Attention and Television

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INTRODUCTION

To be entertaining, a production, regardless of the medium, must get and keep the attention of its audience. This is not to say that attention is synonymous with entertainment. For example, we might pay rapt attention to a tornado headed our way without feeling the least bit entertained. On the other hand, we might find that a special effects movie based on tornadoes would both get our attention and be entertaining. Attention is probably best seen as a necessary but not sufficient condition for entertainment.

There is no simple definition of attention that is inclusive of all the ways in which the term is used. In general, though, the term attention refers to a psychological process by which information, usually from the external environment, is made available for cognitive and emotional analysis. Attention is overtly manifest by orientation of the body, and especially the head and eyes, toward a source of stimulation, and covertly by a variety of physiological activities that serve the purpose of intensifying the processing of the stimulation. Although cognitive theorists make a variety of distinctions between types of attention such as vigilance, orientation, attention to objects, attention to location, and others, media researchers have generally been concerned more simply with attention onset and offset, as well as the intensity of attentional engagement. Cognitive researchers, moreover, have generally studied the role of attention in motivated adult subjects who are instructed to be attentive and who are assigned task situations that are not intrinsically entertaining. Furthermore, cognitive scientists have usually been interested in detailed aspects of attention as it is deployed over time courses of less than a second in duration. Cognitive science, therefore, has had a limited impact on research on attention to media, and that impact has primarily been on studies of intensity of attention.

There has been very little research that directly connects attention to the psychological experience of being entertained, per se. Rather, the extant research examines attention to
entertainment media, usually television, with the goal of developing rules that predict attention onset, continuation, intensity, and offset. In this chapter we summarize the research and theory concerning attention to television. Although there is a small scatter of studies concerning attention to interactive entertainment media, the literature is not yet sufficiently coherent to be worth reviewing here.

The television research generally falls into two classes, each with its own methodologies. Research with children has overwhelmingly focused on visual orientation toward television with looks (visual orientations toward the TV screen) being the primary behaviors measured. Research with adults has more typically focused on issues concerning intensity of attention and has utilized methodologies that are thought to measure intensity, such as the secondary reaction time task and some physiological measures. Not surprisingly, there is an overlap of methodologies such that intensity measures are used in some studies with children, and looks are measured in some studies with adults.

Although there have been a few field investigations, most studies have been laboratory experiments. Child studies have focused on infants and preschoolers, and adult studies have focused on college students. In this chapter, updated from the Anderson and Burns review of 1991, we begin with a brief description of common methodologies, followed by summaries of the research on looks and intensity. We try to characterize our current state of knowledge and theory and suggest significant gaps that should be addressed in future research.

**METHODOLOGY**

**Looks**

Even though they may not be aware of it, when people watch TV they look away from the TV screen with some frequency. Looks are usually measured from video recordings of a person as that person watches television. An experimenter, watching the video, records the video frame number at the beginning of the look and the video frame number at the end of the look. In our laboratory, this procedure is currently accomplished by using the tape-logging utility of the video-editing program, Adobe Premiere. The observer presses an appropriate key at the judged beginning of a look and presses another at the end of the look. The video frames for each event are automatically recorded in a computer file that can be synchronized with respect to events that occur on the TV. A continuous time record of the vicissitudes of looking at and away from the TV is thus obtained. Inter-observer reliability is typically quite high with very little disagreement between observers (e.g., Anderson & Levin, 1976).

**Visual Fixations**

Until recently, given typical screen sizes, the distances viewers sit from them, and the relatively poor detail resolution of standard American video, viewers could pretty well take in the screen image with little necessity for visual scanning (cf, Nathan et al., 1985). Perhaps because of this, very few published studies have attempted to identify where on the TV screen a look is directed. Such studies require the use of an apparatus that can determine the precise direction of gaze. Although such apparatus is now readily available, use of it by media researchers has been limited to special situations such as the use of text in the context of a TV program (e.g., Flagg, 1978). There are, for example, no normative studies of how often viewers move their eyes in the course of watching a TV program, much less any detailed information as to what they look at. This is an area well worth future research, especially as large-screen TV sets become increasingly common, making extensive visual scanning likely.

**Secondary Task**

Another method uses reaction time to a second limited pool of cognitive tasks are tied up by a primary task (e.g., Navoll & C.) orienting toward a button in response to a TV. This method has been used by Richards & Turner, 20 (e.g., Geiger & Reeve).

**Physiological Measures**

The most common physiological measures are skin and brain electrical activity, as recorded from electrodes on the scalp. Volume-conducted cardiac signals are used as a measure of intensity of attention. The alpha rhythm is an index of inattention. Absence of alpha activity, especially if alpha becomes consistent, is an index of attention. The alpha rhythm is usually measured with an electroencephalograph (EEG), which records the electrical activity of the brain. The EEG is typically recorded from a few to more than a dozen electrodes placed on the scalp. The electrodes detect the electrical activity during media consumption, and the EEG is used to measure the degree of attention. The alpha rhythm is an index of inattention. Absence of alpha activity is an index of attention, especially if alpha becomes consistent.

**General Characteristics**

Much of the research concerning attention to television has been conducted in a typical laboratory setting. Viewers are seated in a comfortably furnished room contained in a laboratory or test room, with the equipment for measuring attention as toys for children or a reading table for adults. The equipment for measuring attention is turned on, and stopped recording for brief periods during which the observer codes for looks at the TV.

A few observations about the environment in which attention is measured are in a dark, barren room, with the experimenter situated near the TV 120 to 150 times a minute (Anderson, 1993). Other
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Secondary Task Reaction Times

Another method used to assess attention during television viewing is to measure a viewer's reaction time to a secondary task. The use of this method stems from the theory that there is a limited pool of cognitive resources available to devote to processing. The more that resources are tied up by a primary task, the longer should be the latency of response to a secondary task (e.g., Navon & Gopher, 1979). Secondary tasks in studies of attention to television often entail orienting toward another, intermittent visual stimulus (e.g., distractor slides) or pressing a button in response to a tone that occurs randomly throughout the television-viewing session. This method has been used to measure attention to television in infants and toddlers (e.g., Richards & Turner, 2001), preschoolers (e.g., Lorch & Castle, 1997), and, more often, adults (e.g., Geiger & Reeves, 1993).

Physiological Measures

The most common physiological measures of attention in media research focus on heart rate and brain electrical activity. In both cases, surface electrodes are placed on the chest or on the scalp. Volume-conducting electrical potentials are recorded, amplified, digitized, and subjected to a variety of analyses.

When a person encounters a novel or changed stimulus, that person may react to the stimulus with an orienting response that affects numerous physiological systems, including the cardiac system. Probably reflecting changes in blood flow in the brain, heart rate measurably decelerates. As attention is sustained, the slowed heart rate continues with reduced variability between beats. The heart rate response has been used as a measure of attention both in child studies (e.g., Richards & Casey, 1992) and in research with adults (e.g., Lang, 1990).

The electrical activity of the brain is measured by scalp electrodes in an array ranging from a few to more than a hundred electrodes, depending on the study. Studies of brain electrical activity during media use have generally employed alpha-suppression as the primary measure of attention. The alpha wave is a rhythmic frequency of about 8 Hz and reflects a relaxed state of inattention. Absence of alpha is inferred as indicating focused attention to the medium, especially if alpha blocking is time-locked to some event in the program such as a scene change.

LOOKING AT TELEVISION

General Characteristics

Much of the research on looking at television has been done by our research group. In our typical laboratory study with children or adults, a person is videotaped in a comfortably furnished room containing a TV set, snacks, and objects that afford alternative activities, such as toys for children or magazines and hand-held non-electronic games for adults. In our field research, automated video equipment was set up in homes in the rooms containing TV sets. The equipment automatically began recording the viewing area when the TV set was turned on, and stopped recording when the TV set was turned off. In both cases, the videotapes were coded for looks at the TV.

A few observations are common across all studies of looking at television. Unless viewers are in a dark, barren room, they look at and away from the TV set numerous times over the course of an hour. At home, or in the typical laboratory study, they look at and away from the TV 120 to 150 times an hour (e.g., Anderson, 1985; Anderson & Levin, 1976; Burns & Anderson, 1993). Other research groups report the same phenomenon (e.g., Hawkins et al.,
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When a TV program receives high levels of looking (about 90% of program time), compared to a program that receives a modest amount of looking (about 50% of program time), there are still many looks at and away from the TV, but intervals between the looks become much shorter, and the long looks become much longer. Programs that receive low levels of looking (about 20% of program time) still receive many short looks but there are few, if any, long looks, and the intervals between looks become much longer as the viewer becomes engaged in an alternative activity, such as toy play or reading a magazine (unpublished analyses from our laboratory; also see Hawkins et al., 2005). Fundamentally, high attention to a TV program is reflected in more long looks with only brief pauses between looks.

The Development of Looking at Television

Prior to the 1990s, research from both laboratory and field studies found that looking increased from very low levels during infancy to relatively high levels by age 5 years, finally peaking at about age 12 years, with some decline in looking among adults (see Anderson, Lorch, Collins, Field & Nathan, 1986, for field research; Anderson & Smith, 1984, for a summary of laboratory studies). Absolute levels of looking depend on the types of programs on the TV in relation to the age of the viewer. Not surprisingly, children pay greatest attention to children's programs, and adults pay greatest attention to adult fare (Bechtel, Achelpohl & Akers, 1972; Schmit, Anderson & Collins, 1999). For the most part, at home the increase in looking with age occurs because children pay attention to a greater range of programs as they get older.

Anderson and Lorch (1983) argued that this increase with age reflects greater comprehension ability. They hypothesized that the comprehensibility of programming is the single greatest factor that drives attention by young children to TV. Infants and toddlers under 3 years of age paid little attention to TV because there was relatively little they could understand. This hypothesis was supported by a series of studies relating program comprehensibility to children's attention to TV. In several experiments, for example, preschool children were shown Sesame Street segments that were either the normal segments, or that were reduced in comprehensibility by using either foreign language or backward language, or with the shots re-edited in random order. In the reduced comprehensibility conditions, the children looked less than they did at the normal segments (Anderson, Lorch, Field & Sanders, 1981; Lorch & Castle, 1997; Pingree, 1986).

Although historically infants and toddlers looked relatively little at television under normal viewing conditions at home, that began to change in the 1990s with the success of Teletubbies, a TV program directed at toddlers, as well as the Baby Einstein series of videos directed at infants. Since then, the entertainment industry has discovered that infants and toddlers constitute a lucrative market for video production. Infants pay substantial amounts of attention to baby videos. Rachel Barr and her colleagues (Barr et al., 2003) found that looking at these videos averaged about 60% in a study conducted in the infants’ homes.

The fact that infants may pay relatively high levels of attention to television raises the question of why they pay attention. There are basically two possibilities: the first is that they are watching an essentially kaleidoscopic display with little comprehension. The second is that, like older children, their attention is being-driven at least in part by comprehension. Huson and Wright (1983; 1989) argued that early television viewing is driven passively by

orienting to salient formal features of content with age and experience at first (and free of comprehension and entertainment). In a complex experiment, infants and toddlers looked relatively little at television under normal viewing conditions at home, that began to change in the 1990s with the success of Teletubbies, a TV program directed at toddlers, as well as the Baby Einstein series of videos directed at infants. Since then, the entertainment industry has discovered that infants and toddlers constitute a lucrative market for video production. Infants pay substantial amounts of attention to baby videos. Rachel Barr and her colleagues (Barr et al., 2003) found that looking at these videos averaged about 60% in a study conducted in the infants’ homes.

We have presented the fine details of infant and toddler viewing with age, as compared to computer-generated video, as well as to the single video that received the highest level of looking (about 90% of program time), compared to a program that receives a modest amount of looking (about 50% of program time). This is a most straightforward comparison, but the 18- and 24-month-olds are suggestive that by 18 months of age, infants pay more attention to TV than they did at earlier ages.

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orienting to salient formal features such as cuts, movement, and auditory changes, but that with age and experience attention is such more systematically and cognitively driven in the service of comprehension and entertainment. If so, it may be that during infancy viewing is relatively free of comprehension, but that with age it gradually becomes more cognitive in nature.

In a complex experiment, Richards and Cronise (2000) showed infants aged 6-, 12-, 18-, and 24-months a clip from the movie Follow That Bird, and examined their looking at the clip as compared to computer-generated, randomly moving forms with coordinated sounds. In the most straightforward comparison, 6- and 12-month-olds looked equally at the two displays, but the 18- and 24-month-olds looked substantially more at Follow that Bird. This experiment is suggestive that by 18 months infants begin to prefer a structured video that features animate characters. Because there were many differences between the two displays, rendering a specific interpretation impossible, we are currently replicating the experiment in collaboration with John Richards. In this experiment we are using Teletubbies in three versions: normal video, randomized shots, and backward speech. Because the shots and sound envelopes are identical in all three versions, the primary differences are in sequential or linguistic comprehensibility. We have presented the findings for the 18- and 24-month-olds at an international infancy conference (Frankenfield et al., 2004). Briefly, in keeping with Richars’ earlier findings, there are clear differences such that both age groups have longer looks at the normal version of Teletubbies than at either of the distorted versions. This suggests that by 18 months of age, if not earlier, infants’ attention is at least partially guided by their cognitive processing of the content.

There is some research indicating that looking is responsive to content much earlier. From about 6 months of age, infants who are placed in front of side-by-side TV screens drawing images of their mother and father will selectively look at the image that matches a narrator saying “mama” or “papa” or other term used in the family to identify the mother and father (Tincoff & Jusczyk, 1999). By 6 months, they also prefer to look at television programs with coordinated audio as compared to images with mismatched audio tracks (Hollenbeck & Slaby, 1979). By 14 months of age, infants prefer to look at a video that has a voiceover narrator correctly describing an action compared to the same video with the same voiceover narrator incorrectly describing the action (Hirsh-Pasek & Golinkoff, 1999). These simple examples indicate that, at least in principle, infants can attend to videos based on content, not just on the basis of salient formal features.

Baby videos and shows such as Teletubbies, however, are far more complex than most of the stimuli used in experimental studies with infants. Teletubbies, for example, is an edited program with numerous cuts and other transitions. Processing such transitions with understanding takes considerable perceptual and inferential capacity. In order to comprehend the continuity of content across the transitions (cf., Anderson & Smith, 1984). Although our research (Frankenfield et al., 2004) suggests that infants are sensitive to the canonical order of transitions by 18 months of age, it is not yet clear that younger infants are capable of processing visual transitions at all. Moreover, the evidence for comprehension of videos by children under 2 years of age is very meager, and suggestive of much poorer comprehension of equivalent real-life displays (for a review see Anderson & Pempek, 2005). Overall, it is not known how much infant or toddler attention to baby videos is based on content and how much is based on a kaleidoscopic effect. Nevertheless, infants and toddlers do look at baby videos and TV programs that are made for them. It is an important task for future research to clarify why they do so.

**Formal Features**

Formal features are characteristics of television programs that can be deployed across many types of content and are used to convey content. An obvious example is the cut. Television
programs are typically shot as multiple streams of continuous video which edited and joined by cuts (or other devices such as dissolves, wipes, fades, and the like). Cuts can be used in multiple ways to convey content. Sometimes, they simply provide change of camera angle or distance. Other times, they show who is speaking in a conversation, or they may show a listener’s reactions. At yet other times, they may convey the illusion of a single continuous action sequence, as in a car chase scene, even though the chase may have been filmed in multiple locations over many days of shooting.

Other characteristics of television are not as clearly part of the form, rather than the content, of television; nevertheless, they have generally been grouped under the rubric of formal features. These include animation, visual movement, character type (man, woman, boy, girl, puppet, animal), and audio features such as sound effects, applause, and voice type (man, woman, child, peculiar voice).

A television producer may employ formal features as necessary devices to convey content (for instance, the use of cuts in a chase scene), or she may employ cuts to provide visual or auditory change and variation (for instance, the use of cuts during a monologue). The question is whether formal features influence attention independently of their role in conveying content.

At this point, we do not know of any research that has systematically studied the effects of formal features on attention independently of their use to convey content. Rather, the approach in the three studies that have examined an array of formal features has been to examine the relationship of formal feature occurrence to attention in normal videos. The results of these studies have been remarkably consistent.

Across age groups and across studies, the most consistent formal feature is movement, which is related to enhanced looking (Alwitt, Anderson, Lorch & Levin, 1980; Anderson & Levin, 1976; Schmitt et al., 1999). Viewers look more in the presence of movement from infancy through adulthood (Schmitt et al., 1999). Furthermore, if a viewer is not looking at the screen at the time movement occurs, the viewer is likely to begin looking, probably because of the acute sensitivity of peripheral vision to movement (Alwitt et al., 1980). The response to cuts is also consistent, insofar as looking is greater in an interval following a cut compared to intervals that do not follow cuts. Despite their attention-maintaining capacity, however, cuts do not elicit looking from inattentive viewers as consistently as movement (Alwitt et al., 1980).

The results for character types depend on whether the viewers are adults or children, and the effects are stronger based on voices than on characters’ visual presence. This stronger effect of voices is primarily due to viewers’ ability to hear voices even when they are not currently looking at the TV; consequently, a particular type of voice can suppress or elicit looking, as well as maintain or extinguish looks in progress at the time of voice onset. For children, all three studies find less looking in the presence of men on the screen or sound track as compared to intervals that do not follow cuts. Despite their attention-maintaining capacity, however, cuts do not elicit looking from inattentive viewers as consistently as movement (Alwitt et al., 1980).

Huston and Wright (1983; 1989) provide a lucid theory on the impact of formal features on attention. They note the power of salient formal features to elicit orienting reactions, and suggest that this may be the fundamental effect of formal features in very young viewers. As a child becomes more cognitively mature and experienced in watching television, the effects of formal features in conveying content. Children responding to television; such content thus contrives to target such as peculiar voice and child content. Boys respond to that is intended for the content intended for the child format (using the child format. Despite making refined substantially more

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in watching television, however, the child becomes increasingly aware of the role of formal features in conveying content. Formal features thus come to gain significance in relation to content. Children recognize that adult men are typically associated with adult-level content on television; such content is largely incomprehensible and uninteresting to children. Adult men on television thus come to signal content that is not interesting. Children learn that features such as peculiar voices, brightly colored sets, puppets, and other features combine to signal child content. Boys recognize that certain abrupt editing and sound effect styles signal content that is intended for them, whereas girls recognize that softer editing styles and music signal content intended for them.

The Huston and Wright research group experimentally tested aspects of the theory. Campbell, Wright, and Huston (1987) presented public service announcement-type videos in either a child format (using formal features that are characteristic of children’s programs) or an adult format. Despite making the content as similar between the two formats as possible, children paid substantially more attention to the video presented in a child format. Huston, Greer, Wright, Welch, and Ross (1984) presented abstract video images to children produced and edited with formal features that are characteristic of commercials directed at boys or with formal features that are characteristic of commercials directed at girls. The children distributed their looking at the videos in ways completely consistent with their gender and the production technique.

Pacing and Formal Features

Television shows vary considerably in the density of formal features. Generally speaking, the more formal features per unit time, the more rapidly paced is the show. While it is generally assumed that rapid pacing produces greater attention, especially in children, this has not been subjected to systematic research. Potts, Huston, and Wright (1986), in a study focused on violence, showed a nonviolent children’s TV show that was rapidly paced, a violent children’s show that was rapidly paced, and violent and nonviolent children’s TV shows that were slowly paced. They found greater attention to the rapidly paced shows than to the slowly paced shows with no effect of violence on attention. It should be noted that the differences in attention could have been due to the varying content of the shows rather than the pacing. Nevertheless, their results are consistent with the notion that more rapidly paced programs gain greater attention.

While it may be the case that increased pacing, other things being equal, leads to increased attention, it should also be pointed out that increased pacing tends to increase the information processing burden on the viewer. If the burden becomes too great, the program becomes incomprehensible and for that reason may lose attention. Taking the information processing burden into account, recent successful TV programs for preschoolers have been deliberately slowly paced in terms of the density of formal features (Anderson, 2004). These programs, such as Blue’s Clues, get consistently high levels of attention from preschool viewers (Crawley, Anderson, Wilder, Williams, and Santomero, 1999; Crawley et al., 2002).

Content and Individual Differences

We have already noted that although formal features play an important role in attention to television, attention is primarily in service of the viewer’s processing of the content. For example, children pay much more attention to children’s programs than they do to adult programs. They also pay more attention to children’s programs than they do to commercials for children’s products (Schmitt, Woolf & Anderson, 2003). This latter observation is particularly important insofar as commercials tend to be rapidly paced and dense in formal features.
Techniques for conveying content, such as the use of humor, can also increase attention to programs (Zillmann, Williams, Bryant, Boynton, & Wolf, 1980). On the whole, attention to television appears to be more driven by content than by formal features and pacing.

The meaning of content, however, varies with the individual so that individual needs, interests, capabilities, and other psychological factors determine the attention value of any particular program. Although individual psychological characteristics other than age presumably drive specific patterns of attention to television, there have been only a few studies that have examined this.

One such psychological characteristic is gender. Striking gender differences in program and character preferences begin to emerge in the early elementary school years (age 5 years and older). In particular, there is a shift to preference for same-sex characters, particularly in boys.

One development that occurs at this time of shift is the acquisition of gender constancy. Gender constancy is marked by the onset of understanding that one's own biological sex and gender are not determined by superficial characteristics such as clothing or hairstyle but are relatively immutable (Slaby & Frey, 1975). With this understanding, one might suppose that children would begin to take a great interest in same-sex characters insofar as such characters may provide information about how to behave relative to cultural expectations of gender roles.

In the home television viewing study of Anderson et al. (1985), participating children near the fifth birthday were administered tests of gender constancy. Luecke-Aleksa, Anderson, Collins, and Schmitt (1993) examined home-recorded videotapes of the children's TV viewing and coded the gender of the character (if any) on the screen when the child was watching and when the child was present but not looking at the TV. Both boys and girls who had not achieved gender constancy looked more at female characters than at male characters regardless of whether the characters were adult humans, children, or nonhumans such as puppets. This was consistent with findings for younger children (e.g., Anderson & Levin, 1976). Children who had achieved gender constancy, on the other hand, looked more at same-sex characters, regardless of type. That is, gender-constant girls maintained their preference for female characters, but gender-constant boys consistently paid greater attention to male characters.

Such a shift in attention with the acquisition of gender constancy was predicted by Slaby and Frey (1975) and was also found by them when children watched a movie of a male and female each assembling a bicycle.

Recently, in one of the few studies to employ visual fixation methodology, Linebarger and Chernin (2004, unpublished) found results consistent with those of Luecke-Aleksa et al. (1995) and Slaby and Frey (1975). When gender-constant children look at the screen, they preferentially fixate on same-sex characters when there are multiple characters present. Pre-constant children do not have this preference; rather, they tend to fixate on female characters.

Relatively temporary psychological factors may also induce some attentional bias to content. Anderson, Collins, Schmitt, and Jacobvitz (1996) examined adult TV viewers from the Anderson et al. (1985) home-viewing study. In particular the investigators studied looking at television in relation to stress as measured by the standard Life Events Scale. Not only did they find that program preference was related to stress (for example, stressed viewers gravitated toward comedy), but they also found that attention was related to stress as well. When they watched TV in their homes, stressed men actually looked more at the screen than did men who had experienced less stress. The results were interpreted as being consistent with mood-management theory (e.g., Zillmann & Bryant, 1994), which hypothesizes that media are used to displace anxious thought patterns.

Hawkins et al. (2005) showed several TV programs from different genres to college students. Although they found that the pattern of looking varied according to genre, they found little relationship to individual differences.

Look Termination

There has been rather little work on whether looks at television tend to end (Anderson et al., 1980), consistent with the notion of looking. That said, Richards (1994) hypothesized that boys and girls tend to terminate their attentional focus at different points in their viewing. They found that program preference was related to gender (e.g., Zillmann & Lean, 1994), which is consistent with mood-management theory. Gender differences were revealing: 3-year-olds watched TV more than 2-year-olds but were less likely to look at the screen when looking ended. Look onsets and offsets were determined by different factors. The authors interpreted their results as being consistent with differences in attentional focus. The results were interpreted as being consistent with mood-management theory (e.g., Zillmann & Bryant, 1994), which hypothesizes that media are used to displace anxious thought patterns.

Repetition and Familiarity

With the advent of home video and movies, it is common for individuals to watch the same content repeatedly. There is evidence that people develop preferences for certain TV programs and movies, and that these preferences can be influenced by the repeated exposure to certain content. This is consistent with the idea that individuals develop preferences for certain types of content over time.

In the study by Barr et al. (2003), infants were shown a video of a familiar object and a novel object. They found that infants preferred the familiar object to the novel object. This is consistent with the idea that familiar objects are more attention-getting than novel objects.

Another study by Frey (1975) showed that infants preferred TV programs that they had watched previously to those they had not watched before. This is consistent with the idea that familiarity enhances attention.

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Look Termination

There has been rather little work devoted to the issue of why attention terminates. We do know that looks at television tend to end at content boundaries, other things being equal (e.g., Alwitt et al., 1980), consistent with the notion that comprehension of content is a primary driver of looking. That said, Richards found that sustained heart rate decelerations in infants and toddlers tend to terminate several seconds before the sustained looks end, suggesting some kind of internal state changes before the overt looking behavior is terminated (e.g., Richards & Gibson, 1997). It is not known whether this phenomenon is present in older viewers whose attention may be more schema-driven and therefore more sensitive to content boundaries.

In one experiment (Anderson, Lorch, Smith, Bradford & Levin, 1981), analyses compared the temporal similarities in look onsets and offsets across 3- and 5-year-old children. The age differences were revealing: 3-year-olds were less similar to each other than were 5-year-olds as to when looks began, but 5-year-olds were less similar to each other than were 3-year-olds as to when looks ended. Look onsets were in general more similar across children than were look offsets. The authors interpreted these findings as indicating that 1) look onsets and look offsets were determined by different factors; 2) with experience, children become more stereotyped in their look onsets which are probably cued by formal features as discussed above; 3) look offsets probably reflect idiosyncratic interests in the content of TV. Younger children are more like each other in experience and interests and thus are more likely to lose interest in the content at the same time. Older children are less like each other, both developmentally and in terms of experience, and so are more likely to have different levels of interest in the content thus terminating looks at different times.

Children reliably look away from the TV during extended zoom shots (Alwitt et al., 1980; Anderson & Levin, 1976; Susman, 1978), perhaps because they become disoriented by the constantly changing spatial frame of reference. In addition, adult TV characters tend to terminate young children’s looks at TV as discussed above (Alwitt et al., 1980; Anderson & Levin, 1976). Of course, distractions external to the TV set can terminate looks (Anderson, Choi & Lorch, 1987), but we know little beyond these findings, even though attention offsets are ultimately as important as attention onsets.

Repetition and Familiarity

With the advent of home videocassette recorders it became possible to watch a TV program or movie repeatedly. There is evidence that children have a great tolerance for repetition of favored videos and watch them many times (Mares, 1998). Rachel Barr and her colleagues (Barr et al., 2003) showed familiar or unfamiliar videos in the homes of 12- to 15-month-old infants. They found greater looking at the familiar videos (67%) as compared to the unfamiliar videos (50%). They estimated that the familiar baby videos had been watched an average of 30 times prior to the study, suggesting 1) that familiarity is an important determinant of attention by infants, and 2) that infants tolerate an enormous amount of repetition.

Crawley et al. (1999) showed an episode of Blue’s Clues to 3-, 4-, and 5-year-old children who had not previously seen the series. One group of children saw the same episode on five consecutive days. Only 5-year-old boys showed a slight drop in looking at the program over the five days. On closer examination, the investigators distinguished between educational versus entertainment content within the program. Looking was initially greater to educational content but after three repetitions looking declined to the same level as entertainment content. Crawley
et al. (1999) interpreted the decline as being due to mastery of the educational content after three showings so that the educational content eventually acquired the same status as non-demanding entertainment content. It should be noted that although attention to the episode dropped little, audience participation with this participatory program steadily increased over the five days.

Crawley et al. (2002) extended this line of research by examining familiarity with the whole series Blue's Clues. They compared children who had been watching the program for two years to children who had rarely if ever seen it (usually because Nickelodeon was not offered as part of the basic cable package). When shown a new episode of Blue's Clues that neither group had previously seen, the experienced viewers paid less overall attention to the episode than did the inexperienced viewers. This effect was primarily due to recurrent portions of the program, that is, parts of the program that are highly similar from episode to episode. Experienced and inexperienced viewers paid equivalent levels of attention to portions of the episode that were unique to that episode.

As noted above, Blue's Clues invites audience participation and preschool children readily shout out answers, point to the screen, dance with music, and so on. Crawley et al. (2002), in analyzing patterns of looking, audience participation, and comprehension across the Crawley et al. (1999; 2002) studies, argued that high levels of looking indicate that the children are heavily engaged in information processing and learning. To some extent during these periods of high attention, audience participation is relatively low. As the young audience masters the material and becomes familiar with the episode (with repetition) or with the series as a whole, attention drops while audience participation increases. They argued that audience participation reflects mastery and knowledge, whereas high levels of attention reflect information processing and learning.

LISTENING TO TELEVISION

It is clear that the auditory component of a program is an important predictor of attention to television, even in infants. As noted earlier, infants are responsive to language and the congruency of the audio with the video channel. Also, as noted earlier, infants and preschoolers look less at the TV if the audio track is distorted through reversed speech or foreign language. Furthermore, auditory formal features are highly effective at gaining looking by inattentive viewers. Clearly, listening is an important aspect of attention to television.

That noted, there is little research on auditory attention to television. The primary reason is the difficulty in satisfactorily measuring auditory attention. Unlike visual attention, which has a clear behavioral correlate (i.e., gaze), auditory attention cannot be monitored directly. There have been a few indirect studies that have allowed some inferences.

In one study, five-year-olds either had a variety of toys available while watching an episode of Sesame Street or watched the program without toys available. Not having toys doubled the amount of time that children spent looking at the program but, surprisingly, subsequent tests of comprehension yielded results that were identical for the two groups. This was true for program information presented visually as well as that presented purely through the audio channel. Furthermore, considering the exact time when information critical to answering a question was presented, looking predicted whether the question was later answered correctly, but only for the group with toys (Lorch, Anderson & Levin, 1979). These findings suggest that the children who played with toys, unlike those in the no-toys group, selectively looked at the screen only when critical information necessary for comprehension was presented. The authors concluded that by five years of age, children develop a strategy for dual-tasking during television viewing in that they monitor the audio track at a superficial level for cues of comprehensible central information. This strategy was highly effective in further increase comprehension. Furthermore, young children tend to listen and look at the screen.

A later study by Field and Rolandelli, Wright, Huston, and Cohen-de-Navarre (2001) showed that the auditory component of a program is an important predictor of attention to television. Children were instructed to hold the sound track at which point they had to be based on the audio track. As the program continued, the program's soundtrack was faded in and out. It showed that the students had just been asked a question, recognition accuracy had to be based on the auditory component of the program. The authors hypothesized that, with maturity, auditory attention reflects more mature levels of visual attention.

This is not to say that there is no research on the ability of college students to respond to television. Anderson and Kirkorian tests of comprehension yielded results that were identical for the two groups. This was true for program information presented visually as well as that presented purely through the audio channel. Furthermore, considering the exact time when information critical to answering a question was presented, looking predicted whether the question was later answered correctly, but only for the group with toys (Lorch, Anderson & Levin, 1979). These findings suggest that the children who played with toys, unlike those in the no-toys group, selectively looked at the screen only when critical information necessary for comprehension was presented. The authors concluded that by five years of age, children develop a strategy for dual-tasking during television viewing in that they monitor the audio track at a superficial level for cues of comprehensible central information. This strategy was highly effective in further increase comprehension. Furthermore, young children tend to listen and look at the screen.

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1. ATTENTION AND TELEVISION

An important predictor of attention is the level of responsiveness to language and the ability to understand familiar words and phrases, even when partial. Previous research has shown that children's looking at the screen is related to their ability to understand the program content. This relationship was stronger for 5-year-olds than for 9-year-olds, suggesting that the younger children tend to listen at a level of verbal comprehension primarily when they are also looking at the screen.

A later study by Field and Anderson (1985) replicated the finding that children's looking at the screen predicted their comprehension of purely auditory information. These researchers also found that this relationship was stronger for 5-year-olds than for 9-year-olds, suggesting that the visual and auditory modalities are more interdependent for younger children. That is, 9-year-olds appeared to be better able to listen to the TV when they were not actually looking at it. The authors hypothesized that looking and listening are strongly linked in young children but that, with maturity, auditory attention can be increasingly deployed independently of the focus of visual attention.

Friedlander and Cohen de Lara (1973) investigated individual differences in 5- to 8-year-old children's ability to select clear, intelligible dialogue by using a two-position switch allowing the children to select between video with normal and noise-degraded soundtracks. Subjects were instructed to hold the switch to one side for up to 15 seconds to select a particular soundtrack at which point they would have to release the switch and press it again to maintain the same soundtrack. Seventy-five percent of children in this study clearly preferred normal over degraded dialogue using a selectivity criterion of 65% attention to the normal soundtrack.

Rolandelli, Wright, Huston, and Eakins (1991) adopted a similar technique to study both visual and auditory attention to television in children. Observing 5- and 7-year-olds watching a TV program, they randomly degraded the video, the audio, or both, and informed the children that they could press a lever to “fix” the television when it was not working correctly. This presumably reflects increased engagement in some other non-TV viewing activity, as looking at a magazine.

Friedlander and Cohen de Lara's study was replicated by Anderson and Kirkorian (1985). They found that children's looking at television was related to their ability to select clear, intelligible dialogue. This relationship was stronger for 5-year-olds than for 9-year-olds, suggesting that the visual and auditory modalities were more interdependent for younger children. That is, 9-year-olds appeared to be better able to listen to the TV when they were not actually looking at it. The authors hypothesized that looking and listening are strongly linked in young children but that, with maturity, auditory attention can be increasingly deployed independently of the focus of visual attention.
Consistent with earlier research, looking at the screen was predictive of comprehension for auditory material for the younger age group but not for the older children, further supporting the position that auditory and visual attention become less interdependent with age.

**INTENSITY OF ATTENTION**

There is substantially less known about the intensity of attentional engagement with television than about looking at the screen in general. The most common procedure to estimate intensity of engagement, the secondary task reaction time, is relatively simple but is an indirect measure of attention. Conversely, physiological measures may be more direct measures of attentional engagement, but have yet to be extensively employed. This is partly due to controversies as to what the best physiological measures are, and also to the fact that experienced investigators who use these measures have not, by and large, been interested in attention to media. What research does exist has focused heavily on the distinction between automatic orienting responses elicited by the medium and more sustained attention. Experiments involve varying content, such as emotionally evocative or arousing material, and also examine the degree to which attention is related to developing story structures. A substantial amount of the more recent research in this area has emphasized the interactive effects of form and content on the allocation of attention.

**Secondary Task Reaction Time Studies**

Secondary task reaction time (STRT) studies rely on the assumption that as attention to a primary task (e.g., watching television) increases, so will response time to a secondary task (e.g., pressing a button in response to a tone) due to limited cognitive resources available to process incoming stimuli at any given moment. As such, research presented in this section defined increased intensity of attention as slower reaction times to orient toward distractors or to respond to secondary tasks.

Formal features, such as cuts, elicit attention, at least at the automatic level of an orienting response (e.g., Geiger & Reeves, 1993). Although the onset of a particular structural feature is known to elicit attention at that moment, Geiger and Reeves (1993) found that increasing the number of cuts did not increase overall attention to the television messages as measured by STRT. One study utilizing STRT to measure attention found that subjects were more deeply engaged with structurally simple video than complex (Thorson, Reeves, & Schleuder, 1985). Complexity in this study was defined by the number of movements, pans, zooms, edits, and cuts, rather than the content of the program. Although seemingly counterintuitive, this finding is consistent with earlier studies of attention suggesting that simple or meaningful materials can be more engaging (e.g., Britton, Glynn, Meyer, & Penland, 1982; Britton, Holdredge, Curry, & Westbrook, 1979). Furthermore, this effect seems to be modality-dependent. The density of propositions or meaningful units in the script did not influence reaction time when the secondary task involved responding to a tone. A replication of this study with a visual secondary task (responding to a flash) showed the opposite effect: Subjects were more deeply engaged with commercials with few auditory propositions, but structural complexity of visual features had no effect. These authors reasoned that the subjects were able to “borrow” resources from one modality when the other was consumed by the secondary task.

Engagement also appears to change over the course of a television-viewing session. Using STRT to measure attention, Geiger and Reeves (1993) found that the act of processing cuts became easier over time into the viewing session, consuming fewer resources, so that STRTs immediately following cuts became shorter. In contrast, Lorch and Castle (1997), in a study of 5-year-olds, found that the longer a cut was, the longer the STRT of the viewing session. Perhaps longer cuts are more engaging with the content over time.

With respect to content, several physiological measures are most likely to be considered related or unrelated to content relevance to the ongoing story and to content that is central to the story (e.g., Lorch & Castle, 1997). Other studies investigated the effect of attention to arousing or emotionally evocative content (e.g., Potter, and Kawahara, 1999). Lorch and Castle (1997) found that subjects were more deeply engaged with commercials with few auditory propositions, but structural complexity of visual features was defined as structural complexity; of attention as slower reaction times to orient toward distractors or to respond to secondary tasks.

Heart Rate Studies

One line of research has investigated whether heart rate is related to attention to content that is central to the story. For instance, several STRT studies have investigated the effect of attention to arousal and pacing both on attention to television messages. In one study, subjects were asked to rate their attention to television messages on a scale from one to five. The findings showed that subjects who rated their attention as high had faster heart rates than subjects who rated their attention as low. This finding is consistent with earlier studies of attention suggesting that simple or meaningful materials can be more engaging (e.g., Britton, Glynn, Meyer, & Penland, 1982; Britton, Holdredge, Curry, & Westbrook, 1979).

Finally, Lang and colleagues (1990) found that attention increased with more rapid pacing. In other words, messages with faster-paced segments were more engaging than messages with slower-paced segments. This finding is consistent with earlier studies of attention suggesting that simple or meaningful materials can be more engaging (e.g., Britton, Glynn, Meyer, & Penland, 1982; Britton, Holdredge, Curry, & Westbrook, 1979). Furthermore, this effect seems to be modality-dependent. The density of propositions or meaningful units in the script did not influence reaction time when the secondary task involved responding to a tone. A replication of this study with a visual secondary task (responding to a flash) showed the opposite effect: Subjects were more deeply engaged with commercials with few auditory propositions, but structural complexity of visual features had no effect. These authors reasoned that the subjects were able to “borrow” resources from one modality when the other was consumed by the secondary task.

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Heart rate decelerates...
3. ATTENTION AND TELEVISION

5-year-olds, found that the longest reaction times to random probes were during the second half of the viewing session. Perhaps increased facility in processing cuts allows deeper engagement with the content over time.

With respect to content, several studies have investigated what types of programming and information are most likely to engage viewers. Material presented on television can be considered related or unrelated to immediately previous information and can be categorized by its relevance to the ongoing story structure or plot. Adult subjects are more intensely attentive to content that is central to the plot rather than to incidental detail (Meadcroft & Reeves, 1989). Other studies investigating attention as a function of content compare overall attention to arousing or emotionally evocative material to calm or neutral content. Lang, Bolls, Potter, and Kawahara (1999) found that arousing scenes received greater attention than calm ones.

Lorch and Castle (1997) found that 5-year-olds had shorter reaction times when not looking at the screen than when looking and that, when looking, reaction times were longer for relatively comprehensible versions of Sesame Street as compared to language-distorted (backward speech) versions of the program. This finding demonstrates that cognitive capacity is more engaged during comprehensible material, lending further support to the position that relatively understandable material is more engaging.

Several STRT studies have investigated the interaction between formal features and content. One line of work considered the effects of related versus unrelated cuts. Lang, Geiger, Strickverda, and Sumner (1993) demonstrated that unrelated cuts required more capacity to process than related cuts. Geiger and Reeves (1993) examined the changes in attention immediately after related and unrelated cuts. They found that the overall capacity required to process unrelated cuts remained constant and high compared to the gradually decreasing attention devoted to related cuts. More specifically, these researchers found that attention to related cuts increased very briefly but then decreased within one second following the cut. Conversely, unrelated cuts led to a very brief and initial decrease in attention, by signaling a "release" from the previous content, followed by a sharp increase in attention within one second of the cut associated with attending to the new content. Essentially, these researchers found that the impact of formal features on viewers' attention depends, at least in part, on the overarching content. For instance, there is an automatic orienting response to all cuts, but unrelated cuts require more controlled attention to process and comprehend (Geiger & Reeves, 1993).

Finally, Lang and colleagues (1999) investigated the interaction between arousal and pacing on attention to television messages. Their results indicated that for calm messages, overall attention increased with more rapid pacing. Conversely, attention decreased for arousing content with more rapid pacing. In other words, the least attention was found for slow, calm messages and fast, arousing ones. On the other hand, the greatest amount of cognitive resources was allocated toward fast, calm messages and slow, arousing ones. This finding suggests that arousal and pacing both influence resource allocation and that attention can be maximized by an optimal combination of arousal and pacing that does not overtax cognitive resources. Taken together, STRT studies have demonstrated that automatic and controlled attention is related to both form and content, but to fully predict the intensity of engagement consideration must be given as to how the two interact.

Heart Rate Studies

One line of research has investigated the influence of structural features of television, namely cuts, on attention as measured by heart rate. For instance, the onset of a commercial is known to elicit the orienting response (OR), a component of which is a decrease in heart rate (Lang, 1990). Heart rate decelerates for approximately four seconds after a cut on screen (Lang et al., 1993) found that increasing the cognitive resources available to subjects were more deeply engaged during comprehensible material, lending further support to the position that relatively understandable material is more engaging.
Although some research suggests that overall pacing does not influence broad changes in heart rate over the viewing session (Lang et al., 1999), Lang, Zhou, Schwartz, Bolls, & Potter, (2000) found greater decreases in heart rate in the second half of the viewing session, particularly for fast-paced messages. This is consistent with the STRT results by Lorch and Castle (1997) described above.

An interesting feature of entertainment media that is relevant to attention is screen size. Reeves, Lang, Kim, & Tatar (1999) demonstrated that adults' heart rate decreased significantly more when viewing on large-format (56") screens as compared to moderate (13") or small (2") screens. This effect held regardless of arousal or emotional valence of content. These researchers posit that several known effects of media could be accentuated on large screens, and recommend that screen size be included in future research.

Studies examining the effects of program content on heart rate have focused largely on emotional valence. Heart rate increases over a viewing session for emotional content but decreases for messages rated as rational or a combination of rational and emotional (Lang, 1990). Furthermore, Lang (1990) found that emotional messages increase the intensity of evoked cardiac responses. That is, orienting occurred in response to changes on screen but the intensity of the OR increased with emotionality. Reeves et al. (1999) found that negative content produced greater decreases in heart rate than positively valenced messages, although this effect was only marginal. Lang et al. (2000) posit that related cuts do not tax cognitive capacity, unlike unrelated cuts. Consistent with this position, these researchers found that both related and unrelated cuts led to decreased heart rate but only related cuts showed a complementary increase in memory for the content presented. Furthermore, the production implications of these findings are that producers can maximize learning from information presented in the program by adding attention-getting features that do not tax cognitive capacity. In many ways findings from heart rate studies parallel those exhibited by secondary task reaction time studies.

**Electrophysiological Studies**

There are a few studies that have used EEG to examine attention to television. Rothschild, Thorson, Reeves, Hirsch, and Goldstein (1986) demonstrated that EEG can be used to discriminate scenes that gain and hold attention, those that gain but then lose attention, and those that never succeed in gaining attention. Epochs of alpha suppression (indicative of attention) often begin with some visual change, such as a cut, movement, or commercial onset. Superimposed voiceover also elicits alpha suppression. Rothschild et al. (1986) identified "points of interest" in their television stimuli where the most alpha blocking was observed in adult subjects. Lang (1990), using the same stimuli, found that these points of interest also elicited ORs according to heart rate measures, but she was unable to identify specific formal features common to all or most of these points. Rothschild et al. (1986) suggest that alpha may drop quickly during an OR to a visual or auditory cue, but that the maintenance of attention may depend on the motivation of the viewer or interest in the content. To our knowledge, no studies have since been done to investigate the effects of program content on EEG, but this prediction is consistent with research cited earlier in the present chapter utilizing other measures of attention.

Simons, Detenber, and Cuthbert (2003) showed adults either stills or brief video clips of stimuli that had been known to evoke emotional responses. They found alpha attenuation, indicative of attention, in parietal regions. The attention was produced by both positive and negative emotional clips and, as with other measures of attention, by movement as compared to stills.
in heart rate in 3- to 6-month-olds does not influence broad changes Lang, Zhou, Schwartz, Bolls, & second half of the viewing session, with the STRT results by Lorch and more relevant to attention is screen size. Heart rate decreased significantly pared to moderate (13") or small emotional valence of content. These could be accentuated on large screens, each.

Heart rate have focused largely on emotion for emotional content but devi­ tional and emotional (Lang, 1990), increase the intensity of evoked changes on screen but the intensity found that negative content produced messages, although this effect do not tax cognitive capacity. Researchers found that both related related cuts showed a complementary, the production implications of information presented in tax cognitive capacity. In many

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Attention to television. Rothschild, that EEG can be used to discriminate when lose attention, and those that attention (indicative of attention) often commercial onset. Superimposed 86) identified "points of interest" observed in adult subjects. Lang interest also elicited ORs according to formal features common to all alpha may drop quickly during attention may depend on the knowledge, no studies have since G, but this prediction is consistent with measures of attention.

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3. ATTENTION AND TELEVISION

Smith and Gevins (2004), studying EEG responses to television commercials, found that posterior alpha attenuation (indicative of orienting) was associated with scene changes. Frontal alpha attenuation in the lower frequencies of the alpha range was associated with the subjects’ finding the commercials interesting, and frontal alpha attenuation in the higher frequencies of the alpha range was associated with commercials being recalled. Like the studies based on looking, on STRT, and on heart rate, the EEG studies, taken together, suggest that there are distinct attentional processes associated with initial orienting as compared to more sustained attention. Orienting is elicited by formal features and sustained attention by cognitive engagement with the content.

Developmental Issues in the Intensity of Attention

By and large the research cited in this section was conducted with adult participants. With few exceptions, most of what we know about the intensity of attention is from research with adults. Only very recently have there been studies recording STRT (e.g., Richards & Turner, 2001), heart rate (e.g., Richards & Cronise, 2000), and brain activity (e.g., Richards, 2003) in infants with regard to television viewing. Only a couple of studies have used any measure of intensity of attention, namely STRT, in older children (e.g., Lorch & Castle, 1997). These studies contribute mostly to the literature on attentional inertia and, as such, are described in the following section.

ATTENTIONAL INERTIA

On the whole, research on looking at television has addressed somewhat different questions than has research on intensity of attention. There is one phenomenon of attention to television, however, where both lines of research converge. This phenomenon is referred to as attentional inertia. Attentional inertia is defined with respect to the onset of an episode of attention (usually a look): At episode onset the intensity of attention is low and the episode is fragile and easily disrupted. As an episode is sustained, however, it becomes increasingly robust, less vulnerable to disruption, and information processing becomes more intense. Metaphorically, as an episode of attention to television is sustained, it develops its own inertia.

The term originated with an analysis reported by Anderson, Alwitt, Lorch, and Levin (1979). They plotted look length data from children as a type of hazard function. Hazard functions describe the probability of a failure of some kind of an entity conditional upon the time it has already survived. Hazard functions are used, for example, as part of life insurance calculations concerning the probability of death within the next year as a function of how old the person is currently. Anderson et al. (1979) applied a version of the analysis to looks at television. For a group of 5-year-olds who watched Sesame Street in a room equipped with attractive toys, the hazard of a look ending within 3 seconds from its onset was about .57. Given that the look survived to being 3 seconds old, the hazard of it ending before it became 6 seconds old dropped to .34. Given that the look survived to be 6 seconds, the hazard of termination further dropped to .24 and so on. The entire curve, based on 3 second intervals, showed a smoothly decelerating negative function over time. In other words, the longer a look survived, the lower was its hazard of ending over each succeeding time interval.

Anderson et al. (1979) showed that this hazard function characterized the data of individual children as well as group data and that the function was found with children as young as 12 months of age as well as adults. Subsequently, Richards and his colleagues showed that this function characterizes the television look data of infants ranging from 6 weeks to 24 months (Richards & Cronise, 2000; Richards & Gibson, 1997; Richards & Turner, 2001). Attentional
inertia is not limited to television viewing. The characteristic hazard function is also found for episodes of preschool toy play (Choi & Anderson, 1991) and bouts of music listening by preschoolers (Sims, 2001).

A series of investigations has explored the nature of attentional inertia. One line of research has found that the longer a look at television has been sustained, the less distractible the viewer becomes (Anderson et al., 1987; Richards & Turner, 2001), with a parallel finding for toy play (Choi & Anderson, 1991; Ruff, Cappazolli & Salterelli, 1996): This reduction in distractibility is accompanied by an increase in attentional intensity or engagement as indexed by reaction times to distractors or secondary tasks (Anderson et al., 1987; Choi & Anderson, 1991; Lorch & Castle, 1997). In toy play, as episodes are sustained, the child is more likely to enter a state of deep concentration known as focused attention (Oakes, Ross-Sheehy & Kanass, 2004; Ruff et al., 1996). Progressively deepened engagement as a look at TV is sustained has also been found in analyses of heart rate by Richards and his colleagues (Richards & Cronise, 2000; Richards & Gibson, 1997; Richards & Turner, 2001). Information processing of television is enhanced as a look is sustained. Burns and Anderson (1993) found that recognition memory for program content is increased the longer a look has been sustained at the time that the tested content appeared. Lorch et al. (2004) found that children better understood causal connections in television narratives the longer a look had been in progress when the information about those connections was presented.

Attentional inertia appears to be a general property of attention to entertainment media including TV, toys, and music. A question arises as to what use is attentional inertia. A number of theorists, prior to the discovery of attentional inertia, have argued that the attentional system must have a way to maintain attention to a task or to a source of discourse regardless of momentary fluctuations in interest value, comprehensibility, or other aspects of the source (Hebb, 1949; Hochberg & Brooks, 1978; James, 1890). Hochberg and Brooks (1978), for example, argued that in order to watch a movie, something has to drive attention across the visual content boundaries defined by cuts. In other words, in temporally structured entertainment media, as well as in play activities and perhaps other kinds of activities, there must be a "glue" that maintains attention across content or action boundaries.

Anderson and his colleagues showed that the longer a look has been in progress prior to a complete change in content (as in a shift from program to commercial), the longer the look will remain in progress after the change (Anderson & Lorch, 1983; Burns & Anderson, 1993). Attentional inertia thus serves to sustain attention to completely new content. Anderson and his colleagues have argued that because attentional inertia is found in young infants and across unrelated pieces of content, it is probably a fundamental, biologically based process underlying sustained attention.

Attentional inertia is found in infants’ TV viewing before they could possibly comprehend much on television, and it is also found when infants view stimuli such as computer-generated random forms and sounds. In quantitative analyses of look distributions, however, beginning at about 18 months, infants show greater inertia if the stimuli are structured, normal television sequences (Richards & Anderson, 2004). Inertia is also greater in older than younger children. Together, these results indicate that attentional inertia is enhanced by cognitive comprehension processes. This conclusion is also consistent with studies on the intensity of attention, reviewed above, that find greater attentional engagement with related, as compared to unrelated, edited sequences.

Hawkins and his colleagues have explored this phenomenon more fully, finding that the degree to which looks are driven across content boundaries varies with the type of boundary (Hawkins, et al., 2002; Hawkins, Tapper, Bruce & Pingree, 1995). They argue that there are learned, strategic processes that modify the strength of attentional inertia and that emotional processes may modify it as well. As examples, expecting a transition to be from an entertaining program to a commercial will reduce the intensity of attentional inertia.

THEO

Across all the areas of research reviewed above, the relationship between the television characteristics that may produce transient inattention, produce transient inattention. Certain formal features of media, as well as in play activities and perhaps other kinds of activities, there must be a “glue” that causes a person to start attending to entertainment situations seen in television, attention will be the nature of attentional inertia. We are not aware of any research on this issue, although many of the variables that influence the intensity of attention are less well characterized than the variables that influence the intensity of attention.

In reading for this chapter, we have noted that the television environment is one that is characterized by high levels of attentional intensity or engagement as indexed by reaction times to distractors or secondary tasks (Anderson et al., 1987; Choi & Anderson, 1991; Lorch & Castle, 1997). In toy play, as episodes are sustained, the child is more likely to enter a state of deep concentration known as focused attention (Oakes, Ross-Sheehy & Kanass, 2004; Ruff et al., 1996). Progressively deepened engagement as a look at TV is sustained has also been found in analyses of heart rate by Richards and his colleagues (Richards & Cronise, 2000; Richards & Gibson, 1997; Richards & Turner, 2001). Information processing of television is enhanced as a look is sustained. Burns and Anderson (1993) found that recognition memory for program content is increased the longer a look has been sustained at the time that the tested content appeared. Lorch et al. (2004) found that children better understood causal connections in television narratives the longer a look had been in progress when the information about those connections was presented.

Attentional inertia appears to be a general property of attention to entertainment media including TV, toys, and music. A question arises as to what use is attentional inertia. A number of theorists, prior to the discovery of attentional inertia, have argued that the attentional system must have a way to maintain attention to a task or to a source of discourse regardless of momentary fluctuations in interest value, comprehensibility, or other aspects of the source (Hebb, 1949; Hochberg & Brooks, 1978; James, 1890). Hochberg and Brooks (1978), for example, argued that in order to watch a movie, something has to drive attention across the visual content boundaries defined by cuts. In other words, in temporally structured entertainment media, as well as in play activities and perhaps other kinds of activities, there must be a “glue” that maintains attention across content or action boundaries.

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inertial hazard function is also found and bouts of music listening by emotional inertia. One line of research has consistently sustained the viewer with a parallel finding for toy play activity. This reduction in distractibility is accompanied by a sustained level of engagement as indexed by reaction times; Choi & Anderson, 1991; Lorch & Anderson, 1993. A child is more likely to enter a state of sustained attention at an earlier age and in less time than would have been expected (Richards & Cronise, 2000; Ruff, 1999). They argue that attention to entertainment media sustain is sustained at the time that the tested child is more likely to understand causal connections and engage in parallel attention when the information about a content source is comprehensible, interesting, emotional, and valence; the personal significance of the content to the viewer. In addition, as attention is sustained, engagement progressively deepens. One line of research has been in progress prior to a transition, the longer the look from task to entertainment situations and the less sustained attention in task situations differs from sustained attention in entertainment situations. Why is sustained attention in task situations seemingly effortless whereas sustained attention in entertainment situations seems effortless? Is sustained attention in these contrasting situations fundamentally different in kind? Do they call on different underlying neural mechanisms of attention? We are not aware of published studies that have attempted to systematically explore this issue, although many of the tools described above could be used to do so. This is not the only issue that has received little research.

We also have noted that there is, as yet, little research on auditory attention to entertainment media even though the audio clearly plays an important role. Similarly, although we know that children are tolerant of—and even demand repetition—we know little about the factors that underlie this phenomenon. There is some evidence that repeated viewing of videos declines as children age beyond the preschool years (Mares, 1998), but there have been no systematic investigations beyond the studies cited earlier.

Although the research on attention to television has reached a critical mass, even allowing the development of systematic principles for program design (Anderson, 2004), there has been no parallel research literature on other entertainment media. Even though there is a vast literature on eye movements in reading; for example, there is no literature on the factors that cause a person to start reading, read for some period of time, and then stop reading (analogous to looking at TV). We do not know, for example, whether attentional inertia applies to entertainment reading. Nor is there such a parallel literature on video game play.

Finally, American television is on the verge of becoming a digital medium, with large-screen high-definition television and surround sound becoming common. Digital TV, moreover, affords the possibility of being interactive. While much of what we have learned about attention to television may be applicable to this evolved medium, much may change. On the other end of the spectrum, cell phone users will be able to receive television on two-inch screens. What will be the nature of attention to this evolved medium? Whatever these media may bring to entertainment, attention will still be necessary. Systematic study of attention to the new media will allow us to better understand their impact and help with the rational design of content.
REFERENCES


3. ATTENTION AND TELEVISION


Anderson AND Kirkorian

3. ATTENTION AND TELEVISION


Perception is an elusive concept that is understood from a variety of perspectives. I've seldom heard a consistent definition of the term and its cognates differ across disciplines (cognitive psychology), perceived reality and social behavior. Few examples of different usages have been made, such as groups, society, and even media. Regardless of which of the definitions is correct, each is characterized by the perception of people and social reality, actually suggesting the construction of more elaborate usages such as groups, society, and even media.

In the next section, I provide an overview of the term and its cognates differ across disciplines (cognitive psychology), perceived reality and social behavior. Few examples of different usages have been made, such as groups, society, and even media. Regardless of which of the definitions is correct, each is characterized by the perception of people and social reality, actually suggesting the construction of more elaborate usages such as groups, society, and even media.