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Exposure to television and attention in preschoolers.

Patricia A. Collins
University of Massachusetts Amherst

EXPOSURE TO TELEVISION AND ATTENTION IN PRESCHOOLERS

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PATRICIA A. COLLINS

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Patricia A. Collins

Approved as to style and content by:

Daniel R. Anderson, Chairperson

Nancy A. Myers, Member

Arnold Well, Member

Melinda Novak, Department Head
Psychology

DEDICATION

Dedicated to Grace and Jean Desmond and Arthur and Mary Collins, without whom none of this would have been possible.

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CHAPTER 1

INTRODUCTION

Among the most popular claims made about television's deleterious effects is the shortened attention span of child viewers. Since attentional deployment is a component of most, if not all, cognitive and perceptual performance, such an effect would be expected to have widespread ramifications for developing cognitive capacities. Moreover, effects would be widespread in the population. Academic studies report that preschoolers view an average of approximately thirteen to twenty hours of television per week (Anderson, Field, Collins, Lorch and Nathan, 1985; Huston, Wright, Rice, Kerkman and Peters, 1987), and commercial studies report even greater viewing levels. Thus, the question of whether exposure to television influences children's attentional capacities and/or performance should be of considerable interest to the cognitive developmental psychologist.

The claim that television deleteriously affects children's attention span has taken many forms and can be found in numerous popular books and magazine articles written for parents by journalists, educators, and psychologists. In her book, Breaking the TV Habit Joan Anderson Wilkins (1982) proposes that 'television children' lack the persistence required to solve challenging school problems, are intolerant of the teacher's attention to

anyone but themselves, and generally show attention spans no longer than seven minutes in duration. Similarly, in her popular book, The Plug-in Drug, Marie Winn (1985) argues (based on papers by a few psychologists and psychiatrists) that television's constant changes in visual perspective and rapid pace of information delivery actually program shortened attention spans and hyperactive behavior in children.

The same themes are commonly found in educational publications. With respect to the frequency and short duration of commercials on television, Neil Postman (1979) writes, "...we can assume that our youth are being conditioned to intense concentration for short periods of time and deconditioned, so to speak, to sustained concentration" (p. 166). Another educator, Joel Swerdlow (1981) echoes this opinion with, "...teachers complain about their pupils' passivity, short attention spans, and lack of imagination--characteristics attributable, at least in part, to TV viewing" (p. 52).

Few of the sources that make these claims cite any scientific evidence, however, and those that do rely primarily on correlational data. While a correlation indicates the presence of a linear relation between variables it does not identify the direction or even source of causality. Moreover, the correlations cited by these sources are primarily between hours of exposure to TV

(especially to violent/action-adventure programming) and a single attentional measure that had been incidentally included in studies primarily concerned with school achievement and/or aggressive behavior. Thus, even if television is the causative agent, few of these sources provide any insight into what aspects of the television experience are responsible.

Clearly implicit to all of these claims, however, is the assumption that one's ability to sustain attention is consistent across a variety of task situations (i.e. it is a stable characteristic) and that this characteristic is subject to long-term changes as a result of early experience. In addition, several writers have implied that children who are deficient in this ability as a consequence, or at least also, engage in hyperactive behavior and are intolerant of delays (in gaining the attention of others). While it is plausible that there are consistent individual differences in the ability to sustain attention, the question has rarely been the focus of scientific study. In fact, some researchers have specifically advocated a task dependent approach to the study of attention, at least in adults (Johnston and Dark, 1986). In the developmental literature, review articles on the development of attentional abilities are few in number and generally limited in their focus (c.f. Wright and Vlietstra, 1975; Day, 1975).

This has at least two consequences for evaluating claims about television's impact on developing attentional skills. First, it raises the question of whether a characteristic style or ability to attend exists or whether the popular claims might instead pertain to several different behavioral tendencies. Second, it provides investigators of TV's effects on attention with very few standard measures of attentional abilities for which validity and reliability have been established.

It is unsurprising, then, that the dependent measures employed in investigations of these popular claims vary considerably from study to study. As will be evident, this makes the comparison of results across laboratories and studies quite difficult. It is for this reason that the following literature review describes behavioral measures and analyses in some detail. An historical perspective has been taken as it best reveals the motivation for each study and its design. Together, the studies have primarily addressed the impact of TV exposure on perseverance, impulsivity, tolerance of delays, and restlessness. Following the chronological presentation is a summary which groups findings across studies according to each of these behaviors.

History of the Problem

Turned on Tots (Halpern, 1975), an article written by a psychiatrist, is a 'study' that popular magazines and books have commonly cited as evidence that television viewing has

deleterious effects on attentional abilities. In the article, Halpern reported that several two-year-olds, who had been referred to a mental health clinic because they exhibited hyperactive behaviors, also engaged in incessant recitation of numbers and letters learned from Sesame Street. Halpern proposed that the rapid pacing and repetition of the program may have been more than some children could assimilate. This would cause the same children to respond with "...diffuse tension discharge behaviors, exemplified by unfocused hyperactivity and irritability" (p. 69). This 'study' employed none of sampling and control procedures essential to ascertaining causality. Furthermore, Halpern was unable to replicate his observations. The wave of sensational press that this article generated, however, served to focus researchers' attention on the forms (rather than content) of television as potential agents of change in children's behavior.

At about the same time, Gavriel Salomon, an educational psychologist in Israel, was investigating the possibility that exposure to certain conventional filmic codes improves a child's facility with specific cognitive processes. Research reports from his studies appeared in various journal articles in the early and mid seventies. They are summarized in his book, Interaction of media, cognition, and learning, published in 1979. Salomon noted that many of the codes used in television and films either call upon or

explicitly model specific cognitive processes. The zoom technique, for example, models the process of focusing one's attention on a single item and then relating that item to the whole of which it is a part. Frequent scene changes, on the other hand, could be said to call upon the ability to integrate sequences. Briefly, Salomon (1974, 1979a, 1979b) theorized that exposure to these codes, via film or television viewing, would serve to both activate and cultivate those cognitive processes that they called upon or modeled. While Salomon's studies have incorporated a number of different filmic codes and corresponding cognitive processes, the discussion here is limited to those involving specific attentional skills.

In one study, Salomon (1974) randomly assigned eighth grade Israeli children, who differed in initial cue-attendance ability, to one of four conditions. The conditions differed in the degree to which the process of focusing one's attention was explicitly modeled. Children exposed to films that completely modeled the process of focusing on some detailed part of the whole (i.e. films using zooms), improved in their ability to list details noticed in a complex visual stimulus. In fact, these children performed as well as the group who had practiced this task. Furthermore, both of these groups performed better than the children who viewed only the beginning and end states of the attention focusing process. Finally, all three of the groups who had received training performed

better on the post-test than the no training control group. Together these results suggest that exposure to a film that explicitly models an attentional skill, via repeated use of an analog cinematic code, is as helpful to mastery of that attentional skill as practice. Furthermore, exposure to this explicit modeling is more helpful than exposure to only the beginning and end states of the process to be learned.

When improvement (i.e. difference scores) was examined, however, a different pattern of results emerged. Children who scored lower on the pretest benefited more from seeing the attention-focusing process completely modeled than from practicing the task to be performed. Initial high scorers, on the other hand, improved after practice but did not after exposure to the modeling condition. In fact, high scorers on the pre-test who were assigned to the zoom film condition tended to score lower on the post-test. As discussed in Anderson and Collins (1988), this result was probably due to the fact that zooms in the film condition were randomly ordered. In other words, a zoom-in on a particular section of the Breughel painting was not followed by one that focused on an area adjacent to it. This haphazard approach may have been disruptive to more skilled children who would have utilized a more systematic search pattern themselves (Vurpillot, 1968). Thus, our conclusions should be modified to state that eighth-grade children who are not very accomplished in some attentional skill, benefit more from

repeatedly witnessing a cinematic code that mimics this skill than from practicing the skill itself. Since the post-test was administered immediately after training, our conclusions must be limited to short-term effects.

A second study reported in Salomon (1974) did not replicate the findings of the initial study. There were no significant differences between conditions on the post-test. This was probably due to insufficient exposure to the training conditions and/or a lack of statistical power to detect minor group differences. The training conditions in the second experiment contained only 7.5% of the number of transformations used in the first experiment.

Furthermore, before great confidence is placed in the results of the first study, they should be replicated using a training film that presents a more systematic search of the complex visual stimulus. Moreover, training conditions should systematically vary the amount of exposure to the modeled attention focusing process. This design would also serve to determine whether there is some upper limit to the usefulness of the zoom technique as a model. Even if one accepts the available findings at face value, several crucial questions remain unanswered. For instance, it is not clear that the same benefits would result from exposure to zooms when they are embedded in entertainment television that is viewed at home. In this arena, cinematic techniques are intended not to foster the development of cognitive processes but to convey meaning relevant to the ongoing

narrative. Furthermore, attention to programs may be lower when viewed at home than when viewed in large groups in the laboratory. We know that children's patterns of attention to television are altered when they view with other children (Anderson, Lorch, Smith, Bradford, and Levin, 1981) and when they expect to be questioned and tested about an educational program (Field and Anderson, 1985; Salomon and Leigh, 1984). Moreover, several studies specifically find lower attention to extended zooms (Alwitt et al., 1980; Anderson and Levin, 1976; Susman, 1978). Thus, even if cinematic codes subordinated to the role of conveying meaning are capable of teaching an attentional skill, levels of visual attention at home may be lower, implying that effects would be seen only after extensive exposure.

Salomon (1979) attempted to address some of these issues as part of a longitudinal study designed to assess the effects of exposure to Sesame Street on the cognitive abilities of Israeli children. These children had relatively little previous experience with the cinematic codes frequently used in Sesame Street. The study took place during the first six months of Sesame Street's broadcasting in Israel and involved 93 five-year-olds, 106 second-graders and 118 third-graders. Cumulative exposure to the program was calculated from viewing reports gathered on six different occasions. Children were tested on a number of skills and knowledge areas, both before and after

the broadcast season. The battery included a Figure and Ground test (identifying objects contained in a montage picture) and a Close-up test (choose the long view picture of a close-up), both of which involve the ability to focus one's attention.

Preschoolers showed no differential performance as a function of exposure. For school-aged children, however, amount of viewing of Sesame Street at home was a significant predictor of post-test performance on both measures. As exposure increased, performance on the attention measures improved. Neither of these skills was specifically taught by the program's content. The effects were therefore attributed to experience with the unique cinematic devices used in the program. While this study does suggest an association between exposure to Sesame Street and performance on attention focusing tasks, causality should not be inferred. It is possible that some unmeasured characteristic was responsible for both amount of viewing and post-test performance.

Recognizing this shortcoming of correlational studies, Salomon (1979) reported a final study where 114 second-graders were randomly assigned to view eight hours of either Sesame Street or animal and nature films. A test of perseverance was administered in addition to the attention-focusing tests described above. The subjects were asked to cross out designated numbers in a booklet containing a lengthy list of random digits. There were two major

results. First, the Sesame Street viewing group scored lower on the perseverance task than the animal and nature film group. From this Salomon concludes, "Obviously, the ability to persevere was not affected; rather, it must have been the subject's willingness to persevere that was affected by their exposure to the fast-paced, kaleidoscopic structure of the program" (p. 182). This argument assumes that format was the only way in which the two programs differed. As suggested by Anderson (1985), it is equally likely that the eight-year-olds had become restless from being subjected to watching a program for preschoolers for eight days. Alternatively, the nature films could have increased perseverance with Sesame Street having no effect.

The second major result was that children in the Sesame Street condition performed significantly better on the attention focusing tasks than the children who had viewed the animal and nature films. Given the earlier findings, this is suggestive of a causal relationship between Sesame Street viewing and improved attention focusing skills in second graders. While we might be tempted to conclude that the cinematic codes of Sesame Street were responsible for this effect, several qualifications pertain. First, while the nature films differed from Sesame Street on this dimension, the possibility that other characteristics of the programs were responsible for the effects was not eliminated. More clear cut conclusions about the causal

influence of cinematic codes could have been made if the study included both a description of the exact cinematic codes used in the respective programs and a quantification of their frequency and importance to comprehension. It is also not clear that these results would generalize to viewing of other programs that use these cinematic codes. Moreover, the results were limited to short-term effects seen only in older children, an audience for whom Sesame Street was not designed. In fact, Pinon, Huston and Wright (1980) report that American seven-year-olds view less than one hour of Sesame Street per week. Thus, it is not clear that Sesame Street would have any impact on American children.

In summary then, Salomon's studies have demonstrated that in principle, the ability to focus attention on some part of a visual stimulus can be improved on a short term basis by repeatedly witnessing an analogous cinematic code that demonstrates the process. Practice may achieve the same end in more skilled children. Furthermore, Sesame Street viewing leads to similar short term improvement. This effect may be attributable to Sesame Street's frequent use of cinematic codes. Though an even more tenuous finding, Sesame Street may reduce a child's willingness to persevere in a boring task. It should be noted that in this study, the effects for perseverance (i.e. the willingness or ability to sustain attention) were in the opposite direction of those obtained for the ability to strategically focus

one's attention. This suggests that there are at least two separable components to attentional performance and that they may be effected differently by exposure to television. Finally, the results are applicable only to older children (second and third graders).

Friedrich and Stein (1973) extended the study of television's effect on persistence to a preschool population. The larger study, of which this was a part, was concerned with the effects of prosocial programming on preschool viewers' behavior. Consequently, experimental conditions were varied according to the extensiveness of prosocial messages, not the density of cinematic code use. Ninety-seven preschoolers (aged 3.8 to 5.5 years) were randomly assigned to one of three viewing conditions. They saw either twelve Misterogers Neighborhood, six Batman and six Superman, or twelve "neutral" programs over a four week period. Free play behavior was rated for aggressiveness and prosocial acts throughout the three week baseline, the four week viewing, and the two week post-viewing periods. Persistence in tasks and tolerance of delays in obtaining teachers' attention or in gaining access to play materials were also rated. As noted earlier, some critics of TV have linked delay tolerance with hyperactivity (restlessness) and the shortened attention span purported to result from television exposure. It should also be noted that the

Misterogers Neighborhood episodes included in the study specifically discussed self-control and persistence.

The analyses revealed that exposure to aggressive programming led to consistent decreases in tolerance of delay, both during the viewing period and when it was considered together with the post-viewing period. The prosocial and neutral conditions, on the other hand, showed increases in tolerance for delays that did not differ from one another in magnitude. Furthermore, the relation between exposure to aggressive content and decreased tolerance of delay was greatest for higher SES children. The authors speculated that this especially strong negative relationship occurred because aggressive television content was relatively novel for these children. The higher SES preschoolers tended to prefer children's programming and viewed less TV at home than the lower SES children, who preferred violent programs, and programming intended for adults. Friedrich and Stein's findings, then, contradict Wilkins' (1982) proposal that television viewing in general exerts a uniform negative effect on the ability to tolerate delays for all children. The data suggest that a more accurate contention would be that aggressive programming may decrease tolerance for delays, especially in children for whom this genre is more novel. In addition, exposure to neutral and prosocial programming may increase tolerance for delays.

The persistence results were more complicated. Persistence increased in high IQ children who viewed Misterogers Neighborhood, but decreased for high IQ children in the Batman/Superman condition. Moreover, no change in persistence was observed in the low IQ children, regardless of condition. Interpretation of these findings is difficult. The investigators suggested that the self-control and persistence messages may have been too complex and infrequent for the less intelligent children to understand. It is clear, however, that for whatever reason, task persistence was not as susceptible to the influence of television viewing as tolerance of delays.

Furthermore, before one can conclude that the prosocial and violent messages were responsible for changes in tolerance of delay and persistence, one must acknowledge that the programs also differed in their intent and format of presentation. The authors stated, "There is no way to know for sure which of the many differences among the programs is responsible for their effects" (p. 59). Being unsure of the specific mechanisms responsible for the observed effects, one must be cautious in drawing conclusions and making inferences as to the generalizability of the results to other programs. As we will see, this is a recurrent problem in the television literature.

Friedrich and Stein suspected that changes in behavior occurred because the preschoolers were imitating the specific actions and words modeled by program characters.

Several related studies have demonstrated that impulsive children could learn to respond more reflectively on a variety of tasks after watching a film of someone modeling a reflective style of problem-solving (Denney, 1972; Ridberg, Parke and Hetherington, 1971).

Impulsive children are generally defined in the literature as those who respond quickly and inaccurately in a visual match-to-standard task. Reflectives respond slower and more accurately. There has been considerable discussion and not a small amount of research attempting to discern the causes for the different pattern of responding. Among the variables which have been found to be negatively associated with impulsivity are age, IQ, internal locus of control, cognitive capacity, and the tendency to process information analytically (for reviews see Kemler Nelson and Smith, in press; Messer, 1976; Messer and Schact, 1983). Specifically, impulsives are generally younger, of less cognitive capacity and competence, they tend to devalue their effectiveness in controlling outcomes (the implication being that they therefore make little effort to do so) and they tend to process stimuli as wholes without regard to component parts. There is some suggestion, then, that a pattern of impulsive responding is in part the product of an inability or tendency not to sustain attention as well as difficulty in selectively focusing attention on detail. Thus, the results reported by Friedrich and Stein might

indicate that Misterogers can serve as an effective model of a reflective conceptual tempo.

Stein and Friedrich (1975a, 1975b) directly tested whether broadcast educational programming was capable of effecting change in conceptual tempo and/or persistence. Children (aged 3.6 to 5.1 years) were randomly assigned to view either Misterogers Neighborhood or neutral programs on four consecutive days. Misterogers was chosen because its "...slow, calm, and gentle..." (p. 87) presentation was thought to model a generally reflective conceptual tempo. In addition, the specific episodes that were used emphasized persistence and reflectivity in solving a difficult problem. Persistence in response to frustration was defined as active manipulation of materials while trying to 1) solve a difficult wooden puzzle and 2) maximize the height reached on a post by a weight. In the first task, three of the eight puzzle pieces that were given to the child would not fit. In the second task, the experimenter had predetermined a random pattern of success and failure, though the child believed that his/her range of scores (height of the weight) was determined by the pattern of buttons he/she had pressed. Measures of impulsivity included latency to respond and number of errors on the Kansas Reflection-Impulsivity Scale for Preschoolers (KRISP). This is a version of Kagan's Matching Familiar Figures test specifically adapted for preschoolers. In the test, the child is asked to point out the one line drawing, of three, that matches the standard

shown by the experimenter. Finally, ability to slow down or inhibit movement while slowly drawing or walking a line was recorded.

An interaction between sex and condition indicated that differential television exposure was accompanied by differences in behavior only for the girls. Girls in the prosocial condition had significantly longer response times in the draw and walk a line tasks than the girls exposed to neutral programs. The prosocial group also had relatively more reflective scores on the KRISP (longer latencies and fewer errors) than the neutral group, although this difference did not reach significance. Persistence scores were further complicated by an order effect; the highest and lowest group means on the puzzle and carnival game were obtained by girls in the prosocial condition. Those who received the carnival game first outscored all the other groups on both persistence tasks. Those who attempted the puzzle first, however, showed the least persistence across tasks. Since the carnival game provided more opportunities for success, doing this task first would be more likely to reinforce attempts to put lessons about perseverance to use, thereby increasing the likelihood that a child would maintain this strategy.

Differences between this and the previous field study help to explain the incongruence of some of the findings. The dependent variables in the field study were <u>changes</u> in

free play behavior occurring over a six week period. In the later study, however, performance on experimenter-imposed tasks, measured only after viewing, sufficed. Furthermore, exposure in the second study was only one third as extensive as that in the field study. Thus, the lack of any condition effects for the boys in the present study may have been due to a lack of interest in experimenter-imposed tasks, or positive changes that were equal in magnitude across conditions. Alternatively, boys may be less likely to attend to the messages of Misterogers. If this is the case, four exposures to the program may have been insufficient to induce behavioral changes. Limited exposure may also have accounted for the lack of consistent findings across tasks for the girls.

In summary, the work of Friedrich and Stein suggests that prosocial programming which incorporates messages about self-control, persistence, and the benefits of a reflective approach to problems may induce these behaviors to some degree in preschool viewers, especially girls. Furthermore, viewing violent, action-adventure programs may lead to decreased tolerance for delays and lack of persistence in play. While these results are probably due to the specific content of these programs, including the characters' behavioral styles, it may be that other differences between the programs, such as format, can account for the results equally well. The latter interpretation would corroborate Salomon's interpretation of his persistence data. That is,

the density of formal features that is shared by violent action-adventure shows and Sesame Street could be responsible for the decreased persistence observed in both Salomon's and Friedrich and Stein's studies.

Wright (1974) also suggested that Sesame Street's presentation format represented an impulsive conceptual tempo which contrasted sharply with Misterogers' reflective style. Stein and Friedrich (1975b) argued, however, that since experimental studies failed to induce a more impulsive style across tasks in initially reflective children (Debus, 1970; Denney, 1972; Ridberg, Parke and Hetherington, 1971), it was unlikely that Sesame Street's format would "...reduce ability to sustain such effort" (p.239).

A study by Anderson, Levin and Lorch (1977) directly tested this hypothesis. Two different versions of Sesame Street were created from four different broadcast programs. One version consisted of extremely short and rapidly paced segments, while the other contained only longer, more slowly paced segments. Seventy-two five year old children were randomly assigned to individually view one of the two versions of Sesame Street or to read stories with a parent for the same length of time. Immediately afterwards, children were tested for impulsivity and perseverance. Impulsivity was indexed as latency to respond as well as number of errors on the KRISP. Time to first inattention, number of looks away, and total time attentive to a

difficult wooden puzzle problem were used as measures of persistence. After testing, children were observed during ten minutes of free play. Their activity level and persistence were rated.

Only one analysis yielded a significant condition effect; children in the slow paced group looked away from the wooden puzzle more frequently than children in the reading condition. Given the number of analyses which were run, this result may well have been due to chance. If on the other hand, one were to accept the result as due to experimental manipulation, one would have to conclude that restlessness when confronted with a difficult problem is elevated immediately after exposure to extremely slowly paced, perhaps boring, children's programming.

In any case, this study found no support for the hypothesis that viewing Sesame Street or rapidly paced programming leads to immediate increases in impulsivity and lack of persistence. Furthermore, no relation was found between total amount of home television viewing, as reported by parents, and any of the behavioral measures. While this study presents strong evidence against the proposition that rapidly paced programming leads to immediate decreases in attentional abilities, it does not negate the possibility that cumulative exposure may in the long run have deleterious effects on attention.

Tower, Singer, Singer and Biggs (1979) conducted a study which examined the impact of cumulative exposure to

programs varying in structural format on preschoolers' concentration in play. Fifty-eight preschool children were randomly assigned to view, in groups of six, either Misterogers, Sesame Street, or nature/animal films on ten consecutive school days. The nature films were considered to be a neutral condition, as they were "not specifically designed to encourage behavioral development" (p. 267). Misterogers was characterized as slowly paced and "low-key", thereby providing the child with opportunities to rehearse and assimilate the program's material. Sesame Street, on the other hand, was described as fast-paced, dependent on repetition to teach its lessons, and perhaps so hyped-up as to interfere with learning processes. Children's concentration during free-play was recorded both prior to and during the week following television viewing. Concentration was defined as remaining with an activity, resisting distraction from others and not engaging in hyperactive behaviors.

Analysis of concentration data yielded only one significant effect; children initially low in imagination (below the median) showed significantly larger increases in concentration than those initially high in imagination. Given that the high imagination children tended to decrease in concentration after viewing, this result is probably best explained as an example of regression to the mean. At any rate, this study found no support for the contentions that

1) viewing rapidly paced programming leads to lack of persistence (i.e. concentration) or hyperactive behavior and 2) viewing slowly paced programming results in more persistent play.

The lack of a significant increase in persistence after viewing Misterogers contradicts Friedrich and Stein's persistence results (Friedrich and Stein, 1973; Stein and Friedrich, 1975a). There are several possible explanations for this discrepancy. Unlike Tower et al., Friedrich and Stein's observation period included the four weeks during which exposure took place. The effects that they observed, then, may have been largely immediate and short-lived. Second, the Misterogers episodes used by Friedrich and Stein specifically emphasized persistence and reflectivity; it is unclear whether Tower et al. used episodes with the same emphasis. Third, despite their stronger manipulation, Friedrich and Stein's persistence results were not indicative of large effects. Changes in persistence were small and occurred only for high IQ children. Furthermore, their results were only replicated for a subset of their sample (girls) when exposure was less extensive.

Taken together, the findings from studies of television and perseverance suggest that certain programs may lead to changes in perseverance, namely Batman, Superman, and Misterogers. Furthermore, if these effects do occur, they are probably dependent upon extensive exposure. Moreover, given the results of Anderson et al.'s (1977) study and the

content of the programs used by Friedrich and Stein (1975a), it is unlikely that the pacing of these programs alone was responsible for the effects. Rather, the specific content or messages of these programs were probably the greatest contributors to effecting change.

As we have seen, more reliable effects seem to obtain when impulsivity or tolerance for delays have been the dependent measures. Not surprisingly, the more recent studies in this literature have focused on these behavioral tendencies as the ones most plausibly affected by TV viewing. Moreover, recent research has primarily focused on more slowly manifesting, cumulative effects. Because maintaining experimental control over extended periods of time is often unfeasible, correlational techniques have therefore been used.

C. Anderson and Maguire (1978) conducted such a correlational study. Primarily interested in the relationship between TV viewing and educational performance, they included a measure of impulsivity because they believed it was a good predictor of educational achievement. Third, fourth, fifth, and sixth grade teachers were asked to rate the frequency of impulsive behavior engaged in by three hundred individual Canadian students. Extent of television exposure was determined from the number of programs children checked as frequently viewed on a fifty-two program list. Each program was classified as either serious (i.e.

informational), violent, a situation comedy, or cartoon. Since viewing patterns were similar across grades three and four, as well as across grades five and six, the groups were collapsed and results were reported in terms of two cohorts.

Viewing of violent programming by the younger children was significantly and positively correlated with impulsivity, as was total viewing for the older group. The reported correlations were 0.292 and 0.350, respectively; these figures are assumed to represent Pearson's r values. As stated earlier, causality cannot be inferred from correlational results. It is possible that already impulsive children prefer to view violent adult programming in their early school years. Later, these same children may view more television in general. Alternatively, it might be argued that the intolerance of delay exhibited by preschoolers who viewed Batman and Superman in earlier studies is a phenomenon that generalizes to violent adult shows and impulsivity. In other words, there may be a causal relationship between exposure to violent programming and impulsivity in young children. Later, television viewing in general may displace other activities that would aid the child in learning to control his/her already established impulsive behavior.

In fact, displacement is frequently suggested as the mechanism by which television achieves its purported deleterious effects on cognitive development. Comprehensive critiques of the displacement literature appear in Anderson

and Collins (1988) and Hornik (1981). Generally, television's arrival has been associated with significant drops in the time children spend with other entertainment media and in organized outdoor activities (c.f. Williams and Handford, 1986; Murray and Kippax, 1978; Brown, Cramond and Wilde, 1974; Schramm, Lyle and Parker, 1961). Proponents of the displacement mechanism argue that organized sports, radio listening, movie watching or comic book reading facilitate learning to control impulsive behavior. Even if this is the case, as Hornik (1981) and Anderson and Collins (1988) point out, it is unclear whether contemporary children who reduced their time with TV would engage in the same activities that were typical during an historical period when TV was not widely available.

A direct test of the effects of reducing TV time on impulsivity was conducted by Gadberry (1980). One first grader from each of fifteen pairs matched for age, sex, IQ and amount of viewing were randomly assigned to a restricted viewing condition. For six weeks, these children maintained a level of viewing that was half the total initially reported by their parents. Comparison of viewing logs kept by parents during the experimental period revealed that restricted viewers watched half the number of commercial programs and one sixth the number of aggressive programs (including violent cartoons) reported by the non-restricted group. Public television programs, on the other hand, were

viewed with approximately equal frequency. When Kagan's Matching Familiar Figures test was administered (after the experimental period), the restricted viewers had significantly longer response latencies and fewer errors than the non-restricted group. Unfortunately, the MFF was not given to the children prior to intervention. Thus, one could argue that the experimental group was significantly more reflective from the outset. The author suggested that this was unlikely, given that MFF scores were highly correlated with performance IQ, a measure on which the groups were approximately matched. Thus, Gadberry attributed the more reflective scores to 1) the significantly larger amounts of time these children spent reading than the non-restricted group and 2) their continued viewing of educational public television, which was significantly and positively correlated with MFF latencies ($\underline{r}$ = .39). We can tentatively conclude, then, that when for an extended period of time, children reduce their exposure to commercially aired and violent programming, they adopt a more reflective conceptual tempo. It remains to be determined whether this results from decreased exposure to programs that directly cause impulsive behavior, from concentrated exposure to educational programming, from increased involvement with activities that aid in the development of a reflective conceptual style, or all three.

Singer, Singer and Rapaczinski (1984) reasoned that even if the direct and short-term effects of viewing violent

programming on preschoolers' self-control were small, this pattern of viewing and leisure time use would eventually result in more restless school-aged children. Thus, as part of a longitudinal study of children's media use, Singer et al. (1984) sought to determine whether the kinds of programs that sixty-three six-year-olds viewed predicted self-restraint and restlessness at age nine. Motor restlessness was defined as the amount of annoyance, activity, and restlessness exhibited by a child when asked to wait quietly for an experimenter who fussed with papers for five minutes. A high score on motor restlessness indicated that the child was poor at tolerating the delay. Self-restraint was indexed by the length of time that a child sat still when told to pretend that he/she was an astronaut who often has to sit still for long periods of time. Weekly hours of viewing realistic and fantasy action-adventure programs were determined from one week diaries kept by parents.

The results were rather surprising. Though measured two years prior to the motor restlessness test, viewing of both fantasy and realistic action programs was significantly and positively correlated with restlessness scores ($\underline{r}$ = .32 and $\underline{r}$ = .37, respectively). Moreover, exposure to realistic and fantasy action adventure programs were significant predictors of restlessness (during a delay) after IQ and gender had been entered in the regression equations first.

The relationships were not as strong for self-restraint. Realistic action TV was the only exposure variable correlated with ability to sit still (r= -.26); heavier viewers of this genre were less capable of sitting still. The contribution of realistic action TV viewing to equations predicting self-restraint were inconsistent, however, and when taken together with several background measures accounted for only nine to fifteen percent of the variance in self-restraint scores. In fact, caution should be exercised in drawing any conclusions from the regression analyses because the number of subjects per independent variable was small and it is unclear what criteria were used for inclusion of a variable in the equations. Thus, the regression results may have been due as much to capitalization on chance as they were to true predictive value. Nevertheless, the substantial correlations obtained between variables measured two years apart clearly suggest that some relation exists between viewing realistic and fantasy action programs and measures of self-control, especially tolerance for a delay.

What remains to be determined, is what accounts for this relation, one that concurs with Anderson and Maguire's (1978) findings based on teacher's ratings of impulsivity and Friedrich and Stein's (1973) tolerance of delay results for the Batman and Superman group. Are children who are somewhat impulsive and intolerant of delays more aroused by programs of this class and therefore choose to view them

more often than their more patient peers? If these programs are having a direct effect on child viewers, what characteristics of the programs are responsible? Furthermore, what relation exists between performance on the variables used in some of the preceding studies, for which reliability and validity have not been established, and measures of attentional abilities conventionally used in psychological research? Clearly, as long as these questions remain unanswered, it will be difficult to speculate on the ramifications of this literature's findings for the cognitive development of television viewing children.

Summary

In summary, several investigations have reported significant relations between viewing particular programs and measures of attentional performance and self-control. Others have reported no effect. Whether and in what direction these relations were found depended on the duration of exposure, the specific attentional skills and programs (or program features) studied, and perhaps the measurement instruments employed.

Non-content Features. Of the five studies that specifically investigated the possibility that non-content features of television programs influence attentional skills, two found no immediate or short-term effects of program pacing on perseverance, impulsivity, or concentration in play (Anderson et al., 1977; Tower et al.,

1979). The other three studies indicated that repeated exposure to cinematic techniques, such as the zoom, leads to short-term improvements in the ability to focus attention on details for children not already adept in this skill (Salomon, 1979). Unfortunately, there have been no investigations to date of whether cumulative exposure to rapid pacing eventually effects changes in attentional skills. In addition, Salomon's work with cinematic techniques has thus far been limited to experimentally produced films and Sesame Street, and to older children who are less likely to view this program. Thus, our conclusions are necessarily limited.

While several of the remaining studies in this literature are cited as evidence that non-content features of television programs influence attentional skills, the methods used in these studies are inadequate to address the issue. None of these investigations has with any certainty identified any mechanisms of possible effects. Thus, these studies are at best attempts to detect, not explain, a relationship between exposure to a specific program or a broad class of programs and specific attentional abilities and self-control.

Perseverance. Of the ten studies reviewed, five incorporated measures of persistence (sometimes labeled perseverance or concentration). As already mentioned, the two studies that manipulated pacing found no immediate or short-term effects of exposure on persistence (Anderson et

al., 1977; Tower et al., 1979). In addition, Anderson et al. (1977) reported that a parent's global estimate of their child's total weekly exposure to television was uncorrelated with the child's perseverance in play or in working on a frustrating puzzle. Of the remaining three studies, only one incorporated an action-adventure program. It found that high-IQ children who viewed Batman/Superman exhibited decreased persistence in their free play (Friedrich and Stein, 1973). Viewing Misterogers, on the other hand, was related to increased persistence in high-IQ children (in the same study) and (in another investigation) in girls who experienced relatively less failure in experimenter imposed tasks (Stein and Friedrich, 1975). Finally, eight-year-olds who viewed Sesame Street persevered less in a boring task (Salomon, 1979). Together, the studies suggest that persistence might be affected by exposure to prosocial and aggressive programming, but if it is, the effects are likely limited to subgroups of children (e.g. high-IQ) who have had considerable exposure to the implicated programs.

Delay Tolerance and Restlessness. The results for tolerance of delays and restlessness did not appear to be restricted to such subgroups. In general, intolerance for delays and restlessness were positively related to viewing educational programs and negatively associated with viewing aggressive/commercial programs. Of the two studies that measured tolerance for delays, one examined immediate and

short-term effects (Friedrich and Stein, 1973) and the other correlated delay tolerance with exposure measured two years earlier (Singer et al., 1984). Both found lower levels of delay tolerance in children who viewed action-adventure programming. The experimental study also reported an at least short-term increase in delay tolerance after viewing twelve Misterogers or twelve neutral programs.

There were two studies which examined television's relation to restlessness. One was the correlational study just discussed (Singer et al., 1984). It reported a negative association between diary estimates of exposure to action programming and the ability to sit still. The second found no immediate effect of viewing Sesame Street on the activity level exhibited in free play, nor was this measure correlated with global estimates of total weekly exposure to television. This study did report more looks away when working on a wooden puzzle for children who viewed a slowly paced version of Sesame Street. While these studies suggest that tolerance for delays and perhaps restlessness are related to viewing particular types of programming, there is not sufficient evidence to conclude that television plays the causal role or even that the effects are reliable.

Impulsivity. The results of the impulsivity studies, of which there were four, were no more conclusive. Exposure to a single Sesame Street program (slowly or rapidly paced) did not result in differential performance on the KRISP (Anderson et al., 1977). Nor was KRISP performance

correlated with a global estimate of total weekly exposure. Exposure to four Misterogers programs (as opposed to neutral films) did lead to longer response latencies but only for girls and for the KRISP this trend only approached significance (Stein and Friedrich, 1975). Six weeks of concentrated exposure to educational programs, accompanied by small increases in time spent reading, was associated with more reflective MFF scores than those obtained by other first-graders who watched six times as much violent programming (Gadberry, 1980). Lastly, when impulsivity was measured as behavioral tendencies in school and exposure was measured via a checklist, impulsivity was found to be positively associated with both total exposure and exposure to violent programming, but it was uncorrelated with exposure to informational programming (C. Anderson and Maguire, 1978). Thus, exposure to educational and aggressive programming might, over time, affect a preschooler's conceptual tempo, but again, the findings are tenuous. Moreover, it is again impossible to determine the mechanisms of the observed relationships.

Statement of the Problem

Unfortunately, most studies have classified programs according to global content differences such as prosocial, action-adventure or educational. It is possible, then, that programs which fell into different classes shared a number of characteristics including pacing, density of formal

features, character actions, etc. When attentional performance has been found to vary as a function of exposure to these broad classes of programs, it has therefore been difficult to ascertain the likely reason for the phenomenon. Obviously, the surest test of a program feature's ability to effect change in preschoolers' attentional performance or self-control would involve exposing children to programs that are identical except in the degree to which the program characteristic under examination is used. Such a design is similar to those employed by Anderson et al. (1977) and Salomon (1974).

The literature indicates, however, that effects most reliably result from cumulative exposure. Creating a series of programs to satisfy several experimental conditions and exposing preschoolers to them over an extended period of time is an expensive prospect. Before undertaking such a project it would be helpful to have both confirmation of the earlier reported significant effects and a better indication of which program characteristics were most likely responsible.

The study reported here takes several steps toward that end. Data collected included two estimates of the weekly television exposure experienced by 330 five-year-olds as well as their performance in several tasks designed to measure attentional abilities and parent estimates of their temperament. Exposure was indexed using viewing diaries. It has been established that these diaries provide

reasonably accurate estimates of time spent with TV (Anderson et al., 1985). The TV logs and check lists sometimes employed in this literature have not been similarly evaluated.

All programs reported to have been viewed by at least one five-year-old were classified on a number of dimensions including intended audience, content and format differences. Content and other categories were precisely defined using a categorization system designed by and in use in another laboratory. This allows direct comparison of the results reported here and those that might be obtained by others using the same system. It also means that the present study is, at least in principle, open to future replication. In addition, this categorization scheme should facilitate isolating which of the many candidate content and format characteristics might be responsible for any observed "effects".

The test battery included measures of impulsivity, restlessness and perseverance (in several task environments) in the laboratory, as well as behavioral tendencies exhibited at home. This made it possible to examine 1) how consistent attentional behavior was across different task environments, 2) how impulsivity, restlessness and perseverance in the laboratory were related, and 3) how behavioral dispositions reported by parents were related to performance in any or all of the laboratory tasks.

In addition, several of the tests included here duplicated, or were similar to, those used in earlier research. Thus, it was possible to examine whether the significant relations found in earlier correlation research would be supported when precisely defined program categories and a validated measure of exposure were employed. Like the earlier correlational studies, this design prohibits casual inference. It may be that children of different attention skill levels choose to view different programs, or that some third unmeasured variable is responsible for both individual differences in attentional behavior and program selection. Nevertheless, if television exposure <u>does</u> effect changes in attentional performance, one would expect to observe a correlation between the respective measures, especially given the statistical power that such a large number of subjects afforded. Thus, the results of the present study can also be examined with the purpose of determining whether in-home levels of television exposure are related to attentional performance and self-control in ways consistent with the effects induced when exposure was experimentally controlled.

In sum, this study provides information about 1) the kinds of programming five-year-olds are exposed to at home, 2) how that exposure is related to sustained attention, impulsivity, and/or restlessness when confronted with a variety of laboratory tasks, 3) whether consistent individual differences in the ability to sustain attention

exist, and 4) how behavioral dispositions observed by parents are related both to laboratory performance and in-home levels of television exposure. This body of knowledge should guide the design of future experimental studies and inform speculation as to causal relationships.

CHAPTER 2

METHOD

The data for this project are taken from a larger ongoing study of TV viewing at home by preschoolers and their families. Data were collected during 1980 and 1981 in the Springfield, MA area. The complete data base includes the measures to be described, as well as time-lapse video tapes of in-home TV viewing, parental attitudes toward TV, demographics, and schedules of daily activities. Detailed descriptions of data collection and reduction are available in Anderson et al. (1985) and in Nathan, Anderson, Field, and Collins (1985).

Subjects

Three hundred twenty-eight preschoolers (160 boys, 168 girls) within three months of their fifth birthday when first contacted, participated in the study. The children were from predominantly white, middle-class families. Only three percent of our sample was black and seventy-seven percent of the families were from the two highest income and status levels outlined by Hollingshead's Four Factor Index of Social Status (1975). Ninety-eight percent of the fathers were employed, all of them full-time. However, only thirty-seven percent of the mothers were employed, and of those that were, only eight percent worked full-time. Thus, the participants were primarily from white middle class traditional nuclear families. More detailed demographics

and information about leisure-time activities are available in Anderson et al. (1985).

Data Collection Procedure

On two separate occasions, approximately five weeks apart, each five-year-old and his/her parent visited the Child Study Center in Springfield, MA. During the first laboratory session, the parent filled out the Demographic Questionnaire and the Peabody Picture Vocabulary Test was administered to the five-year-old (focus child). The focus child then viewed a Sesame Street program while his/her parent completed another questionnaire irrelevant to the present study. Finally, while the child was tested (for gender constancy, a measure not relevant to the present paper) the parent was acquainted with the home-viewing diaries and any questions about filling them out were answered. The parents were then given one Nielsen-like ten day diary for each working television set in the home (see Home Viewing Diaries section below). Completed diaries were mailed back to the Child Study Center in the envelopes provided.

Approximately three weeks after the first diary period had ended, parents were mailed diaries for the second diary period which commenced five days later. Within five days after the second diary period had ended, parent and child were again seen at the Child Study Center and completed diaries were collected. It was during the second laboratory

session that information about the child's temperament was gathered and measures of cognitive status were administered. While the child was being tested on the attentional tasks, the parent remained in the reception room and completed three questionnaires. The questionnaires included one concerning the child's temperament, as well as two dealing with recent major life events and any changes in family television viewing that may have occurred during participation in the study.

The order of testing for the focus child was as follows. Detailed descriptions of the measures appear below. First, the child was introduced to a video game called Blinky Bug, which was designed to measure sustained attention in a vigilance task. After demonstrating understanding of the game during a practice trial, the child played Blinky Bug for ten minutes and his/her performance was recorded. The experimenter and child then moved to another room and the child attempted to solve Banta's difficult wooden puzzle for five minutes. Next, the Kansas Reflection-Impulsivity Scale for Preschoolers (KRISP) was administered. The experimenter and child then went back to the original room and Blinky Bug was played for another ten minutes. Afterwards, a Sesame Street character recognition test was given and then the parent and child were thanked for their participation and given a gratuity of fifteen dollars to compensate them for the considerable time and trouble invested in the research.

Cognitive Task, Laboratory Viewing and Temperament Measures

The means, medians and standard deviations of all the cognitive status variables are presented by task and sex in Tables 1 through 4. The distribution of each variable was examined first visually via stem and leaf plots and then statistically with Kolmogorov-Smirnoff's test for goodness of fit (Siegel and Costellano, 1988). This test calculates the average distance (DN) between a variable's observed cumulative relative frequency distribution and that which would be expected if a sample of the size collected had been drawn from a specific theoretical distribution. When a variable was clearly non-normal an attempt was made to identify the parent distribution (e.g. lognormal, beta or Weibull), and to find a transformation that if necessary could be used to stabilize variance and make the data more nearly normal.

Statistical Analysis Procedures

T-tests of mean differences between groups, e.g. male versus female, were all based on groups of unequal sizes. In this situation, error and power rates are especially susceptible to distortion by violations of the homogeneity of variance assumption. Thus, in accordance with recommendations by Myers and Well (in press), the following procedure was used in choosing an appropriate test statistic. When variables were approximately normally distributed and group variances exceeded a two to one ratio,

Welch's (1938) t was used. In order to evaluate whether skewed and/or long-tailed distributions had equal variances, each score was replaced by the absolute value of its deviation from its group median. If a t-test on these data was non-significant, the groups were assumed to have the same variance (Brown and Forsythe, 1974). If in addition, the groups' frequency distributions were similar in shape, Mann-Whitney's U test was chosen as the appropriate test for group differences in location. On the other hand, if Brown and Forsythe's (1974) procedure indicated unequal group variances, either a Welch's t on the original data or a standard two sample t on transformed data was used. Average response time in the KRISP task, for example, was lognormally distributed and Brown and Forsythe's test indicated unequal group variances for males and females. Thus, a Welch's t was calculated.

Attention to TV

During the first laboratory session, the focus child and parent were brought to a room with a TV and toys where they were invited to watch a forty minute Sesame Street program. The parent was given a questionnaire to complete during the program and was instructed not to draw her child's attention toward herself or to the TV screen. An experimenter, who observed the focus child from behind a one-way mirror, depressed a button once when the child was visually oriented to the screen then again when a look was terminated. Toy play was simultaneously rated using another

set of buttons. Each button press sent a signal to a Cromemco Z2D microcomputer which then calculated interval length between behavior on- and off-set. Four measures of attention to the program were calculated for each subject. Percent visual attention was the proportion of time that the child was visually oriented to the screen. In addition, the number of looks at the screen and the average duration of both looks and pauses (i.e. looks away from the screen) were computed. When visual orientation to the screen has been rated with the same procedure used here, interobserver reliabilities have been high (e.g. Anderson and Levin, 1976, reported that $\underline{r}$ = .98). After approximately half the subjects had been run, the computer set-up became inoperable and button presses were instead recorded on magnetic tape. The tape was later input to a computer program that calculated interval durations.

While the number of looks, average look length and percent visual orientation toward the screen were calculable for 290 subjects, only 162 subjects had complete viewing data. This partial data loss was apparently the result of random equipment failures. There were no significant differences in percent visual orientation and average look length for complete and partial data subjects. Subjects with partial data did tend to have fewer looks at the the screen, but this difference only approached significance (107 versus 113.5 median number of looks, $Z = -1.65$, $p =$

.0989). Thus, while all laboratory viewing analyses included only subjects with complete data, the conclusions drawn from them can be generalized to the population sampled.

Focus children looked at the screen for an average 52.0% of the Sesame Street program. This is consistent with levels reported in comparable studies where toys were available during laboratory viewing sessions (e.g. Lorch, Anderson and Levin, 1979). Percent attention was normally distributed, and like the rest of the variables in this set, there was no difference in mean performance as a function of sex.

Children looked at and away from the set between 38 and 320 times during the 40 minute session. Number of looks was lognormally distributed with a mean and median of 119.871 and 113.5 respectively.

The distributions of average look and pause lengths were quite similar. Both were lognormally distributed. While average look length averaged 12.84 seconds across subjects, with a median of 10.44 seconds, average pauses were slightly shorter with a mean and median of 11.136 and 9.585 seconds, respectively. Average looks and pauses both showed considerable individual variability. Looks ranged in average length from 2.396 to 54.994 seconds, while pauses ranged in average length from 2.781 to 62.483 seconds. There was very little if any correspondence between average

look and pause lengths (r = -.148, b = -.180, t = -1.891, p = .06).

Earlier research has indicated that certain characteristics of programs (comprehensibility and formal features, for example) are reliable correlates of a five-year-old's attention and inattention to the TV set (c.f. Alwitt, Anderson, Lorch and Levin, 1980; Anderson and Levin, 1976; Anderson, Lorch, Field, and Sanders, 1981; Calvert, Huston, Watkins and Wright, 1982). Thus, one could say that when watching television, a child's pattern of visual attention is in part structured by the program itself. Sustained attentional engagement is not, however, demanded when viewing Sesame Street as it is when attempting the persistence and vigilance tasks included in this study. The attention to Sesame Street measures are included, then, as a means of determining whether a child's attention to an entertaining and meaningful stimulus is related to his/her ability to sustain attention when externally imposed tasks clearly demand it. Many of television's critics imply that this is the case.

Banta Puzzle

Ability to persist in a difficult problem-solving situation was indicated by attention to and successful completion of Banta's puzzle (Banta, 1970). The puzzle consists of non-interlocking wooden pieces that when properly placed lie flat within a square wooden frame. The completed puzzle was shown to the focus child while the task

was explained. All of those pieces which were not glued to the frame were then removed, the frame was turned ninety degrees, and the child was asked to replace the pieces so that they lay flat. The subject was given a maximum of five minutes to solve the puzzle. Scoring procedures were somewhat different than those proposed by Banta (1970). Time to first inattention, number of looks away and total time on task (i.e. attending) were recorded online by the experimenter. If a child successfully completed the puzzle, it was given to the child to solve again until the five minute period was up. This task is similar to Stein and Friedrich's (1973) puzzle problem, and was also used by Anderson et al. (1977). Levin (1977) using Banta's original scoring procedures, found a modest test-retest correlation of .55.

Only 32 subjects solved the Banta puzzle within the five minutes allotted, 15 of them were female. There were no significant sex differences for any of the Banta measures.

Time to first inattention was lognormally distributed, therefore, highly skewed, with a median of only 24 seconds but a mean of 58.49 seconds. Seventy-five percent of the subjects had looked away by the time 69 seconds had elapsed. The total number of looks away ranged from zero to thirty-six with a mean and median of 7.65 and 6.0 respectively. A square root transformation made this distribution more

nearly normal (DN from .139 to .07). Most of the children (75%) actively worked on the puzzle for at least 89 percent of the allotted time. The average and median times on task were 275.66 seconds and 285.05 seconds respectively.

IQ

Mental age and IQ were derived from performance on Peabody's Picture Vocabulary Test (PPVT). Subjects generally tested above average in IQ; the mean percentile score was 72.8. Boys scored slightly but significantly higher than girls, 114.49 versus 111.15 (t = 2.073, SE = 1.613, n = 326, p = .039), a difference of just over six percentile points. This measure was included in order to examine the possibility that the relationship(s) between television viewing and cognitive skill(s) vary as a function of intellectual competence, as has been found in several investigations by other researchers (Friedrich and Stein, 1973; Morgan and Gross, 1980; Morgan and Gross, 1982).

KRISP

The Kansas Reflectivity Impulsivity Scale for Preschoolers (KRISP) was administered and yielded the average latency to respond and the number of errors as indices of conceptual tempo. The task requires the child to look at a line drawing and then select from four alternatives the one drawing that matches the standard. After a warm-up of five trials, time to initial response in seconds and success or failure were recorded for ten test items. Individuals who, in a visual discrimination task,

respond with longer latencies and fewer errors are described as having a reflective conceptual tempo (Kagan, Rossman, Day, Albert and Philips, 1964).

The KRISP, or the MFF from which it was derived, was used in three of the four studies that examined television's possible relation to impulsivity. As noted earlier, impulsivity as defined by performance in this task has been attributed to (among other things) an inability or tendency not to sustain focused processing, less cognitive capacity and/or competence (to generate strategies, for example) and difficulty focusing on detailed parts of wholes. It was of interest, then, to determine not only how performance in the KRISP was related to television exposure but how it related to performance in other tasks as well.

Although one subject made as many as sixteen errors, the preponderance of children (94.8%) made fewer than nine mistakes in the ten trials. In fact, the average and median number of errors were a low 3.24 and 3.0 respectively. These almost duplicate the 3.25 errors published as the norm for middle-income class children between 4 years 7 months and 5 years 6 months of age (Wright, 1978). As with the normative sample, there was no difference between boys and girls in the number of errors committed.

Girls were, however, significantly faster responders than the boys (4.37 vs. 4.91 seconds respectively, Welch's $\underline{t}' = -2.919$, $p < .01$). While Wright (1978) reported the

same sex effect, there were differences between this and the normative sample. Namely, girls in the present study had significantly shorter average latencies than their counterparts in the normative sample (4.37 vs. 4.88 seconds, Welch's $\underline{t}' = 1.913$, $df = 127$, $p < .05$ one tailed). This led to a significantly smaller overall mean in the present study than that reported by Wright (1978) (4.64 vs. 5.18 seconds, $\underline{t} = 3.13$, $df = 499$, $p < .005$).

Wright (1978) also reported a -.282 correlation between latency and number of errors for this age group. The correlation for the present sample was substantially smaller, $\underline{r} = -.183$. A plot of the residuals, however, revealed extreme heteroschedasticity. When scores were transformed to stabilize variance the correlation was -.255 ($b = -.115$, $\underline{t} = -4.779$, $n = 327$, $p < .001$). It is unclear whether these procedures were used in the normative study.

Attempts to validate the KRISP through 1) predicting performance from Brazleton's Neonatal Assessment Scale and 2) correlating age four performance with that at age five, have met with little success (Wright, 1978). Hence, this measure is not recommended for diagnostic purposes. Test-retest reliability over periods up to eight weeks, however, is moderate and there is substantial variability in performance between individuals (Wright, Salkind and Denney, 1979; Wright, 1978). Given this and the fact that it has been used in three of the earlier studies, the KRISP was considered appropriate for inclusion in the present study.

Parent Temperament Questionnaire

Among the materials completed by parents was Thomas and Chess' Parent Temperament Questionnaire (1977). The inventory describes children's possible behavioral responses to seventy-two specific situations. The parent was asked to rate the frequency of these responses using a seven point Likert type scale that ranged from hardly ever to almost always. Responses to items that involved the same temperament characteristic were averaged to yield nine subscale scores (the summary scores were expressed in one hundred point units, i.e. an average of 1 was recorded as 100). The three subscales used in the present study were activity level, persistence, and distractibility.

The distribution of each of the variables was reasonably well fit by a normal distribution. Boys and girls showed equal levels of persistent behavior. Activity level scores, on the other hand, were significantly lower for girls than boys, 372.405 versus 391.356 ($\underline{t}$ = 2.014, SE = 9.410, n = 328, p = .045). Thus, girls were reported to have a lower level, tempo and frequency of motor activity than boys. There was also a significant sex difference in distractibility scores. Environmental stimuli were more effective in interfering with or "altering the direction" (Cameron, 1978, p.236) of girls' rather than boys' ongoing behavior (493.548 vs 471.375 , $\underline{t}$ = 2.355, SE = 9.416, n = 328, p = .019). Included as "environmental stimuli" were

adult attempts to divert a child's attention to a desired focus. Thus, higher distractibility scores are in part indicative of more compliant behavior.

Vigilance Task

Maintained visual orientation toward task materials is often considered indicative of sustained effort. Visual orientation and allocation of processing resources, however, are not synonymous. It is possible for an individual to be visually oriented toward something in the environment without actively processing information concerning that stimulus. More figuratively, one's eyes may be 'parked' in one place while the mind's eye is focused elsewhere. Classically, the vigilance paradigm has been employed as a means of studying adults' sustained focused processing. Anderson and his colleagues have developed a version of the vigilance task specifically adapted for use with young children (Lorch, Anderson, and Collins, in preparation).

The task requires the child to continuously watch a character ("Blinky Bug") on a CRT. Blinky Bug is taking a walk and is supposed to stay on the road. Sometimes Blinky is naughty and jumps onto the grass. The child is asked to press a button as soon as he/she sees Blinky on the grass so that Blinky knows he hasn't fooled the child. From the proportion of signals detected, the false alarm rate, and the response times to both momentary and continuous signals (Blinky jumps around on the grass until the child responds)

one is able to calculate the average length of the child's bouts of remaining alert to stimulus information.

The logic of the calculations is as follows. Continuous signals sometimes occur during attentive episodes, sometimes during periods of inattention. When the child is attentive, the latency to respond represents the timing necessary to make the appropriate motor movements. When the child is inattentive during a continuous signal (i.e. a continuously deviant jump), the latency to respond has an additional component, namely, the time to notice that signal. It can be assumed that on average the continuous signal will occur halfway through periods of inattention. Furthermore, the probability of being attentive at the time of a signal can be calculated for each child from the proportion of signals he/she detected. The response time to a continuous signal can then be estimated in the long run to be equal to the sum of the probability of being attentive multiplied by the time needed to make a motor response, and the probability of being inattentive at signal onset multiplied by the sum of the time necessary to notice the signal and make a response. This identity can be written algebraically as:

$$RT_c = (P_h * RT_m) + ((1 - P_h) * (I/2 + RT_m))$$

RT_c is the average response time to continuous signals, P_h is the probability of a hit, RT_m is the average response time to momentary signals, and I is the average length of

inattentive episodes. Solving for the average length of inattentive episodes (I) results in :

$$I = ((2 * (RT_c - RT_m)) / (1 - P_h))$$

To calculate the probability of a hit (P_h), one divides the number of signals responded to within 2 seconds (the definition of a hit) by the sum of the number of momentary signals actually presented and the number which would have occurred during continuous signal events. The false alarm rate is then subtracted from this quantity to account for the fact that some of the button presses which met the definition of a hit may have been random rather than intentional. This corrected proportion of signals detected is a measure of the subject's success in remaining alert (i.e. attentive) over the duration of the task. Thus, the probability of a hit can also be expressed as:

$$P_h = A / (A + I)$$

A is the average length of attentive episodes. Solving for A results in:

$$A = (I * P_h) / (1 - P_h)$$

Using these formulas, the probability of a hit and the average length of attentive and inattentive episodes were derived for each child in each session of the vigilance task. The false alarm rate and the total time each session ran were also recorded. In addition, the experimenter rated online the percent of total task time that the subject remained visually oriented toward the CRT screen.

As a result of equipment failures, only 145 subjects provided any valid data during the two sessions with the vigilance task. Moreover, while 137 subjects had complete data for session one and 127 for session two, only 120 subjects had non-missing values for all measures in both sessions. To further complicate matters, a simulation study demonstrated that sessions must run at least 10 minutes before estimates of the average length of attentive and inattentive episodes are reliably accurate (Lorch, Anderson & Collins, in preparation). Only 105 subjects met this condition for both vigilance sessions.

These 105 subjects were compared to the 40 subjects with incomplete and/or less than ten minutes of data for all cognitive measures. There were no significant differences between groups in I.Q. nor in any of the Banta or KRISP measures. As can be seen in Tables 5 and 6, however, partial data subjects had a significantly higher false alarm rate and lower percent visual orientation toward the screen during both vigilance task sessions. In addition, they had a significantly higher number of false alarms in session one and both longer average response times to continuous signals, and longer average inattentive episodes in session two.

Thus, the non-completers had more difficulty, or were less willing, to sustain visual orientation to the screen and it appears that in the second session this was partly due to longer looks away. Interestingly, the probability of

a hit did not differ by group. One could argue, then, that while the partial data subjects' lapses in focused processing were longer, they were also apparently few enough in number not to significantly alter overall success. This group's average attentive episode length was no greater than that for completers, however, and the number of false alarms was elevated. Thus, one could alternatively argue that the probability of a hit was equal in both groups because non-completers simply pressed the "hit" button with greater frequency regardless of the Blinky Bug character's position.

Given the differences in vigilance performance, it was deemed most appropriate to eliminate the partial data subjects from all vigilance task analyses. Any other approach would result in subject populations that varied according to the measure of interest and the type of analysis undertaken. For example, a repeated measures analysis of average attentive episode length could only include the 105 better performing subjects. The same analysis of visual orientation to the screen would include an additional 14 partial data subjects. Eliminating partial data subjects from all analyses, then, yields the substantial advantage that all conclusions are relevant to the same (albeit superior) population.

In addition to the partial data subjects, two complete data subjects were deleted. While both of the subjects remained in front of the screen for the entirety of both

sessions, their scores in the second session indicated that they did little more than that. One subject had so few hits that with only nine false alarms her corrected probability of a hit was negative. Her average inattentive episode length was therefore set to ten minutes (the entirety of the task), and the probability of a hit was set to zero. The second subject's average inattentive episode length was far greater than that for any other subject (55.448 seconds, a full 13.6 standard deviations above the 5.291 second mean of the other subjects' scores). His average response time to continuous deviant jumps was similarly excessive (23.252 seconds, 12.19 standard deviations above the 2.396 second average of the other subjects' scores). Thus, it appears that neither subject was willing to play during the second session of the "Blinky Bug Game". While it might be argued that this is a valid response, these subjects were identified as outliers (having significant studentized residuals and Cook's distances that exceeded one) in every correlation involving average response time and average inattentive episode length. Thus, to ensure that each element of the correlation matrices involving vigilance measures were based on the same number of subjects, these two subjects were eliminated.

The probability of a hit was the only variable from each session that was approximately normally distributed. All other variables were characterized by long-tailed, often skewed distributions. As a result, the most appropriate

test for sex effects was often the Mann-Whitney U (see Analysis Procedures section above). Both the median number and rate of session one false alarms was higher for boys than for girls (13 versus 7, $Z = 2.53$, $n = 102$, $p < .012$; and .027 versus .020, $Z = 2.79$, $n = 102$, $p < .005$, respectively). Since none of the other variables for either session showed a sex effect, it would seem that girls and boys were equally successful in maintaining attention in the vigilance task.

Results of analyses comparing session one to session two performance suggested that this was not entirely true. A repeated measures analysis of variance (subjects by trials) was calculated separately for each variable. Both percent visual orientation toward the screen and the corrected probability of a hit decreased significantly from session one to session two (92.9 to 86.2 percent, $F_{1,102} = 41.392$, MSE = .005, $p < .001$; and .498 to .442, $F_{1,102} = 12.210$, MSE = .013, $p = .001$). It was not surprising, then, that the average response time to continuous signals was longer in session two than session one (2.396 versus 1.790 seconds, $F_{1,102} = 20.218$, MSE = .933, $p < .001$), as was average inattentive episode length (4.804 vs. 3.393, $F_{1,102} = 20.788$, MSE = 4.930, $p < .001$). These decrements in performance were <u>not</u> accompanied by significantly shorter attentive episodes. In fact, girls' attentive episodes were on average significantly longer in the second session (3.56

vs. 5.515, $\underline{t}_{53} = -2.1984$, SE = .888, $p < .04$). Boys' attentive episodes, on the other hand, showed little change (4.616 to 3.817). This produced a significant sex by trials interaction ($F_{101} = 5.947$, MSE = 16.345, $p = .016$) in a sex by trials repeated measures analysis. When average inattentive episode length was subjected to the same analysis it, too, revealed a significant sex by trials interaction ($F_{1,101} = 4.037$, MSE = 4.787, $p = .047$). The significant increase in the length of inattentive episodes was more marked for girls than boys (Girls 3.305 to 5.299, $\underline{t} = -4.1412$, SE = .485, n = 54, $p < .001$; Boys 3.49 to 4.258, $\underline{t} = -2.137$, SE = .358, n = 49, $p = .038$). No other sex by trials interaction was significant. For the probability of a hit, however, the sex by trials interaction apparently accounted for enough between session variability to render the earlier reported trials effect non-significant. Boys showed an average 7.7 percent drop in the probability of a hit versus the 3.6 percent average drop for girls.

In sum, there were small but significant drops in percent visual orientation for both sexes. This was likely the result of longer looks away given the increases in the average response time to continuous signals and the longer inattentive episode average, especially for girls. These longer looks away were partially offset, for girls, by a significant increase in the average length of attentive episodes. Since boys did not show this increase, the drop in the probability of a hit was somewhat greater for them.

Thus, there were small but significant decreases in the levels at which both covert and overt attention were sustained over the time course of the task and they were somewhat more marked for boys than girls. These decrements were likely the result of fatigue.

Several general comments about performance in the vigilance task are in order. While average attentive episode length ranged from .184 to 27.609 seconds, the median length was only 2.147 seconds. For most subjects, then, success over the course of each ten minute session would require <u>at least</u> several instances of re-recruiting and focusing attentional processes. There was substantial variability in the extent to which this was achieved. The probability of a hit ranged from a low of a 4.7 to a high of 91.5 percent. These scores were approximately normally distributed with a mean and standard deviation of 47 and 23.4 percent. Thus, despite the rather straight-forward response requirements, remaining alert to Blinky Bug's movements over the course of ten minutes was not an easy task for many of these subjects. Subjects were far more likely to remain visually oriented to the screen. These scores ranged from 50.1 to 100 percent and were clearly positively skewed. The mean and median were 89.6 and 94.9 percent, respectively. That the distributions of percent visual orientation and the probability of a hit were so markedly different suggests that, at least for some

subjects, lapses in focused processing were not always accompanied by looks away from the CRT.

Home-viewing Diaries

Parents were given one ten-day diary for each working television set in the home. Viewing was recorded in fifteen minute blocks that spanned from six a.m. to two a.m. the following day. For each fifteen minute block, parents indicated whether the TV was on, to what station and program it was tuned and who was in the room. In addition, eleven codes were used to indicate why the focus child began and ended each viewing session. Individuals were marked as present if they were in the viewing room for six or more minutes of a fifteen minute block. Each fifteen minute block consisted of sixteen columns. Two columns were used to designate TV on or off, one for channel, one for program name, ten for viewer presence (one for each family member and visitors), and two for the reason that a five-year-old began/ended a viewing session. Parents were asked to put a question mark in any column about which they were uncertain.

One thousand thirty six diaries were collected from the 330 families who completed the study. The diaries had to be preprocessed to resolve ambiguities arising from incomplete blocks or conflicting information. For instance, a block might contain a channel number without any program name. In this case, TV Guides were consulted and the program name was provided. In another case, a parent may have consistently designated viewer presence only in those fifteen minute

blocks during which programs began. The diary instructions specified that the first block during which a viewer was present be marked by an 'X'. Continued presence through subsequent blocks of time was to be marked by a line trailing from the initial 'X'. A consistent lack of trailing lines, then, may have meant that family members always watched only the first fifteen minutes of the programs listed. We judged this to be unlikely and marked the empty blocks until a program's end as periods of experimenter uncertainty. In another diary, where lines were used regularly, empty blocks between X's marking presence at program onsets were left blank. Where we could, we replaced question marks with information from TV Guides. Remaining question marks were entered as parent uncertainty. When preprocessing was complete, a computer text file version of each diary was created.

Most families were apparently certain of the programs that were on the TV set when the focus child was in the room; more than 75% of them never made use of the parent uncertainty code. For more than half the five-year-olds (59.4%), however, there was at least one fifteen minute block where the experimenter was unable to determine the program name from what was written in the diary. In general, the impact of such ambiguities was small amounting to an average of just over one half hour of viewing time per

week, which accounts for an average of only 4% of total viewing time.

Earlier papers from this database compared the amount of exposure reported in the diaries with that observed on time-lapse video tapes recorded in the homes of ninety-nine families. The diaries were found to be reasonably accurate estimates of time spent with TV, especially for the five-year-olds who were the focus of the study (Anderson et al., 1985; Choi, Anderson, Burns, Collins and Field, 1987). When uncertainty was included as exposure, the correlation between the estimates was somewhat higher but the means based on the two different estimates were significantly different from one another (Choi et al., 1987). Unfortunately, the accuracy of the diaries with respect to the particular program being viewed awaits further analysis of the home-viewing tapes. Given that broadcast schedules are largely consistent from week to week and they are published on a weekly basis, it is likely that agreement between the tapes and the diaries will be at least as high for programs viewed as it was for viewer presence.

Before analyses for the present project could be undertaken, all the diaries had to be edited to standardize the spellings of the approximately 1300 different programs that were mentioned as having been viewed. This was accomplished by creating a semi-complete dictionary of correct spellings and running a spell-checking utility on each diary. Alternative spellings for the most popular

programs were not changed at this stage, as it would have slowed the process considerably. Instead, a computer program was written to automatically replace any program name found in a diary that matched those on a list of all the common permutations of standard spellings. It was determined during the spell-checking process that the same name was sometimes used to refer to different programs. For example, both the live-action and cartoon versions of Batman may have been referred to by that name. Thus, TV Guides were again consulted to determine the broadcast times of programs whose names were frequently confused, and the diaries were edited accordingly.

While all diaries included ten days of data, they began on different days of the week for different families. Thus, the three days of the week that were sampled twice in each diary varied across families. Since it is unlikely that the amount of time spent viewing specific program types is consistent across days of the week, including all ten days of data could artificially create differences in exposure between five-year-olds. For example, one family may have begun its diary on a Friday while another started on Monday. Using all ten days of their respective diaries to calculate exposure could result in relatively higher amounts of cartoon viewing for the first child simply because his diary included two Saturday mornings. Thus, days one, two and ten

were eliminated from each diary period, leaving fourteen days of data for each five-year-old.

A computer program was then run on each diary to determine exactly which of the 1181 shows mentioned in the diaries were on while focus children were in the room. This computer program searched for all those fifteen minute blocks when the TV was on and the five-year-old was in the room. Blocks where either the parent or experimenter were uncertain whether the five-year-old was in the room were ignored. The program name reported for each valid block of focus child exposure was then compared to a list of program names compiled from all the previously processed diaries. If a program name did not appear on the list it was added. Running this program on all the diaries produced a list of 666 unique television shows to which at least one five-year-old had been exposed.

Program Classification

Once spellings had been standardized and the master list of focus child programs had been created, a database containing the names and corresponding characteristics of the TV programs was created. Each program was classified on nine different dimensions defined by researchers at the Center for Research on Television's Influence on Children (CRITC). If a program from our master list also appeared on the CRITC listing, it was classified exactly as the Kansas group had determined. The remaining programs, where possible, were classified using the CRITC definitions.

Programs with which the experimenter and her colleagues were familiar were easiest to classify. Less familiar programs had to be classified on the basis of descriptions provided in TV Guide. Unfortunately, descriptions were not always sufficient and missing codes had to be entered as values on some of the dimensions. We were able to at least partially classify all but eight of the 666 programs listed in the diaries when five-year-olds were in the room.

The proportion of the total 666 programs that was codable on each dimension was: length in minutes = 91.44%; audience = 92.4%; informative purpose = 93.54%; religious = 98.05%; animation = 94.14%; program type = 90.39%; expectation/familiarity = 88.59%; time/content demands = 86.94%; station type = 96.85%. These proportions are within 3.5 percentage points of those published in Huston et al., 1987. Time/content demands and expectation/familiarity were the most difficult to code primarily because TV Guide rarely provides detailed format descriptions. Fortunately, the focus children spent little time with those programs which were difficult to code. Average weekly exposure to programs that were uncodable on the time/content demands, for example, was 51.72 minutes. This amounts to an average 5.7% of total weekly exposure to television. Thus, the overwhelming majority of the time subjects spent with television was classified according to the CRITC coding scheme.

What follows are descriptions of the nine dimensions on which the programs were coded.

Program Length. The length of the program in minutes was recorded.

Audience. Programs were assigned a value of one or two based on whether they were intended for children or adults. Programs aimed at viewers who were twelve years of age or younger were assigned a value of one. All other programs were coded as intended for adults.

Informative. This characteristic also referred to the producer's intention and required a yes/no decision (1 = No, 2 = Yes). Educational programs that are entertaining (e.g. Sesame Street) were scored as yes. Coverage of a sporting or cultural event, however, was not considered to have an informative purpose, unless it was part of a summary or magazine format program such as Wide World of Sports.

Religious. This characteristic also required a yes/no decision (1 = No, 2 = Yes). Programs were coded as religious (Yes) if they were services or promoted a particular religious point of view.

Animation. One of three codes was assigned to each program to denote whether it was animated, live or both (the codes were 3, 1 and 2, respectively).

Program Type. Programs were classified as one of thirty-one different types. For example, news and weather, people and places magazine show, situation comedy, westerns and medical dramas. The thirty-first category, movie, was

added by our laboratory. Each of the program types is briefly defined in Appendix. Although the definitions presented there are abbreviated versions of those provided in the CRITC Program Categorization System Coding Manual, the reader is assured that all the requirements of the CRITC definitions were applied in categorizing programs in this project.

Expectation/Familiarity. This characteristic refers to the degree to which content and presentation format are similar across episodes of a program. As such, this dimension is intended to index the extent to which viewers could bring prior knowledge of a program, in the form of expectations or schemata, to bear on interpretation of future episodes. Programs were assigned one of four codes, ranging from a series with the same major characters and settings from one episode to the next (expectation = 1), to programs with no continuing characters or settings (expectation = 4).

Content/Time Demands. This attribute concerns the usual length of time devoted to a continuing plot or theme. The modal length of a program's content units was rated as falling within one of eight time intervals. These intervals ranged from less than five minutes (content/time demands = 1) to an indefinite number of episodes (e.g. soap operas, which were assigned a value of eight). Content units are defined as involving, "...inter-related content such that

understanding any one part hinges at least partially on recalling or processing the rest of it" (CRITC, 1983, p.18). Thus, this characteristic indexes the temporal integration necessary for full comprehension of the program. This is not equivalent to a measure of the span of attention or even percent attention necessary to understand a program. However, it does give us an approximation of the extent to which a program consists of disjoint material. Presumably, the more a program's content is disjoint, the shorter the period of continuous attention required for its comprehension. As we saw in the introduction, Tower et al. (1979) believed that Sesame Street's frequent changes in topic matter within a program hindered its educational effectiveness and made it likely to engender a lack of concentration in free play.

Station Type. Each program was coded as having been broadcast by either a commercial, public or cable station (the codes were 1, 2, and 3, respectively).

Table 1

Cognitive task and TV viewing variables[a] means, medians and standard deviations by sex

	Females		Males	
	Mean	Median	Mean	Median
Banta				
First Look Away	63.744 (80.367) n = 167	29.100	53.244 (75.483) n = 159	20.300
No. Looks Away	7.707 (6.501)	6.000	7.642 (5.435)	7.000
Time On Task	75.810 (26.522)	284.700	275.494 (30.692)	285.700
KRISP				
Avg. Response Time	4.367[b] (1.550) n = 167	4.110	4.914[b] (1.824) n = 160	4.660
No. of Errors	3.257 (3.002)	2.000	3.225 (2.431)	3.000
Laboratory Viewing				
Avg. Look Length	12.462 (8.160) n = 84	9.341	13.247 (8.791) n = 78	11.216
Avg. Pause Length	10.602 (7.122)	8.969	11.711 (7.130)	10.675
Avg. Play Length	62.854 (38.887)	52.729	59.539 (31.862)	53.277
No. of Looks	125.417 (50.745)	117.500	113.359 (41.951)	109.500
Pct. Attention	.523 (.169)	.505	.518 (.173)	.525

[a]Standard deviations in parentheses

[b]$t' > 2.918$, $p < .01$

Table 2

IQ and Parent Temperament Questionnaire[a] means, medians and standard deviations by sex

	Females		Males	
	Mean	Median	Mean	Median
PPVT				
IQ	111.145[b] (14.476) n = 166	110.000	114.488[b] (14.637) n = 160	117.000
Percentile	69.807 (26.389)	76.000	75.944 (25.060)	87.000
Temperament				
Activity Level	372.405[b] (84.514) n = 168	375.000	391.356[b] (85.883) n = 160	400.000
Distractibility	493.548[b] (83.235)	487.000	471.375[b] (87.299)	475.000
Perseverance	410.185 (64.767)	412.000	410.113 (64.818)	412.000

[a]Standard deviations in parentheses

[b]$t > 1.968$, $p < .05$

Table 3

Session one vigilance task means, medians[a] and standard deviations by sex

	Females		Males	
	Mean	Median	Mean	Median
Average Length				
Attentive Episode	3.563 (4.418) n = 54	2.169	4.616 (5.440) n = 49	2.757
Inattentive Episode	3.305 (2.858)	2.324	3.491 (3.015)	2.766
False Alarm Rate	0.043 (0.056)	0.023[b]	0.055 (0.048)	0.043[b]
No. False Alarm	12.759 (16.860)	7.000[c]	16.000 (14.265)	13.000[c]
Pct. Attention	.927 (.098)	.975	.931 (.088)	.962
Prob. of a Hit	.477 (.256)	.477	.520 (.207)	.502
Average Response Time				
Continuous Signals	1.869 (1.292)	1.319	1.704 (0.940)	1.385
Momentary Signals	0.816 (0.109)	0.820	0.795 (0.088)	0.778

[a]Standard deviations in parentheses

[b]Medians differ, $p < .01$

[c]Medians differ, $p < .005$

Table 4

Session two vigilance task means, medians[a] and standard deviations by sex (n's = 54 and 49)

	Females		Males	
	Mean	Median	Mean	Median
Average Length				
Attentive Episode	5.515 (8.292)	2.066	3.817 (4.042)	2.211
Inattentive Episode	5.299 (4.207)	4.061	4.258 (3.035)	3.602
False Alarm Rate	0.041 (0.067)	0.020	0.041 (0.075)	0.027
No. False Alarms	12.185 (20.082)	6.000	12.367 (22.586)	8.000
Pct. Attention	.847 (.196)	.951	.879 (.131)	.929
Prob. of a Hit	.441 (.277)	.459	.443 (.245)	.461
Response Time				
Continuous Signals	2.632 (2.040)	1.879	2.135 (1.223)	1.719
Momentary Signals	0.804 (0.104)	0.802	0.796 (0.135)	0.780

[a]Standard deviations in parentheses

Table 5

Complete and partial data subjects
session one vigilance variables
means, medians and standard deviations[a]
(n's = 105 and 32)

	Subjects with complete data		Subjects with partial data	
	Mean	Median	Mean	Median
Average Length				
Attentive Episode	4.252 (5.362)	2.350	3.580 (5.456)	2.504
Inattentive Episode	3.507 (3.010)	2.658	22.554 (105.422)	3.215
False Alarm Rate	0.050 (0.053)	0.037[b]	0.089 (0.140)	0.052[b]
No. False Alarms	14.705 (15.992)	11.000[c]	26.188 (42.080)	14.500[c]
Pct. Attention	.926 (.097)	.968[c]	.877 (.143)	.932[c]
Prob. of a Hit	.496 (.235)	.494	.440 (.206)	.409
Avg. Response Time				
Continuous Signals	1.819 (1.151)	1.385	2.009 (1.225)	1.621
Momentary Signals	0.805 (0.09)	0.796	0.823 (0.096)	0.820

[a]Standard deviations in parentheses

[b]Medians differ, $p < .05$

[c]Medians differ, $p < .10$

Table 6

Complete and partial data subjects
session two vigilance variables
means, medians and standard deviations[a]

	Subjects with complete data		Subjects with partial data	
	Mean	Median	Mean	Median
Average Length				
Attentive Episodes	4.738 (6.643) n = 105	2.176	3.675 (3.656) n = 22	1.825
Inattent. Episodes	10.955 (58.364)	4.013[b]	35.412 (126.270)	7.885[b]
False Alarm Rate	0.041 (0.070)	0.023[c]	0.075 (0.081) n = 23	0.050[c]
No. False Alarms	12.181 (21.010)	7.000	14.000 (14.039)	10.000
Pct. Attention	.856 (.174)	.938[c]	.735 (.186)	.726[c]
Prob. of a Hit	.435 (.263)	.453	.340 (.267)	.304
Avg. Response Time				
Continuous Signals	2.655 (2.716)	1.807[b]	4.116 (3.598)	3.360[b]
Momentary Signals	0.801 (0.120	0.796	0.766 (0.133)	0.772

[a]Standard deviations in parentheses

[b]Medians differ, $p < .05$

[c]Medians differ, $p < .005$

CHAPTER 3

RESULTS: COGNITIVE VARIABLES

Implicit to claims about television's negative impact on attention is the assumption that one's ability to recruit and maintain attention is a stable characteristic, consistent across situational demands. Exposure to television purportedly shortens the child's attention span in all variety of tasks and as a result (or at least in conjunction with this) the child is more restless, perhaps hyperactive, and is intolerant of delays. The primary aim of the cognitive variable analyses, then, was to determine whether the pattern of correlations between variables generally supported or refuted these notions. For example, are behavioral tendencies at home related to attentional patterns exhibited in the laboratory? Is there any correspondence between attentional style when engaged in a cognitively receptive activity such as television viewing and that employed during more attention demanding tasks such as the Banta puzzle and vigilance task? In general, are there consistent individual differences in the tendency or ability to sustain attention in a variety of tasks?

Correlations within Tasks

As a preliminary step to cross task correlational analyses, within task correlations were calculated for each task, by sex and for the group as a whole. Examination of the within task correlations served several purposes.

First, it was important to determine whether any of the measures from a particular task were redundant. Second, by providing information about how different aspects of behavior were related within a task, these correlations might provide guidance in predicting and interpreting cross-task correlational results. Third, as part of the within task correlational analyses, reliabilities across vigilance sessions were calculated. These correlations provided important information about the consistency with which attention (both overt and covert) was deployed, i.e. the extent to which sustained focused processing and visual orientation might be stable characteristics.

Before correlations were calculated, scatter plots were examined for possible outliers and obvious departures from linearity and bivariate normality. Scatter plots of correlated bivariate normal variables are elliptical (Stevens, 1986). The Parent Temperament Questionnaire plots showed no evidence of curvilinearity and were generally elliptical. The Banta, KRISP, laboratory TV viewing and vigilance plots, on the other hand, were neither linear, nor elliptical. The lack of bivariate normality was expected since only two of the sixteen variables from these four tasks were themselves normally distributed (a necessary but not sufficient condition for bivariate normality).

Of the fourteen non-normal variables, eight were measures of time best fit by a lognormal distribution and

four were count variables best fit by the normal distribution after being subjected to a square root transformation. Variables that are counts or measures of time are often so distributed (Cohen and Cohen, 1975, Chapter 6).

When square root and logarithmic transformations successfully normalize data, they do so primarily by "pulling-in" data that comprise the long right tail. Such radical altering of the original distribution is theoretically justified when it is believed that the underlying construct being measured accrues at a diminishing rate (Cohen and Cohen, 1975, p. 251). In the present context it might be argued that attentional engagement accrues at a diminishing rate over time. While not designed to directly test this hypothesis, studies which have examined the time course and nature of play episodes and looks at the television provide some supportive evidence. Looks at TV and play episodes are lognormally distributed both within and across subjects. Plots of the conditional probability that TV looks (or play episodes) are maintained through successive three second intervals show <u>negatively accelerated</u> increasing curves, and several studies have suggested that this pattern reflects underlying changes in the strength of attentional engagement (c.f. Anderson, Choi and Lorch, 1987; Choi and Anderson, in preparation; Lorch and Castle, 1986). If this is the case, logarithmic transformations would be theoretically justified; they would

accurately reflect that additive changes in attentional engagement are associated with proportionate changes in the length of looks. One would expect attentional engagement to be similarly related to the length of looks and processing episodes measured in the Banta and vigilance tasks.

The variables were, therefore, transformed and scatter plots were again examined. Many of the plots were clearly more linear. Before transformation, for example, percent visual orientation to Sesame Street increased with average look lengths at a negatively accelerated rate, leveling off at approximately forty seconds. In other words, increasingly larger increments in average look length were necessary to "effect" the same unit change in percent visual orientation. When average look lengths were lognormally transformed, however, the function had constant slope (i.e. was linear) and was considerably more elliptical. This suggests that the increasingly larger increments were actually indicative of constant proportionate change. An added benefit of the transformations was improved homoschedasticity. This ensures more accurate estimates of population correlation coefficients.

In the correlational analyses which follow, Fisher Z transforms were used to test comparisons of correlations across sex (Cohen and Cohen, 1975). As Steiger (1980) recommends for sample sizes greater than 30, Z_1 was used to test whether a single variable was more correlated with one

of two other variables (i.e. $r_{12} = r_{13}$). Bonferroni's inequality was used to keep family-wise alpha at a five percent level unless otherwise noted.

Attention to TV

Since none of the correlations between variables from this task differed significantly by sex (see Table 7), male and female data were combined. As can be seen in Table 8, percent visual orientation to the screen was the best summary measure of attentiveness to Sesame Street in the lab. It was significantly correlated with all other variables from this task (r must exceed .207 to limit Type I error to five percent for the matrix). There were apparently many distinct styles of attention to the screen; the frequency of attentional shifts bore little relation to percent visual orientation, and average look and pause lengths were uncorrelated. The frequency of attentional shifts appeared to index a general restlessness. Subjects with more looks had significantly shorter average looks both at and away from the screen (r's = -.736 and -.500, respectively). That the number of looks was not equally predictive of cumulative time oriented to the screen suggests that such restlessness was not as a rule disruptive of attention to the program. Of course processing may have been "shallower" and comprehension poorer for these subjects. Alternatively, since audio information was available even when not looking, looks away may not have

been indicative of total disengagement with program material.

Banta Puzzle

The relative lack of a relation between number of looks and cumulative attention was not duplicated when confronted with a frustrating problem-solving task. Number of looks away was the best summary measure of attention to the Banta puzzle. It was substantially correlated with both time to first look away and total time on task. Children who looked away frequently, also terminated their first look sooner (r = -.653, b = -.791, t = -15.528, n = 326, $p < .001$) and actively worked for cumulatively less time (r = -.537, b = -13.424, t = -11.473, n = 326, $p < .001$) than children with few looks away. As can be seen in Table 9, these relations were generally consistent across sex, although when a girl who was apparently uninterested in the task (only 114.6 total seconds on task and three looks away from the puzzle, Cook's distance = 4.73) was deleted, the relation between number of looks away and time on task was greater for girls than boys (r's = -.672 and .563, Z = 2.095, $p < .02$). Thus, whether restlessness was a by-product of frustration with the Banta puzzle or whether a general tendency to be restless interfered with the task of remaining focused on the task, the two appeared to be more closely linked in this environment than in the television viewing context, especially for girls.

It is also interesting to note that time to first look away was only moderately correlated with total time on task (r = .393, b = .019, t = 7.688, $p < .001$). Thus, perseverance when initially confronted with the task was not an especially good predictor of the willingness to persevere over the entire time allotted.

Temperament

Distractibility and persistence were moderately correlated in the direction one would expect. Children who were more persistent were somewhat less distractible (r = -.358, b = -.475, t = 6.93, n = 328, $p < .001$). This relationship was relatively constant across sex (r's = -.378 and -.345 for females and males, respectively). Also similar across sex (r's = -.169 and -.141), but counter intuitive, was the small negative correlation between activity level and distractibility scores (r = -.167, b = -.166, t = -3.052, n = 328, $p < .003$). It is unclear why children who were reported to be more active motorically would be less distractible. Perhaps parents who perceived their child to be more active had more difficulty in altering the same child's focus of attention. In any case, the variables shared less than three percent of their variance. It should be noted that unlike the variables from the cognitive tasks, the subscales from the Parent Temperament Questionnaire were not expected to be highly correlated with one another. The subscales were specifically designed to quantify distinct traits, and were

most likely derived via a factor or principal components analysis.

Vigilance

It was reported in the Methods section that performance deteriorated somewhat from session one to session two. As can be seen in Table 10, however, reliabilities were generally high. Percent visual orientation to the CRT was the most consistent across sessions ($\underline{r}$ = .831, $\underline{t}$ = 14.985, $p < .001$), average attentive episode length was the least ($\underline{r}$ = .522, $\underline{t}$ = 6.148, $p < .001$). With the exception of the number (.866 versus .626, $Z = 2.12$, $p < .02$) and rate (.865 versus .605, $Z = 2.425$, $p < .01$) of false alarms, reliabilities were equivalent across sex. Girls were significantly more consistent in the number of false alarms committed than boys. As was reported above, boys had significantly more false alarms than girls in session one, but dropped to an equivalent number in session two.

In light of these substantial reliabilities, a decision was made to average performance across sessions for the correlational analyses. While information about session variability is undeniably lost, this method has at least three significant advantages. First, extreme scores, which pose particularly difficult problems for correlational analysis, are made less so. Second, it reduces the number of correlations to be presented by half. Third, while fatigue may have affected session two performance, the

differences were small, and as a measure based on two observations, the average is likely a better estimator of subjects' true scores. Thus, except where patterns were markedly different across sessions, the correlations reported below were based on average scores.

Presented in Table 11 are summary statistics for the averaged variables. Again, the only variable that was approximately normally distributed was the probability of a hit. The only variables to show significant sex differences were the number and rate of false alarms. The boys' median scores were higher than the girls' (10 versus 7, R_1 = 58.225, R_2 = 46.352, Z = 2.012, $p < .045$; .035 versus .023, R_1 = 58.633, R_2 = 45.213, Z = 2.412, $p < .017$).

Attentiveness in the vigilance task was measured on three levels. Average attentive episode length indicated the length of time for which the subject was able to continuously monitor Blinky Bug's movements (i.e. was continuously alert). The probability of a hit measured success in remaining alert during the entirety of the task. Finally, the cumulative level of visual attention was indexed by percent visual orientation.

It was noted in the Methods section that while visual orientation to the screen was generally high, success in remaining alert to Blinky Bug's movements was considerably lower. This suggested that at least some of the time spent visually oriented to the screen involved periods when focused processing had lapsed. If subjects <u>had</u> been alert

whenever looking at the CRT, one would expect the correlation between percent visual orientation and the probability of a hit to approach one (see Table 12). In fact, the probability of a hit accounted for less than forty-two percent of the variability in visual orientation ($\underline{r}$ = .648, b = .348, $\underline{t}$ = 8.541, n = 103, p < .001). Thus, while success in the vigilance task required visual orientation to the CRT, the two were not synonymous.

It should be noted that the relation between visual orientation and the probability of a hit was somewhat greater for girls than boys ($\underline{r}$'s = .717 and .524, Z = 1.634, p < .058, one tailed). Thus, girls were somewhat more likely to be cognitively engaged with the task when oriented to the CRT than boys. In other words, when not focused on Blinky Bug's movements, girls were somewhat more likely to look away than boys.

A look away was by definition a period of inattention. This explains why the largest correlates of percent visual orientation were the average response time to continuous signals ($\underline{r}$ = -.786, b = -.173, $\underline{t}$ = -12.793, n = 103, p < .001) and average inattentive episode length ($\underline{r}$ = -.670, b = -.107, $\underline{t}$ = -9.078, n = 101, p < .001). These correlations did not differ by sex (see Table 13).

Also substantially correlated for both boys and girls (see Table 13), were the probability of a hit and average attentive episode length ($\underline{r}$ = .750, b = .172, $\underline{t}$ = 11.380, n

= 103, $p < .001$). Subjects who managed to be more alert over the ten minute task, did so by sustaining individual bouts of focused processing for longer periods of time. It should be recalled, however, that most subjects' attentive episodes lasted on average for only several seconds. Thus, even the most successful subjects had to repeat the process of recruiting and sustaining attention at least several times.

While most of the correlations between vigilance measures were the same across sex, those involving the number of false alarms were not. Girls', but not boys', false alarms were significantly negatively correlated with percent visual orientation to the CRT ($\underline{r} = -.518$, $b = -6.597$, $\underline{t} = -4.364$, $n = 54$, $p < .001$). Given the substantial negative correlations between measures of inattention and visual orientation, it follows that girls' false alarms would be positively correlated with response time to continuous deviations ($\underline{r} = .446$, $b = .554$, $\underline{t} = 3.595$, $p = .001$) and average inattentive episode length ($\underline{r} = .435$, $b = .194$, $\underline{t} = 3.482$, $p = .001$). All three tests for sex differences were significant (all Z's > 1.991, $p < .047$).

Since boys had more false alarms than girls only in session one, one might expect that the differences in correlations with false alarms originated there. Examination of the correlations in Table 14 reveals, however, that the opposite was true. It was only in session two that girls' false alarms were significantly correlated

with visual orientation (r = -.571, b = -.054, t = -5.016, n = 54, $p < .001$), response time to continuous signals (r = .535, b = .186, t = 4.571, $p < .001$), and average inattentive episode length (r = .522, b = .237, t = 4.410, $p < .001$). It is not obvious why longer looks away and cumulatively less time spent visually oriented to the CRT would be associated with more false alarms, especially only for girls and only in session two.

False alarms might have been indicative of impulsivity. The literature on impulsivity suggests that non-strategic (i.e. impulsive) responding in the KRISP might be attributable in part to a lack of ability, or willingness, to sustain effort. Since the second vigilance session took place after completing all other laboratory tasks, both increased false alarms and reduced visual orientation might have been the product of fatigue in sustaining effort. This interpretation is supported by the significant negative correlation between girls' false alarms and the probability of a hit (r = -.420, b = -.056, t = -3.334, $p < .003$). Girls who over the course of the vigilance task were less successful in remaining alert, also produced more false alarms.

It is interesting to note that for neither sex in either session were false alarms significantly correlated with the average length of attentive episodes. Thus, if girls' second session false alarms represent an impulsivity

born of cognitive fatigue it is not fatigue in the sense of sustaining individual episodes of focused processing. Rather what appears to be involved is fatigue at the level of persevering in general, of consistently reasserting effort to be both visually oriented and cognitively alert after the previous episode of processing had lapsed.

As we have already seen (see Table 10), the degree to which subjects persevered in this sense was markedly consistent across sessions. In fact, the measures that were most correlated across sessions were the cumulative level of visual orientation and overall success in remaining alert to Blinky Bug's movements. Moreover, while not different from one another, the reliabilities for percent visual orientation ($Z^*_2 = 8.29$, $p < .001$) and the probability of a hit ($Z^*_2 = 6.211$, $p < .001$) were both significantly larger than that obtained for average attentive episode length. Thus, if a cross situational ability to sustain attention exists it likely involves the ability to persevere in general and not the ability to continuously sustain individual bouts of focused processing. In other words, when attentional deployment is compared across situations where task demands differ, one is most likely to observe consistent individual differences in the cumulative levels of visual orientation and cognitive engagement exhibited and least likely to observe them in the spans of engagement by which these cumulative levels were achieved. Perhaps when parents, educators and critics of TV use the term "attention

span" it is not the individual spans of engagement to which they refer but rather the degree to which individuals persevere in general.

In sum, the within task correlations for the vigilance task suggest that there is a distinction between visual orientation and focused processing. Visual orientation to the CRT was not always accompanied by attentive processing of the signals presented there. There also appeared to be a distinction between the ability to continuously sustain an episode of focused processing and the tendency to persevere over the course of the task. While substantially positively correlated with one another, the former was uncorrelated with cumulative levels of visual orientation and with false alarm behavior; the latter was correlated with both, especially for girls. Finally, the correlations between session one and session two performance suggested that the most consistent individual differences involve perseverance at the level of whether the child continued to persevere, both in terms of visual orientation and cognitive effort, throughout the time allotted. The average length of individual episodes of cognitive effort showed considerably more within subject variability.

Cross Task Correlational Analyses

As noted at the start of this section, a primary aim of this project was to determine the extent to which preschoolers exhibit a characteristic ability to sustain

attention in a variety of contexts. It was also of interest to determine whether and how such a characteristic "attention span" might be related to impulsivity and restlessness. As we have seen, the correlations between measures from the same task have provided some insight into the answers to these questions. A more appropriate approach to these problems, however, would involve comparing attentional performance in tasks with different cognitive demands.

Sustained Attention

The cognitive demands of the Banta and vigilance tasks clearly varied. One was designed as a measure of perseverance in a frustrating task, the second was more similar to the traditional signal detection type tasks. The correlations between Banta and vigilance measures are presented by sex in Table 15. Since none of the relations differed significantly by sex, only those based on combined data are discussed (see Table 16). Nine of the twenty-one correlations between Banta and vigilance measures were significantly different from zero. The largest of these correlations was between percent visual orientation to the CRT and total time oriented to the Banta puzzle (r = .640, b = 144.028, t = 8.328, n = 102, $p < .001$). In fact, cumulative time spent oriented to the puzzle was more correlated with each vigilance variable than either of the other two Banta measures. Similarly, percent visual orientation to the CRT was more correlated with all three

Banta variables than any other vigilance measure. Thus, there appear to be consistent individual differences in the extent to which subjects persevered in remaining visually oriented to task materials, both across the two vigilance sessions and across different task environments as well.

It was more difficult to assess whether individuals were also consistent in the extent to which they successfully sustained focused processing in different tasks. While the probability of a hit indexed success in sustaining focused processing over the time course of the vigilance task, there was no analog measure for the Banta puzzle. One would expect, however, that active involvement with the puzzle would require visual orientation toward it. As can be seen in Table 16, total time oriented to the Banta puzzle was positively correlated with the probability of detecting Blinky Bug's deviant jumps ($\underline{r}$ = .423, b = 51.044, $\underline{t}$ = 4.662, n = 102, $p < .001$). Moreover, since time spent visually oriented to the Banta puzzle might have included periods when focused processing had lapsed (the within task correlations revealed that this was definitely the case in the vigilance task), the correlation between actual levels of sustained focused processing in the two tasks may have been more substantial. It appears, then, that performance in the Banta and vigilance tasks was influenced not only by the specific demands of each task but by individual differences in the ability or willingness to sustain both

focused processing and visual orientation over the time course of any task.

The next question to be addressed was whether bouts of focused processing also showed consistent individual differences across task environments. In other words, did the subject who continuously monitored Blinky Bug's movements for longer periods of time, on average, also exhibit longer bouts of actively working on the Banta puzzle than other subjects.

One means of addressing this question was to examine the correlation between the average length of attentive episodes in the vigilance task and the time to the first look away from the Banta puzzle. As can be seen in Table 16, there was a small positive correlation between these two variables ($r = .216$, $b = .265$, $t = 2.210$, $n = 102$, $p < .03$); small enough not to be significant when a Bonferonni procedure was used to control the error rate for the matrix. Of course, time to the first look away from the Banta puzzle may not have been representative of the average length of all such looks. If not, then the correlation calculated was not an accurate test of whether individual differences in the average length of attentive episodes exist.

Another approach was feasible. It involved estimating the average length of looks at the puzzle. Experimenters recorded both the number of looks away from the puzzle and total time oriented to the task. Since every child with zero looks away was recorded as having been oriented for a

total of five minutes (the duration of the task), it was assumed that all children were visually oriented at task onset. The experimenters did not note whether the child was looking at or away from the puzzle when the task was terminated. The actual number of looks at the puzzle, then, was either equal to the number of looks away, or it exceeded that number by one. Two estimates of average look length were therefore calculated by dividing total time on task by each of these numbers.

The smaller of the two estimates was most correlated with the average length of attentive episodes in the vigilance task ($\underline{r}$ = .238, b = .201, $\underline{t}$ = 2.453, n = 102, $p < .02$). Since this was the least reliable vigilance measure, the correlation was also calculated separately for each vigilance session. While the relation was somewhat more substantial for session two ($\underline{r}$ = .250, b = .168, $\underline{t}$ = 2.584, $p < .012$) than one ($\underline{r}$ = .113, b = .086, $\underline{t}$ = 1.138, $p < .258$) the difference was not significant ($Z_1 = .836$). Thus, the average length of time for which an individual remained visually oriented to the Banta puzzle bore little relation to the average length of time for which he or she was able to remain continuously alert in the vigilance task.

It is possible that bouts of focused processing in the two tasks actually were substantially correlated but that our measures were too crude to detect the relation. As noted above, looks at the puzzle may have included periods

when the commitment of processing resources had lapsed. Thus, the small correlations cannot be considered proof that there are no individual differences in the length of time for which focused processing can be continuously sustained. On the other hand, they offer little convincing evidence to the contrary. Moreover, in light of the fact that the average length of attentive episodes showed the least consistency (of the all the vigilance measures) across vigilance sessions, it is unlikely that the average length of time for which processing is sustained in different tasks is as correlated as the cumulative levels of visual orientation and focused processing ultimately achieved were found to be.

Impulsivity and Sustained Attention

The data presented thusfar suggest that a characteristic tendency to persevere does exist. As already noted, there has been some suggestion in the impulsivity literature that the tendency or willingness to sustain effort impacts the pattern of responding likely to be exhibited in the match-to-standard task. Specifically, if one is incapable or unwilling to persevere, then it is impossible to systematically compare sample drawings to the standard. The lack of strategic examination is likely to result in more errors. This suggests that perseverance in the Banta and vigilance tasks should be negatively correlated with the number of errors committed in the KRISP.

The correlations between KRISP and Banta variables are presented by sex and for all subjects in Table 17. Although the correlations were generally larger for girls than boys, none of the differences were significant (even at a ten percent single test alpha level). Thus, discussion is limited to the correlations based on combined data. As can be seen in Table 17, though small, all three correlations were significantly different from zero. The smallest two indicated that subjects who were more accurate in the KRISP tended to continuously attend to the Banta puzzle for longer periods of time. Children with fewer KRISP errors worked longer before their first look away ($\underline{r}$ = -.160, b = -.274, $\underline{t}$ = -2.918, n = 326, $p < .008$) and looked away from the Banta puzzle fewer times overall ($\underline{r}$ = .172, b = .243, $\underline{t}$ = 3.150, n = 326, $p < .008$). The largest correlation, however, involved total time oriented to the Banta task. Children who spent cumulatively more time working on the Banta puzzle made fewer errors in matching KRISP drawings to the standard ($\underline{r}$ = -.246, b = -8.672, $\underline{t}$ = -4.565, n = 326, $p < .001$). Thus, while other factors clearly contribute, it appears that KRISP accuracy may well have been influenced by the subject's tendency or ability to keep trying, to persevere.

If this is the case, then the number of errors in the KRISP should also correlate negatively with the probability of a hit and/or visual orientation to the CRT. In fact, as can be seen in Table 18, the number of KRISP errors was significantly correlated with both the probability of

detecting Blinky Bug's deviant jumps (r = -.297, b = -1.103, t = -3.125, n = 103, $p < .003$) and percent visual orientation to the CRT (r = -.350, b = -2.421, t = -3.757, n = 103, $p < .001$). Closer examination revealed, however, that these relations were limited to the female subjects (see Table 19).

Girls with more KRISP errors were less likely to remain visually oriented to the CRT (r = -.469, b = -3.077, t = -3.831, n = 54, $p < .001$) and detected a smaller proportion of Blinky Bug's deviant jumps (r = -.454, b = -.169, t = -3.675, n = 54, $p < .002$). Moreover, since visual orientation to task materials was closely related to the length of inattentive episodes (see Correlations within Tasks, above), the number of KRISP errors for girls was predictably correlated with average inattentive episode length (r = .510, b = .590, t = 4.275, n = 54, $p < .001$) and average response time to continuous signals (r = .584, b = .871, t = 5.183, n = 54, $p < .001$) as well. All four correlations were significantly different from those obtained for boys (all Z's > 1.864, $p < .063$).

Although inconsistent with the Banta results, which were equally valid for boys and girls, these results would seem to support the suggestion made earlier (see Correlations within Tasks) that impulsivity and cognitive effort might be more correlated in girls than boys. This suggestion was originally offered as an interpretation of

why only girls' false alarms were correlated with the probability of a hit and visual orientation in the vigilance task. One might expect, then, that the number of KRISP errors would be positively correlated with the number of false alarms for girls.

The correlation for girls was significant using a five percent single test alpha (r = .277, t = 2.079, n = 54, $p <$ .043). It did not, however, exceed the critical value set when controlling Type I error rate for the family of correlations. Since it was only in session two that false alarms were related to visual orientation and cognitive effort, one might expect that the correlation with KRISP errors would also be largest for session two. In fact, the correlation in session two was somewhat larger (r = .316, t = 2.402, n = 54, $p <$ .020) than that found for session one (r = .209, t = 1.543, n = 54, $p <$ .129), but neither was significant using a five percent family-wise alpha. Thus, while a consistent tendency to sustain effort and visual orientation may have contributed to impulsivity in the vigilance and KRISP tasks, the level of impulsivity exhibited in each was considerably less consistent.

As already noted, one means by which a tendency to sustain effort might improve accuracy in the KRISP is by enabling the subject to carry-out comparison strategies. If subjects are carrying-out a strategic comparison of sample drawings to the standard, one might expect them to take longer to formulate a response. This implies that response

latencies in the KRISP should be related to the visual orientation and cognitive engagement measures derived from the Banta and vigilance tasks. As can be seen in Tables 17, 18, and 19, however, the average latency to respond was not correlated with any of the Banta and vigilance measures for either sex or for the group as a whole.

It is unclear, then, by what means increased cognitive effort and visual orientation would contribute to better accuracy in the KRISP. Perhaps IQ contributed to both KRISP accuracy and perseverance in the Banta and vigilance tasks. Subjects with higher IQ's may have (in the past) experienced more success in difficult tasks, or may have been less challenged by the Banta puzzle and the vigilance task and, therefore, were more inclined to persevere.

As can be seen in Table 20, although IQ was not highly correlated with attention to the Banta and vigilance tasks, it was significantly negatively correlated with KRISP accuracy ($\underline{r} = -.290$, $b = -.016$, $\underline{t} = -5.446$, $n = 326$, $p < .001$), for the group as a whole and for each sex individually. Moreover, though not significantly different from zero using a Bonferroni procedure, the correlations with measures of girls' visual orientation in the vigilance task were significantly different from those obtained for the boys. It was of interest, then, to determine whether the variability shared by the number of KRISP errors and

perseverance in the vigilance and Banta tasks could be attributed to differences in IQ.

Table 21 presents the partial correlations (by sex and for all subjects) tested by the regression coefficient associated with each. The zero order correlation between first look away from the Banta puzzle and the number of KRISP errors may have been a consequence of the variability each measure shared with IQ. The same might be said of the number of looks away from the Banta puzzle and the number of KRISP errors for boys. As can be seen in Table 21, it was only these relations that failed to be significant after controlling for IQ. The remainder of significant zero-order correlations between Banta and vigilance measures and the number of KRISP errors apparently involved variability that was unique with respect to IQ. Thus, the positive relation between KRISP accuracy and a general tendency to persevere was not attributable to differences in intellectual competence.

To some extent, KRISP accuracy measures the ability to selectively focus attention (on detail). The vigilance and Banta measures index the ability to sustain attention over time. Perhaps what is driving the correlations between the two, then, is a general ability to control attentive processes. If this is the case, the sex differences suggest that girls may be more consistent in the extent to which they exert this control in different tasks.

To summarize, the cross task correlational analyses have thusfar partially confirmed the assumption underlying many claims of television's deleterious effects, namely, that children have a characteristic attentional style. Visual orientation to task materials was highly consistent not only across vigilance sessions but across both tasks (Banta and vigilance) in which it was measured. There were also indications that cognitive effort, in the sense of focused processing, was somewhat consistently sustained over the time course of both tasks. Due to the non-parallel nature of the measures involved, however, it was unclear whether the actual relation was more substantial. The same uncertainty applied to the smaller correlations involving measures of the average length of time for which individual processing episodes were sustained. Thus, while there was little evidence of a characteristic span of attention, the possibility of its existence could not be ruled out. It was noted, however, that given the pattern of vigilance reliabilities, it was unlikely that individual differences in "attention span" were as marked as those found for persevering in general (in sustaining visual orientation and focused processing over the entirety of each task).

There was some evidence that the tendency to persevere in sustaining cognitive effort and visual orientation may have contributed to success in the KRISP task, especially for girls. IQ was examined as a possible source of this covariation. As a significant predictor of both KRISP

accuracy and the duration of the first episode of attention to the Banta puzzle, IQ was found to account for their shared variability. The remaining correlations between the number of KRISP errors and attention (overt and covert) to the Banta and vigilance tasks were independent of IQ. Thus, by what means the tendency to persevere might have improved KRISP accuracy was unclear, especially since time to make a KRISP response was uncorrelated with any of the measures of cognitive effort and visual orientation. The possibility was raised that these correlations indicate a relation between the ability to selectively focus and sustain attention, especially for girls.

Attention to Television

Many claims of television's deleterious effects on attention originate from concern over hours spent with programs like Sesame Street that require only short spans of attention for comprehension of their segments. Some critics hypothesize that the patterns of attention fostered by these programs transfer to other task environments. Other critics have hypothesized that children are mesmerized by the density of formal features characteristic of programs like Sesame Street. As a consequence of either displacement, lack of practice, or dependence on attention-getting devices, these children become incapable of sustaining attention in other contexts. Thus, this hypothesis might predict that it is the children who are most attentive to

television that are most susceptible to its deleterious effects. Both hypotheses would expect attention to television to be correlated with the ability to maintain attention in experimenter imposed tasks.

In fact, attention to television was generally uncorrelated with performance in any of the cognitive tasks (see Tables 22, 23 and 24). Boys' KRISP reaction times did correlate negatively with proportion of time spent looking at the TV screen ($\underline{r}$ = -.222, b = -.479, $\underline{t}$ = -1.998, n = 79, $p < .05$). The same trend was not significant for girls ($\underline{r}$ = -.020, b = -.041, $\underline{t}$ = -.177, n = 83, $p > .05$), however, nor was the difference in correlations statistically significant ($Z = 1.286$, $p > .05$). This suggests that the correlation is the same for both populations and that it should be estimated using combined data. This correlation was not different from zero ($\underline{r}$ = -.122, b = -.265, $\underline{t}$ = -1.554, n = 162, $p > .05$). The only other significant correlation indicated that children who looked away from the TV for longer average periods of time, also tended to have more false alarms in the vigilance task ($\underline{r}$ = .246, b = .908, $\underline{t}$ = 2.463, n = 96, $p < .02$). For either sex alone, this trend was only marginally significant.

In fact, if a Bonferonni procedure were used to maintain a five percent Type I error rate for each matrix, none of the correlations between TV viewing variables and performance in the the Banta, KRISP and vigilance tasks would be significantly different from zero. Moreover, the

relations seemed to contradict one another. One suggested that (for boys) increased attention to TV was associated with more impulsive KRISP behavior, the other indicated that more looking away from the screen was associated with random, perhaps impulsive, behavior in the vigilance task. It seems unlikely that both of these relations were real. In any case, there was scant evidence to support the hypothesized link between attention to TV (at least Sesame Street) and attentional behavior in other task environments. This clearly contradicts the hypothesis that the attentional patterns fostered in the television viewing situation transfer to other contexts.

Parent Temperament Questionnaire

Although sustained attention while viewing television was generally unrelated to sustained attention while tackling laboratory tasks, the possibility remained that one or the other or both might be related to behavioral tendencies observed at home. The popular books and magazine articles which warn of television's negative effects on attention often cite anecdotal reports by parents. Many are similar in vein to Halpern's description (see Chapter One) which suggests that television-mesmerized children are subsequently hyperactive and easily distracted. Thus, attention to Sesame Street in the laboratory might be related to parent reported levels of distractibility, motoric activity and persistence.

Attention to the other laboratory tasks might also be related to PTQ scores. Some of the items contributing to PTQ scores, for example, involved activities such as toy play. Like the cognitive tasks in the laboratory, these activities involve active manipulation of task materials. Moreover, the temporal structure of that interaction is entirely determined by the child. Other items contributing to PTQ scores were similar to the laboratory testing situation in general. Specifically, they rated the child's response(s) to adults attempts to direct behavior and/or the focus of attention. Finally, the popular literature often links the shortened attention span purported to result from television viewing with hyperactivity. This suggests that as a measure of the tempo, frequency and level of motor activity in the home, the activity level might correlate with sustained attention in the laboratory tasks.

Tables 25 and 26 present the correlations between PTQ scores and the cognitive task measures (including watching Sesame Street) by sex and for all subjects, respectively. It will be recalled that boys were assigned significantly higher activity level scores and that girls had significantly higher scores on the distractibility subscale. The parent reports suggested, then, that boys were engaged in motor activity and girls were distractible in more situations than the opposite sex. Thus, one might expect to observe sex differences in the correlations between these subscales and performance in the cognitive tasks. In no

case, however, did the tests for sex differences produce significant results.

For the group as a whole, only activity level was linearly related to any measure from the cognitive tasks. Three correlations were significantly different from zero. All three seemed to indicate a relation between level of motoric activity at home and that exhibited in the lab. The number of looks away from the Banta puzzle ($\underline{r}$ = .150, b = 11.257, $\underline{t}$ = 2.735, n = 326, p = .007) and the number of KRISP errors ($\underline{r}$ = .150, b = 15.876, $\underline{t}$ = 2.737, n = 327, p = .007) were equally positively correlated with activity level scores. The correlation with the number of vigilance false alarms was somewhat larger ($\underline{r}$ = .264, b = 13.898, $\underline{t}$ = 2.746, n = 103, p = .007). It should be noted that since boys' activity level scores were higher on average than girls', using this equation would produce higher estimates of false alarms for boys, on average, than for girls. In fact, boys did have significantly more false alarms than girls. The correlation with activity level scores suggests that this may have been the case because boys in general exhibit a heightened level of physical activity relative to girls.

Of course, all three correlations were small (activity level scores accounted for no more than seven percent of the variability in any of the laboratory measures). There was considerable variability, then, in the number of false alarms, KRISP errors, and looks away from the Banta puzzle

within groups of subjects with the same activity level scores. Thus, while there was a tendency for children who were more active at home to be more physically active in the laboratory, the relation was not an especially strong one.

Several other things about the correlations between PTQ scores and performance in the Banta, KRISP, and vigilance tasks should be noted. First, at least for this sample of preschoolers, there was no indication that activity level (hence, hyperactivity) is related to the ability to sustain attention. Nor was the ability to sustain attention (either overtly or covertly) related to parent perceptions of distractibility and persistence. Thus, either parents make poor judgments of their child's ability to persist, or the temperament evident in social situations and routine activities is largely unrelated to cognitive competence in sustaining attention when confronted with relatively novel and cognitively challenging tasks.

Only one correlation between the PTQ and TV variables was significant, and it involved distractibility. Intuitively, one might expect distractibility scores to be positively correlated with the number of looks away and/or negatively associated with the length of looks at the screen. Instead, distractibility scores were negatively correlated with pause lengths ($\underline{r}$ = -.207, b = -36.564, $\underline{t}$ = -2.674, p = .008). It is unclear why this would be the case.

In sum, just as attention to television was unrelated to performance in the cognitive tasks, it was generally

uncorrelated with perseverance, distractibility and activity level displayed at home. Moreover, parents' perceptions of their child's tendency to be distractible or persistent bore no relation to their child's ability to sustain attention in a variety of laboratory tasks. Perceptions of the child's tendency to be motorically active, on the other hand, did tend to coincide to some degree with laboratory observations.

Summary

The analyses reported in this Chapter attempted to answer the question, do preschoolers exhibit a characteristic attention span? In other words, are individual differences in the ability to sustain attention consistent across a variety task environments? The results suggest that the answer to this question is a qualified yes.

There were consistent individual differences in attentiveness, both in terms of visual orientation and focused processing, across the two ten minute vigilance sessions. Moreover, subjects who persevered in being visually oriented and cognitively alert in the vigilance task also persevered (i.e. spent cumulatively more time actively working) with the Banta puzzle. There was only weak support, however, for the notion that preschoolers were consistent in the length of time for which they could, or would, sustain individual bouts of focused processing (on average). Thus, while subjects who were generally more

perseverant in a task did tend to have longer bouts of attention to it on average, the extent to which they persevered in general was highly consistent across vigilance sessions and tasks, the average span of attention was not.

There was some evidence that the ability or willingness to persevere in general contributed to KRISP accuracy, especially for girls. Although total time oriented to the Banta puzzle was correlated with the number KRISP errors for both sexes, it was only in the female group that KRISP accuracy was also related to perseverance in remaining visually oriented and cognitively alert in the vigilance task. In addition, it was only for girls that the same measures from the vigilance task were found to be correlated with the number of false alarms committed. These findings suggested that impulsivity and sustained cognitive effort (i.e. perseverance) might be more related in girls than boys.

The possibility that the tendency to persevere contributed to KRISP accuracy by enabling the subject to employ a strategic method of comparing sample drawings to the standard was examined. If this was the case, the method was no more time consuming than the more error prone method(s) used by less perseverant subjects. Perseverance in the Banta and vigilance tasks was uncorrelated with average latency to a KRISP response. The possibility that the more perseverant subjects were in general more intellectually competent and therefore more successful in

the KRISP task was also examined but received no support from the data. Removing variability due to IQ left the majority of significant zero-order correlations unchanged. Thus, it was unclear why KRISP accuracy and perseverance were positively correlated, although the suggestion was made that what was being tapped was an ability to control attentive processes in general.

The extent to which the tendency to persevere in laboratory tasks might be characteristic of behavior observed by parents was examined by correlating PTQ subscales with attentional performance in the laboratory. In general, parent reports of distractibility and persistence were unrelated to laboratory behavior. Of course it is possible that the levels of perseverance observed in the lab are similar to those that occur at home but that the PTQ subscales failed to accurately reflect that relation. It has already been noted that items contributing to the persistence and distractibility subscales included both perseverance in cognitive tasks and persistent emotional responses, often in social situations. Inclusion of both emotional and cognitive persistence in the same subscale has in the past lead to poor internal consistency (Palisin, 1986). This suggests that emotional and cognitive persistence are unrelated. Moreover, in this case, the combination of the two item types might be responsible for

the lack of coincidence between parent reports and laboratory observations.

The one subscale of the PTQ that did correlate significantly with behavior observed in the laboratory was activity level. Though small, the correlations suggested that there was some tendency for subjects who were more active at home to exhibit higher levels of activity in the lab. Activity level was not, however, correlated with any of the measures of sustained attention. This contradicts the position held by several TV critics that hyperactivity and the ability to sustain attention are related.

Finally, attention to Sesame Street in the laboratory was compared to attention to the other laboratory tasks and to parent reports of persistence, distractibility and activity level. Attention to television was in general uncorrelated with any of these measures. Thus, there was no evidence that subjects who were more attentive to Sesame Street (perhaps "mesmerized" by it) had more difficulty in sustaining attention to the other laboratory tasks than other subjects, nor were they more physically active or restless at home or in the lab. Likewise, subjects who had relatively short looks at the screen were no more or less likely to be attentive in the other tasks. It seems clear, then, that the cognitive demands of television viewing and the other tasks were markedly different and that it is unlikely that patterns of attention fostered by Sesame Street transfer to other cognitive tasks. If time spent

with television does impact the ability to sustain attention (and it is programs with a format similar to Sesame Street that are most often hypothesized to do so), then some mechanism other than transfer is likely involved.

The next Chapter of analyses look for correlational evidence of the hypothesized relation between time spent with TV and attention. If the effects are as widespread as the popular literature claims them to be, the analyses presented thus far suggest that it is not because some fundamental ability to sustain individual episodes of attentive processing has been altered. Rather, widespread effects on attention are more likely to involve a general ability or tendency to persevere. This was the most consistent aspect of attentional performance across tasks. Moreover, if this general tendency to persevere is affected, there was some evidence to suggest that the ability to selectively focus attention might also be impacted (i.e. KRISP accuracy), especially for girls.

Table 7

Correlations among TV viewing variables by sex[a]
females above diagonal, males below
(n's = 84 and 78)

	Percent Attention	No. of Looks	Avg. look Length	Avg. pause Length
Pct. Attention		-.297	.837	-.650
No. of Looks	-.216[b]		-.726	-.495
Avg. Look	.797	-.746		-.163[c]
Avg. Pause	-.708	-.496	-.149[c]	

[a] $p < .008$ when female $|r| > .287$, male $|r| > .298$

[b] $p = .058$

[c] $p > .10$

Table 8

Correlations among TV viewing variables[a]
all subjects with complete TV data
(n = 162)

	Percent Attention	No. of Looks	Avg. Look Length	Avg. Pause Length
Pct. Attention	1.000			
No. of Looks	-.256	1.000		
Avg. Look	.814	-.736	1.000	
Avg. Pause	-.676	-.500	-.148b	1.000

[a] $p < .008$ when $|r| > .207$

[b] $p = .06$

Table 9

Correlations among Banta puzzle measures by sex[a]
females above diagonal, males below
(n's = 167 and 159)

	Time to First Look Away	Time on Task	No. of Looks Away
Time to First Look Away		.410	-.659
Time on Task	.381		-.568[b]
No. of Looks Away	-.650	-.515	

[a] $p < .001$ for all elements

[b] $r = -.672$ when outlier is deleted, which is significantly different from males ($p < .02$)

Table 10

Reliabilities across vigilance sessions

	Females (n = 54)	Males (n = 49)	All Subjects (n = 103)
Average Length			
Attentive Episodes	.624	.550	.522
Inattent. Episodes	.555	.655	.575
False Alarm Rate	.865[a]	.605[a]	.732
No. False Alarms	.866[b]	.626[b]	.744
Pct. Attention	.852	.820	.831
Prob. of a Hit	.820	.750	.789
Avg. Response Time			
Continuous Signals	.573	.686	.605
Momentary Signals	.543	.637	.573

[a] $Z > 3.068$, $p < .001$

[b] $Z > 2.911$, $p < .002$

Table 11

Vigilance measures averaged across sessions
means, medians and standard deviations by sex[a]

	Females		Males	
	Mean	Median	Mean	Median
	(n = 54)		(n = 49)	
Average Length				
Attentive Episode	4.539 (5.787)	2.023	4.216 (4.186)	2.359
Inattentive Episode	4.302 (3.131)	3.451	3.874 (2.751)	3.057
False Alarm Rate	0.042 (0.060)	0.023[b]	0.048 (0.055)	0.035[b]
No. False Alarms	12.47 (17.845)	7.000[b]	14.184 (16.712)	10.000[b]
Pct. Attention	.887 (.142)	.963	.905 (.105)	.944
Prob. of a Hit	.459 (.254)	.490	.482 (.211)	.453
Response Time				
Continuous Signals	2.251 (1.488)	1.831	1.919 (0.995)	1.622
Momentary Signals	0.810 (0.093)	0.813	0.795 (0.102)	0.780

[a]Standard deviations in parentheses

[b]Medians differ, $p < .05$

Table 12

Correlations among vigilance measures[a] all subjects (n = 103)

	Avg. Attent.	Avg. Inatt.	No. False Alarms	Pct. Visual Orient.	Prob. of a Hit	RT Cont.
Avg. Inatten.	.092					
False Alarms	.029	.259				
Pct. Visual	.284	-.670	-.388			
Prob. of Hit	.750	-.557	-.146	.648		
RT Contin.	-.259	.917	.289	-.786	-.795	
RT Moment.	-.057	.479	-.034	-.347	-.359	.531

[a] $p < .002$ when $|r| > .302$

Table 13

Correlations[a] among vigilance measures by sex
females above diagnonal, males below
(n's = 54 and 49)

	Avg. Attent. Episode	Avg. Inatten. Episode	No. False Alarms	Pct. Visual Orient.
Avg. Attent.		-.017	-.020	.390
Avg. Inatten.	.248		.435[b]	-.670
False Alarms	.089	.050[b]		-.518[b]
Pct. Vis. Orient.	.094	-.681	-.205[b]	
Prob. of Hit	.710	-.482	.023	.524
RT Continuous	-.081	.926	.078[b]	-.770
RT Momentary	-.082	.499	-.141	-.493

Continued, next page

[a]Female $|r| > .412$, male $|r| > .431$, $p < .002$

[b]$Z > 1.78$, $p < .074$, two-tailed

Table 13, cont.

	Prob. of Hit	RT Cont.	RT Mom.
Avg. Attent.	.774	-.366	-.030
Avg. Inatten.	-.610	.916	.458
False Alarms	-.271	.446[b]	.075
Pct. Vis. Orient.	.717	-.795	-.246
Prob. of Hit		-.643	-.326
RT Continuous	-.727		.474
RT Momentary	-.402	.606	

Table 14

Correlations[a] between false alarms and other vigilance measures by sex and session

	Session one		Session two	
	Females (n = 54)	Males (n = 49)	Females (n = 54)	Males (n = 49)
Average Length				
Attentive Episodes	.190	-.130	-.140	-.008
Inattent. Episodes	.205[b]	-.192[b]	.522[b]	.136[b]
Pct. Attention	-.322	-.165	-.571[b]	-.205[b]
Prob. of a Hit	-.031	.034	-.420[b]	.042[b]
Avg. Response Time				
Continuous Signals	.155	-.045	.535[c]	.080[c]
Momentary Signals	-.006	-.044	.136	-.310

[a]Female $|r| > .358$, male $|r| > .375$, $p < .008$

[b]$Z > 1.99$, $p < .05$

[c]$Z = 2.58$, $p < .01$

Table 15

Banta performance correlated with vigilance measures by sex
(n 's = 54 and 48)

	Females[a]			Males[b]		
	First Look Away	No. Looks Away	Time on Task	First Look Away	No. looks Away	Time on Task
Avg. Length						
Attentive	.260	-.275	.209	.167	-.176	.360
Inattentive	-.182	.241	-.347	-.226	.268	-.361
False Alarms	-.124	.144	-.380	-.277	-.095	-.113
Pct. Attention	.389	-.535	.672	.398	-.353	.639
Prob. of a Hit	.313	-.339	.364	.334	-.360	.505
Average RT						
Continuous	-.282	.332	-.405	-.322	.341	-.514
Momentary	-.093	.126	-.036	.026	.083	-.357

[a] $p < .002$ when $|r| > .411$

[b] $p < .002$ when $|r| > .435$

Table 16

Banta variables correlated with vigilance measures
all subjects
(n = 102)

Avg. Length	First Look Away	No. of Looks Away	Time on Task
Attentive	.216	-.229	.275
Inattentive	-.198	.250	-.352
No. False Alarms	-.195	.048	-.198
Pct. Attention	.384	-.455	.640
Prob. of a Hit	.316	-.343	.423
Avg. Resp. Time			
Continuous	-.291	.329	-.447
Momentary	-.031	.100	-.204

[a] $p < .002$ when $|r| > .302$

Table 17

KRISP variables correlated with Banta measures by sex and for all subjects (n's = 167 and 159)

	Avg. Response Time	No. of Errors
Females[a]		
First Look Away	-.013	-.177
No. of Looks Away	.057	.224
Time on Task	.030	-.289
Males[b]		
First Look Away	-.091	-.137
No. of Looks Away	.102	.104
Time on Task	-.041	-.206
All Subjects[c]		
First Look Away	-.063	-.160
No. of Looks Away	.080	.172
Time on Task	-.009	-.246

[a] $p < .008$ when $|r| > .205$

[b] $p < .008$ when $|r| > .209$

[c] $p < .008$ when $|r| > .146$

Table 18

KRISP variables correlated with vigilance measures[a]
all subjects
(n = 103)

	Avg. Response Time	No. of Errors
Average Length		
Attentive	-.020	-.175
Inattent.	-.130	.258
No. False Alarms	-.048	.157
Pct. Attention	.140	-.350
Prob. of a Hit	.057	-.297
Avg. Response Time		
Continuous	-.124	.355
Momentary	-.135	.245

[a] $p < .004$ when $|r| > .281$

Table 19

KRISP measures correlated with vigilance variables by sex
(n's = 54 and 49)

	Females[a]		Males[b]	
Average Length	Avg. Resp. Time	No. of Errors	Avg. Resp. Time	No. of Errors
Attentive	-.027	-.171	-.037	-.170
Inattent.	-.223	.510[d]	.014	-.094[d]
No. False Alarms	-.088	.277	-.048	.013
Pct. Attention	.166	-.469[c]	.063	-.129
Prob. of a Hit	.127	-.454[d]	-.076	-.043[d]
Avg. Resp. Time				
Continuous	-.204	.584[d]	.037	-.022[d]
Momentary	-.216	.301	.117	.027

[a] $p < .004$ when $|r| > .385$

[b] $p < .004$ when $|r| > .403$

[c] $Z > 1.86$, $p < .063$

[d] $Z > 2.19$, $p < .028$

Table 20

IQ score correlated with cognitive task variables

Banta[a]	Females (n = 166)	Males (n = 159)	All Subjects (n = 325)
First Look Away	.260	.164	.203
No. Looks Away	-.177	-.085	-.132
Time On Task	.144	.074	.106
KRISP[b]	(n = 166)	(n = 160)	(n = 326)
Avg. Response Time	.043	.017	.046
No. of Errors	-.272	-.322	-.290
Vigilance Task[c]	(n = 54)	(n = 49)	(n = 103)
Avg. Attent. Epis.	.107	.203	.147
Avg. Inatt. Epis.	-.237[d]	.072[d]	-.107
No. of False Alarms	-.251	-.290	-.260
Pct. Vis. Orient.	.253[d]	.052[d]	.182
Prob. of a Hit	.263	.132	.213
RT Continuous	-.289[d]	.003[d]	-.178
RT Momentary	-.202	-.135	-.173

[a]Female $|r| > .185$, male $|r| > .189$, all subjects $|r| > .132$, $p < .017$

[b]Female $|r| > .174$, male $|r| > .177$, all subjects $|r| > .124$, $p < .025$

[c]Female $|r| > .396$, male $|r| > .415$, all subjects $|r| > .290$, $p < .007$

[d]$Z > 1.83$, $p < .068$, two-tailed test

Table 21

KRISP errors correlated with other cognitive tasks
IQ partialled

Banta[a]	Females (n = 166)	Males (n = 159)	All Subjects (n = 325)
First Look Away	-.113	-.090	-.108
No. Looks Away	.187	.081	.141
Time On Task	-.262	-.194	-.226
Vigilance Task[b]	(n = 54)	(n = 49)	(n = 103)
Avg. Attent. Epis.	-.137	-.114	-.130
Avg. Inatt. Epis.	.464	-.075	.235
No. of False Alarms	.190	-.089	.061
Pct. Vis. Orient.	-.411	-.120	-.308
Prob. of a Hit	-.390	-.000	-.238
RT Continuous	.531	-.027	.315
RT Momentary	.242	.132	.197

[a]Female $|r| > .185$, male $|r| > .189$,
all subjects $|r| > .132$, $p < .017$

[b]Female $|r| > .389$, male $|r| > .415$,
all subjects $|r| > .290$, $p < .007$

Table 22

TV variables correlated with Banta and KRISP measures
(n's = 83, 79 and 162)

	Percent Attention	No. of Looks	Avg. Look	Avg. Pause
Females				
Banta				
First Look Away	.078	-.138	.163	.101
No. of Looks	-.170	.071	-.179	.074
Time on Task	.122	-.026	.109	-.043
KRISP				
Avg. Resp. Time	-.020	-.029	.015	.060
No. of Errors	.017	.012	-.043	-.047
Males				
Banta				
First Look Away	-.002	.120	-.091	-.101
No. of Looks	.057	-.019	.048	-.040
Time on Task	.121	-.055	.120	-.049
KRISP				
Avg. Resp. Time	-.222[a]	.069	-.182	.138
No. of Errors	.106	-.117	.138	-.005
All Subjects				
Banta				
First Look Away	.040	-.025	.049	.001
No. of Looks	-.060	.030	-.074	.018
Time on Task	.121	-.040	.114	-.046
KRISP				
Avg. Resp. Time	-.122	-.007	-.065	.115
No. of Errors	.053	-.034	.026	-.030

[a] $p < .06$

Table 23

TV variables correlated with vigilance measures by sex[a] (n's = 51 and 45)

	Percent Attention	No. of Looks	Avg. Look	Avg. Pause
Females[a]				
Average Length				
Attentive Epis.	-.071	-.022	-.010	.113
Inattent. Epis.	-.248	-.004	-.143	.260
No. False Alarms	-.123	-.115	.015	.228
Pct. Attention	.192	-.029	.140	-.137
Prob. of a Hit	.135	-.031	.111	-.103
Avg. Resp. Time				
Continuous	-.171	.002	-.107	.165
Momentary	-.086	.025	-.043	.118
Males[b]				
Average Length				
Attentive Epis.	-.196	.040	-.197	.081
Inattent. Epis.	-.046	.054	-.038	.005
No. False Alarms	-.190	-.129	-.043	.258
Pct. Attention	.051	-.016	.036	-.032
Prob. of a Hit	-.135	.042	-.166	.038
Avg. Resp. Time				
Continuous	-.018	.008	.021	.036
Momentary	-.066	.045	-.041	.072

[a] $p < .007$ when $|r| > .295$

[b] $p < .007$ when $|r| > .315$

Table 24

TV variables correlated with vigilance measures[a]
all subjects
(n = 96)

Average Length	Percent Attention	No. of Looks	Avg. Look	Avg. Pause
Attentive Epis.	-.131	.001	-.092	.098
Inattent. Epis.	-.139	.024	-.091	.124
No. False Alarms	-.166	-.126	-.020	.246[b]
Pct. Attention	.122	-.026	.094	-.084
Prob. of a Hit	.006	-.004	-.009	-.033
Avg. Resp. Time				
Continuous	-.091	.008	-.048	.097
Momentary	-.071	.036	-.039	.089

[a] $p < .007$ when $|r| > .215$

[b] $p < .02$

Table 25

Parent Temperament Questionnaire scores correlated with cognitive task and TV viewing variables by sex

	Activity Level		Distractibility		Persistence	
	Females	Males	Females	Males	Females	Males
Banta[a]						
First Look Away	-.041	-.211	.022	-.055	.107	.080
No. Looks Away	.129	.174	.036	-.019	-.112	-.114
Time On Task	-.139	.026	.041	-.081	.021	.098
KRISP[b]						
Avg. Resp. Time	.033	.023	-.030	-.137	.151	.043
No. of Errors	.177	.116	-.069	.031	.023	-.031
TV Viewing[c]						
Average Look	.168	.029	.026	.063	-.106	-.142
Average Pause	-.083	.092	-.181	-.217	.072	.043
No. of Looks	-.098	-.098	.078	.026	.035	.095
Pct. Attention	.146	-.045	.154	.156	-.148	-.131
Vigilance Task[d]						
Avg. Attent.	-.068	.073	-.220	.088	.110	.022
Avg. Inatt.	-.007	.064	-.200	.106	.104	-.122
No. False Alarms	.237	.272	-.123	-.388	.059	.071
Pct. Oriented	-.152	-.043	.124	-.104	-.050	.159
Prob. of a Hit	-.004	-.004	-.014	.072	-.037	.078
RT Continuous	.025	.025	-.111	.065	.070	-.075
RT Momentary	-.123	-.289	.089	.219	-.194	-.102

[a]Female $|r| > .184$, male $|r| > .189$, $p < .017$

[b]Female $|r| > .173$, male $|r| > .177$, $p < .025$

[c]Female $|r| > .270$, male $|r| > .280$, $p < .013$

[d]Female $|r| > .362$, male $|r| > .380$, $p < .007$

Table 26

Parent Temperament Questionnaire scores correlated with cognitive task and TV viewing variables

	Activity Level	Distract.	Persist.
Banta[a]			
First Look Away	-.131	.019	.093
No. Looks Away	.150	.008	-.113
Time On Task	-.052	-.023	.061
KRISP[b]			
Avg. Resp. Time	.044	-.104	.095
No. of Errors	.150	-.025	-.002
TV Viewing in Lab[c]			
Average Look	.117	.033	-.120
Average Pause	.023	-.207	.060
No. of Looks	-.121	.071	.057
Pct. Attention	.051	.155	-.140
Vigilance Task[d]			
Avg. Attent. Epis.	-.001	-.096	.077
Avg. Inatt. Epis.	.016	-.051	.006
No. False Alarms	.264	-.252	.068
Pct. Vis. Orient.	-.098	.022	.028
Prob. of a Hit	.003	.014	.010
RT Continuous	.013	-.024	.011
RT Momentary	-.210	.162	-.154

[a]When $|r| > .133$, $p < .017$

[b]When $|r| > .124$, $p < .025$

[c]When $|r| > .194$, $p < .013$

[d]When $|r| > .262$, $p < .007$

CHAPTER 4

RESULTS: TELEVISION EXPOSURE AND ATTENTION

A central question of this thesis was whether exposure to television was related to perseverance, impulsivity or restlessness. Earlier research has produced inconsistent results. For example, two experimental studies reported beneficial effects of viewing Mister Rogers (Friedrich and Stein, 1973; Stein and Friedrich, 1975) on perseverance but a third found no such effect (Tower et al., 1979). This may have been attributable to the fact that Friedrich and Stein used Mister Rogers episodes with content specifically designed to teach perseverance and the benefits of a reflective (rather than impulsive) style of problem solving (Friedrich and Stein, 1973); Tower and colleagues did not. Other differences between studies comprising this literature include the use of different and often unvalidated measures of television exposure, perseverance, impulsivity, and restlessness as well as incomparable program categories (primarily because they were left undefined).

Data collected as part of the Home Viewing Study (see Methods) provided an opportunity to examine the same relations while correcting some of the methodological shortcomings of earlier research. These data are based on a large sample of preschoolers and include both precisely defined program categories and a validated measure of television exposure. In addition, the battery of tasks and

questionnaires provided several measures of both impulsivity and perseverance as well as a validated measure of activity level. The goal of the analyses, then, was to reproduce (if possible) the relations between television exposure, sustained attention, impulsivity and restlessness that have been reported in the literature.

Program Categories

All individual programs and program types used in earlier research were included in these analyses. Sesame Street, Mister Rogers, nature films, Batman, Superman, and fast versus slowly paced programming were included in one or more of the five studies that examined the effects of television exposure on perseverance. The studies that examined effects on impulsivity and/or restlessness additionally included fantasy action-adventure, realistic action-adventure, violent, educational, entertainment, and commercial versus public broadcast programming as well as cartoons and situation comedies.

Some of these program types were readily defined in terms of the CRITC coding system (see Table 27 for a summary of definitions in terms of CRITC codes). The "program type" dimension of the CRITC coding system, for example, included a specific code (19) for situation comedies. These programs were defined as comedy stories with regular casts, the members of which frequently find themselves in "silly or ludicrous situations" (see Appendix). While there was no

specific code for nature programs, the science and nature variety of documentary programs ("program type" = 12) was used to approximate the nature films employed by Salomon (1979). Cartoons were simply defined as all programs that were entirely animated (animation = 3). The commercial versus PBS distinction made by Gadberry (1980) was achieved here by including both cable and commercial station programs in the commercial programming category.

The CRITC coding system did not include a dimension to rate the degree of violence in a program. Most programs in which violence figured prominently (except movies), however, would have been coded as belonging to one of the four action-adventure "program type" categories ("program type" = 21, 22, 23 or 25). Thus, exposure to the action-adventure class of programs was used as the best approximation of exposure to violent programming. Because exposure to Batman and Superman was rare (only 11 percent of subjects experienced even fifteen minutes exposure to either program) and the original investigators employed these programs as examples of violent programming (Friedrich and Stein, 1973), action-adventure programming was also used as a substitute for Friedrich and Stein's Batman/Superman condition.

The four action-adventure categories ("westerns", "police/detective/crime", "other", and "horror" programs) did not distinguish between fantasy and realistic programming as Singer et al. (1984) did. It was possible, however, to divide the action programs into those that were

at least partially animated (animation = 2 or 3) and those that were not (animation = 1).

The informative purpose dimension was used to create the educational and entertainment categories. Educational programs were defined as those intended to inform and entertainment programs were those produced without such an intent. This meant that programs like the evening news were included in the educational category. When the study which made the educational/entertainment distinction (Gadberry, 1980) described educational programs, however, it referred only to programs intended for children. Thus, an additional child-informative category was included here. It was comprised of all programs that were both produced for child audiences and intended to inform.

The least obvious categories to define were those concerned with program pacing. Precise definition of this aspect of program format is notably lacking in the popular and scientific literatures. Most pacing related hypotheses, however, have taken one of two forms. The first is concerned with the density of formal features. It argues that exposure to programs with rapid auditory and visual changes, i.e. those dense with television's "special effects", leads to mesmerized viewers. These viewers then have difficulty sustaining focused processing in other contexts, either because television provides no practice with this skill, and it displaces time with activities that

do, or because viewers become incapable of sustaining attention in the absence of attention-getting devices.

The second pacing related hypothesis focuses on the frequency of content changes. Postman (1979), for example, argued that child viewers have no need to use or develop their ability to attend to and integrate material over long intervals because uninterrupted intervals of related television content are brief. Others have argued that like programs dense with formal features, those with many short content units lead to mesmerized or at least intellectually passive viewers because the viewer has little if any time to reflect before the next brief segment begins (c.f. Singer, 1980; Tower et al., 1979). This second form of the pacing hypothesis, i.e. that which was concerned with the length of related segments of content, was testable using the CRITC codes for content time demands.

Programs with content units averaging fifteen or fewer minutes in length were categorized as fast paced. Moderately paced programs had content units from sixteen to sixty minutes long, and the content units of slowly paced programs extended beyond sixty minutes but were complete within a single program episode. The two remaining pacing formats involved programs whose story lines (i.e. related content) spanned multiple episodes. Programs with story lines that were complete within a finite number of episodes were labeled as miniseries. Because less than sixteen percent of subjects (51 of 328) had any exposure to programs

in this category, it was dropped. Soap operas had greater viewership. They were defined as programs with story lines that in principle involved an infinite number of episodes.

Once the program categories of interest had been defined, a computer program calculated the amount of exposure to each type of program for each focus child. As indicated in the Methods section, seven consecutive data days were selected from each diary period. The number of hours of exposure to each program type, as well as to television of any kind, were then averaged across diary periods.

Tables 28 and 29 present the mean, median and standard deviation for each category of exposure for the entire sample and for the subset of 103 subjects who had usable vigilance data, respectively. When one compares the mean and median levels of exposure, it is clear that each of the exposure distributions was skewed to the right. For every program category there were a large number of children with relatively little or no exposure to it. This was also true when the distributions of exposure times for males and females were examined separately (see Tables 30 and 31).

Sex Differences. When parent populations are skewed (as these obviously are), the Wilcoxon Rank Sum (WRS) has a power advantage over t-tests for group differences (Myers and Well, in press). The non-parametric test may produce false rejections, however, when the groups' distributions

are not similarly shaped. Tables 32 and 33 present the skew and kurtosis values calculated for the distributions of male and female subjects for each program category. These values varied substantially by sex, both for the entire sample and for the subset of vigilance subjects. This suggested that the shape of the distributions might be different for the male and female populations. Alternatively, the fluctuations in skew and kurtosis values might reflect normal sampling variability. While not a test for group differences in skew or kurtosis, a t-test of average absolute deviations from group medians (Brown and Forsythe, 1974) can indicate whether skewed distributions have significantly different variances and, therefore, are differently shaped. In this case, the variances for male and female samples were similar for all program categories but one. Thus, the WRS was used to detect significant differences in group location (i.e. the medians) for all program categories except realistic action programming.

Exposure to realistic action programs was more variable for boys than girls. In addition, boys were exposed to more realistic action-adventure programming on average than girls (1.091 versus .771 hours per week, $\underline{t}' = 2.687$, $df' = 310$, $p < .008$). In fact, all kinds of action-adventure programming appeared to be more popular with boys than girls. Boys were exposed to more hours of both fantasy action (0.750 versus 0.500 median hours, $Z = 2.241$, $p < .025$) and action-adventure programming in general (1.750 versus 1.250 median

hours, $Z = 3.065$, $p < .002$). Boys also tended to spend more time with cartoons (2.875 median hours versus 2.000, $Z = 2.557$, $p < .011$).

The vigilance sample was also examined for sex differences in exposure hours. As with the entire sample, male subjects spent significantly more time with cartoons than girls (2.875 versus 1.75 median hours per week, $Z = 2.187$, $p < .029$). Exposure to the various categories of action programming also showed patterns of sex differences that were similar to those found for the entire sample. Levels of exposure were higher for boys; fantasy action programs showed the smallest difference, action programming in general the largest. Despite the fact that the sex differences were greater than those for the full sample, they were not statistically significant. Levels of exposure to the three action program categories in the vigilance and non-vigilance samples were therefore compared. This was done separately for males, females and all subjects combined. Since all of these tests were non-significant, it seems likely that the lack of significant sex differences in exposure to action programming for the vigilance sample was due to a lack of power. The vigilance sample was roughly one third the size of the entire sample.

There was one category of programming for which exposure levels did vary for vigilance and non-vigilance subjects. Female vigilance subjects were exposed to less

Mister Rogers programming on average than their non-vigilance counterparts (.273 versus .433 hours per week, $t' = -2.173$, $df' = 152$, $p < .032$). The samples of boys had levels of exposure that were similar to one another and to that of the non-vigilance girls. This led to a significant sex difference in Mister Rogers exposure for vigilance subjects (.250 versus .000 median hours per week, $Z = 2.236$, $p < .025$).

In sum, with the exception of Mister Rogers, hours of television exposure were similar for vigilance and non-vigilance subjects. Levels of exposure were generally similar across sex as well. The exceptions involved exposure to cartoons and action-adventure programming which boys spent more time with than girls. These sex differences are in line with those reported by earlier studies. Comstock, Chaffee, Katzman, McCoombs and Roberts (1978) found that boys reported a greater preference for cartoons and action-adventure programming than girls and Huston et al. (1987) found that three to five year-old boys spent more time with cartoons and action-adventure programming than girls of the same age.

Cognitive Measures

The Home Viewing Study provided a variety of measures of perseverance, impulsivity and restlessness. Of the seven perseverance measures, two indexed the length of individual episodes of focused processing. They were time to first look away from the Banta puzzle and the average length of

attentive episodes in the vigilance task. The Banta puzzle was used by Anderson et al. (1977) and a task similar to it was employed by Stein and Friedrich (1975). Also included was a measure of the extent to which subjects were visually persistent throughout the ten minute vigilance task, namely percent visual orientation to the screen. As reported in Chapter Three, though visual persistence was related to success in maintaining focused processing (probability of a hit) the two were not synonymous. Thus, the probability of a hit was included as an index of the subject's perseverance in sustaining focused processing over the course of the vigilance task. The last of the direct measures of perseverance was the total time spent oriented to the puzzle and/or its pieces. It indexed the extent to which subjects persevered over the entirety of the five minute Banta task.

Finally, the PTQ distractibility and persistence subscales were also included. As noted in Chapter Three, these subscales combined emotional and cognitive persistence. Thus, the pattern of correlations with exposure to television might deviate markedly from those found for the direct observations of cognitive persistence in the laboratory.

The number of errors and latency to respond in the KRISP task were used to measure impulsivity. They had been used in two earlier studies. A third used Kagan's Matching Familiar Figures task, from which the KRISP was derived. It

was suggested in Chapter Three that the number of KRISP errors might also index the ability to focus attention on detail. The number of vigilance false alarms was included as an additional measure of impulsivity (falsely anticipating Blinky Bug's movements). It is possible, however, that it might instead be an indicator of restlessness (randomly pressing the "hit" button). Finally, the PTQ activity level subscale was included as the best available measure of a general tendency to be restless.

The means, medians and standard deviations for these variables are available in Tables 1, 2 and 11.

Perseverance Predictions

Earlier studies of television's impact on perseverance have included measures of success in remaining alert during a tedious task, perseverance in the Banta (and a similar) puzzle, qualitative ratings of persistence (or concentration) in play, and the average length of play episodes (a measure of the average span of attention or persistence). Thus, supportive evidence of previous findings was anticipated to most likely involve the Home Viewing measures that attempted to quantify perseverance in sustaining focused processing (both in terms of general perseverance throughout the task and the average length of individual episodes of focused processing).

More specifically, Friedrich and Stein's studies would predict positive correlations between Mister Rogers and the perseverance measures and negative ones with action

adventure programming (to support their Batman/Superman findings). Anderson et al. (1977), on the other hand, would anticipate no relation between perseverance (especially in the Banta task) and either total exposure or exposure to fast or slowly paced programming. Salomon (1979) would predict a negative correlation between Sesame Street exposure and/or a positive correlation between nature programming exposure and perseverance. His dependent measure was success in remaining alert during a tedious task. Thus, the most direct confirmation of Salomon's findings would involve the probability of a hit.

Salomon attributed his results to Sesame Street's rapid pacing, by which he most likely meant the density of formal features. Given Sesame Street's short content units, however, other theorists might attribute the effect to the frequency of content shifts. If this were the case, fast paced programming, as defined in this study, should show the same effect. Moreover, a strong version of this hypothesis would additionally predict that the same perseverance measures should correlate positively with programs in which content units are longer.

Analytic Procedures

When one is interested in the "effect" of one variable on another in non-experimental studies one typically employs a regression model. Standardized regression coefficients are then used to compare effect size across different

independent variables (here, categories of exposure) within a population. Because standardized regression coefficients are dependent on the ratio of predictor to outcome variable standard deviations, however, they are sample specific statistics. Thus, to compare effects across populations (e.g. sex) statistical texts recommend that the unstandardized regression coefficient (which is relatively stable across samples) be used (Pedhazur, 1982).

Analyses therefore began with the calculation of both standardized and unstandardized regression coefficients in separate regression equations for each category of exposure. Since the standardized regression coefficients were therefore equal to the Pearson r's, the r values were used to test whether categories of exposure were significant predictors of the perseverance (or impulsivity or restlessness) measures (i.e. r values were tested for significant departure from zero). To test whether the "effects" were the same for males and females, the unstandardized regression coefficients from each sample were tested for identity. This was accomplished by testing whether the coefficient associated with the sex by exposure term (in regression equations that included sex, exposure time, and sex by exposure time terms) was significantly different from zero.

The results of the interaction term tests were identical to those produced by Z tests for sex differences in Pearson r values. This can be attributed to the fact

that none of the laboratory and PTQ variables had significantly different variances by sex after being transformed and only one exposure variable produced such a difference (realistic action programs). In other words, the ratios of predictor to outcome variable standard deviations were similar for males and females. Thus, both Pearson r and b values are presented only in the text. Tables contain Pearson r values and Z tests of their identity across sex.

Before presenting the results of these analyses several other notes about analytic procedures are in order. First, all residuals were examined for evidence of outliers. When a data point was found to have a Cook value greater than one it was deleted and the regression equations and statistical tests were repeated (including examination of the new residuals). To report the results of this process would make the results unduly complicated. Thus, the only data deletions reported were those that led to changes in the significance of a correlation and those that involved correlations that were significantly different from zero before and after deletions.

Second, the tables for this section include correlations for males, females, and all subjects for every combination of exposure and cognitive variables. As was the case for the analyses reported in Chapter Three, however, the correlation calculated for the group as a whole was deemed relevant only when the test for sex differences was

non-significant. In other words, the sample estimate based on all subjects was deemed appropriate only when it was reasonably clear that the relation was the same for males and females. Combining data then yields more reliable estimates (and powerful tests) of the relation in the population of all five year olds. The primary concern in setting alpha levels for tests of sex differences, then, is the possibility of committing Type II errors.

Pedhazur (1982) argues that the decision to combine data should, therefore, be based on tests where alpha levels are set to a minimum of ten percent. Given the large number of tests to be conducted with this data set, however, family-wise error rates are likely to be quite high even when using a five percent single test alpha rate. Families in this case could be defined as all correlations with the same dependent measure (n = 18) or as all correlations with the same program category (n = 4). Inspection of Tables 34, 35, 37 and 39 reveals, however, that (especially for the vigilance variables) the correlations for males and females often differed in both size and direction. Failure to reject under these circumstances is particularly likely to lead to inaccurate conclusions. If two variables are positively correlated in one population and negatively correlated in another but the Z test fails to detect this difference in the sample estimates, the resulting correlation based on all of the data will likely be zero.

To avoid such a situation, the more liberal ten percent alpha (1.645 critical Z) was adopted.

Third, the reader will note that contrary to the analyses reported in Chapter Three, a Bonferroni procedure was not used (at least initially) in testing whether correlations were significantly different from zero. This was done because the majority of significant findings reported in earlier studies were identified using a five percent single test alpha level.

Perseverance Results

The pattern of correlations identified in the present study deviated markedly from the predictions outlined above. Tables 34 through 39 present the correlations between the different categories of program exposure and the different measures of perseverance for males, females, and all data combined.

PTQ Results. None of the correlations involving PTQ perseverance differed significantly by sex (see Table 34). The same was not true of PTQ distractibility scores. Girls who spent more time with soap operas were reported by their parents to be less distractible than those with less soap opera experience (r = -.208, b = -11..377, t = -2.738, n = 168, $p < .01$). The same was not true for boys and the difference between the correlations was significant (r's = -.208 and .012, $Z > 2.000$, $p < .045$).

None of the correlations between PTQ measures and exposure categories for which sex differences were non-

significant were significantly different from zero when male and female data were combined (see Table 36). Thus, parent reports of their child's perseverance and distractibility in daily activities were generally unrelated to television exposure. Given the general lack of relations between PTQ scores and laboratory measures of perseverance (see Chapter Three), however, it would be difficult to argue that these null results are particularly damning of earlier findings.

The one correlation that was significant was not predicted by earlier research. Moreover, given the large number of correlations calculated, it is possible that it was due only to chance. If not, it is unclear what processes might have given rise to it.

Banta Results. Of the thirty-six correlations between exposure hours and the two Banta measures, only two differed significantly by sex (see Table 35). Both involved exposure to slowly paced programming. It's relation with both time to first look away (r's = .143 and -.126, $Z > 2.449$, $p < .014$) and total time on task (r's = .181 and -.008, $Z > 1.717$, $p < .099$) differed by sex. Of the four correlations (two per sex) only that involving girls' total time on task was significantly different from zero (r = .181, b = 4.188, t = 2.361, n= 167, $p < .020$).

When the correlations between exposure to the remaining categories of programming and the Banta variables were calculated using combined data (see Table 35), one was found

to be significantly different from zero. Those focus children who spent more time with Sesame Street tended to have longer first looks at the Banta puzzle (r = .109, b = .077, t = 1.975, n = 326, $p < .050$).

This correlation contradicts the length of content units form of the pacing hypothesis. Since Sesame Street is a program with frequent content shifts, exposure to it would be expected to correlated negatively with the length of time for which attention is sustained in frustrating task. On the other hand, the positive correlation between slowly paced program exposure and total time oriented to the Banta puzzle could be construed as supportive of a strong version of the same pacing hypothesis. Given that one would expect 1.8 of the thirty-six Banta correlations to be significant by chance (operating with a five percent alpha), it could also be argued that both were chance findings.

In any case, neither the first span nor the total time that focused processing was sustained in the Banta task were related to television exposure in ways that would have supported earlier research.

Vigilance Measures. As noted above, the vigilance task provided two additional measures of the ability to sustain focused processing. One, the probability of hit, indexed the extent to which the child persevered in such efforts over the course of the task. The other, average attentive episode length, indexed the average duration of such bouts of attention. Both were correlated with perseverance in the

Banta task, especially the probability of a hit. Nevertheless, there was considerable variability left unaccounted for when each was correlated with its analogue from the Banta task. Thus, despite the lack of it in the Banta results, it was possible that evidence supportive of the earlier perseverance studies would be found using these vigilance measures.

Table 37 presents the correlations between exposure hours and both the probability of a hit and average attentive episode length by sex. Three of the relations between exposure hours and the probability of a hit differed significantly by sex. For two, exposure to child-informative programming (r's = -.155 and .214, $Z = 1.741$, $p < .082$) and exposure to Mister Rogers (r's = -.155 and .214, $Z = 1.839$, $p < .066$), the trends were negative for girls and positive for boys. For the third, exposure to nature programming (r's = .129 and -.237, $Z = 1.849$, $p < .065$), the directions were reversed. None of these correlations were significantly different from zero for either sex. Nor were any of the correlations with the remaining categories of programming once data had been combined (see Table 38). Thus, success in remaining alert (i.e. persevering in sustaining focused processing) in the vigilance task was unrelated to television exposure of any kind that has been examined in earlier perseverance research.

The results were somewhat different for the average length of attentive episodes. Eight of the eighteen correlations between this measure and the various exposure categories differed significantly by sex (see Table 37). Those eight categories were child-informative, commercial, educational, entertainment, fast and moderately paced programming, as well as situation comedies and total exposure. In all cases the trends were negative for girls and positive for boys. Of these eight correlations, two were significantly different from zero, but only for girls. Female subjects who spent more time with moderately paced programming ($\underline{r}$ = -.298, b = -.101, $\underline{t}$ = -2.449, n = 54, $p < .030$) and/or situation comedies ($\underline{r}$ = -.287, b = -.160, $\underline{t}$ = -2.163, n = 54, $p < .036$) had shorter episodes of focused processing on average than girls with less exposure to these classes of programming. None of the correlations with the remaining ten program categories were significantly different from zero when the male and female data were combined (see Table 38).

The reader might have noticed that the negative correlations with girls' exposure to moderately paced programming and situation comedies were larger for the probability of a hit than those just reported for the average length of attentive episodes ($\underline{r}$ = -.307, b = -.024, $\underline{t}$ = -2.326, n = 54, $p < .025$; $\underline{r}$ = -.343, b = -.044, $\underline{t}$ = -2.631, n = 54, $p < .011$). Because the correlations for boys were also slightly negative, however, the sex tests were not

significant at the ten percent alpha level. Following our analytic procedures this would indicate that estimates of the population correlations should be based on combined data. Those correlations were not significant. Regardless of whether one chooses to emphasize the significant correlations for girls or the lack of a significant difference, however, neither the probability of a hit nor the average length of attentive episodes provided evidence to corroborate earlier findings.

If one does accept the negative correlations between the girls' probability of a hit and exposure to situation comedies and moderately paced programming, it would be difficult to argue that all four significant correlations involving girls' focused processing in the vigilance task were due to chance. Of the programs to which five-year-olds were exposed, eighty-six were classified as situation comedies, more than any other type of program. In fact, 14.7 percent of all commercial and cable station programs were classified as situation comedies (none of the programs aired on PBS were sitcoms). In the same vein, moderate pacing was the most typical format of cable and network shows. Roughly fifty-seven percent (56.6) of the programs aired on these stations had content units lasting between sixteen and sixty minutes. The pattern of correlations with the probability of a hit and attentive episode length could be interpreted, then, as indicating that exposure to the

most typical of commercial programs is negatively associated with sustaining focused processing, at least in a signal detection type task.

The final measure of perseverance taken from the vigilance task was percent visual orientation to the CRT. The correlations between these scores and the various categories of exposure are presented in Table 39 for females, males and all data combined. Unlike the other measures from the vigilance task, none of the correlations differed significantly by sex. Thus, only those correlations based on all 103 vigilance subjects are discussed.

Seven of the eighteen categories of exposure were significantly correlated with percent visual orientation to the CRT. One of those seven involved soap operas. After a female subject who was identified as an outlier (she had 5 hours of soap opera exposure, more than any other subject and 5.7 standard deviations above the group average; she was oriented to the CRT for 97.8% of the allotted time, higher than other subjects with substantial exposure to soap operas) was deleted, exposure to soap operas was negatively correlated with visual persistence in the vigilance task (r = -.249, b = -.407, t = -2.657, n = 102, $p < .012$). This correlation seems to contradict the negative relation with PTQ distractibility scores reported above.

All of the remaining significant correlates of percent visual orientation were also negative. The largest involved

exposure to Sesame Street (r = -.271, b = -.017, t = -2.834, $p < .007$). In fact, every one of the categories to which Sesame Street belonged was also negatively correlated with perseverance in remaining visually oriented to the CRT. Exposure to public broadcast (r = -.222, b = -.010, t = -2.287, $p < .025$) and educational (r = -.222, b = -.007, t = -2.290, $p < .025$) programming, for example, were both negative correlates. Child-informative (r = -.221, b = -.007, t = -2.275, $p < .026$) and fast paced programming (r = -.206, b = -.005, t = -2.113, $p < .038$) were as well. Since Sesame Street was the most popular program among the focus children (both in terms of the number of children exposed to it and average weekly exposure hours), it is unsurprising that the negative correlation for total exposure was also significantly different from zero (r = -.197, b = -.003, t = -2.019, $p < .047$). One could argue, then that, with the exception of the correlation with soap opera exposure, each of these correlations was a manifestation of the negative correlation between Sesame Street exposure and visual persistence.

Since none of these categories were correlated significantly with success in remaining alert to Blinky Bug's movements (the probability of a hit) or with the average length of time for which focused processing was sustained, there was apparently little if any cost associated with these subjects' reduced levels of visual

orientation to the screen. This contrasts with Salomon's negative finding with Sesame Street; his dependent measure was less success in remaining alert during a tedious task. Thus, while the correlations with percent visual orientation to the CRT were in the same direction as that found by Salomon (and that would be predicted by the pacing hypothesis), the fact that they were limited to this measure suggests that the relations have less to do with sustained attention in the sense of allocating processing resources and more to do with the willingness or ability to maintain a general orientation to the assigned task. Thus, what might be indicated by these correlations is a relation between Sesame Street exposure and the tendency to sit still, to moderate physical activity. If this is the case, one might expect the same categories of programming to correlate positively with activity level scores and perhaps with the number of false alarms, especially for girls. Those correlations are reported below.

Partial Correlations. All of the significant correlations involving the perseverance measures are presented in Table 40 for easy reference. The only correlations that seemed to constitute a real pattern, i.e. that could not just as readily be interpreted as chance findings, were those linking focused processing with both situation comedies and moderately paced programming and those involving visual orientation to the CRT just discussed. As already noted, situation comedies and those

programs with content units of moderate length were the most typical of commercial station fare. Sesame Street was the single most popular program among the focus children. Moreover, total exposure was most correlated with the same perseverance measures that were significantly correlated with these categories of programming. One could argue, then, that a large component of these relations might be attributable to increased exposure to television in general. In other words, if a child were to spend more time with television, that time was likely comprised of exposure to these programs, and one could therefore argue that it is this increase in time with television, not attributes specific to the program types, that is driving the correlations.

It was of interest, then, to determine which, if any, of the significant relations identified via zero-order correlations continued to be significant after removing variability attributable to total exposure. The partial correlations resulting from this procedure reveal the relations between categories of exposure and perseverance for subjects with the same total exposure to television. If exposure to a particular category of programming is associated with perseverance not only for the population in general but within groups of subjects with the same total exposure, it is more difficult to claim that the relation

reflects an association between perseverance and television time in general.

Since the correlations between total exposure and both the PTQ and Banta measures were small it is unsurprising that girls' exposure to soap operas ($r_{12.3}$ = -.209, b = -13.263, t = -2.742, n = 168, p < .01) and slowly paced programming ($r_{12.3}$ = .181, b = 4.894, t = 2.509, n = 167, p < .014) continued to be significantly negatively correlated with PTQ distractibility and total time attentive to the Banta task, respectively, after controlling for total exposure. Likewise, removing the variability due to total exposure had little impact on the positive correlation between time to first look away from the Banta puzzle and exposure to Sesame Street ($r_{12.3}$ = .110, b = .095, t = 1.978, n = 326, p < .050) for male and female data combined.

Partialing total exposure from the correlations with vigilance performance, on the other hand, reduced many of the correlations to zero. The partial correlations between the various categories of program exposure and the measures of focused processing in the vigilance task are presented by sex in Table 41. Neither of the two categories of program exposure that had been significantly correlated with the average length of girls' attentive episodes (situation comedies and program with moderate pacing) were significant after controlling for total exposure.

Similarly, the negative relation between soap opera exposure and visual orientation to the CRT (after the

outlier was deleted) could be attributed to the variability that each measure shared with total exposure (see Table 42). The four categories to which Sesame Street belonged also failed to predict percent visual orientation after controlling for total exposure. The partial correlation for exposure to Sesame Street, however, was significantly different from zero ($r_{12.3} = -.196$, $b = -.015$, $t = 2.003$, $p < .049$). The beta coefficient noted here was that obtained in a regression equation predicting visual persistence with both total exposure and hours of exposure to Sesame Street.

Thus, those subjects who spent more time with television were also likely to be oriented to the CRT for cumulatively less time. The same could be said of those subjects who spent more time with Sesame Street, soap operas, child-informative, educational, fast paced and public broadcast programming. In addition, an individual subject was likely to show the same visual persistence as other subjects with the same total exposure regardless of whether he or she spent more or less time with soap operas, child-informative, educational, fast paced or public broadcast programming than they did. If, on the other hand, that same subject were to have spent more time with Sesame Street than other subjects with the same total exposure, he or she was also likely to have demonstrated lower levels of visual orientation in the vigilance task.

The partial correlations in Table 42 also suggest that within groups with the same total exposure to television, persistence in remaining visually oriented to the assigned task was greater for those individuals who spent more time with cartoons ($r_{12.3}$ = .225, b = .017, t = 2.309, p < .024), action-adventure ($r_{12.3}$ = .249, b = .021, t = 2.563, p < .012; after an outlier was deleted), and fantasy action ($r_{12.3}$ = .210, b = .028, t = 2.145, p < .035) programs. It is unclear what processes produced these "effects". If it is the restlessness component of visual orientation to the CRT that is involved then the correlations contradict the negative relations reported by Singer et al. (1984). It is possible that subjects with more exposure to fantasy and action narratives interpreted Blinky Bug's journey as an adventure and, therefore, were more willing to sit through it. Since the partial correlations between the probability of a hit and attentive episode length were not significant, however, it is clear that even if such a strategy was employed it had no benefit in terms of staying alert (just as reduced visual orientation in heavier viewers of Sesame Street had no cost).

There did appear to be a benefit in terms of maintaining focused processing for those girls (within groups with the same total exposure) who spent more time with nature programming ($r_{12.3}$ = .275, b = .263, t = 2.038, p < .048). See Table 41. This is supportive of Salomon's finding that subjects who were exposed to nature programming

were more successful in remaining alert in a tedious and repetitive task than children exposed to Sesame Street (though he interprets the finding as indicative of a negative consequence of Sesame Street exposure). It is unclear why this relation was limited to girls.

Finally, two of the correlations in Table 41 should be of interest to those readers who are of the opinion that the negative correlations between the girls' probability of a hit and both situation comedy and moderately paced program are of interest (despite the lack of significant sex differences). As was the case with average attentive episode length, the probability of a hit was not correlated with girls' exposure to moderately paced programming after controlling for total exposure. Time with situation comedies, on the other hand, shared enough unique variability with the girls' probability of a hit to remain significantly negative ($r = -.286$, $b = -.039$, $t = -2.126$, $p < .039$). The partial correlations for male and female data combined were not significantly different from zero.

Summary and Discussion. In sum, only one category of program exposure was correlated with the perseverance measure most similar to that used in the original study in the same direction as that which would have been predicted by that study. Nature program exposure was positively correlated with the probability of a hit after controlling for total exposure, but only for girls. The small positive

correlation between Sesame Street exposure and time to first look away from the Banta puzzle, on the other hand, might be interpreted as contradicting findings from the same study. The Banta puzzle was not as similar to Salomon's measure as the vigilance task was, however. The probability of a hit in the vigilance task and Salomon's measure both indexed the child's success in remaining alert throughout the assigned task.

Other significant correlations identified in these analyses involved categories of exposure used in earlier impulsivity and restlessness studies (e.g. situation comedies, cartoons, and amount of exposure to fantasy action adventure programs). Of these, action-adventure and fantasy action programs were positively related to the perseverance measure most indicative of restlessness (percent visual orientation). The original study which related this category of program exposure to restlessness, however, reported that the association was negative. Other significant correlations identified in the present study were in the opposite direction of what one would expect given earlier findings and hypotheses concerned with perseverance. For example, a strong version of the pacing hypothesis would predict a positive association between exposure to moderately paced programs and perseverance. Instead, this category of programming was negatively correlated with the probability of a hit and average attentive episode length. The negative correlation between

cumulative time spent oriented to the CRT and soap opera exposure also contradicts a strong version of the pacing hypothesis.

The last set of correlations were in the direction predicted by earlier work, but were limited to the one measure of perseverance least indicative of sustained focused processing. Those correlations were the negative ones between exposure to Sesame Street, and the categories to which it belonged, and percent visual orientation to the CRT. The pacing hypothesis and Salomon's findings would predict negative correlations but in both cases one would expect those relations to involve maintaining focus on Blinky Bug's movements or time actively working on the Banta puzzle, not remaining oriented to the CRT.

Finally, it is important to note that most of the "effects" identified were small. In finding them, a single test alpha level of five percent was employed. Given the large number of correlations calculated, this is an extremely liberal strategy. Had a Bonferonni procedure been used, many of the correlations identified would not have been large enough to be statistically significant. To illustrate, consider the significant zero-order correlations (see Table 40). If a one percent alpha level were employed (smaller than required for families defined as all correlations between the same category of exposure and perseverance measures from the same task (n's of two or

three), but larger than if families were defined as all correlations with a single perseverance measure (n = 18)), only three of the correlations would be large enough to be significantly different from zero. They were the negative correlation between girls' soap opera exposure and PTQ distractibility, the negative correlation between the same category of exposure and percent visual orientation to the CRT and the negative correlation between Sesame Street exposure and visual orientation. Clearly, two of the three contradict one another. Of the partial correlations that controlled for total exposure, only that between girls' exposure to soap operas and PTQ distractibility was large enough to be significant.

Thus, not only were few of the relations with the perseverance measures supportive of earlier research, but the overwhelming majority of those identified were small enough to be considered tenuous by conservative researchers.

Impulsivity and Restlessness Predictions

As noted in the beginning of this Chapter, the Home Viewing Study provided four measures of impulsivity and restlessness. Of the four, only average latency to respond and the number of errors in the KRISP were used in earlier studies of television's impact. The number of false alarms was included as a third measure of impulsivity. Since the number of false alarms was significantly correlated with activity level scores and for girls, with visual orientation to the CRT, however, they might also have been the result of

restlessness. The fourth measure was the activity level subscale of the PTQ. Although not used in any earlier studies of television's relation to restlessness, it has been validated as a measure of a child's tendency to be physically active, or what might be labeled an inability to moderate physical activity (Palisin, 1986).

The earlier studies investigating how television exposure is related to impulsivity and restlessness have generally reported that exposure to commercial and/or violent programming was positively associated with these tendencies and that the relations were negative for PBS and/or educational programming. All of the findings did not, however, conform to this pattern. Thus, the specific predictions that would be generated from each of the individual studies are provided below. Those related specifically to impulsivity are presented first.

Based on Gadberry's work, one would predict positive correlations between KRISP response latency and exposure to both PBS and child-informative programming and negative correlations with action-adventure, commercial and total exposure. In addition, each of these program categories should correlate with the number of KRISP errors, although the sign of each would be reversed (response latency and the number of errors in the KRISP were negatively correlated). C. Anderson and Maguire's (1978) results would generate similar expectations for total exposure and exposure to

action adventure programming (the category in the present study used to estimate exposure to violent programs). Moreover, Stein and Friedrich's (1975) findings with the KRISP, as well as with subjects' response times when asked to slowly walk or draw a line, would lead to similar predictions for exposure to Mister Rogers, although they would be limited to girls.

Several of the earlier findings were ones of no effect. C. Anderson and Maguire, for example, reported that teacher ratings of impulsivity were uncorrelated with exposure to situation comedies, cartoons or informational programming. The finding for the last category, informational programs, contrasts with Gadberry's suggestion that impulsivity is related (negatively) to educational program exposure. In contrast with both Gadberry and C. Anderson and Maguire's work, Anderson et al.'s (1977) results predict no relation between KRISP performance and total exposure. In addition, Anderson and colleagues report no immediate effects of viewing either a slow or fast paced version of Sesame Street. Thus, this study would also predict that there would be no correlation between exposure to either fast or slowly paced programs and KRISP performance.

The predictions for PTQ activity level scores were based on studies that examined television's impact on motor activity, restlessness and/or tolerance for delays. The findings for delay tolerance were included here because Singer et al.'s (1984) results for tolerance of delays were

quite similar to those obtained with their measure of restlessness. Essentially, they reported that six-year-olds exposure to the two sub-categories of action adventure programming, realistic and fantasy action, was positively related to the restlessness they exhibited at age nine. In addition, Friedrich and Stein (1973) reported that repeated exposure to Batman and Superman led to decreased tolerance for delays in preschoolers and exposure to Mister Rogers had the opposite effect. Together these studies suggest that all three categories of action programming should be positively correlated with PTQ activity level scores (and perhaps the number of vigilance false alarms) and that the relation(s) should be negative for exposure to Mister Rogers.

Again the pattern of results reported by Anderson et al. (1977) deviated from this pattern. They found that total exposure to television was uncorrelated with the level of motor activity subjects exhibited during ten minutes of free play (engaged in immediately after Sesame Street exposure). Moreover, contrary to what the pacing hypothesis would predict, they found no significant differences as a function of which version of Sesame Street had been viewed. Thus, this study would predict that like KRISP performance, PTQ activity level scores and vigilance false alarms should be uncorrelated with both total exposure and exposure to fast paced programming.

Finally, several categories of programming were reported (in the perseverance section above) to be negatively correlated with percent visual orientation to the CRT. This was the only perseverance measure to show these relations. Apparently there was no cost (in terms of detecting Blinky Bug's deviant jumps) associated with the lower levels of visual persistence observed in children who spent more time with Sesame Street and the categories of programming to which it belonged. Thus, it was suggested that what these relations might represent is a link between exposure to this class of programs and the child's tendency to be physically active or the ability to sit still. If this is the case, then exposure to the same program categories should be positively correlated with PTQ activity level scores. Moreover, since percent visual orientation was fairly highly correlated with the number of false alarms, at least for girls (r's = -.518 and -.205 for females and males respectively), one might also expect positive correlations between the same categories of programming and the number of false alarms.

Impulsivity and Restlessness Results

Presented below are the results of the impulsivity and restlessness results organized by dependent measure. While several of the results conformed to predictions, others not only did not support the results of earlier work but were in the opposite direction of what was expected.

False Alarms. The correlations between the various categories of exposure and the number of false alarms are presented by sex and for all subjects in Table 43. As can be seen there, seventeen of the correlations were similar enough across sex to warrant combining the male and female data. When this was done, none of the correlations were significantly different from zero. Thus, contrary to what one might have expected given the visual orientation results, and contrary to the impulsivity predictions, the number of false alarms was apparently unrelated to television exposure.

There was one exception. Slowly paced programming was positively correlated with false alarms (r = .315, b = .246, t = 2.273, n = 49, $p < .029$), but only for boys (r's = .315 and -.038, Z = 1.829, $p < .07$). Since this was the only significant correlation, one could argue that it was likely produced by chance.

Activity Level. As can be seen in Table 44, however, boys' exposure to slowly paced programming was also significantly positively correlated with PTQ activity level scores (r = .205, b = 11.607, t = 2.638, n = 160, $p < .01$). The same was not true of girls and, again, the difference was significant (r's = .205 and -.025, Z = 2.179, $p < .03$). Thus, it appears that boys who spent more time with slowly paced programming were reported by their parents to be more motorically active and they exhibited that tendency by responding randomly in the vigilance task. Since it was

unclear why more active boys would spend more time with slowly paced programming or why exposure to it might engender restlessness, the specific programs making up that category of programming were examined. Fully one half of the programs classified as slowly paced were programs covering a sporting event. Thus, this pattern of relations with slowly paced programming might indicate a tendency for more active boys to prefer watching adults engage in competitive sports.

Also significantly different from zero only for boys ($\underline{r}$'s = -.195 and .073, Z = 2.449, $p < .014$) was a negative correlation between PTQ activity level scores and exposure to Mister Rogers ($\underline{r} = -.195$, b = -28.441, $\underline{t} = -2.493$, n = 160, $p < .015$). This supports Friedrich and Stein's finding with the tolerance for delays, but it is unclear why the "effect" would be limited to boys. Friedrich and Stein's was not.

The remaining correlations with activity level scores were not significantly different by sex and were therefore calculated using combined data. As can be seen in Table 44, six of these sixteen correlations were significantly different from zero using a five percent single test alpha level. All were positive. The largest involved exposure to commercial ($\underline{r} = .159$, b = 2.006, $\underline{t} = 2.912$, n = 328, $p < .005$) and entertainment programming ($\underline{r} = .144$, b = 1.925, $\underline{t} = 2.624$, n = 328, $p < .01$), as well as total exposure ($\underline{r}$ =

.147, b = 1.433, $\underline{t}$ = 2.691, n = 328, p < .008). The most common format of commercial programs, moderate pacing, was also a significant correlate ($\underline{r}$ = .124, b = 2.846, $\underline{t}$ = 2.220, n = 328, p < .028). Thus, children who spent more time with television, and apparently with the most typical of its fare, were perceived by their parents to be more active than subjects with lower levels of television exposure. Exposure to the same class of programs was reported by Gadberry to be associated with higher degrees of impulsivity.

The remaining two significant correlations with activity level scores involved exposure to more unique program formats. Exposure to soap operas ($\underline{r}$ = .111, b = 7.751, $\underline{t}$ = 2.019, n = 328, p < .045) and fast paced programs ($\underline{r}$ = .109, b = 1.774, $\underline{t}$ = 1.971, n = 328, p = .050) were both positively correlated with activity level. The former, at least in principle, contradicts a strong version of the pacing hypothesis. The second would certainly support it. Both it should be noted were also found to be significantly negatively correlated with percent visual orientation to the CRT. In fact, exposure to short paced programs was no longer a significant predictor of visual persistence when the variability due to activity level scores was removed ($\underline{r}_{12.3}$ = -.192, $\underline{t}$ = -1.957, n = 103, p > .05), nor was exposure to soap operas ($\underline{r}_{12.3}$ = -.176, $\underline{t}$ = 1.794, n = 103, p > .05). Thus, the lower levels of visual orientation observed in children who spent more time with soap operas

and fast paced programs may have been an example of the restlessness noted by parents.

As with the perseverance results, it was of interest to determine whether these correlations continued to be significant after controlling for time with television in general. It seemed especially likely that time with television in general would account for the relations between activity level scores and exposure to the different classes of program format. When one includes the relation with boys' exposure to slowly paced programming, activity level scores were positively associated with exposure to every possible program format (in terms of content unit length).

Presented in Table 45 are the partial correlations (by sex and for all subjects) between activity level scores and the seventeen program categories, controlling for total exposure. None of the pacing categories were significant predictors of restlessness after the variability shared with total exposure was removed; nor was exposure to commercial or entertainment programming. For several categories of exposure these non-significant partial correlations were the result of the fact that exposure to each was so highly correlated with total exposure as to be almost redundant (see Table 46). This was especially true of the correlations between total exposure and exposure to commercial ($\underline{r}$ = .923, b = 1.196, $\underline{t}$ = 43.318, $p < .001$) and

entertainment programming (r = .860, b = 1.184, t = 30.403, $p < .001$).

Other program categories shared far less variability with total exposure. Less than twenty-three percent of the variance in exposure to slowly paced programming, for example, was accounted for by total exposure. Since none of the partial correlations involving these classes of exposure were significantly different from zero, however, it is clear that whatever variability they did have in common with total exposure was sufficient to account for the significant correlations with activity level scores.

There was one exception, exposure to Mister Rogers. Controlling for total exposure, boys' activity level scores were still significantly negatively correlated with exposure to Mister Rogers ($r_{12.3}$ = -.263, t = -3.399, $p < .002$). Thus, within groups of boys with the same total exposure, those who were perceived by their parents to be less motorically active were also likely to spend more time with Mister Rogers. This result provides even more convincing evidence in support of the negative relation between Mister Rogers exposure and delay intolerance reported by Friedrich and Stein, although it is still unclear why it applied only to boys.

KRISP Results. The correlations between exposure to Mister Rogers and KRISP performance were more complicated (see Table 47). Stein and Friedrich's results for the KRISP and the slowly walk and draw a line tasks would predict sex

differences in the relation between Mister Rogers exposure and impulsivity. They found positive relations with response latencies in each of the tasks but only for girls. Here, the correlation with the number of KRISP errors did differ significantly by sex (r's = .114 and -.106, Z = 1.970, $p < .049$). In neither population, however, was the correlation large enough to be significantly different from zero. For average latency to respond, the correlation with girls' exposure to Mister Rogers was negative (r = -.162, b = -.095, t = -2.115, $p < .037$). When compared with the result for boys, the Z test was only marginally significant (r's = -.162 and .016, Z = 1.621, $p < .110$), and the correlation based on combined data was not different from zero (see Table 48). If one believes that the sex difference was large enough to warrant separate correlations then Stein and Friedrich's impulsivity results are supported to the extent that sex differences were found for both KRISP measures. The direction of the significant correlation for girls' average latency to respond, however, was in the opposite direction of that reported by Stein and Friedrich. Girls with more extensive Mister Rogers exposure had shorter not longer response latencies. Of course, the correlations obtained with combined data were no more supportive of the earlier findings.

The results for exposure to soap operas were more in line with expectations (based on the activity level and

visual persistence results). Although the correlations with both measures of KRISP performance were somewhat larger for girls, the differences were not significant. The correlations based on combined data were significantly different from zero for both the number of KRISP errors ($\underline{r}$ = .150, b = .099, $\underline{t}$ = 2.736, $p < .008$) and average latency to respond ($\underline{r}$ = -.123, b = -.036, $\underline{t}$ = -2.255, $p < .028$). Thus, those subjects who spent more time with soap operas behaved more impulsively in the KRISP, were reported by parents to be more restless and were less willing, or capable, of remaining visually oriented to the CRT during the vigilance task.

None of the other categories of programming were significantly correlated with KRISP performance when male and female data were combined. This was because the majority of correlations with both the number or errors and average latency to respond were in opposite directions for males and females. Exposure to five categories of programming, Sesame Street and the four categories to which it belonged, tended to be associated with shorter response latencies in girls and longer ones in boys. As can be seen in Table 47, these differences were significant (all Z's > 1.711, $p < .09$). None of the correlations were significantly different from zero, however, for either sex.

The correlations between the same categories of programming and the number of KRISP errors also differed significantly by sex (all Z's > 2.982, $p < .003$). In this

case, however, each was also significantly different from zero. For girls, the relations were positive, for boys, they were negative. Specifically, the number of errors committed by boys was most negatively correlated with child-informative programming (r = -.238, b = -.050, t = -3.081, n = 160, p < .003), followed by exposure to educational programming (r = -.226, b = -.042, t = -2.915, n = 160, p < .005) and time with the most popular program of this type, Sesame Street (r = -.200, b = -.079, t = -2.570, n = 160, p < .012). These correlations provide support for Gadberry's suggestion that exposure to the educational programming on PBS was associated with less impulsivity. In fact, PBS program exposure was also negatively correlated with the number of KRISP errors (r = -.199, b = -.051, t = -2.559, n = 160, p < .012). Moreover, since Sesame Street, and in fact more than fifty-three percent of child-informative programs were classified as fast paced, it is unsurprising that exposure to fast paced programming was also negatively correlated with the number of KRISP errors (r = -.178, b = -.027, t = -2.279, p < .025) for boys.

What was puzzling, however, was the fact that while exposure to these program types was associated with more accuracy in the KRISP for boys, exposure to the same was associated with less accuracy for girls. Again the largest correlation involved exposure to child-informative programming (r = .205, b = .043, t = 2.694, n = 167, p <

.009). The order, by size, of the remaining categories differed from that obtained for the boys. Time with Sesame Street produced the second largest relation (r = .190, b = .083, t = 2.485, n = 167, $p < .015$), followed by exposure to public broadcast (r = .164, b = .046, t = 2.219, n = 167, $p < .036$) and educational programming (r = .154, b = .028, t = 2.000, n = 167, $p < .048$). Notably absent from the set of significant correlations for girls was one involving exposure to fast paced programming (r = .145, b = .023, t = 1.885, $p > .05$). Thus, contrary to the results for boys, the girls' results supported neither Gadberry's findings nor Salomon's finding involving the ability to focus on detail.

The might reader recall that the same categories of exposure were negatively correlated with percent visual orientation to the CRT for both sexes. Since the probability of a hit was not similarly associated with exposure to Sesame Street and the categories to which it belonged, it was concluded that there was no real cost associated with the lower levels of visual attention observed in subjects exposed to these program categories. This conclusion was accurate in that none of the correlations with the probability of a hit and average attentive episode length were different from zero for either sex alone or when data were combined. The pattern of correlations for each sex (see Table 37) was similar, however, to that obtained for the average latency to a KRISP response (in Table 47). The boys' correlations, though non-

significant, were all positive, the girls' were all negative. One could argue, then, that there was some indication that boys' exposure to Sesame Street (and other child-informative programs with the same format) was associated with more proficiency in the vigilance task and more reflective, perhaps strategic performance in the KRISP.

It is plausible, then, that boys who spent more time with these programs were intellectually more competent than those with less exposure. In fact, as can be seen in Table 48, boys' exposure to each of the five program categories of interest was significantly positively correlated with IQ scores. Moreover, while the correlations were also significant for girls they were generally smaller than those obtained with the sample of boys. In the case of child-informative (r's = .152 and .382, $Z = 2.227$, $p < .013$, one-tailed test) and educational programming (r's = .158 and .338, $Z = 1.726$, $p < .042$, one-tailed test), the differences were significant. It was of interest, then, to determine whether the correlations with the number of KRISP errors (which were significantly negatively correlated with IQ in both populations, see Table 20) were still significant after controlling for differences in IQ.

The partial correlations calculated toward this end are presented by sex and for all subjects in Table 49. None of the partial correlations were significantly different from zero for boys. Thus, the more accurate KRISP behavior

observed in boys who spent more time with Sesame Street (and similar child-informative programs) might have been a consequence of more intellectually competent boys choosing to spend more time with these programs. Alternatively, exposure to these programs might have improved both IQ and KRISP accuracy. If so, Salomon would argue that what is impacted by exposure to these programs is not intellectual competence, per se, but the visual scanning or search that is required in both the PPVT and KRISP tasks. As described in the Chapter One, several of Salomon's studies have suggested that exposure to the cinematic techniques typical of Sesame Street (and other programs) leads to improved visual search skills.

It is possible that exposure to these cinematic techniques had a similar effect on girls' visual scanning skill but that the effect was weaker and/or that it was overshadowed by another process or processes operating in the opposite direction. In support of this interpretation is the fact that each of the relations with the number of KRISP errors (identified by significant zero-order correlations) was larger after the variability due to IQ had been removed. In addition, although the zero-order correlations with total exposure and exposure to both Mister Rogers and fast paced programming were non-significant, once variability attributable to IQ was removed, the relations were significantly different from zero ($\underline{r}_{12.3}$ = .153, $\underline{t}$ = 1.983, n = 166, $p < .050$, $\underline{r}_{12.3}$ = .203, $\underline{t}$ = 2.654, n = 166,

$p < .01$, and $r_{12.3} = .198$, $t = 2.578$, $n = 166$, $p < .012$, respectively). Thus, there may well have been two sources of covariation between the number of KRISP errors and exposure to Sesame Street-like programs for girls. One was responsible for a small positive association with KRISP accuracy, perhaps via effects on visual scanning skill, the other was responsible for a larger negative association.

It is not obvious why this negative association was only observed in girls. Combined with the trend for shorter average response latencies, however, it seems that what is being indicated is a positive relation between impulsivity and exposure to child-informative programming like Sesame Street.

Girls' exposure to Sesame Street, child-informative, educational, fast paced and public broadcast programming were all highly correlated with total exposure (see Table 46). In fact, with the exception of exposure to educational programming, all of these categories of programming were significantly more correlated with girls' total exposure than with boys' (all Z's > 1.758, $p < .040$). It was of interest, then, to determine whether the correlations with KRISP accuracy might in large part be attributable to exposure to television in general rather than to any characteristics specific to these program types, especially for girls.

The partial correlations between the number of KRISP errors and the different categories of exposure, after controlling for total time with TV, are presented in Table 50. As can be seen there, while the correlations with boys' accuracy in the KRISP were relatively unaffected by this procedure (most were actually a bit larger than their zero-order counterparts), only one of the categories of exposure continued to be a significant predictor of girls' performance. That category involved exposure to child-informative programming ($r_{12.3} = .169$, $t = 2.186$, $n = 167$, $p < .031$). It should be noted that while this partial correlation was significantly different from zero it, too, was smaller than the original zero-order correlation.

Thus, one could argue that while girls' exposure to Sesame Street, educational, fast paced, public broadcast and child-informative programming were all associated with more impulsive behavior in the KRISP, the source of those relations was time with television in general, and not any characteristic unique to those classes of programming. The one exception might be exposure to child-informative programming but even there the partial correlation would not have been significant had a Bonferonni procedure been employed to control Type I error rate.

Taken together with the results for boys, it appears that there may be some characteristic unique to Sesame Street like programs that is positively associated with KRISP accuracy. Moreover, whatever that characteristic is,

the relation between exposure to it and KRISP accuracy might be a consequence of the viewing choices made by intellectually more competent children or it might reflect a positive impact of exposure on visual scanning ability. If the latter of these is the source of covariation, then Salomon's work would suggest that future research should focus on the effects of the specific cinematic techniques used in these programs. Finally, there appears to be an additional source of covariation between exposure to these categories of programming and KRISP accuracy that is negative, and probably attributable to time spent with television in general. For boys the former source of covariation appears to be stronger, for girls it is the latter. The end result is correlations with KRISP accuracy that vary in direction by sex.

Summary and Discussion. The correlations relating television exposure to impulsivity and restlessness in this sample did not always support the specific predictions generated from the results of earlier studies. On the other hand, the results did seem to indicate that television exposure and these behavioral tendencies are significantly related in preschool children.

The results involving PTQ activity level scores, for example, only partially supported one of the reported findings between television exposure and restlessness. The general pattern of correlations with activity level scores,

however, seemed to indicate that exposure and restlessness were related, primarily in a positive direction. The finding which received only partial support was the negative one between delay intolerance and exposure to Mister Rogers reported by Friedrich and Stein (1975). Hours of exposure to Mister Rogers were negatively correlated with activity level scores, but only for boys. In addition, though Sesame Street was assigned the same CRITC code values as Mister Rogers, activity level scores were not correlated with exposure to Sesame Street nor were they correlated with exposure to the categories to which both programs belonged. Thus, not only was there a negative relation between exposure to Mister Rogers and activity level scores, but that relation apparently involved some characteristic of the program not shared with Sesame Street and not identified by the CRITC coding system.

An obvious possibility is the content and/or character actions that are typical of Mister Rogers episodes. Though not quantified, Mister Rogers' demeanor has been described as "calm". His speech and movements are deliberate and not at all rushed like those of the "Speedy Delivery" man character who sometimes visits him. Thus, Mister Rogers may serve as an effective model of calm and controlled behavior for preschool boys. Alternatively, less active boys may prefer to spend time with a program hosted by a male whose behavior is similar to theirs.

It is possible that the correlation was limited to boys because they are of the same sex as the model. Friedrich and Stein's results indicated, however, that Mister Rogers had the potential to effect changes in delay tolerance in preschool children of both sexes. Moreover, the violence literature suggests that models of aggressive behavior are not necessarily any more effective when they are the same sex as the viewer (see Huesmann, 1982, and Huesmann and Eron, 1986, for reviews). Thus, it is unclear why the correlation with exposure to Mister Rogers was limited to boys.

It should be noted, however, that whatever process(es) (modeling, or program preference, or both) account for the negative relation between boys' activity level scores and exposure to Mister Rogers, the same one(s) are likely to account for the positive relations between exposure to slowly paced programming and both activity level scores and the number of false alarms. As noted above, the category of slowly paced programs was primarily comprised of programs covering sporting events. Moreover, while some of these sports programs might have had female participants (e.g. tennis and golf), the majority were sports with exclusively male participants (e.g. hockey, football, boxing, basketball, etc.). Thus, not only did less active boys spend more time with programming portraying a calm Mister Rogers, but more active boys spent more time with programs portraying physically active and competitive males.

The two remaining predictions for the PTQ activity level correlations involved action program and total exposure. The former was predicted to correlate positively with activity level scores, the latter, negatively. The data from this study contradicted both. None of the three correlations with the different types of action programming were significantly different from zero. In addition, total exposure and the exposure categories with which it was most correlated (commercial and entertainment programming) were positively associated with the activity level reported by parents.

In fact, these were among the largest correlations between television exposure and behavioral tendencies identified in this study. All three were large enough to exceed the critical value established when using a one percent single-test alpha level. While these results do not conform to Anderson et al.'s (1977) findings with a global measure of TV and activity level exhibited in free play, they do support claims made in the popular literature. Namely, that exposure to television leads to higher levels of motor activity in children.

Although many of the same reports attribute this relation to the pacing of programs and/or a shortened attention span, there was little evidence of either in this study. As stated in the summary of the perseverance analyses, there was little if any relation between the

ability to sustain attention, especially focused processing, and exposure to television. Moreover, if rapid pacing were responsible for the relation between exposure and activity level, one would expect exposure to programs with the shortest content units to correlate positively and exposure to programs with longer content units to be either negatively correlated or to show no association with activity level at all. Instead, all four pacing categories were positive correlates of activity level scores, and the smallest correlation involved exposure to fast paced programming. None continued to be significant after controlling for time with television in general.

It could be argued, of course, that it is not the length of content units that is the effector of change but the frequent use of cinematic devices unique to television (incidentally, devices that are not frequently used in Mister Rogers). Although never quantified, Sesame Street is a program generally agreed in the popular and research literatures (e.g. Salomon, 1979) to be a program that makes especially frequent use of these devices. Thus, if exposure to cinematic techniques was responsible for the positive relation between television exposure and the tendency to be motorically active, one would expect exposure to Sesame Street to reflect that relation. In fact, exposure to Sesame Street was uncorrelated with PTQ activity level scores both before and after controlling for exposure to television in general. Thus, it seems unlikely that

exposure to the cinematic devices unique to television were responsible for its relation with activity level scores.

There are, of course, a myriad of potential reasons for this relationship. It is possible, for instance, that time spent with television displaces time spent in more physically tiring outdoor activities (see Chapter One for a discussion of the displacement hypothesis and research findings). On the other hand, it is possible that weather or seasonal conditions (which were not controlled for here) induced both the higher levels of restlessness and exposure to television.

The results of the analyses examining television's relation to impulsivity have already been discussed in detail (see KRISP Results section above). Briefly, like the activity level results, the results with KRISP performance only partially supported the findings reported in the literature, but in general suggested that television exposure and performance in the KRISP were related.

Exposure to child-informative, educational, and public broadcast programming, as well as exposure to Sesame Street were all negatively correlated with the number of errors that boys committed in the KRISP. Fast paced program exposure was also a negative correlate, but unlike the other program categories, this correlation was small enough that had a one percent single-test alpha been employed it would not have been significantly different from zero. It was

unlikely, then, that exposure to short content units was responsible for these relations.

It was noted that this pattern of correlations was consistent with Gadberry's interpretation of her results. Namely, that exposure to child-informative programming is associated with better performance in the MFF (here, the KRISP). Another set of analyses, however, suggested that the correlations with boys' accuracy in the KRISP might have been a function of intellectual competence. Specifically, these analyses suggested that more intelligent boys might choose to view more informative programming and, by virtue of their intellectual competence, make fewer errors in the KRISP. On the other hand, the pattern of relations was also consistent with the hypothesis that exposure to this type of programming positively impacts both intellectual competence and performance in the KRISP, perhaps by improving visual scanning abilities. If the latter scenario is legitimate, then Salomon's work which indicates a positive impact of exposure to cinematic devices on visual scanning ability offers a potential mechanism for the effect.

Moreover, the fact that exposure to Mister Rogers did not correlate with boys' accuracy (before or after controlling for either IQ or total exposure) lends some credibility to the hypothesis that exposure to cinematic devices is important to the relations between exposure and boys' accuracy. As noted above, while Mister Rogers and Sesame Street were identically coded using the CRITC system,

they are generally agreed to vary in terms of their use of cinematic devices. Thus, the fact that exposure to Sesame Street and all of the categories to which both it and Mister Rogers belong were significant correlates of boys' accuracy in the KRISP but exposure to Mister Rogers was not suggests that the source of significant covariation is a characteristic of Sesame Street not shared with Mister Rogers, perhaps the density of cinematic code use.

To identify cinematic codes as the possible mechanism of the observed relations does not, of course, necessarily imply that causality flows from exposure to the competencies involved in the KRISP and PPVT tasks. It is possible that a certain level of cognitive competence is necessary before the child is able to comprehend enough of Sesame Street to make it a favorite program. This cognitive competence might involve the ability to selectively focus attention, or visually scan, general world knowledge, familiarity with television's forms or all of the above. All have been found to contribute to comprehension of television (for a review see Anderson and Collins, 1988). Finally, except for the fact that they had significantly higher IQ scores, it is unclear why the positive relation with KRISP accuracy was limited to boys.

There was some suggestion that the same effect might be operating in the girls' data. When variability due to IQ was removed, the positive correlations with the number of

errors committed in the KRISP increased in size. Even if there was some positive "effect" (on KRISP accuracy) of the time girls spent with these programs, however, it was probably small and was clearly overshadowed by a stronger positive relation between impulsivity (or at least error prone responses) and time with television. Although small, the correlation between girls' exposure to child-informative programming and KRISP accuracy continued to be significant after controlling for total exposure (it was the only one of these program categories to do so). Thus, future analyses might identify the source of the general, unpredicted, pattern of relations with girls' accuracy in the KRISP by looking at the patterns of correlations for each child-informative program viewed by this sample and then comparing those results with the similarities and differences in these programs' content and form.

Finally, it should be noted that the results of this study were supportive of neither C. Anderson and Maguire's finding that impulsivity is related to violent program (here, action) exposure nor Stein and Friedrich's finding that exposure to Mister Rogers was positively associated with response latencies. In fact, the only significant correlate of response latency was exposure to soap operas. Children who spent more time with soap operas had both shorter response times and committed more errors in the KRISP. Exposure to soap operas, then, was also the only exposure variable that was correlated with performance in

the KRISP in a way that satisfies Kagan's definition of an impulsive pattern of responding. Thus, it is possible that the other correlations obtained with the number of KRISP errors are actually indicative of some behavioral tendency other than impulsivity. Moreover, since the pattern varied as a function of sex, it is possible that KRISP accuracy was indicative of different behavioral tendencies in male and female subjects.

Attention to Television

The final analysis examined the relation between exposure to television and attention to Sesame Street in the laboratory. Although earlier reports have found that attention to television is uncorrelated with time spent with the medium (Anderson et al., 1985), both visual orientation and time with television have been undifferentiated with respect to program type. There are good reasons to suspect that time with and attention to a specific program or program type are related. One could argue, for example, that both program selection and attention reflect interest in the program. In addition, since attention to television has been found to vary with the comprehensibility of the content, and comprehensibility has, in turn, been found to be a function (in part) of familiarity with television's forms, it stands to reason that exposure to the forms and content of a program should be positively related with attention to that program.

Presented in Table 51 are the correlations between the various categories of television exposure and attention to Sesame Street in the lab. Of the eighteen correlations, seven differed significantly by sex (all Z's > 1.09, p < .087). They involved entertainment, slowly paced, commercial, action and realistic action, moderately paced and total exposure. In each case, the correlation was not significantly different from zero for the girls, and for the boys, it was significantly negative. The negative correlations with boys' exposure ranged from a high of $\underline{r}$ = -.291 (b = -.039, $\underline{t}$ = -2.714, p .009) for exposure to realistic action programming to a low of $\underline{r}$ = -.231 (b = -..010, $\underline{t}$ = -2.068, p < .043) for exposure to moderately paced programming. Moreover, only two of the correlations were large enough to be significant when using a one percent single-test alpha level. They involved exposure to realistic action and slowly paced programming ($\underline{r}$ = -.292, b = -.028, $\underline{t}$ = 2.660, p = .010).

As was already stated, slowly paced programming was primarily made up of exposure to live coverage of mostly male, competitive sports. In addition, it has been reported that there is a five to one ratio of males to females in the casts of police-detective shows (Greenberg, 1982), one of the four action categories. Exposure to slowly paced and live action programming, then, appears to reflect time spent with programs that center around males engaged in action. Thus, the negative correlations with Sesame Street might

indicate that boys who spend more time with these programs have less interest in Sesame Street.

Notably absent from Table 51 is a significant correlation (for either sex or for the group as a hole) involving exposure to Sesame Street. It is not obvious why levels of exposure to other programs are correlated with attention to Sesame Street and time with Sesame Street is not. The results from two research reports based on the same data (Huston et al., 1987; Pinon, Huston and Wright, 1989) provide some help in interpreting these results. By means of multiple regression and analysis of variance, Huston and colleagues found that young children's levels of exposure to entertainment programs were in large part predicted by individual differences specific to the child such as gender and age. Exposure to Sesame Street, on the other hand, was largely determined individual differences external to the child, including parental encouragement of viewing, age of siblings, and whether the child was at home during the day. In addition to these findings, it has been suggested elsewhere that parents may use Sesame Street as a means of keeping their child occupied while they accomplish other tasks (c.f. Field, 1987 and Gadberry, 1974). Thus, while attention to Sesame Street may indicative of interest in the program, levels of exposure in the home may be less so. Hence, the lack of a correlation between the two.

These findings emphasize the need for additional studies which examine the relations between exposure and attention to other programs, including other educational programs. In addition, these findings have implications for studies (such as the present one) that attempt to determine the possible consequences of exposure to television from estimates of time with TV. Specifically, they imply that correlations between exposure to Sesame Street and cognitive skill may be more indicative of relations between home environment and cognitive competence than the correlations obtained with other programs are. In general, then, it would be advisable to attempt to measure and control for parental influence on viewing levels in future studies concerned with the effects of exposure to different kinds of programming.

Table 27

Program category definitions

Program Category	Definition in terms of CRITC codes
Action Adventure	Program Type = 21, 22, 23 or 25
Cartoons	Animated = 3
Child Informative	Audience = 1 and Informative Purpose = 2
Commercial	Station Type = 1 or 3
Educational	Informative Purpose = 2
Entertainment	Informative Purpose = 1
Fantasy Action	Animated = 2 or 3 and Program Type = 21, 22, 23 or 25
Fast Paced	Content Time Demands = 1 or 2
Moderately Paced	Content Time Demands = 3 or 4
Mini Series	Content Time Demands = 7
Nature	Program Type = 12
Public Broadcasting	Station Type = 2
Realistic Action	Animated = 1 and Program Type = 21, 22, 23 or 25
Situation Comedies	Program Type = 19
Slow Paced	Content Time Demands = 5 or 6
Soap Operas	Content Time Demands = 8

Table 28

Mean and median hours of exposure with standard deviations
(n = 328)

Program Type	Mean		Median
Action Adventure	1.957	(1.921)	1.500
Cartoons	2.957	(2.637)	2.250
Child Informative	4.388	(3.839)	3.625
Commercial	10.888	(6.792)	9.938
Educational	5.399	(4.375)	4.250
Entertainment	8.945	(6.394)	7.750
Fantasy Action	1.030	(1.194)	0.750
Fast Paced	7.803	(5.234)	6.750
Moderately Paced	4.940	(3.670)	4.313
Mister Rogers	0.415	(0.587)	0.250
Nature	0.234	(0.463)	0.000
Public Broadcasting	2.865	(3.016)	2.000
Realistic Action	0.927	(1.084)	0.563
Sesame Street	1.776	(1.946)	1.250
Situation Comedies	2.531	(2.350)	1.750
Slow Paced	0.904	(1.340)	0.500
Soap Operas	0.531	(1.227)	0.000
Total Exposure	15.117	(8.802)	13.750

Table 29

Vigilance sample mean and median hours of exposure with standard deviations
(n = 103)

Program Type	Mean	Median
Action Adventure	2.107 (2.281)	1.375
Cartoons	2.806 (2.397)	2.125
Child Informative	4.450 (4.017)	3.625
Commercial	10.583 (6.702)	9.375
Educational	5.144 (4.261)	4.250
Entertainment	8.648 (6.469)	7.750
Fantasy Action	1.074 (1.276)	0.750
Fast Paced	7.257 (4.904)	6.250
Moderately Paced	4.985 (3.836)	4.750
Mister Rogers	0.375 (0.494)	0.250
Nature	0.208 (0.371)	0.000
Public Broadcasting	2.632 (2.896)	2.000
Realistic Action	1.033 (1.278)	0.625
Sesame Street	1.704 (2.019)	1.000
Situation Comedies	2.421 (2.207)	2.000
Slow Paced	0.981 (1.712)	0.375
Soap Operas	0.416 (0.806)	0.000
Total Exposure	14.461 (9.139)	12.375

Table 30

Mean and median hours of exposure with standard deviations by sex (n's = 168 and 160)

Program Type	Females		Males	
	Mean	Median	Mean	Median
Action Adventure[a]	1.704 (1.828)	1.250	2.223 (1.966)	1.750
Cartoons[a]	2.727 (2.807)	2.000	3.198 (2.430)	2.875
Child Informative	4.297 (4.062)	3.563	4.484 (3.600)	3.813
Commercial	10.589 (6.853)	8.875	11.202 (6.734)	10.500
Educational	5.294 (4.607)	4.188	5.509 (4.130)	4.563
Entertainment	8.533 (6.376)	7.000	9.377 (6.405)	8.250
Fantasy Action[b]	0.933 (1.232)	0.500	1.132 (1.147)	0.750
Fast Paced	7.493 (5.466)	6.438	8.129 (4.974)	7.500
Moderately Paced	4.690 (3.567)	3.938	5.202 (3.769)	4.625
Mister Rogers	0.379 (0.586)	0.000	0.454 (0.587)	0.250
Nature	0.206 (0.468)	0.000	0.263 (0.457)	0.000
Public Broadcasting	2.667 (3.018)	1.750	3.073 (3.008)	2.063
Realistic Action[c]	0.771 (0.979)	0.500	1.091 (1.165)	0.875
Sesame Street	1.653 (1.956)	1.000	1.905 (1.932)	1.375
Situation Comedies	2.563 (2.444)	2.000	2.497 (2.255)	1.688
Slow Paced	0.808 (1.141)	0.500	0.996 (1.520)	0.625
Soap Operas	0.641 (1.521)	0.000	0.416 (0.801)	0.000
Total Exposure	14.606 (9.076)	12.438	15.654 (8.500)	15.125

[a] $Z > 2.617$, $p < .010$

[b] $Z = 2.299$, $p < .023$

[c] $\underline{t}' = 2.687$, $p < .008$

Table 31

Vigilance sample mean and median hours of exposure with standard deviations by sex
(n's = 54 and 49)

Program Type	Females		Males	
	Mean	Median	Mean	Median
Action Adventure	1.863 (2.259)	1.188	2.375 (2.298)	1.875
Cartoons[a]	2.549 (2.637)	1.750	3.089 (2.090)	2.875
Child Informative	4.317 (4.167)	3.500	4.597 (3.833)	4.125
Commercial	9.398 (5.757)	8.000	11.888 (7.452)	10.625
Educational	4.887 (4.397)	4.000	5.429 (4.132)	4.625
Entertainment	7.664 (5.349)	6.688	9.732 (7.420)	8.250
Fantasy Action	1.016 (1.440)	0.563	1.138 (1.078)	1.000
Fast Paced	6.655 (5.073)	5.563	7.921 (4.673)	7.250
Moderately Paced	4.326 (3.220)	3.688	5.712 (4.334)	5.000
Mister Rogers[b]	0.273 (0.392)	0.000	0.487 (0.570)	0.250
Nature	0.148 (0.293)	0.000	0.273 (0.434)	0.000
Public Broadcasting	2.498 (2.893)	1.875	2.781 (2.922)	2.000
Realistic Action	0.847 (1.099)	0.500	1.237 (1.434)	1.000
Sesame Street	1.708 (2.146)	0.813	1.699 (1.892)	1.250
Situation Comedies	2.123 (1.962)	1.938	2.750 (2.426)	2.250
Slow Paced	0.928 (1.324)	0.500	1.038 (2.070)	0.250
Soap Operas	0.479 (0.924)	0.000	0.347 (0.655)	0.000
Total Exposure	13.218 (8.442)	10.500	15.832 (9.753)	14.000

[a] $Z > 2.236$, $p < .025$

[b] $\underline{t}' > 2.298$, $p < .030$

Table 32

Skew and kurtosis of exposure hour distributions for male and female subjects (n's = 168 and 160)

Program Type	Females		Males	
	Skew	Kurt.	Skew	Kurt.
Action Adventure	2.244	6.356	1.382	2.885
Cartoons	2.488	8.789	1.083	1.197
Child Informative	2.033	5.457	1.010	1.120
Commercial	1.294	1.744	1.051	1.690
Educational	1.898	4.801	0.862	0.276
Entertainment	1.395	1.962	1.449	3.557
Fantasy Action	2.584	7.857	1.511	2.565
Fast Paced	1.848	4.710	0.556	-0.385
Moderately Paced	1.143	1.070	1.211	2.117
Mister Rogers	1.903	3.176	1.413	1.190
Nature	3.429	13.737	2.543	7.946
Public Broadcast	2.123	6.120	1.099	0.730
Realistic Action	2.427	7.354	1.808	5.368
Sesame Street	2.311	8.016	1.214	0.969
Situation Comedies	1.439	1.715	1.138	0.917
Slow Paced	2.025	5.290	3.882	22.523
Soap Operas	4.038	20.606	2.608	8.070
Total Exposure	1.487	2.931	1.058	2.595

Table 33

Skew and kurtosis of exposure hour distributions for male and female vigilance subjects (n's = 54 and 49)

Program Type	Females		Males	
	Skew	Kurt.	Skew	Kurt.
Action Adventure	2.336	5.792	2.161	7.401
Cartoons	1.764	2.684	0.603	-0.150
Child Informative	2.109	4.594	1.558	3.190
Commercial	0.980	0.503	1.518	3.224
Educational	2.117	4.659	1.356	2.502
Entertainment	0.973	0.349	1.958	5.416
Fantasy Action	2.530	6.229	1.544	3.655
Fast Paced	2.297	5.959	0.884	0.921
Moderately Paced	1.065	1.439	1.608	3.252
Mister Rogers	1.270	0.357	1.351	1.168
Nature	2.235	4.065	1.699	1.925
Public Broadcast	2.369	6.768	1.597	2.801
Realistic Action	2.426	7.236	2.044	5.853
Sesame Street	2.562	8.247	1.608	2.369
Situation Comedies	1.610	2.889	1.308	1.494
Slow Paced	1.999	3.776	4.077	19.420
Soap Operas	2.741	8.743	1.728	1.518
Total Exposure	1.662	3.140	1.934	5.100

Table 34

PTQ distractibility and persistence scores correlated with exposure hours by sex (n's = 168 and 160)

Program Type	Distractibility[a]		Persistence[a]	
	Females	Males	Females	Males
Action Adventure	.099	-.006	-.034	-.071
Cartoons	.037	-.007	-.004	-.071
Child Informative	-.010	.032	-.079	-.002
Commercial	-.051	-.009	-.030	-.073
Educational	-.054	.003	-.074	.000
Entertainment	-.029	.002	-.005	-.090
Fantasy Action	.108	-.037	-.025	-.053
Fast Paced	-.046	.018	-.049	-.077
Moderately Paced	.039	.014	-.021	-.047
Mister Rogers	-.092	.000	-.023	.004
Nature	.061[b]	-.004	-.150	-.035
Public Broadcast	-.032	.058	-.044	-.050
Realistic Action	.049	.027	-.032	-.067
Sesame Street	-.037	.050	-.009	-.069
Situation Comedies	.018	-.003	.026	-.036
Slow Paced	-.045	-.058	-.041	-.002
Soap Operas	-.208*	.012*	.035	-.056
Total Exposure	-.056	.005	-.045	-.077

[a]Female $p < .05$ when $|r| > .198$; $p < .01$ when $|r| > .151$;
Male $p < .05$ when $|r| > .155$; $p < .01$ when $|r| > .203$

[b]$r = .160$ after outlier deleted

*$Z > 2.000$, $p < .045$

Table 35

Banta measures of perseverance correlated with exposure hours by sex
(n's = 167 and 159)

Program Type	Time on Task[a] Females	Males	First Look Away[a] Females	Males
Action Adventure	-.005	.027	.104	-.037
Cartoons	.028	.034	.070	.001
Child Informative	-.048	.052	.077	.121
Commercial	-.011	-.022	.022	.004
Educational	-.016	.002	.065	.106
Entertainment	.021	.022	.036	-.057
Fantasy Action	.039	.034	.113	-.035
Fast Paced	-.013	.034	.059	.083
Moderately Paced	-.005	.010	.018	-.043
Mister Rogers	.036	.077	.061	.109
Nature	.051	-.038	.086	-.093
Public Broadcast	-.004	.083	.094	.081
Realistic Action	-.059	.012	.053	.053
Sesame Street	-.047	.093	.102	.129
Situation Comedies	-.011	.040	-.043	-.063
Slow Paced	.181*	-.008*	.143*	-.126*
Soap Operas	-.034	-.046	-.039	.033
Total Exposure	.014	.008	.065	.010

[a] Female $p < .05$ when $|r| > .151$; $p < .01$ when $|r| > .198$;
Male $p < .05$ when $|r| > .155$; $p < .01$ when $|r| > .203$

*$Z > 1.717$, $p < .099$

Table 36

Non-vigilance measures of perseverance[a] correlated with exposure hours (n's = 326 and 328)

Program Type	Banta		PTQ	
	Time on Task	First Look Away	Distract. Score	Persist. Score
Action Adventure	.011	.023	.026	-.052
Cartoons	.030	.032	.005	-.034
Child Informative	.002	.095	.007	-.044
Commercial	-.017	.010	-.036	-.051
Educational	-.007	.082	-.030	-.040
Entertainment	.021	-.014	-.022	-.046
Fantasy Adventure	.035	.038	.027	-.038
Fast Paced	.010	.065	-.023	-.062
Moderately Paced	.003	-.018	.017	-.034
Mister Rogers	.057	.079	-.054	-.010
Nature	.005	-.004	.021[b]	-.094
Public Broadcast	.041	.082	.004	-.046
Realistic Adventure	-.019	-.002	.017	-.050
Sesame Street	.026	.109	-.002	-.038
Situation Comedies	.015	-.051	.010	-.003
Slow Paced	.068	-.011	-.060	-.019
Soap Operas	-.035	-.007	-.112	.004
Total Exposure	.011	.034	-.034	-.060

[a] $p < .05$ when $|r| > .108$; $p < .01$ when $|r| > .142$

[b] $r = .062$ when outlier is deleted

Table 37

Measures of focused processing in the vigilance task correlated with exposure hours by sex
(n's = 54 and 49)

Program Type	Prob. of a Hit[a] Females	Males	Avg. Att. Episode[a] Females	Males
Action Adventure	-.048	-.010	-.087	.071
Cartoons	-.051	.073	-.180	.112
Child Informative	-.165*	.180*	-.182*	.245*
Commercial	-.229	-.003	-.247*	.188*
Educational	-.167	.118	-.173*	.224*
Entertainment	-.232	.005	-.212*	.140*
Fantasy Action	-.003	-.021	-.095	.034
Fast Paced	-.162	.162	-.195*	.266*
Moderately Paced	-.307	-.055	-.298*	.096*
Mister Rogers	-.155*	.214*	-.085	.178
Nature	.129*	-.237*	.118	-.126
Public Broadcast	-.148	.156	-.147	.129
Realistic Action	-.094	-.001	-.054	.088
Sesame Street	-.173	.150	-.154	.152
Situation Comedies	-.343	-.027	-.287*	.109*
Slow Paced	-.137	-.002	-.020	.103
Soap Operas	-.049c	.035	.083	.098
Total Exposure	-.223	.041	-.210*	.212*

[a]Female $p < .05$ when $|r| > .268$; $p < .01$ when $|r| > .347$;
Male $p < .05$ when $|r| > .281$; $p < .01$ when $|r| > .364$

[c]$r = -.236$ when outlier is deleted

*$Z > 1.741$, $p < .082$

Table 38

Measures of focused processing in the vigilance task[a] correlated with hours of exposure for all subjects (n = 103)

Program Type	Prob. of a Hit	Avg. Attent. Episode
Action Adventure	-.026	-.012
Cartoons	.001	-.063
Child Informative	-.021	-.002
Commercial	-.103	-.019
Educational	-.046	-.003
Entertainment	-.098	-.021
Fantasy Action	-.007	-.045
Fast Paced	-.023	-.003
Moderately Paced	-.163	-.084
Mister Rogers	.046	.062
Nature	-.052	-.003
Public Broadcast	-.014	-.024
Realistic Action	-.039	.024
Sesame Street	-.044	-.030
Situation Comedies	-.178	-.084
Slow Paced	-.059	.047
Soap Operas	-.024[b]	.083
Total Exposure	-.091	-.003

[a] $p < .05$ when $|r| > .193$; $p < .01$ when $|r| > .252$

[b] $r = -.122$ when outlier is deleted

Table 39

Percent visual orientation in the vigilance task[a] correlated with exposure hours
(n's = 54, 49 and 103)

Program Type	Females	Males	All Subjs.
Action Adventure	.052	-.103[b]	-.002[b]
Cartoons	.105	-.194	.010
Child Informative	-.276	-.144	-.221
Commercial	-.127	-.220	-.147
Educational	-.260	-.180	-.222
Entertainment	-.113	-.183	-.126
Fantasy Action	.109	-.178	.016
Fast Paced	-.219	-.219	-.206
Moderately Paced	-.120	-.133	-.106
Mister Rogers	-.225	-.015	-.096
Nature	.055	-.218	-.037
Public Broadcast	-.279	-.154	-.222
Realistic Action	-.035	-.031[c]	-.021[c]
Sesame Street	-.319	-.195	-.271
Situation Comedies	-.209	-.072	-.130
Slow Paced	-.092	-.207[d]	-.138[d]
Soap Operas	-.195[e]	-.095	-.168[e]
Total Exposure	-.189	-.249	-.197

[a]Female $|r| > .268$, male $|r| > .281$, all $|r| > .193$, $p < .05$

Female $|r| > .347$, male $|r| > .364$, all $|r| > .252$, $p < .01$

[b] r's = .080 and .119 when outlier is deleted
[c] r's = .197 and .065 when outlier is deleted
[d] r's = .041 and -.048 when outlier is deleted
[e] r's = -.348 and -.249 when outlier is deleted

Table 40

Significant correlates of the perseverance measures

Prog. Type	Banta Time on Task	Banta First Inatten.	PTQ Distract.	Atten. Episod.	Pct. Visual Orient.
Child Inf.					-.221*
Education.					-.222*
Fast Paced					-.206*
Mod. Paced				-.298[a]*	
PBS					-.222*
Sesame St.		.109*			-.271**
Sitcoms				-.287[a]*	
Slow Paced	.181[a]*				
Soap Operas			-.208[a]**		-.249**
Total					-.197*

[a]Significant for girls only

*$p < .05$

**$p < .01$

Table 41

Partial correlations between hours of program exposure and focused processing in vigilance task by sex controlling for total exposure
(n's = 54 and 49)

Program Type	Prob. of a Hit[a]		Avg. Att. Episode[a]	
	Females	Males	Females	Males
Action Adventure	.151	-.072	.080	-.171
Cartoons	.154	.064	-.047	-.080
Child Informative	.022	.188	-.036	.159
Commercial	-.062	-.126	-.139	-.042
Educational	.022	.114	.000	.134
Entertainment	-.088	-.075	-.070	-.124
Fantasy Action	.184	-.086	-.047	-.217
Fast Paced	.079	.189	-.021	.168
Moderately Paced	-.216	-.176	-.216	.172
Mister Rogers	-.104	.210	-.030	.143
Nature	.275	-.252	.254	-.181
Public Broadcast	.022	.155	.000	.042
Realistic Action	.049	-.041	.085	-.089
Sesame Street	-.038	.152	-.021	.052
Situation Comedies	-.286	-.041	-.229	-.037
Slow Paced	-.022	-.050[b]	.117	-.089[b]
Soap Operas	.038[c]	.019	.172	.000

[a]Female $|\underline{r}_{12.3}| > .270$, male $|\underline{r}| > .284$, $p < .05$;
Female $|\underline{r}_{12.3}| > .349$, male $|\underline{r}_{12.3}| > .368$, $p < .01$

[b]$\underline{r}_{12.3} = .015$ and .024 when outlier is deleted

[c]$\underline{r}_{12.3} = -.163$ when outlier is deleted

Table 42

Partial correlations[a] between exposure hours and percent visual orientation to the CRT controlling for total exposure
(n = 103)

Program Type	
Action Adventure	.224[b]
Cartoons	.225
Child Informative	-.125
Commercial	.100
Educational	-.125
Entertainment	.095
Fantasy Action	.210
Fast Paced	-.083
Moderately Paced	.085
Mister Rogers	-.050
Nature	.029
Public Broadcast	-.136
Realistic Action	.147[c]
Sesame Street	-.196
Situation Comedies	-.029
Slow Paced	.000
Soap Operas	-.104[d]

[a] $p < .05$ when $|r_{12.3}| > .194$; $p < .01$ when $|r_{12.3}| > .254$

[b] $r_{12.3} = .249$ when outlier is deleted

[c] $r_{12.3} = .180$ when outlier is deleted

[d] $r_{12.3} = -.190$ when outlier is deleted

Table 43

False alarms correlated with exposure hours
(n's = 54, 49 and 103)

Program Type	Females[a]	Males[b]	All Subjs.[c]
Action Adventure	-.106	.152	.022
Cartoons	-.119	.133	-.008
Child Informative	.059	-.054	.014
Commercial	.042	.276	.175
Educational	.044	.021	.041
Entertainment	.067	.251	.174
Fantasy Adventure	-.139	.164	-.019
Fast Paced	.061	.082	.082
Moderately Paced	.075	.199	.153
Mister Rogers	-.133	-.176	-.124
Nature	-.037	-.096	-.048
Public Broadcast	.098	-.111	.009
Realistic Adventure	-.035	.120	.059
Sesame Street	.193	-.083	.077
Situation Comedies	.183	.174	.188
Slow Paced	-.038*	.315*	.155
Soap Operas	.035	.111	.053
Total Exposure	.041	.225	.142

[a] $p < .05$ when $|r| > .268$, $p < .01$ when $|r| > .347$

[b] $p < .05$ when $|r| > .281$, $p < .01$ when $|r| > .364$

[c] $p < .05$ when $|r| > .193$, $p < .01$ when $|r| > .252$

* $Z = 1.829$, $p < .067$

Table 44

PTQ activity level score correlated with exposure hours (n's = 168, 160, and 328)

Program Type	Females[a]	Males[b]	All Subjs.[c]
Action Adventure	-.041	.131	.061
Cartoons	-.006	.070	.038
Child Informative	.108	.013	.066
Commercial	.114	.199	.159
Educational	.121	.035	.083
Entertainment	.065	.212	.144
Fantasy Adventure	-.043	.076	.022
Fast Paced	.114	.090	.109
Moderately Paced	.053	.177	.124
Mister Rogers	.073*	-.195*	-.051
Nature	.042	.031	.043
Public Broadcast	.066	-.012	.035
Realistic Adventure	-.023	.147	.083
Sesame Street	.084	.067	.082
Situation Comedies	.056	.151	.099
Slow Paced	-.025*	.205*	.110
Soap Operas	.163	.061	.111
Total Exposure	.094	.195	.147

[a] $p < .05$ when $|r| > .151$, $p < .01$ when $|r| > .198$

[b] $p < .05$ when $|r| > .155$, $p < .01$ when $|r| > .203$

[c] $p < .05$ when $|r| > .108$, $p < .01$ when $|r| > .142$

* $Z > 2.179$, $p < .029$

Table 45

Partial correlations between activity level scores and exposure hours controlling for total exposure (n's = 168, 160 and 328)

Program Type	Females[a]	Males[b]	All Subjs.[c]
Action Adventure	-.137	.000	-.056
Cartoons	-.096	-.102	-.092
Child Informative	.066	-.119	-.039
Commercial	.077	.054	.064
Educational	.080	-.110	-.030
Entertainment	-.039	.090	.039
Fantasy Adventure	-.127	-.068	-.092
Fast Paced	.069	-.106	-.035
Moderately Paced	-.031	.040	.025
Mister Rogers	.049	-.263	-.106
Nature	.024	-.041	-.025
Public Broadcast	.024	-.130	-.066
Realistic Adventure	-.079	.050	.025
Sesame Street	.039	-.035	-.017
Situation Comedies	.024	.045	.025
Slow Paced	-.074	.126	.053
Soap Operas	.137	-.020	.056

[a] $p < .05$ when $|r| > .151$, $p < .01$ when $|r| > .198$

[b] $p < .05$ when $|r| > .155$, $p < .01$ when $|r| > .203$

[c] $p < .05$ when $|r| > .108$, $p < .01$ when $|r| > .142$

Table 46

Exposure to each program category correlated with total exposure
(n's = 168, 160 and 328)

Program Type	Females[a]	Males[b]	All Subjs.[c]
Action Adventure	.651	.698	.673
Cartoons	.672	.716	.692
Child Informative	.676*	.555*	.622
Commercial	.935	.910	.923
Educational	.709	.610	.665
Entertainment	.861	.858	.860
Fantasy Action	.598	.646	.621
Fast Paced	.871*	.789*	.835
Moderately Paced	.724	.789	.835
Mister Rogers	.353	.270	.316
Nature	.418	.332	.380
Public Broadcast	.648*	.506*	.582
Realistic Action	.462	.542	.502
Sesame Street	.654*	.482*	.575
Situation Comedies	.602	.601	.600
Slow Paced	.414	.501	.457
Soap Operas	.510	.371	.441

[a] $p < .05$ when $|r| > .151$, $p < .01$ when $|r| > .198$

[b] $p < .05$ when $|r| > .155$, $p < .01$ when $|r| > .203$

[c] $p < .05$ when $|r| > .108$, $p < .01$ when $|r| > .142$

* $Z > 1.758$, $p < .040$, one-tailed test

Table 47

KRISP measures correlated with exposure hours
(n's = 167 and 160)

Program Type	No. of Errors		Avg. Latency	
	Females	Males	Females	Males
Action Adventure	.041	.034	-.112	-.038
Cartoons	.005	.017	-.070	-.092
Child Informative	.205*	-.238*	-.090*	.149*
Commercial	.111	.011	-.113	-.024
Educational	.154*	-.226*	-.093*	.136*
Entertainment	.077	.050	-.110	-.044
Fantasy Adventure	.033	-.040	-.066	-.098
Fast Paced	.145*	-.178*	-.128*	.063*
Moderately Paced	.061	.085	-.054	-.033
Mister Rogers	.114*	-.106*	-.162	.016
Nature	.055*	-.135*	-.067	.050
Public Broadcast	.164*	-.199*	-.111*	.106*
Realistic Adventure	.034	.096	-.126	.033
Sesame Street	.190*	-.200*	-.095*	.106*
Situation Comedies	.068	.080	-.026	-.030
Slow Paced	-.035	-.081	.003	.094
Soap Operas	.188	.088	-.132	-.089
Total Exposure	.122	-.070	-.119	.035

[a] $p < .05$ when $|r| > .151$; $p < .01$ when $|r| > .198$

[b] $p < .05$ when $|r| > .155$; $p < .01$ when $|r| > .203$

* $Z > 1.711$, $p < .089$, two-tailed

Table 48

IQ correlated with hours of exposure
(n's = 166, 160 and 326)

Program Type	Females[a]	Males[b]	All Subjs.[c]
Action Adventure	.025	-.051	.001
Cartoons	.056	.063	.068
Child Informative	.152*	.382*	.259
Commercial	.018	-.079	-.024
Educational	.158*	.338*	.242
Entertainment	.010	-.134	-.054
Fantasy Adventure	.042	.049	.054
Fast Paced	.154	.288	.221
Moderately Paced	-.051	-.139	-.087
Mister Rogers	.275	.360	.321
Nature	.192	.235	.218
Public Broadcast	.211	.383	.301
Realistic Adventure	-.007	-.134	-.057
Sesame Street	.128	.299	.217
Situation Comedies	-.041	-.147	-.092
Slow Paced	.038*	-.149*	-.058
Soap Operas	.038*	-.181*	-.045
Total Exposure	.091	.072	.088

[a] $p < .05$ when $|r| > .151$, $p < .01$ when $|r| > .198$

[b] $p < .05$ when $|r| > .155$, $p < .01$ when $|r| > .203$

[c] $p < .05$ when $|r| > .108$, $p < .01$ when $|r| > .142$

*$Z > 1.707$, $p < .089$

Table 49

Partial correlations between KRISP errors and exposure hours controlling for IQ
(n's = 166, 160 and 326)

Program Type	Females[a]	Males[b]	All Subjs.[c]
Action Adventure	.049	.000	.036
Cartoons	.000	.038	.025
Child Informative	.259	-.131	.095
Commercial	.121	-.085	.062
Educational	.207	.131	.062
Entertainment	.081	.000	.051
Fantasy Adventure	.042	-.027	.000
Fast Paced	.198	-.094	.072
Moderately Paced	.049	.038	.051
Mister Rogers	.203	.000	.117
Nature	.113	-.066	.036
Public Broadcast	.234	-.085	.092
Realistic Adventure	.024	.054	.051
Sesame Street	.234	-.115	.080
Situation Comedies	.060	.038	.044
Slow Paced	-.024	-.137	-.076
Soap Operas	.207	.027	.144
Total Exposure	.153	-.047	.067

[a] $p < .05$ when $|r| > .151$, $p < .01$ when $|r| > .198$

[b] $p < .05$ when $|r| > .155$, $p < .01$ when $|r| > .203$

[c] $p < .05$ when $|r| > .108$, $p < .01$ when $|r| > .142$

Table 50

Partial correlations between KRISP errors and exposure hours controlling for total exposure (n's = 167, 160 and 327)

Program Type	Females[a]	Males[b]	All Subjs.[c]
Action Adventure	-.048	.115	.020
Cartoons	-.103	.095	-.020
Child Informative	.169	-.241	-.009
Commercial	.000	.179	.081
Educational	.096	-.232	-.047
Entertainment	-.053	.214	.066
Fantasy Adventure	-.048	.000	-.026
Fast Paced	.081	-.202	-.048
Moderately Paced	-.039	-.228	.068
Mister Rogers	.075	-.090	.000
Nature	.000	-.118	-.048
Public Broadcast	.112	-.191	-.029
Realistic Adventure	-.022	.160	-.026
Sesame Street	.147	-.191	-.009
Situation Comedies	.000	.153	.064
Slow Paced	-.095	-.054	-.084
Soap Operas	.148	.123	.148

[a] $p < .05$ when $|r| > .151$, $p < .01$ when $|r| > .198$

[b] $p < .05$ when $|r| > .155$, $p < .01$ when $|r| > .203$

[c] $p < .05$ when $|r| > .108$, $p < .01$ when $|r| > .142$

Table 51

Attention to "Sesame Street" correlated with hours of exposure

Program Type	Females[a]	Males[b]	All Subjs.[c]
Action Adventure	.034*	-.261*	-.107
Cartoons	.133	-.114	.035
Child Informative	.006	-.048	-.016
Commercial	.050*	-.256*	-.097
Educational	.019	-.090	-.028
Entertainment	.065*	-.254*	-.088
Fantasy Adventure	.073	-.130	-.010
Fast Paced	.087	-.122	-.003
Moderately Paced	.041*	-.231*	-.095
Mister Rogers	-.051	.052	-.002
Nature	-.011	.121	.055
Public Broadcast	.045	-.017	.018
Realistic Adventure	-.027*	-.297*	-.171
Sesame Street	.074	-.080	.006
Situation Comedies	.066	-.179	-.044
Slow Paced	.039*	-.292*	-.144
Soap Operas	-.132	-.041	-.096
Total Exposure	.056*	-.233*	-.079

[a] $p < .05$ when $|r| > .214$, $p < .01$ when $|r| > .279$

[b] $p < .05$ when $|r| > .222$, $p < .01$ when $|r| > .290$

[c] $p < .05$ when $|r| > .154$, $p < .01$ when $|r| > .201$

* $Z > 1.709$, $p < .088$, two-tailed test

CHAPTER 5

CONCLUSIONS

The popular claims of television's negative effect on attention have taken several forms, but most state that time with television, especially rapidly paced programming, leads to a short attention span, intolerance for delays and increased restlessness, perhaps even hyperactivity. The few studies that have investigated these potential effects reported that impulsivity and restlessness may be positively related with exposure to violent and/or commerical programming, and negatively related with exposure to public broadcast and/or educational programming. In addition, one experimental study suggested that educational and violent programming, respectively, have the potential for beneficial and deleterious effects on perseverance in play. Finally, while a series of studies indicated that exposure to television's unique forms (i.e. cinematic devices) might improve one's ability to selectively focus visual attention, exposure to the same might hinder the ability to persevere in remaining alert during a boring task.

More often than not, however, these significant relations (especially with perseverance) have been obtained with a single program, thought to represent a broadly defined category of programming. In addition, the measure(s) used to index perseverance, restlessness and impulsivity have often been unique to individual studies and

open to questions as to their validity. Perhaps even more important to understanding the meaning of the observed relations is the fact that little is known about children's attention. This pertains both to the question of how consistent individuals are in sustaining attention, and how attention might be related to the other behavioral tendencies with which it is popularly said to be associated (i.e. impulsivity and restlessness). In sum, while the literature indicates possible effects of television on attention, it has been difficult to assess the validity, generalizability, and potential mechanisms of these findings.

The present study attempted to address some of these problems. It used validated measures of television exposure and restlessness, as well as the most frequently used measure of impulsivity in children. In addition, sustained attention was measured both while viewing television and while engaged in two challenging tasks that might be said to involve more productive cognition than does TV viewing. Finally, exposure to television was differentiated by program types that were defined on the basis of differences in both content and form. This study, then, provided an opportunity to examine how consistent preschooler's attention is in different contexts, how it is related to restlessness and impulsivity, and how all three are related to television exposure.

Analysis of the attention data suggested that consistent individual differences in the ability to sustain attention do exist. Subjects showed highly consistent levels of visual orientation and focused processing across two different tasks, as well as across two different sessions of a vigilance task. There was considerably more individual variability across sessions in the average length of time for which subjects could or would continuously sustain focused processing. Moreover, attempts to relate the length of processing episodes in different tasks met with limited success. It was concluded, then, that there was little evidence to support the notion that a characteristic span of attention exists. Rather, it is more likely that when parents and educators speak of a child's "attention span" it is the child's tendency to generally persevere (in sustaining either visual orientation, or focused processing, or both) to which they refer.

Analysis of the attention data also revealed that perseverance in sustaining visual orientation and focused processing were unrelated to attention in the television viewing context. One could argue, of course, that the availability of audio information in the television viewing situation makes it impossible to know with certainty (from measures of visual orientation) whether the viewer was attentive to the program's content. Research suggests, however, that auditory and visual orientation are closely linked in children, especially at the level of semantically

processing program material (Field and Anderson, 1985; Lorch et al., 1979). It seems likely, then, that the consistent tendencies to persevere both visually and cognitively, identified in the other laboratory tasks, might be applicable only to tasks requiring productive cognition. Conversely, to the extent that attention to Sesame Street in the laboratory is indicative of attention to Sesame Street at home, these results suggest that the patterns of attention elicited during viewing are unlikely directly transfered to other task environments. Thus any relations between exposure to Sesame Street and the tendency to persevere that were found in this and other studies must have been due to some mechanism other than transfer.

When perseverance in the Banta and vigilance tasks were compared with scores on the PTQ persistence and distractibility subscales, they were generally found to be uncorrelated. The pattern of correlations with visual attention to Sesame Street were generally the same. These findings might be interpreted as indicating that perseverance in the laboratory is unrelated to that exhibited at home (or that parents are inaccurate observers). It was concluded, however, that the lack of significant correlations was just as likely due to the fact that these two subscales include items relevant to both cognitive and emotional persistence (which are apparently

uncorrelated) and therefore are incapable of detecting any consistencies that might actually obtain.

The activity level subscale from the PTQ has been reported to be more internally consistent (Palisin, 1986). Thus, when these scores were not found to be correlated with any of the measures of perseverance in the laboratory, it was concluded that the ability or tendency to sustain attention (both overt and covert) is uncorrelated with a child's typical level of motor activity. This directly contradicts the link made by several of television's critics between the shortened attention span that purportedly results from television exposure and hyperactivity.

Finally, there was some suggestion that perseverance in sustaining visual orientation and focused processing (at least in a vigilance task) are not synonymous. Moreover, since the correlation between the two was significantly smaller for boys, it was concluded that the distinction between visual and cognitive persistence might be greater in this population.

Other sex differences were obtained in the analyses that related measures of perseverance and with impulsivity. Girls', but not boys', levels of visual orientation and cognitive persistence in the vigilance task were positively correlated with the number of false alarms. Moreover, it was only for girls that the same measures were significantly correlated with accuracy in the KRISP. These findings were interpreted as suggesting that the tendency to be generally

more perseverant in sustaining visual orientation and focused processing are more related in girls than boys.

The results of a study conducted by Victor, Halverson and Montague (1985) have some bearing on this issue. They found that ratings of impulsivity and accuracy in the KRISP were more correlated in girls than boys. Moreover, when variability in IQ scores (as measured by performance in the PPVT) was controlled for, only the correlation for girls was still significant. Victor and colleagues interpret these findings as indicating that cognitive effort and behavioral impulsivity are more related in girls than boys. In addition, this pattern of relations seems to indicate that while accuracy in the KRISP may be a reasonably good indicator of impulsivity in girls, its value as a measure of the same in for boys is questionable. The fact that girls', but not boys', false alarms were positively correlated with the number of KRISP errors would support such a conclusion.

Finally, activity levels scores were found to be positively correlated with the number of looks away from the Banta puzzle, the number of false alarms in the vigilance task, and the number of errors in the KRISP. It was concluded, then, that a preschooler's tendency to be motorically active apparently impacts physical behavior in a wide variety of tasks. Since the correlations were small (accounting for no more than seven percent of the variance

in any of the other measures) it was further concluded that these contributions are likely small.

In sum, there was general support for the notion (implicit to claims of television's impact on attention span) that there are definite cross-task consistencies in the extent to which preschooler's persevere in sustaining attention to assigned tasks. In addition, there was support for the link between sustained attention (or perseverance) and impulsivity, at least in girls. The results of this study did not support, however, the notion that activity level or (restlessness) is related to preschooler's ability to sustain attention. Finally, there was no evidence to support the notion that patterns of attention to television transfer to other task environments.

The results of the analyses relating television exposure to perseverance, impulsivity and restlessness did not generally support many of the specific predictions generated from individual findings produced by earlier studies. They did , however, suggest that television exposure is related to impulsivity and activity level. The evidence for a relation with perseverance was weak.

The results of the activity level analyses were the most straight-forward. They suggested that boys' activity levels scores were negatively associated with exposure to Mister Rogers. Because activity level scores were not correlated with exposure to an identically coded program (Sesame Street), or with any of the categories to which

Mister Rogers belonged, it was concluded that the relation with Mister Rogers was likely attributable to the content and/or character actions specific to that program. In support of this interpretation were the positive associations between boys' exposure to slowly paced programming and both activity level scores and the number of false alarms. The slowly paced category of programming was primarily comprised of programs that provide live coverage of sporting events (primarily those involving male participants). Thus, less active boys spent both more time with Mister Rogers, and less time with programs portraying physically active males. It is possible then, that boys choose to spend time with programs that portray male characters whose behavior is similar in tempo to theirs. On the other hand, since Friedrich and Stein (1973) demonstrated the definite potential of Mister Rogers and Batman/Superman to impact the tolerance of delays in preschoolers, it is also possible that exposure to the calm behavior characteristic of Mister Rogers and the active behavior characteristic of male athletes increases the incidence of these behaviors in its viewers. If this is what accounts for the observed relations, it is unclear why they would be limited to boys since earlier research has indicated that it is identification with, not similarity of sex, that influences the effectiveness of televised models.

The other significant correlates of activity level scores were unlikely attributable to preferences for, or effects of, specific content. Specifically, total exposure to television and its largest correlates (entertainment and commercial programs) were positively correlated with activity level scores. This relation did not vary significantly by sex. The possibility that this was due to exposure to fast paced programming, either in terms of content unit length or the density of cinematic code use, was not supported by these data. It was suggested that perhaps exposure to television in general displaces time with more physically tiring activities, or that weather or seasonal conditions, uncontrolled for in this study, might have increased both total exposure and restlessness.

Finally, it is important that future research isolate the mechanism(s) of these relations as children's level of motor activity has been shown to be negatively correlated with academic achievement (Palisin, 1986), at least in the early grades.

Although the KRISP was concluded in this and another study to be a better indicator of impulsivity in girls than boys, the girls results were more inconsistent with earlier impulsivity results than were the results for boys. Girls' exposure to Sesame Street and the classes of exposure to which it belonged was negatively associated with accuracy in the KRISP. In addition, exposure to the same programs was negatively correlated with visual persistence in the

vigilance task. Moreover, there was a trend (though the correlations were non-significant) for exposure to the same programs to be negatively associated with cognitive persistence in the same task. Since girls' impulsivity and perseverance were correlated, one might conclude that exposure to Sesame Street and other educational programs leads to increased impulsivity in girls.

This seems unlikely given that other researchers have found that exposure to educational programming is negatively related to impulsivity. An alternative explanation derives from the pattern of correlations between exposure to the different categories of programming and attention to Sesame Street in the laboratory. Though exposure to other classes of programming (live action and slowly paced) were correlated with attention, exposure to Sesame Street was not. On the basis of this and the results from other studies, it was concluded that time with Sesame Street may be an especially poor indicator of program interest (and perhaps the attention that results from it). In fact, the results from other studies have suggested that exposure to Sesame Street is reflective of individual differences in home environment and exposure to other programs is more indicative of individual differences specific to the child. Moreover, there is some suggestion in the literature that parents use Sesame Street as a means of keeping their child occupied while they accomplish other tasks. It is possible,

then, that what the positive relations between impulsivity and girls' exposure to Sesame Street reflect are differences in the home environments of more or less impulsive children. It is also possible that parents make more use of Sesame Street as a means of occupying their child's time if that child is impulsive. Moreover, the lack of the same relations in the boys data are readily explained by the fact that KRISP accuracy has not been found to be a good measure of behavioral impulsivity in that population.

In fact, exposure to this class of programs was positively correlated with boys' accuracy in the KRISP. In addition, while visual persistence in the vigilance task was lower in the same children, there was some suggestion that they sustained a higher level of cognitive persistence. It was suggested, then, that boys' exposure to these programs was associated with more strategic performance in both the vigilance and KRISP tasks and that this might reflect differences in intellectual competence. The data generally supported this interpretation. None of the correlations between KRISP accuracy and these classes of exposure was significant after controlling for IQ. Moreover, it was noted that performance in the KRISP and the PPVT (which was used to measure IQ) both involve the ability to visually scan or selectively focus attention, an ability found by Salomon to be positively affected by exposure to television's cinematic devices. It was suggested, then, that accuracy in the KRISP was positively related with

exposure to Sesame Street (and since this was the most popular program, with the categories to which it belonged as well) because exposure to Sesame Street improves intellectual competence, perhaps especially the ability to selectively focus attention. Equally supported by this data was the hypothesis that intellectually more competent boys spend more time with Sesame Street because they are more capable of decoding its forms and/or comprehending its content. Determining of which is the case must await future research.

In sum, the results from this study provide support for the popular claim that activity level and exposure to television are positively related. It was suggested that this relation might indicated an effect of displacement. The possibility that this relation was attributable to weather or seasonal conditions, however, could not be ruled out. The remainder of the results did not fit well the patterns of relations reported by other studies. While the pattern of correlations for girls might indicate that exposure to television and impulsivity are related, the class of programs, child-informative programs (especially Sesame Street), that reflected this relation were found by others to be negatively associated with impulsivity. Moreover, the results for boys (for which there was apparently no good measure of impulsivity in this study) suggested that exposure to the same class of programs may be related to

intellectual competence, and perhaps, the ability to selectively focus attention. Finally, since exposure to Sesame Street has been found to be especially (compared to entertainment programming) indicative of preschoolers' home environment. Thus, the pattern of results with performance in the KRISP might have indication some interaction between parental influence on television or other characteristics of the home, sex of the child, intellectual competence and impulsivity. Clarification of these relations awaits future research.

Finally, as correlational results, these findings are certainly open to alternative interpretations. It is believed, however, that those offered are most consistent with the pattern of relations obtained overall. If a general conclusion can be draw from them it would be that there was no evidence that time spent with television is negatively related with cognitive abilities involved in focusing and sustaining attention. In fact, there was some evidence to the contrary, at least with respect to selectively focusing attention. While activity level scores were positively related to exposure to television and activity level has been found to correlate with academic achievement, it seems unlikely that this relation was due to an inability to attend to the tasks assigned in school, since activity level scores and the general tendency to persevere were unrelated. Activity level has, however, been reported to correlate with aggressive behavior (c.f.

Huesmann and Eron, 1986). Thus, if the positive relation between television exposure and activity level scores has any bearing on academic achievement, it would be by altering the character of the child viewer's interactions with others, and others' perceptions of the child.

APPENDIX

PROGRAM TYPE DEFINITIONS

Non-fiction, Informative, or Instructive Programs

1) Direct instruction - program communicates formal or academic training

2) How to and informational - program demonstrates or teaches information/skills to be used in viewer's life

3) Religious service - program presents a religious service

Non-fiction, Informative, Real World Programs

4) News/weather - program is a regularly scheduled news or weather broadcast

5) News/special coverage - news coverage of special events, includes concluding commentary like that which follows Presidential news conferences

6) News analysis and commentary - program that discusses or offers opinions and analysis of current events

7) News and current events magazine - program with segments longer than nightly news that cover current events, feature stories

8) Sports, coverage of events - live or taped footage of most of a competitive event

9) Sports magazine - program with excerpts from several sporting events

10) Documentary of visual arts, history, people - factual presentation focusing on one of these three topics

11) Talk show/interview - serious program where host interviews guests and issues are discussed

12) Documentary of science and nature - factual presentation focusing on these two topics

Non-fiction Entertainment Programs

13) Reality programs - programs centered on incredible events, facts and personal feats

14) Talk show/variety - program combines performances with interviews, category includes programs reviewing hits from other media

15) People and places magazine - programs comprised of feature story segments emphasizing human interest

16) Game show - programs where contestants compete for prizes

17) Variety - programs combining performances, vignettes, comedy, etc. that may also include educational bits

18) Cultural events, performances - coverage of specific cultural events

Fiction Comedy

19) Situation Comedy - presents humorous stories involving regularly appearing characters

20) Other comedy stories - fictional story programs featuring humor, including cartoons

Fiction/Action/Adventure

21) Western - story programs set in American west featuring adventures and heroes

22) Police/Detective/Crime - story programs focusing on police, detectives and criminals

23) Other action/adventure - all other programs featuring adventure, heroes and/or crime, in which humor is not a major component

25) Horror/scary - program content is frightening, suspenseful or gory

Fiction, Other Drama

24) Medical - fictional story programs focusing on medical personnel

Fiction, Other Drama, Continued

26) Soap Opera - programs that indefinitely continue to follow drama in the lives of a regular cast of fictional characters

27) Other - serious dramas that don't fit any other categories

28) Historical drama - programs dramatizing real historical events

29) Classic drama - programs that dramatize pre-twentieth century classic plays or books

30) Modern classics - dramatizations of twentieth century classics

31) Movies - dramas or comedies originally seen in theatres, and made for TV movies that are listed as such in TV Guides.

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