and more inaccurate responses on tasks measuring alerting and executive network skills compared to children from higher income families. Other research focused on children from low income families has found that individual differences in attention network skills related to motivation and temperament (Chang & Burns, 2005) and executive network skills related to analogical reasoning (Weatherholt, Harris, Burns, & Clement, 2006).

Both the orienting and alerting networks appear to be very relevant for understanding children's patterns of visual attention in the context of television viewing. Previous research on attentional inertia and television viewing has shown that children and adults look to and from the television many times, representing shifts in attention (Anderson et al., 1987; Lorch & Castle, 1997; Richards & Turner, 2001). There is also evidence that orienting network skills develop in correspondence with the eye movements associated with television viewing (Posner, Rothbart, Thomas-Thrapp, & Gerardi, 1998). As reported by Burns and Anderson (1993), adults are able to sustain looks across television content boundaries (e.g., commercials), which suggests the involvement of the alerting network (e.g., vigilance). Based on the current literature, it is expected that better orienting and alerting network skills will relate to increases in total looking time and time spent in long looks to the television.

Home environment

There is increasing research evidence that the home environment affects attentional development (Dumas et al., 2005; Evans, 2004). Home chaos, defined as overcrowding, inconsistent daily schedules, and high noise levels, has been shown specifically to be important for the development of attention in children from low income households (Dumas et al., 2005; Evans, 2004; Wachs, 1979). Higher levels of home chaos have been shown to relate to parent reports of high impulsivity and low attentional focusing (Dumas et al., 2005), persistence, and other measures of children's attention (Evans, Hygge, & Bullinger, 1995). Matheny, Wachs, Ludwig, and Phillips (1995) suggested that children living in chaotic homes may learn to filter out high levels of stimulation including developmentally beneficial information. Higher home chaos has also been associated with parents' lower verbal responsiveness (Evans, Maxwell, & Hart, 1999), which may negatively relate to children's attention skills (Robinson, Burns, & Davis, 2008). Although levels of home chaos and socioeconomic status are often related (Dumas et al., 2005; Evans, Gonnella, Marcynyszyn, Gentile, & Salpekar, 2005), chaos has been shown to independently affect cognitive development (see Hart, Petrill, Deckard, & Thompson, 2007).

Another home factor suggested to relate to developing attention skills is the amount of television watched in the home. Some studies have identified that increasing amounts of home television viewing are associated with attention difficulties (Christakis et al., 2004; Courage & Setliff, 2009; Levine & Waite, 2000), but Anderson and Levin (1976) found that children's home television viewing habits did not negatively impact measures of visual attention during television viewing in a laboratory setting. In addition, a longitudinal study by Acevedo-Polakovich, Lorch, Milich, and Ashby (2006) found that higher amounts of home television viewing predicted lower visual attention to the television in an experimental setting by children without ADHD; however, this effect was not present for children with ADHD. It is possible that attention to television in natural settings require different processes than attention to television in laboratory settings. In the current study, we examined whether aspects of the home environment, measures of chaos and the amount of home television viewing, related to total time spent looking and time spent in long looks to the television in a laboratory setting.

Current study

Children's television viewing during the absence and presence of continuous distractors was first examined for two characteristic patterns of looking. Our first goal was to establish the phenomenon of attentional inertia in our sample of children from low income families by analyzing the probabilities that looks would continue the longer they were maintained (i.e., conditional probabilities). Second, we examined whether looking to the television was characterized by many short looks and few long looks, which would reflect the typical lognormal distribution for television viewing behaviors. We fit the distribution of look durations to hypothetical distributions in order to determine if the lognormal distribution best described children's looking patterns. Our third goal was to examine changes in children's looking patterns by varying the presence of continuous distractors. We examined the existence of attentional inertia and the lognormal distribution of looks in both conditions in which continuous distractors were present (distractor condition) and absent (no-distractor condition).

Following this, we examined two factors that may underlie looking patterns in the no-distractor and distractor conditions. Due to the developmental nature of the study, we first conducted preliminary analyses to determine the need to statistically control for age, sex, and cognitive ability. The first set of factors focused on core attention skills. As detailed above, better orienting and alerting network skills