Online and Offline Assessment of the Television Audience

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Every day millions of Americans spend time at home with television. In a typical viewing session they enter a TV viewing area, turn on the TV if it is not already on, look at the television for some period of time, look away, and look back again. Sometimes, or perhaps most of the time, they listen to the audio. They may leave the viewing area and then return. They may engage in a variety of concurrent activities, ranging from homework to housework to lovemaking to sleeping. They may change the channel, turn off the TV set or exit the viewing area. Subsequently, TV viewers may remember some of the content, and their economic, social, political, and intellectual behavior may be influenced.

This wide range of activity falls roughly under the rubric of "watching TV". Watching TV requires decision processes which lead a person to enter the viewing area and be exposed to TV programming. Watching TV involves overt and covert attentional activities including accomodating to or ignoring a distracting viewing environment. Watching TV requires comprehension strategies of considerable complexity. Watching TV means choosing programming and eventually deciding to stop watching TV. Given that Americans spend a large portion of their lives in front of TV sets, a scientific understanding of "watching TV" is of considerable utility for a variety of economic and social policy concerns. In this chapter we describe research on processes occurring during TV viewing with a particular emphasis on recent efforts to analyze the moment by moment flow of attention to and comprehension of television. We contrast this "online" approach to understanding TV viewing to the more usual "offline" approaches which gather information from a variety of sources outside the viewing situation. The online work reviewed in this chapter is oriented toward a basic scientific understanding of television viewing. We believe that a basic understanding of TV viewing will be of considerable use in designing and employing effective audience assessment techniques both on- and offline.

Offline research on TV viewing

The industries and institutions that produce television technology, programming, advertising, and instruction must daily make significant practical decisions based on considerations of the television audience. These decisions stem from anecdote, assumption, experience, intuition, and sometimes systematic empirical research about the composition of the audience and the ways they "watch TV". The decisions are not based on a well structured general theory of TV viewing as such a theory does not exist.

When systematic research-based information is available, it is most frequently obtained offline. Viewers are queried at a

time when they are not in the act of watching TV about viewing habits, attitudes, preferences, memories, expectations, and behaviors. In the case of children, parents are often the respondents. The instruments for offline research are questionnaires, comprehension tests, viewing diaries, telephone interviews, discussion groups, and others. The results of offline research form much of the basis for evaluating the success of TV programs, for choosing advertising strategies, and for informing national debates about the effects of television on social behavior. Whole industries and professions have sprung up to collect and interpret offline data. Sociologists, social psychologists, and statisticians have found employment away from academia to design, interpret, and use offline research about television viewing.

The success of offline research is undeniable. Without offline research, estimating the size and composition of the television audience would be mere guesswork, and the very economic basis of commercial broadcast television would be doubtful. Offline copy testing and product attitude testing provide major sources of information about the likely success of commercials, and are routinely employed in planning advertising campaigns. The research itself, furthermore, is relatively inexpensive to carry out and can optimally obtain data from a large number of respondents in a matter of days.

Offline research, however, has its problems. The central problem is that the validity of offline instruments is usually unknown. The viewing diary, as employed by the major TV rating services, is a straightforward example. The primary purpose of the diary is to determine the composition of the television audience at particular times. Viewers are asked to check off each 15-minute interval of each day that they watch TV. They are also asked to indicate to which channels their TVs are tuned and which programs they watched. There have been, however, few systematic attempts to determine the accuracy of viewing diaries, or to determine what kinds of reporting biases are typical. There is some evidence that diaries may not be wholly accurate. In a study employing video cameras in homes, Bechtel, Achelpohl, and Akers (1972), for example, reported that viewing diaries overestimated actual viewing by about 30%. We will discuss this and other studies in more detail later, but the point is that attempts to validate even the most commonly used offline measure of TV viewing have raised serious questions about its accuracy. The validity of most other offline research has not been examined.

A second problem with offline research is that it is best used to measure relatively enduring behaviors and traits of which the respondent has some conscious awareness. Memory for commercials, product attitudes, and liking of TV programs are typical examples. It is likely, however, that some issues, such as amount of attention paid to the news, are not fully available to conscious introspection. A third and related problem is that questions employed in offline research instruments require active

interpretation by the research subject. A given question may produce different interpretations by different subjects, while two questions which attempt to assess the same thing may produce two different interpretations by the same subject.

As examples of these problems, consider some offline research in which we asked parents about their preschool children's television viewing behaviors (Anderson, Alwitt, Lorch & Levin, 1979). In one part of a questionnaire, we provided an extensive listing of current TV programs and asked the parents to indicate how many minutes per week their children watched each of those programs. In another part of the questionnaire we asked how many hours their children watched TV each morning, afternoon, and evening of each day of the week. The underlying question in both of these measures was the same: How much television did the children watch? Parents consistently estimated greater amounts of viewing by the children when the program list was used (22.7 hours per week) as compared to the other measure (24.2 hours per week). Thus, two different offline measures gave different estimates of behavior from the same respondents. We also asked the parents a number of questions about the age their child consistently started to watch television. Not only did the parents indicate different ages depending on the question, but also, the ages they gave depended on the current age of the child. Parents of older children gave greater ages than parents of younger children. The pattern of results indicated that parents of older children had different criteria for the onset of TV viewing than the parents of the younger children. They had, therefore, different interpretations of the same questions based on their different experiences.

Besides questions of validity and subjects' interpretations of research questions, there are some kinds of information about television viewing that simply cannot be reliably obtained offline. For example, it is doubtful that a person could accurately estimate what percentage of time he or she actually looks at the TV screen. It is even more doubtful that the viewer could accurately estimate the frequency of looks at the TV or how long they last. People probably do not know how frequently they leave the viewing room during a night of TV viewing or how long they are gone before they return. Respondents probably do not know how much they listen to the TV or whether they listen more when looking as compared to not looking at the screen. Issues of this sort are best studied by online research techniques involving ongoing moment by moment observation of TV viewing.

Online measures of TV viewing

There has long been a recognition that online measures of TV viewing are desirable and potentially useful. The most basic technique, used by A.C. Nielsen and by Arbitron for years, is a device that simply records whether a TV set is on and to what channel it is tuned. More sophisticated approaches examine TV viewing itself. An early measure, developed initially for radio,

is the Lazarsfeld-Stanton technique in which people are presented programming and asked to push buttons corresponding to their liking or disliking of the material. The buttons are connected to a device which records when the button pushes occur. Temporal profiles of audience liking for the material are constructed and sometimes used by producers to revise the program material prior to broadcast (Levy, 1982). A similar technique has been used with school-age children by Children's Television Workshop who employed specially- designed portable microcomputers in schools as part of the process of doing formative research for "3-2-1 Contact". There have also been occasional uses of online physiological measures such as heartrate, galvanic skin response, voice stress analysis, and derivative measures from electroencephalographic recording. Also employed, especially with children, are ratings of visual orientation toward the television screen, a measure pioneered primarily by Children's Television Workshop (Palmer, 1972). Today, a number of advertising research firms offer services based on many of these online techniques. The general form of these services is to produce a profile of response over the timecourse of the program. Interpretation of the profiles is usually that the program is good (in terms of the measure used) when the response is high and the program is bad when the response is low. One examines the profile and attempts to determine what in the program causes any given peak or valley in the response.

Profiles of online response to programs and commercials address the need to assess audience behavior beyond the reach of offline measures. Like many offline measures, however, the validity of these online techniques is usually based more on intuition than on research and established theory. The general problem in choosing an online measure is in assessing its meaning. If we do not have a basic scientific understanding of the online aspects of television viewing, we cannot interpret the relationship of any given measure to behavioral outcome except by pragmatic guess.

Basic online research on television viewing

Despite the economic and social importance of television, the total amount of university based online research is small, primarily due to the expense of such research and a corresponding lack of funding. Television related industries have not perceived the advantages of basic research on television. High technology industries and federal science agencies, in contrast, have funded relatively large amounts of university research on the online aspects of computer use. The goal of much of that research is to develop scientific theories as to how programs and programming languages should be structured so that humans can use them with maximum effectiveness. There has not been an analogous commitment by the broadcast industry to support research aimed at a scientific understanding of television viewing.

Recently, however, a small scattering of scientists, [illegible] basic research on

the online aspects of TV use. Funding for this research has come not from industry but almost entirely from government agencies and private foundations concerned with the welfare of children. Therefore, the emphasis in this new work has been on children's TV viewing and not on other areas of interest to television production and marketing groups. Substantial progress, nevertheless, has been made in understanding the online process of TV viewing and a scientific theory of TV viewing can be considered a real possibility. In the remainder of this chapter we will describe this progress with special reference to conceptions of audience assessment.

Descriptive online field studies

An obvious but frequently neglected first step in research is systematic detailed description of the phenomenon in question. There have been few such descriptions of TV viewing, perhaps because TV viewing appears to be such an obvious and transparent behavior. There also may be few such descriptions because truly systematic observation of TV viewing with a large and diverse sample of subjects is a difficult and expensive undertaking. There have been, to our knowledge, only three field studies on a substantial scale which have attempted to describe home television viewing behavior. These three studies all have in common the installation of automated film or video equipment in homes, with one camera shooting the viewing area and another shooting the TV screen. In each of these studies the equipment would automatically begin recording when the TV set was turned on and stop recording when the TV set was turned off. The two early studies (Allen, 1965; Bechtel et al., 1972) were only briefly and sketchily reported. The third study (Anderson, Field, Lorch, Collins & Nathan, 1984; Anderson, Lorch, Field, Collins & Nathan, 1984; Nathan, Anderson, Field & Collins, in press), is as yet only partially analyzed. Nevertheless, these three studies by themselves provide a significant glimpse into the nature of television viewing. An impressive aspect of these studies is that while they were done in different geographic areas, over three decades, the observations from each prove to be very similar. Despite evolving receiver and video production technologies, and despite fads and enduring changes in TV program content, home television viewing behavior appears remarkably constant.

The Allen study.

Allen (1965) published only a brief report of his observations based on time-lapse filming of family TV viewing in Oklahoma and Kansas during the early 1960's. He noted that the viewing room contained no viewers 19% of the time the TV was on. Of the time that viewers were present, he noted that they were frequently inattentive, with nobody actually looking at the TV an additional 21% of set-in-use time. The audience tended to be especially inattentive during the daytime and they engaged in a variety of concurrent activities during TV viewing 25% of the time they were with TV. Children were described as frequently

"eating, drinking, dressing, sleeping, playing, and fighting. Often they pay no attention to the TV, and may leave the room for periods varying from one minute to a half hour. As the number of small children in a family increases so does total set-in-use time and 'no audience' time" (p. 5). Adults were described as also frequently inattentive: "Adults eat, drink, sleep, play, argue, fight, and occasionally make love in front of the TV set" (p. 6). Taken together, no audience or an inattentive audience were observed during 52% of set-in-use time in the morning, 47% in the afternoon, and 35% at night. During commercials, these figures were, respectively, 58%, 54%, and 43%.

Allen (1965) was the first to convincingly demonstrate the variability and richness of TV viewing behavior at home. This variability contains within it a double challenge. To the TV producer or advertiser the challenge is to get and maintain the viewers' attention or at least assess the practical consequences of variable attention. To the scientist the challenge is to untangle and account for this variability.

The Bechtel, Achelpohl, and Akers study.

As part of the Surgeon General's investigation into the effects of television on social behavior in the early 1970s, a field observation study was commissioned. Bechtel et al. (1972) installed video cameras and microphones in the homes of 20 families in Kansas City, Missouri, for six-day periods. Their sample, methodology, and results were reported in more detail than Allen's (1965) research. Limiting factors, however, included the small sample size and a frequent lack of statistical analysis. Since they reused the videotapes throughout the course of the research, their analyses of viewer behavior were also limited.

As we noted earlier, Bechtel et al. (1972) compared viewing diaries to observed viewing. Importantly, they implicitly defined "watching TV" as actually looking at the TV rather than as simply being in the same room with a TV set in use. They found that the percent agreement between viewing diaries and observed visual attention ranged from 92% in the best case to 54% in the worst case, with the average agreement being 71.4%. They found underreporting of viewing time was rare (5.5%) whereas overreporting was relatively frequent (24.9%). Unfortunately, Bechtel et al. (1972) do not provide data sufficient to determine whether the underreporting is due to the family members defining "watching TV" as simply being present with a set in use. If so, the families may have accurately reported their presence but not their attention. This, of course, is an example of how research subjects may interpret an offline research instrument in a manner different from the investigator.

As found by Allen (1965), the viewers in the Bechtel et al. (1972) study did not look at the TV all the time it was on. Movies were the programs most attended to, such that 76% of the

time a movie was on at least one person was looking at it. In descending order, children's shows received the next most attention, 71%, followed by suspense series, 69%, religious programs, 67%, family series, 66%, game shows, 66%, talk shows, 64%, melodramas, 60%, sports events, 60%, news, 55%, and finally, commercials, 55%. These figures can be roughly compared to Allen (1965) who reported 65% for evening programs and 57% for evening commercials. The consistency across studies is impressive.

Pechtel et al. (1972) divided their sample into three age groupings: children (1 to 10 years of age), adolescents (11 to 19 years), and adults (20 to 75 years). Overall, the children visually attended 52% of the time they were with TV, the adolescents attended at a level of 60%, and the adults attended at a level of 65%, suggesting to Pechtel et al. an inverted U relationship of attention and age. The investigators noted that women attended less than men which they suggested might be "related to a kind of housewife syndrome" (p. 203). Attention to different types of programs, reasonably, varied with the age of the viewer. Children attended most to children's programs (86%) and least to melodrama and sports (8%). Adolescents attended most to suspense programs (81%) and least to sports (13%). Adults looked most at movies (78%) and least at commercials (52%).

Like Allen (1965), Pechtel et al. (1972) observed a good deal of activity concurrent with TV viewing. They found families to be surprisingly sociable while watching TV, with talking the most common activity, followed by eating. They pointed out that viewers come and go while the TV set is on but provided no details on frequency. They also noted distinctive and regular styles of family TV viewing.

Pechtel et al. (1972) concluded the report of their observations with a sense similar to that of Allen (1965) of the dynamic complexity of TV viewing: "The findings point to the fact that television viewing is a complex and various form of behavior intricately interwoven with many other kinds of behavior. It will not be a simple matter to sort out how ... the interfering behaviors filter out the television stimulus. Clearly, watching television ... is a mixture with many threads of which the viewer seems only partially aware" (p. 200).

The Anderson et al. study

As part of our program of research on the online aspects of television viewing, we installed time-lapse video cameras in the homes of 100 families from the Springfield, Massachusetts metropolitan area (Anderson, Field, Collins, Lorch & Nathan, 1981). The families all had a child near the fifth birthday and were, by and large, white and middle-class. The families consisted of 272 children ranging in age from infants to 17 years of age and 102 adults from 18 to 62 years of age. Equipment was placed in homes for 10 full days of time-lapse recording. One video frame was recorded each 1.2 seconds that the TV was on, or

at a ratio of 36 hours of real time to 1 hour tape time. The camera that shot the viewing area was equipped with a wide angle lens with auto-servo iris that allowed it to record in widely varying light levels encountered in homes. The equipment automatically began recording when the TV set was turned on and stopped recording when the TV set was turned off. Over a 20 month period about 4500 hours of recordings were obtained. Technical details about the recording procedure may be found in Anderson et al. (1984).

In addition to the families who had observation equipment installed in their homes, the study included several control groups of families who went through all the same procedures but did not get equipment installed in their homes. These control groups were used to assess the effects of the observation equipment on subject selection and viewing behavior as reported in viewing diaries.

The analyses from this study will be in progress for several years with the results published as a series of papers in research journals. To date the analyses which have been completed from this study concern four issues: 1) The effects of the observational equipment itself on subject selection and viewer behavior. 2) Viewer distances and visual angles relative to the TV set. 3) Accuracy of viewing diaries as compared with observed viewer presence and observed viewer visual attention. 4) Age trends in visual attention to TV. Our findings from each of these areas will be summarized with emphasis on the accuracy of viewing diaries and on age trends.

The effects of observation equipment on subject selection and viewer behavior

There is a kind of Heisenberg principle inherent in much behavioral science research; the behavioral system being examined may be changed by the very fact that it is being studied. The problem is most extreme, of course, when the subjects are aware of the behavior being studied. Research on television viewing would appear to be no exception to this problem. For home observation studies, the major question is whether the behavior observed is different from that which normally occurs without observation. Ultimately, the question is probably undecidable barring observation procedures which would violate research ethics. We have, nevertheless, some information on the issue. At this point we have compared our experimental families to our control families on a large number of demographic and other measures. We have also compared the reported TV viewing of the 5-year-olds in the experimental families to the reported viewing of the 5-year-olds in the control families.

The results are encouraging. While a lower percentage of families agreed to participate in the experimental group, the families that did participate were not significantly different from control families on a large number of demographic variables and other measures including attitudes toward television and

family stress (Anderson, Field, Collins, Lorch & Nathan, 1985).

During the time the observation equipment was installed in the homes of the experimental group, there were no significant differences in reported viewing by the 5-year-olds as compared to the control groups. The presence of the observation equipment did not have systematic effects on the parents' reports. It should be noted, on the other hand, that the 5-year-olds might be among the viewers least affected by the presence of the observation equipment. It remains to be seen whether systematic differences [illegible]. At this time, however, we have found no evidence of systematic effects of home observation on subject selection or viewing behavior.

Viewer distances and viewing angles

A subsidiary issue we have examined in our home viewing data is the location of the viewer relative to the TV set. Although information about viewing distances and viewing angles is relevant to a variety of enterprises including the design of new screen technologies, the design of characters and graphics for videotext displays, as well as for considerations of receiver radiation emissions on viewer health, there has been no previous online study. One offline study has been reported (National Center for Radiological Health, 1968). In that study, families in the Washington, D.C. area were interviewed as to how far viewers typically sat from their TV receivers. In general, children under age 15 years were reported to watch from an average of 90 in. and viewers 15 years and over watched from an average of 123 in.

We analyzed the viewing locations of each viewer in a subset of 78 families of our home viewing study (Nathan et al., in press). Without going into the detailed findings here, we compared our data with those obtained by the National Center for Radiological Health some 14 years earlier. The average distance we found for viewers over 15 years (120 in.) was only about 7 in. further than the earlier research, and the average distance for viewers under 15 years (80 in.) was within an inch of that found by the earlier research. Again, where a comparison is possible, there is impressive consistency in TV viewing behavior across decades and geographical regions. Also, our online research in the field was able to validate the earlier offline research.

There are two additional points to be made from our analysis of viewer location. The first is that children were much more variable in their viewing position than were adults. This is indirectly illustrated in Figure 1 which shows the percentage of time that viewers of different age groups spend sitting or lying on a chair or couch. Not only do adults view from furniture nearly all the time, but they almost always watch television from exactly the same location. We will comment more on this issue later, but suffice it to note that TV viewing behavior changes in many respects from early childhood to adulthood.

Insert Figure 1 about here

The second point to be made from the analysis of viewer location concerns the issue of the visual angle subtended by the screen from the perspective of the viewer. The horizontal visual field is around 180 degrees. Most of our visual activity, however, makes use only of the middle of the visual field which consists of the region of parafoveal vision (about 10 degrees aroun the center horizontally) and the foveal region in the very center of the visual field (about 1.5 degrees horizontally). The parafoveal region allows detection of movement and moderately good resolution of detail and color whereas the foveal region allows extrememly fine resolution of detail and color. Figure 2 plots the average visual angle subtended by the TV screen for viewers of different age groups. Note that only the children sit close enough to the TV so that part of the image falls outside the parafoveal region, and even they sit so that the screen nicely frames the parafoveal region. Consider an implication of this observation: Viewers need few eyemovements in order to perceive the television image. Indeed, perception research has indicated that picture identification is most rapidly and efficiently accomplished at a visual angle of about 11.5 degrees and under. Viewers place themselves so that they can readily and efficiently perceive the rapidly paced sequence of relatively simple images typical of contemporary broadcast television.

Insert Figure 2 about here

Comparisons between viewing diaries and observed viewing

Our home viewing study included as a major goal the comparison of viewing diaries to videotaped observations of TV viewing. The Pechtel et al. (1972) study provides some reason to question the validity of viewing diaries. The problem is that Pechtel et al. (1972) did not provide sufficient information to settle the question. They found only that families overestimated viewing when the criterion for TV viewing was eyes actually directed toward the TV screen. In particular, they did not determine whether the families may have accurately reported the presence of family members in the viewing room. The diaries may thus be accurate records of what most people consider to be "watching TV", namely present in a room with a set in use.

Our viewing diaries were fashioned after those used by the major rating services; the families were asked to indicate during each 15 minute block whether the TV was on, what program was on, and who was present. There were also a number of questions about the viewing behavior of the 5-year-old, since the study in many respects concentrates on the viewing behavior of these "focus" children. We examined the diaries with respect to

the focus children separately from the other family members since the parents may have been particularly diligent about maintaining the viewing diaries for these children.

Observers rated the videotapes on a time-sampling basis such that they stopped a tape after each 55 minutes of set in use time and noted who was in the room and whether or not each person in the room was looking at the TV. Interobserver agreement was quite high (see Anderson et al., 1988 for details). At this time our analyses compare diaries to the videotapes only in terms of total amount of time that each viewer was present and total amount of time each viewer looked at the TV. In later work we will examine the accuracy of the diaries with respect to viewing of specific TV programs.

We found that parents were highly accurate in indicating the "focus" 5-year-olds' presence in the viewing room. On the average, the viewing diaries indicated that the 5-year-olds were with television 14.2 hours per week and our observations showed them present 13.4 hours per week. The difference is not significant. The correlation between time the child was present and the time indicated by the diaries was high and significant, $r(95)=.88$, $p<.001$. Parents accurately maintained viewing diaries for young children when those children were the focus of the research effort. It was quite clear that the parents did not fill out the viewing diaries in terms of whether or not the child was actually paying attention to the TV. The actual observed hours of visual attention by the 5-year-olds was 8.3; this figure was significantly different from the 14.2 hours reported in the diaries. If the criterion for TV viewing had been visual attention to the TV, then the diaries indeed overestimate TV viewing by 53%.

The correlation of total time looking with the diary time, while significant, was reduced, $r(91)=.67$. The significant correlation is due to the obvious fact that the more time one spends in the presence of a set in use, the more time one will, in general, look at it. There is, however, no significant correlation between the time 5-year-olds spend with TV and the percent of that time spent visually attending to the TV, $r(92)=-.10$. "Heavy" viewers are not more or less likely to look at the TV than "light" viewers, given that they are with TV.

The question remains whether the viewing diaries are accurate for other members of the family who are not the focus of the research effort. The accuracy of the diaries for these family members is probably more like the accuracy of the diaries analyzed by the major TV rating services, since no particular family members are the focus of the diaries. Our analyses indicated that the diary accuracy depended on the age of the family member. Using the age categories employed by the major rating services, we found that parents were only moderately accurate in recording the presence of very young children aged 2 to 5 years (we excluded the "focus" 5-year-olds from the analysis). These children were observed to be present an average

of 11.7 hours per week whereas the diaries indicated they were present 12.6 hours per week. The difference is not significant and the correlation was only a middling $r(35)=.60$, $p<.001$. It is clear, therefore, that the parents did not keep as accurate records of these preschoolers' presence as they did for the "focus" 5-year-olds ($r = .94$).

The 6- to 11-year-olds presented a similar picture of diary accuracy. Although the averaged observed time with television (11.2 hours) was not significantly different from the diaries (10.1 hours), the correlation was even lower although it was still significant, $r(80)=.41$, $p<.001$. Apparently these mobile children present special problems to parents for recording TV viewing. Children this age are notoriously poor at time estimates and may watch TV frequently when parents are not around to observe.

Adolescents age 12 through 17 years, on the other hand, were recorded with accuracy matching the focus children. They were observed to be present 8.4 hours per week whereas the diaries indicated they were present an average of 7.2 hours per week. The difference was not significant, and the correlation was substantial, $r(13) = .82$, $p < .001$.

Finally, adults' time with television was also reasonably accurately recorded in the diaries. Adults were observed present an average of 10.5 hours per week and the diaries indicated 10.4 hours. The correlation was a fairly high $r(190) = .91$, $p < .001$.

As summarized in Figure 3, our online observations indicate that viewing diaries are quite good instruments when a particular family member is the focus of research. They are also good for recording viewing time of adolescents and adults. The diaries are otherwise only fair to poor instruments for recording the presence of children.

Insert Figure 3 about here

These analyses are presently limited to total time with television. It remains to be seen how accurately the diaries identify the viewing of particular programs. The accuracy of diaries for nonfocus children is likely to be poor since they are only fair predictors of simple time with television.

Age trends in visual attention to TV

The Allen (1965) and Pechtel et al. (1972) studies provided some indication that there is an inverted-U shaped function of visual attention to television as a function of age. Specifically, attention may increase through childhood, peak in adolescence, and decline among adults. Unfortunately, neither of these studies pursued the issue in any detail.

A number of studies using preschool children as subjects have found that visual attention to television increases throughout the preschool years. These studies were based on observations of TV viewing of one to three hours of children's programming in a research center viewing room (Alwitt, Anderson, Lorch & Levin, 1980; Anderson & Levin, 1976; Anderson, Lorch, Field & Sanders, 1981; Anderson, Lorch, Smith, Bradford & Levin, 1981). There have been only two such "laboratory" studies examining age trends in attention to TV in older children and these have produced mixed results. One study (Field & Anderson, in press) found an increase in attention from 5- to 9-years of age, and another (Calvert, Huston, Watkins, & Wright, 1982) found no change from 5 years to 10 years. There have been, to our knowledge, no laboratory studies examining age trends in visual attention to TV with adults.

We analyzed our home TV viewing data for age trends in visual attention. The results may be seen in Figure 4. The solid line is the best fitting polynomial function for ages 2 to 17 years. The data points are averages at each age, with the open square the average for men and the open diamond the average for women. As can be seen in the figure, visual attention dramatically increases during the preschool years, reaches a peak during early adolescence, and finally drops during adulthood. While there was no significant age trend after 18 years, adult men paid significantly more attention to the TV than adult women. These results provide considerably more detail about age trends in visual attention than the previous studies, but again the results are quite consistent with those studies. Television viewing behavior has remained within constant parameters across three decades of observation.

Insert Figure 4 about here

Additional observations.

We have described here only the beginnings of our analyses of home TV viewing behavior. Many matters of description remain, including: analyses of concurrent activities during TV viewing; accuracy of diaries in relation to the viewing of specific programs; analyses of visual attention to commercials; analysis of viewer exits from the viewing room during programs and commercials. We would like to point out that our observations of thousands of hours of television viewing behavior have convinced us (along with Allen, 1965 and Bechtel et al., 1972) that families incorporate television into their lives in highly individual ways, but ways which are remarkably consistent and stereotyped from day to day. Television becomes part of a complex family ecology and is frequently a central feature of a large part of family activity.

Despite this complexity, however, we believe that many aspects of TV viewing are common to virtually all viewers and subject to relatively straightforward research analysis. In many

cases ideal analyses require observation of viewing with experimentally produced television programming shown under controlled circumstances. Such online "laboratory" research allows detailed examination of patterns of attention and comprehension. A body of such research has now emerged--primarily with children--and it has produced the beginnings of systematic and detailed scientific theory. Such an effort must supplement online field observation in order to form and test hypotheses with rigor and power.

Toward a theory of TV viewing: Online laboratory studies

The goal of our online laboratory research is to describe the moment by moment flow of attention and comprehension of television. Issues include the interrelationship between attention and comprehension and their relationship to the TV program, viewing environment, and individual characteristics of the viewer. In the remainder of this paper we will briefly describe the major findings of online research with young children and suggest some ways in which these findings may relate to adult TV viewing. We will then describe in some detail a particular aspect of television viewing, attentional inertia, that we have studied in adults as well as children.

Visual attention to TV has been the primary focus of many of our research efforts. By "visual attention" we mean visual orientation toward the TV screen. Although there has been some work on individual eye movements and fixations on the TV screen (e.g., Flagg, 1979), it is our position that visual attention is at this time more profitably studied in terms of overall visual orientation toward the screen. The reasoning for this position follows primarily from the work described above concerning the visual angle formed by the screen from the perspective of the viewer. Viewers by and large sit far enough from the TV that the screen is centered within parafoveal vision, allowing rapid identification of scenes with minimal eye movements. Studies of eye movements during television viewing are probably best pursued when the television content of interest is text or stable scenes requiring detailed visual inspection.

In considering visual attention, it should be clear from our research on home TV viewing that viewers do not simply sit and stare at the screen. Rather, visual attention varies considerably, and every viewer looks at the TV, looks away, and looks back again repeatedly throughout a viewing session.

Consider our analyses of two adults watching TV at home (taken from the videotapes of our online home viewing study). One of these viewers is a 32-year-old woman and the other is a 33-year-old man. We rated the woman's visual attention to TV for 9 days, over 85 viewing sessions totalling 12 hours. The man was rated over 11 days for 56 sessions totalling 10 hours. The rating was accomplished by means of a computer controlled videogame [illegible] videotapes of [illegible] and women, pressing a button when, in their judgement, the viewer

initiated a look at the TV screen and releasing it when the look terminated. Each button press and release caused the computer to store the current video frame number at the time of the press and release. The rater was able to reverse the deck and rerate any part of the videotape. In this manner a continuous record of the temporal fluctuations of visual attention to the television was stored by the computer for further analysis.

We found that the man looked at the TV 67% of the time he was in the viewing room, and his looks at the TV lasted an average of 27.5 seconds. Nonlooking "pauses" between looks lasted an average of 12.3 seconds (for technical reasons, our finest temporal resolution in this study was 1.2 seconds; these data do not therefore include very brief glances to or away from the TV). The woman looked at the TV 85% of the time she was in the viewing room; her looks lasted an average of 17.9 seconds. Her nonlooking pauses lasted an average of 22.2 seconds. Importantly, in both viewers, most looks at the TV are short, under 10 seconds in length. The relative frequency distributions of look length are plotted for the man in Figure 5 and for the woman in Figure 6. It should be clear that continuous episodes of visual attention as long as 60 seconds are relatively rare. These relative frequency distributions are typical of both child and adult TV viewers. Every one of hundreds of visual attention protocols we have examined shows this predominance of short looks at the TV.

Insert Figure 5 about here

Insert Figure 6 about here

These simple observations indicate that visual attention to television is highly variable in nature. In our laboratory research with children, our work has been oriented toward explaining why, at some point in time, a child looks at the TV, and why at some later time the child looks away. From this research we have been able to develop four major principles of attention to television. We will present three of these principles and briefly describe the supporting evidence; the fourth principle, attentional inertia in TV viewing will be described in more detail. More extended descriptions of this research can be found in Anderson et al. (1979), Anderson and Lorch (1983) and Anderson and Smith (1984).

Principle 1: Attention depends on concurrent activities and the viewing environment.

This is a straightforward principle but requires explicit statement. When children were shown Sesame Street with toys available for concurrent play, they averaged 88% visual attention. When children were shown the same programs without toys available, they averaged 87% visual attention (Lorch, Anderson & Levin, 1979). From ours and others' observations of

TV viewing at home as well as from survey data (e.g., Robinson, 1981), time-sharing of TV viewing with other activities is quite common. For example, the woman whose attention data are illustrated in Figure 6 constantly time-shared TV with other activities such as sewing, eating and talking to her children. The man whose data are illustrated in Figure 5 engaged in less time shared activity and as a consequence had relatively fewer short looks and greater overall attention. Part of understanding online aspects of TV viewing, therefore, requires an accounting for the shifts of attention between the TV and the other ongoing activities.

Principle 2: Visual attention is maintained by active cognitive involvement with program content.

This principle also seems straightforward but should be considered in contrast to an alternative and popular hypothesis of attention as being passively driven by the rapidly paced "formal features" of television. Such an alternative hypothesis underlies many of the popular books written about TV viewing in which viewers, particularly young children, are characterized as being passive victims of television. The movement, color, fuzzy edges, zooms, pans, and cuts of contemporary television capture and maintain attention, according to this alternative hypothesis, so that the viewers are mesmerized, unable to process the program with normal cognitive skills and judgement. Especially for children, television becomes a "plug-in drug" (e.g., Mander, 1978, Moody, 1980, Winn, 1978) and the viewer becomes a "passive vessel of reception". Our second principle, on the other hand, indicates that viewers process television programs much as they might books, conversations, and lectures. If the TV program contains content that is comprehensible and not overly predictable, and if it addresses in one fashion or another the viewers' interests and current entertainment or information needs, attention is maintained. This would seem to be a common sense position except that the alternative position is so frequently believed.

The evidence for principle 2 comes from a series of studies with preschool children. The general conjecture underlying these studies is that if principle 2 is correct, a major determinant of young children's moment by moment fluctuations of attention to television is the moment by moment comprehensibility of the TV program from the perspective of those children. The reasoning behind this conjecture is that, to a very young child who has limited vocabulary, experience, and cognitive skills, much of television is in fact incomprehensible. If attention to television is maintained by cognitive involvement with the content, then it would seem that comprehensibility of the content is a necessary (although not sufficient) ingredient to maintain a young child's attention.

Three lines of evidence emphasize the importance of comprehensibility for young children's attention. The first is that, as predicted from the comprehensibility hypothesis, visual

attention to television increases dramatically with age throughout the preschool years, finally leveling off during late childhood. This prediction follows because with age the young child gains the vocabulary and cognitive skills by means of which more and more of television becomes comprehensible. This predicted increase in visual attention with age was found in a number of laboratory studies (Alwitt et al., 1980; Anderson & Levin, 1976; Anderson, Lorch, Field & Sanders, 1981) as well as in our field study of TV viewing (see Figure 4). The passively driven attention hypothesis simply cannot account for this increase since even infants' attention should be passively driven by the formal features of television.

The second line of evidence in support of the comprehensibility hypothesis comes from an analysis of preschoolers' visual attention to Sesame Street in relation to the dialogue. We rated each utterance in 15 different Sesame Street programs as having either an immediate or nonimmediate referent. An immediate referent means that the subject of the dialogue was visually or auditorily present. A nonimmediate referent means that the subject of the dialogue was displaced in time and space. An example of an immediate dialogue is a discussion about a bicycle that is present on the screen. An example of a nonimmediate dialogue is a discussion about a shopping trip which occurred earlier in the day. Since virtually all theories of cognitive development would consider immediate dialogue as generally more easy for preschoolers to comprehend than nonimmediate dialogue, the prediction derived from principle 2 is that preschoolers should pay more attention during immediate than nonimmediate dialogue. That is exactly what was found (Anderson et al., 1981).

The third line of evidence involved deliberately distorting the comprehensibility of Sesame Street in such a way that the formal features (the look and sound of the program) were undisturbed. This was accomplished in three ways: 1) Segments were edited so that the scenes occurred in random order. Editing was done at preexisting edit points so that the same number of cuts appeared as in the original segments. 2) Professionally dubbed foreign language segments were obtained. We also had the English language versions of these same segments. 3) In some segments we used a special editing technique to reverse each utterance of the dialogue in place. In this way voice quality, intonation, and approximate lip synch were maintained, but the utterances were backward. Again, the results were straightforward; preschoolers attended much less to the distorted segments than to normal segments, despite the fact that the formal features in the distorted segments were undisturbed. It is therefore clear that even young children's attention to television is maintained in part by their cognitive involvement with the content.

For adult viewers, and older children, for that matter, principle 2 implies cognitive involvement beyond the relationship between comprehensibility and attention. Although there are

occasional points where a program may be incomprehensible to an adult, as in a foreign language broadcast, variations in adult attention are surely more related to complex interactions between the viewers' experiences, preferences, and the particular content of the program. If the comprehensibility principle applies, it will generally apply when the program is overly comprehensible or too predictable, as in a summer rerun of a program the viewer has already seen. In any case, a good deal of work remains in elaborating this principle, especially for adult viewers. There are some online indications, for example, that adults frequently use TV for relaxation, escape, and for minimal cognitive involvement (e.g., Csikszentmihalyi & Kubey, 1981). It is an open question as to whether a program which is highly effective in maintaining attention serves the viewer's need for a relaxing stimulus. If the relaxation is obtained by replacing the content of one's spontaneous thoughts with externally structured content, then a high-attention highly involving program may serve the purpose well. It may be, on the other hand, that the viewer wants the program not to demand high attention, especially when the viewer engages in concurrent activities while watching TV. Such a possibility is not inconsistent with principle 2, it only suggests that viewers may have strategies for program selection that are not always biased toward high-attention content.

Principle 3: When not paying attention, the viewer monitors the audio for cues signaling content worthy of attention.

An obvious issue is what TV viewers do when they are not paying visual attention to the TV. The issue is significant because viewers spend a substantial portion of their time with television not obviously paying attention. A young child who has toys available, for example, will play with the toys, look up at the TV, go back to playing with toys, look up at the TV again, and so on perhaps 150 times an hour (e.g., Anderson & Levin, 1976). Our work indicates that children learn at an early age to monitor the audio track for cues signaling the presence of comprehensible and, to them, interesting content. When such a cue is detected, the child suspends toy play and pays full attention to the TV. The work indicates, furthermore, that when not looking at the TV, the young child is by and large not listening to the audio at a level of word and sentence meaning. With age the viewer becomes more able to decouple visual and auditory attention so that audio processing at the level of meaning is more likely to occur when the viewer is not looking at the TV.

Again, there are three lines of evidence supporting this principle. An examination of the relationship between various auditory and visual attributes of television programs and visual attention provides the first evidence. In this research, consideration is made of whether the viewer is looking at the television at the time an attribute occurs. Visual attributes cannot influence attention if the viewer is not looking at the TV

when the attribute occurs, but auditory attributes can potentially influence the viewer in either case. The results of this research (Alwitt et al., 1980) indicated that there were many more effective auditory attributes during periods of visual inattention than during periods of visual attention. Of 18 auditory attributes examined, 8 elicited visual attention from inattentive preschoolers. These were auditory change, sound effects, laughter, women's voices, children's voices, peculiar voices, and instrumental music. Three attributes inhibited attention; that is, the child was less likely to look at the TV if one of these attributes was present on the audio: men's voices, individual singing, and slow music. Importantly, the effects of auditory and visual attributes were considerably less pronounced if the child was looking at the TV when the attribute occurred. This latter finding is consistent with the notion that the viewer, when looking, is likely to be involved with the content, per se, and not with relatively superficial attributes.

The relationship of auditory attributes and visual attention can be further clarified when the results for very young children (under 3 years of age) are considered. The audio attributes do not have the same effects on these young children. In fact, there is generally no relationship between audio attributes and visual attention. Only at about three years and older does the relationship appear (Levin & Anderson, 1976). We have interpreted the effects of auditory attributes on visual attention as the children having learned strategies of watching television, strategies which are first acquired at about three years of age. The strategy is one of monitoring the audio at a nonsemantic level of analysis for cues indicating comprehensible content. An example of a cue is a peculiar voice, such as Bugs Bunny's voice. We suggest that the child learns, over many hours of exposure to television, that a peculiar voice signals content that is meant for children and thereby more likely to be comprehensible and entertaining. Upon hearing a peculiar voice, the child looks up and pays full attention. In contrast, adult male voices, which inhibit looking at the TV, are ubiquitous on television and are probably not predictive of concrete content comprehensible to young children. In fact, adult male voices may signal relatively abstract adult oriented content. Adult male voices become learned as cues to disregard the TV. With such cues, the young viewer can effectively divide attention between television and toy play, attending to the TV during those times when the content is most likely to be understandable and therefore entertaining.

The second line of evidence supporting principle 3 concerns the effects of artifically raising young viewers' visual attention to a television program and then assessing their comprehension of the program. Recall that visual attention to Sesame Street in an environment without toys doubles young children's visual attention as compared to viewing with toys. After showing Sesame Street to 5-year-olds in these two conditions, we tested their comprehension. We found no difference in comprehension between the two groups, despite the

fact that visual attention in the no toys groups was double that of the toys group. The explanation of this seemingly astounding result is straightforward: Even by age five, children have developed a sophisticated strategy of dividing attention between television and a concurrent activity. The strategy is one of using the audio track to cue attention to the comprehensible parts of the program. In this manner the child looks at the screen during those parts of the program most crucial to the child's understanding. Raising attention to the program beyond the level the child devotes during toy play had no effect because the child was already nearly maximally efficient at processing the content.

The third line of evidence in favor of principle 2 comes from analyses of the relationship between looking at the TV and comprehension of the TV program. It should be obvious that memory for purely visual content is positively correlated with visual attention at the time that content is presented, and indeed a high correlation is found (Field & Anderson, in press; Lorch et al., 1979). Similarly, a high correlation is found between visual attention and memory for audiovisual content presented redundantly in both modalities. The crucial question is the relationship between visual attention and memory for purely auditory material. The answer is that memory for auditory content is in fact substantially greater if the viewer is looking at the TV at the time the content is presented (Field & Anderson, in press; Lorch et al., 1979).

Principle 2 is crucial for understanding the online nature of television viewing. The principle emphasizes both the audiovisual nature of television as a medium and how the audio is used by the viewer to guide attention between concurrent activities and the TV set. The research indicates that a viewer is more likely to listen to the audio at a level of semantic understanding if the viewer is looking at the TV. The research also indicates that the viewer, when not looking at the screen, tends to listen to the audio at the level of critical cues signaling significant content. These cues then elicit full attention. TV viewing can thus be seen as a rational, somewhat strategic and learned form of medium processing.

It should be pointed out, however, that the portrait of the online dynamics of TV viewing elaborated thus far is based primarily on research with young children. At this time our knowledge of the online aspects of adult TV viewing is quite limited. We have some indications, however, that adults and older children process the audio to a greater extent than younger children when not looking at the TV. Field and Anderson (in press) found that the linkage between looking and auditory memory while still substantial, is weaker in older children (9-year-olds) than younger children (5-year-olds). Also, the observation that adults at home look less at the TV (see Figure 4) than children may indicate that they listen more to the TV than children. It is also possible that adults have more sophisticated strategies for monitoring the audio for cues which

then elicit full attention. It should be apparent that a priority for future research on principle 3 is the study of adult viewers, and especially the nature of their auditory attention when they are not paying visual attention.

Principle 4: Attentional inertia

It should be apparent by now that visual attention to television consists of frequent alternating episodes of looks and nonlooking pauses. We have shown that the pauses are maintained in part by the viewers' tendency to timeshare television viewing with concurrent activities (Principle 1). During the pauses the viewer tends to monitor the audio at a nonsemantic level of analysis for cues signaling interesting or entertaining content. When such a cue is detected, the viewer looks at the TV; certain cues, on the other hand, may predict uninteresting content and may actually inhibit looking (Principle 3). Once looking, visual attention is then maintained by the viewers' relatively active cognitive involvement with the content (Principle 2). In broad outline, these principles can by themselves account for the temporal flow of visual attention to television. Our research suggests, however, a fourth principle of attention to television, a principle we call "attentional inertia" (Anderson et al., 1979).

To understand the analysis which underlies attentional inertia, consider the concept of "survival" curves as frequently employed in biological and engineering research. The survival curve for the human life span plots the probability that a person will survive through an interval of time given that he or she has already survived to that interval. The resulting curve for humans shows an initial rise from infancy to early childhood and then a slow and steady decline from early childhood through old age. A person who is 20 years old, for example, has a substantially higher probability of surviving to 30 than a person who is 60 years old has of surviving to 70. In fact, virtually all animal species have such declining survival curves. In contrast, engineering analyses show that the survival curve for computer chips has the opposite trend: the longer a chip has functioned without failure, the more probable it is that it will continue to function.

The issue of interest here is the survival curve for visual attention to television. On the basis of a priori hypotheses, one might expect the curve to be flat if a look at television is maintained only by involvement with the specific content of a television program as suggested by Principle 2. This follows because the content unfolds inexorably regardless of how long the viewer has been continuously looking at the TV. Boring content which terminates looking could occur at any point in the "life span" of the look in progress. Thus, the probability of a look continuing would be constant regardless of how long the look has already been in progress.

A second possibility is that after some period of time,

the viewer may become visually fatigued or habituated to the content, suggesting that the survival curve would drop over time. A third alternative suggests that when a viewer initiates a look at the TV, it takes some time before he or she becomes fully cognitively involved. In this case, the viewer is more likely to end a look before full involvement is attained, thus producing a low rate of survival if the look has lasted only a short time, and a high rate of survival if a look has lasted longer. Thus the survival curve would reflect the time course for the full recruitment of attention.

The results of the survival probability analysis are straightforward: The survival curve is invariably an increasing negatively accelerated function whether plotted on group data or for individuals (Anderson et al., 1979). It is this observation of the increasing survival curve for visual attention to television that we call attentional inertia. The longer a viewer has continuously maintained visual attention to television, the more probable it is that he or she will continue to maintain visual attention.

Figures 7 and 8 illustrate the survival curves, over 10 second intervals, for the man and woman TV viewers observed at home whose TV attention data were discussed earlier. Very similar curves are found in our laboratory studies with children (Anderson et al., 1979) and with college students (Anderson & Lorch, 1983). Notice that the curves for the man and the woman appear very similar despite the differences in the level of attention (67% for the man and 45% for the woman). In fact, the woman's curve begins at an initially lower probability of survival but levels off after about 60 seconds at a higher level of survival than the man's curve.

Insert Figure 7 about here

Insert Figure 8 about here

An implication of this difference between the curves for these two viewers is illustrated in Figures 9 and 10. Instead of plotting survival probability, these curves plot survival time. That is, given that a look has survived to a given point in time, the curve plots the expected time that the look will remain in progress. These curves indicate that the small differences in the survival probability curves have large consequences for survival time. Although the woman infrequently looks at the TV for as long as 30 seconds, when she does she can be expected to look a relatively long time. The man, on the other hand, more frequently looks at the screen as long as 30 seconds, but his expected additional span of visual attention is shorter than that of the woman.

Insert Figure 9 about here

Insert Figure 10 about here

At the descriptive level, there is very little difference in the attentional inertial functions for adult and child viewers. For all viewers, visual attention appears to go through a period of consolidation or recruitment such that a look is likely to end within a few seconds of its onset, but if it survives, it may remain in progress for several minutes. In experimental work with children, we have examined the consequences of attentional inertia for television viewing.

One issue we have considered is whether the viewer becomes less responsive to external distractions as a look at television is maintained. Such an increasing resistance to distraction would be expected if the attentional inertia curve in fact reflects an underlying process of progressive recruitment of attentional resources to the television program. As more attentional resources are devoted to the program, fewer resources can be devoted to processing the external viewing environment and concurrent activities. (The concept of attentional resources is commonly employed in attention and performance theory, e.g., Kahneman, 1973; Posner, 1978). To test this idea, we developed a laboratory TV viewing situation in which distracting slides were irregularly presented on a screen to the side of the TV set. Each distractor was presented for 4.0 seconds and was signaled by a loud .5 second "beep". The question addressed by the research is whether the viewer is more or less distractible early in the course of a look at the TV as compared to later. The experiment used preschoolers as subjects, and the TV program was Sesame Street.

The results were clear: The children were twice as likely to be distracted by the slide if the slide came on when a look had been in progress for less than 15 seconds than if a look had been in progress for more than 15 seconds (Anderson, Choi & Lorch, 1980). One apparent consequence of attentional inertia, therefore, is resistance to distraction away from the TV.

Given that attentional inertia indicates a progressive recruitment of attention, the question then arises, attention to what? One possibility is that attentional inertia reflects increasing involvement with specific program content, such as a particular plot line or the development of a particular set of characters or ideas. This idea is consistent with Principle 2 (attention maintained by active cognitive involvement with program content) but elaborates the principle by adding that cognitive involvement takes time to develop. If this notion is correct, then attentional inertia should be reset or terminated when one program ends and another program (such as a commercial) begins.

An alternative, but not necessarily mutually exclusive, conception of attentional recruitment is that attention is being recruited to the source of the currently involving content; that is, to the television medium itself. This notion suggests that once a viewer maintains attention for some time there will be a tendency to continue to maintain attention regardless of changes in content or lapses in comprehensibility. A consequence of this alternative idea of attentional inertia is that once attention has been fully recruited, attention tends to be maintained across content boundaries.

We tested these alternative hypotheses by a detailed examination of children's visual attention to Sesame Street. This popular program is in magazine format with about 40 segments averaging about 90 seconds each. Important for our analysis, the content of any segment in the programs we used was independent of the preceding segment in style as well as characters and concept. For example, a film about pairs of animals was succeeded by an animated cartoon about the alphabet. The issue in our analyses was whether attentional inertia served to "drive" visual attention across the content boundaries between these segments, or whether the process was "reset" at those content boundaries.

We examined each look which was in progress at the time a content boundary occurred. The analysis compared the time each look was in progress up to the content boundary to the time that each look remained in progress after the content boundary. The results again were clear but suggested that both hypotheses about attentional inertia were correct. Content boundaries did have a strong tendency to terminate looks, but the longer a look was in progress prior to the content boundary, the less likely would it be terminated and the longer it remained in progress after the content boundary. Thus visual attention is sensitive to content boundaries, but also attentional inertia serves to drive attention across such boundaries. Attentional inertia, therefore, represents recruitment of attention not only to specific content but to the medium in general. It thus acts as a kind of attentional "glue" which serves to maintain attention across viscissitudes in content and momentary lapses in interest value. Attentional inertia may in fact be a primary mechanism by which viewers pay attention to some commercials.

An additional note should be made about the attentional inertia analyses. We have here been concentrating on visual attention to television, but recall that viewers also spend substantial portions of their time with TV not looking at the screen. During these pauses in visual attention the viewer is frequently engaged in a concurrent activity including conversations, eating, knitting, reading, and the like. A question of interest is what the survival probability of these nonviewing pauses looks like. In general, we have found that survival curve for pauses increases in a fashion somewhat similar to that for looks at the TV (Anderson et al., 1979). The longer a viewer engages in the concurrent activity, the more likely it is that he or she will continue to do so. Rephrasing this, the

longer it has been since the viewer last looked at the TV, the less likely it is that he or she will look back. These results are illustrated in Figures 11 and 12 for the same man and woman observed at home whose attention data we have been using throughout this section of the chapter. Again, these results are characteristic of every viewer, child and adult, we have examined (see Anderson et al., 1979; Anderson & Lorch, 1983). Attentional inertia may thus characterize far more about human behavior than television viewing, per se.

Insert Figure 11 about here

Insert Figure 12 about here

Summary and conclusions

Online research on television viewing, although in many ways in its scientific infancy, has already clarified significant aspects of television viewing behavior. Academically based online research goes beyond the approach of simply preparing profiles of viewer response in relation to ongoing program content. It is providing detailed descriptions of television viewing at home, and through laboratory research, is providing fundamental principles necessary to the establishment of scientific theory. Online research, furthermore, is being used to elaborate and verify the commonly used offline approaches to television viewing.

One theme that emerges from this research is that television viewing behavior is consistent over decades, and is regular and apparently scientifically lawful in nature. The levels of attention and the kinds of behaviors engaged in while viewing TV have been repeatedly found in home observation studies across decades and in different regions of the country.

The regularity and consistency of viewing behavior makes an analytic science of watching people watch television a sensible endeavor. By applying careful observational methodologies, and by making full use of modern microcomputer and video technologies, detailed descriptions of TV viewing behavior can provide the anchor points for theory development and the hypothesis testing for theory refinement. Already we have been able to develop, test, and verify four principles of television viewing behavior. The first principle emphasizes the importance of timesharing as one of the determinants of the dynamics of TV viewing. Nonviewing pauses are maintained by these timeshared activities, and indeed, the longer such a nonviewing activity is maintained, the less likely it is that the viewer will look back at the TV.

The second principle notes the importance of TV content per

so as the primary determinant in maintaining a viewer's attention to television. This principle, of course, requires an enormous amount of additional elaboration and refinement, and in fact, we are continuing to elaborate the relationship between cognitive processing and TV program structure (e.g., Smith, Anderson & Fischer, in press).

The third principle states that the viewer monitors the audio for cues to significant content, and that this monitoring, especially in children, is at a largely nonsemantic level of analysis. This principle underscores the rational and somewhat strategic nature of TV viewing such that the viewer has learned that some cues should elicit attention and other cues should inhibit attention. Even in young children, this strategy produces surprisingly efficient information processing of TV content.

Finally, the fourth principle notes that shifts in attention are not accomplished instantaneously, despite the frequent shifts in looking to and away from the screen. Rather, the finding of attentional inertia indicates that a progressive recruitment of attention occurs that may take from 15 to 20 seconds to complete. When it is complete, the viewer is resistant to external distraction and will tend to pay attention even across major changes in content which would otherwise terminate attention.

In the context of assessment of the television audience for commercial purposes, the obvious question is of what use is all this? We will offer some specific and general suggestions. First, our home observations indicate that viewing diaries are reasonably valid offline instruments for assessing the presence of adolescent and adult viewers. They are, however, at best only fair instruments for assessing the child audience, especially the schoolage audience which is of greater commercial importance than the preschool audience. We suggest that new forms of assessment should be developed to keep track of this particular subgroup. Second, viewer presence does not in any way guarantee viewer attention. Viewers of all ages are remarkably variable in their attention to television. Third, analyses of viewer attention reveal regularities which can be applied to considerations of particular program-advertisement combinations. For example, programs which produce high levels of attention should have the effect of driving attention into commercial blocks. Interestingly, programs which produce low attention and involvement can also produce attention to commercials if the commercials provide opening auditory cues indicating the presence of entertaining or significant content. The inattentive audience will more or less automatically look at the screen following such auditory cues. The attention of this audience, however, may not be fully recruited by the commercial until it is half complete. Since a substantial portion of the television audience may actually prefer programs which demand low levels of attention, somewhat different advertising strategies may be appropriate depending on the audience segment in which the advertiser is interested, the time of day, and other factors. Online research

indicates that audience assessment procedures should take these issues into account.

On a final note it should be clear that the research we have described in this chapter is basic research oriented toward a scientific understanding of television viewing. Nevertheless, the history of science has shown time and again that basic research frequently leads to commercial application, often in ways initially unimagined by the researchers. We believe that online research on television viewing is beginning to provide the empirical and theoretical base for just such applications.

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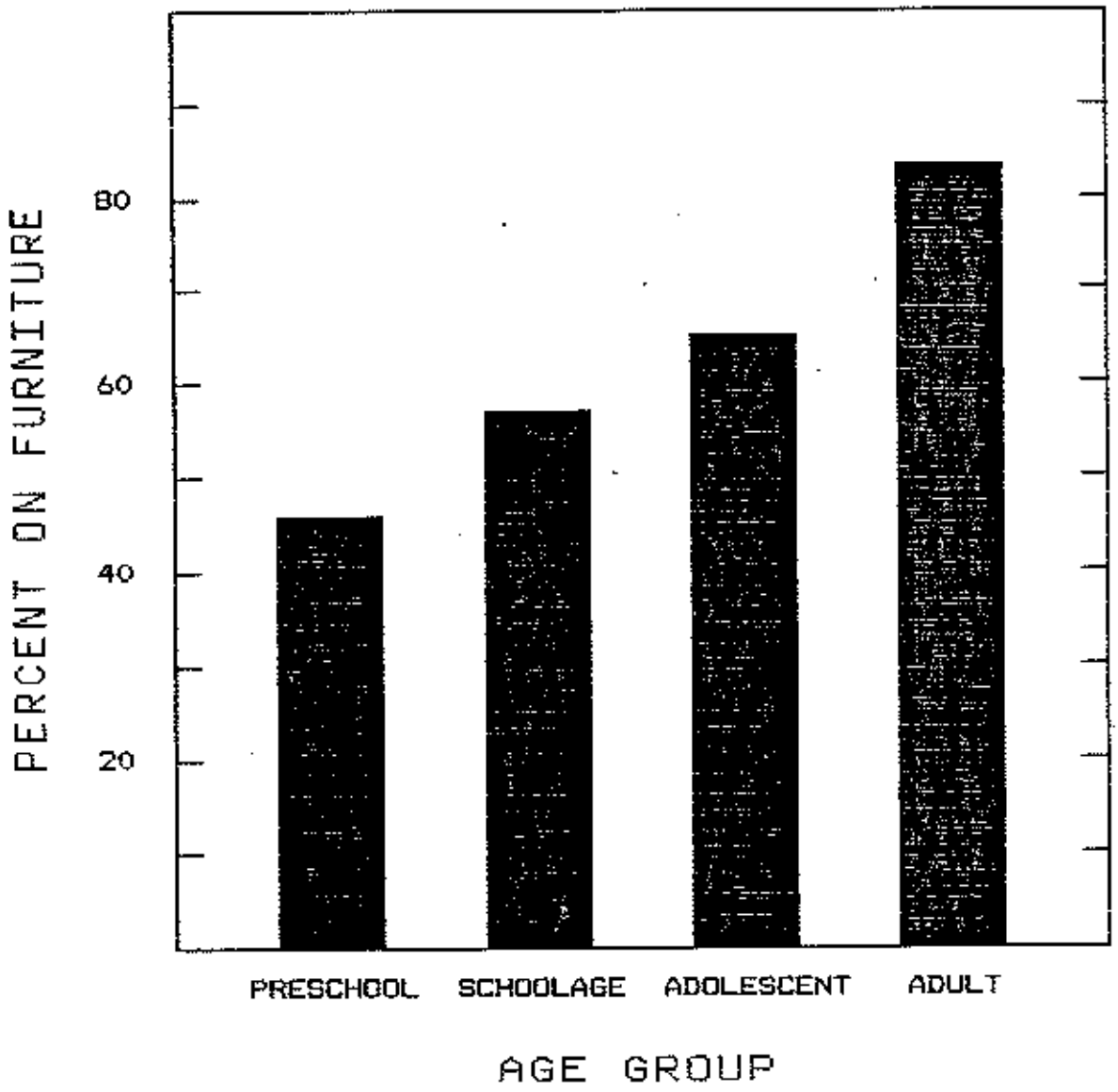
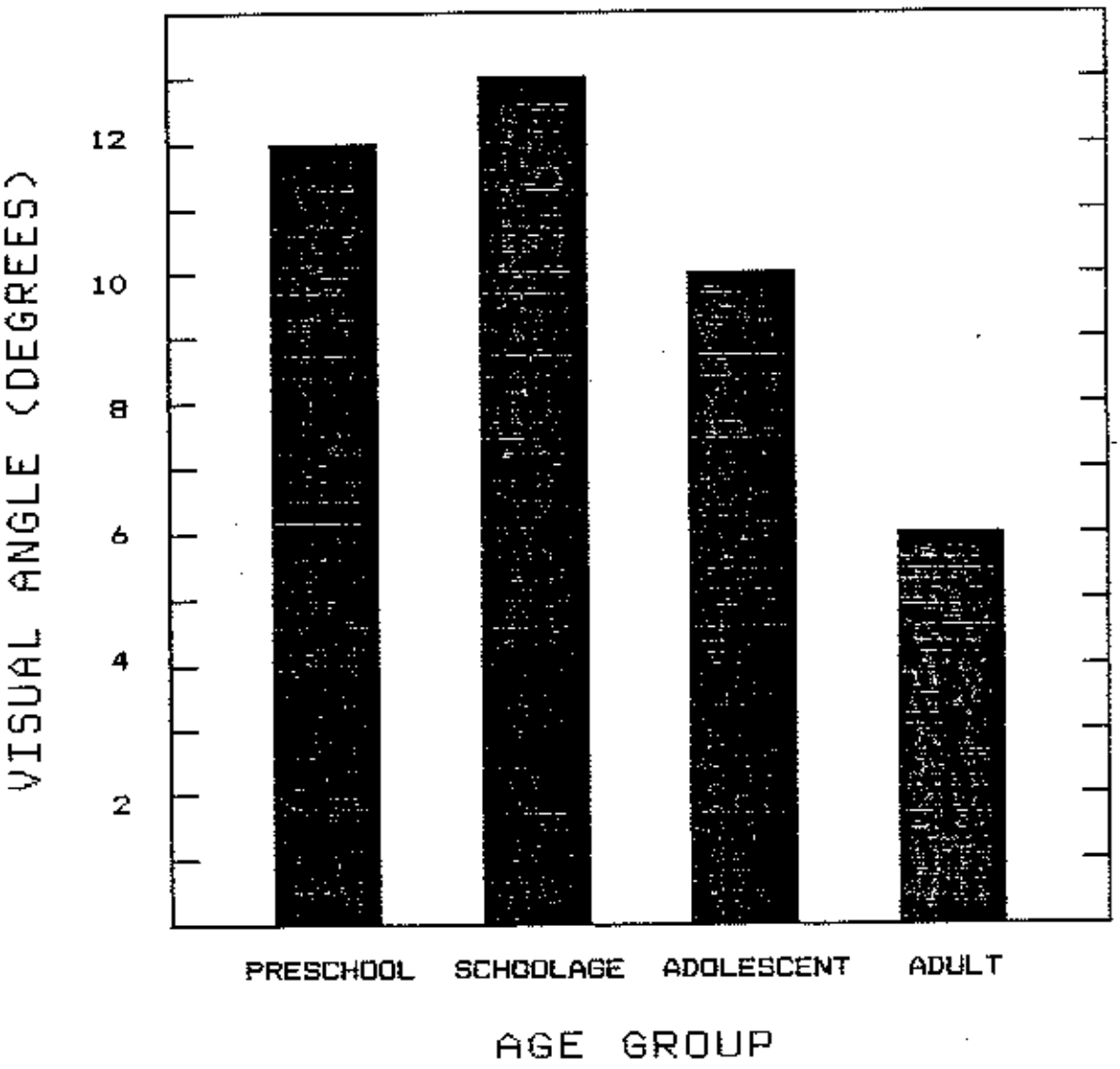
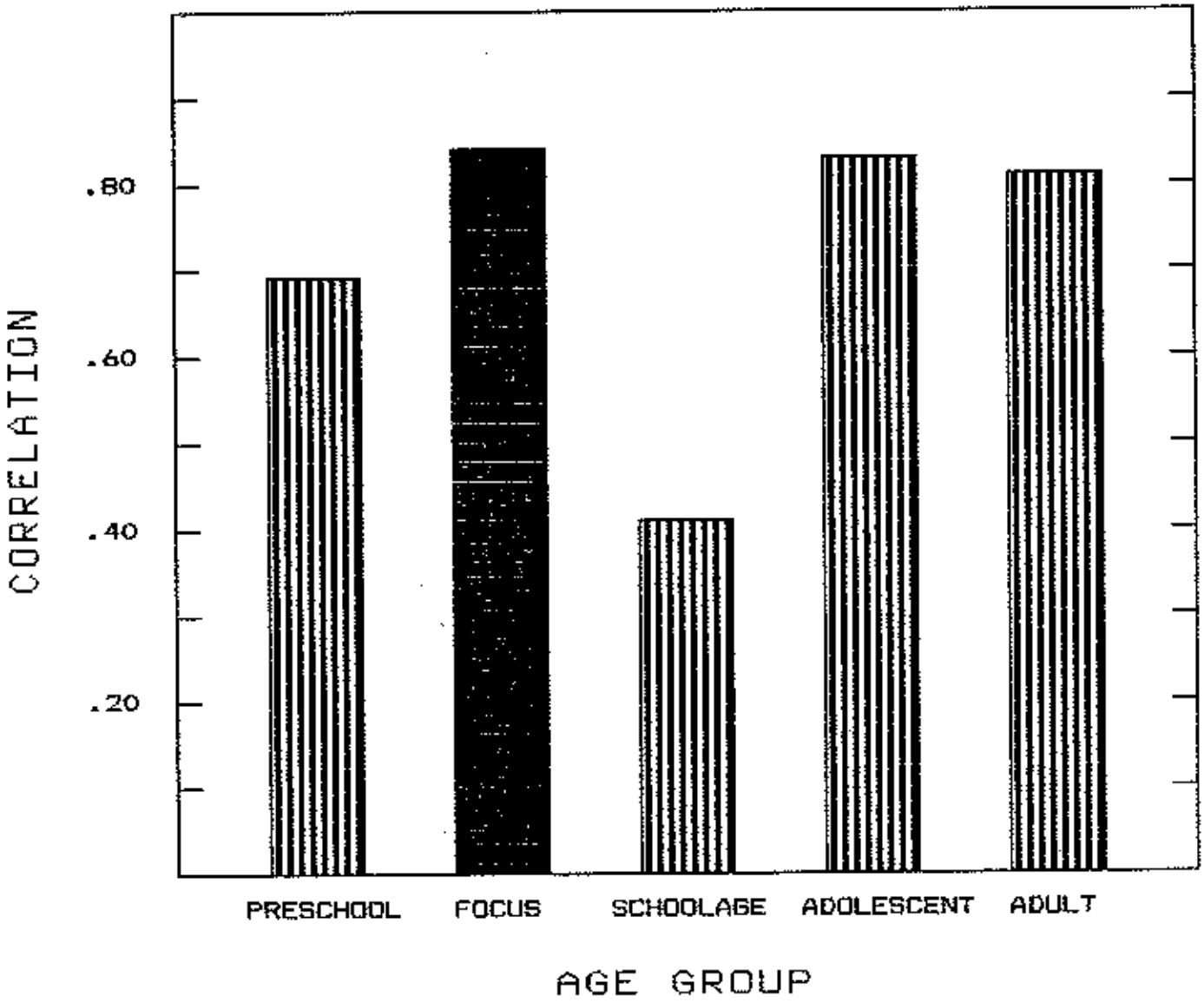


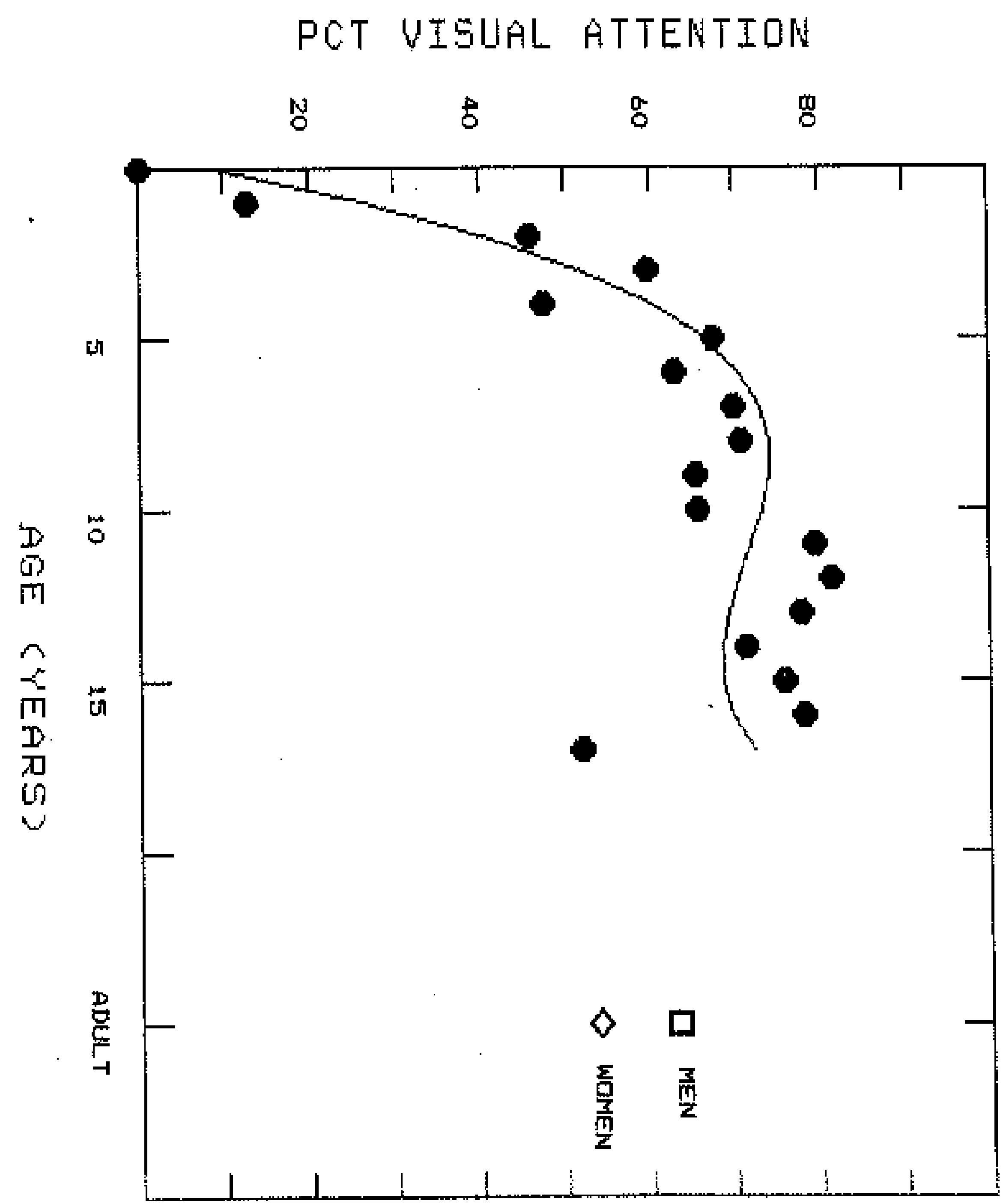
PERCENT VIEWING TV FROM FURNITURE

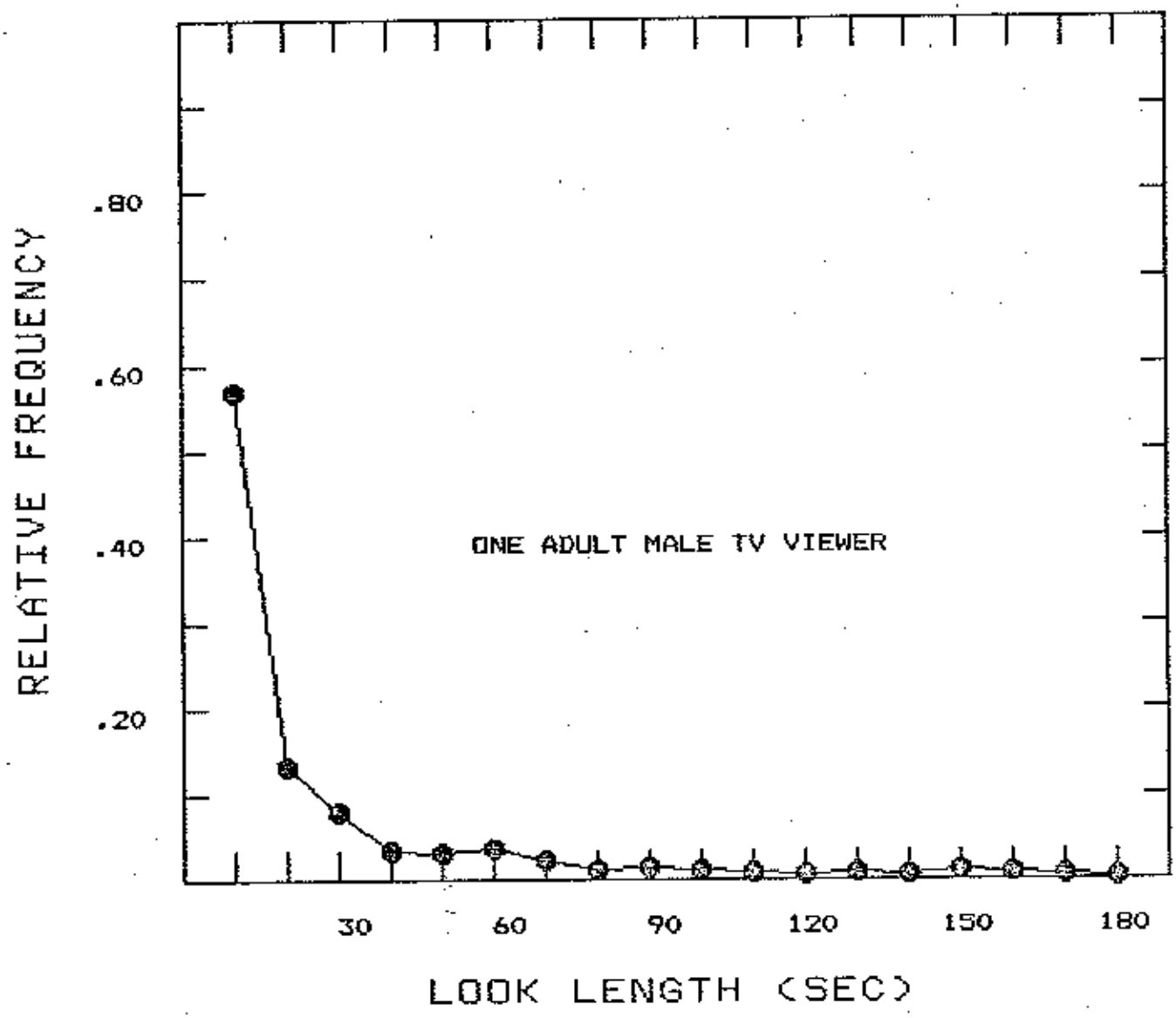


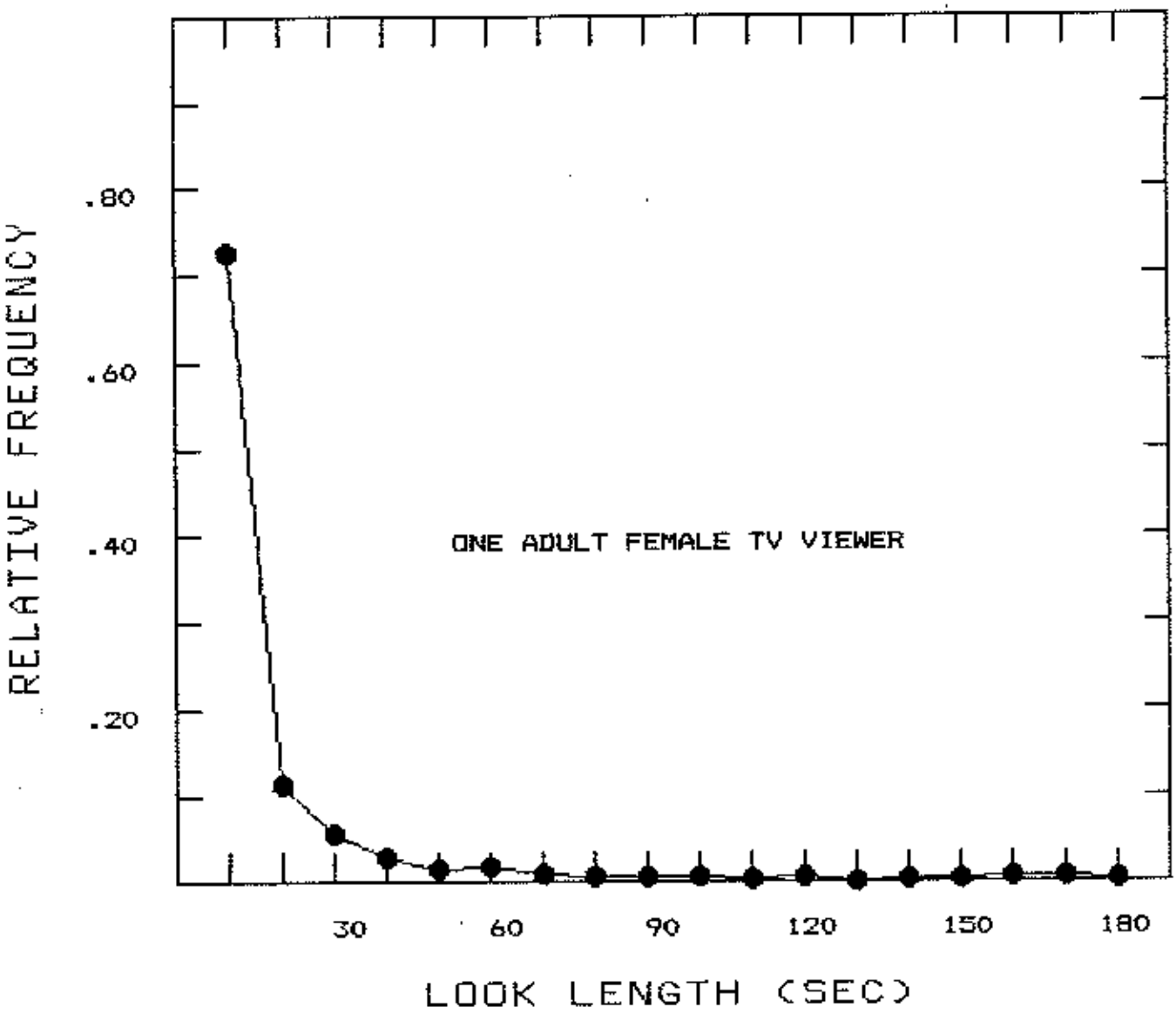
VISUAL ANGLE SUBTENDED BY TV HORIZONTALLY

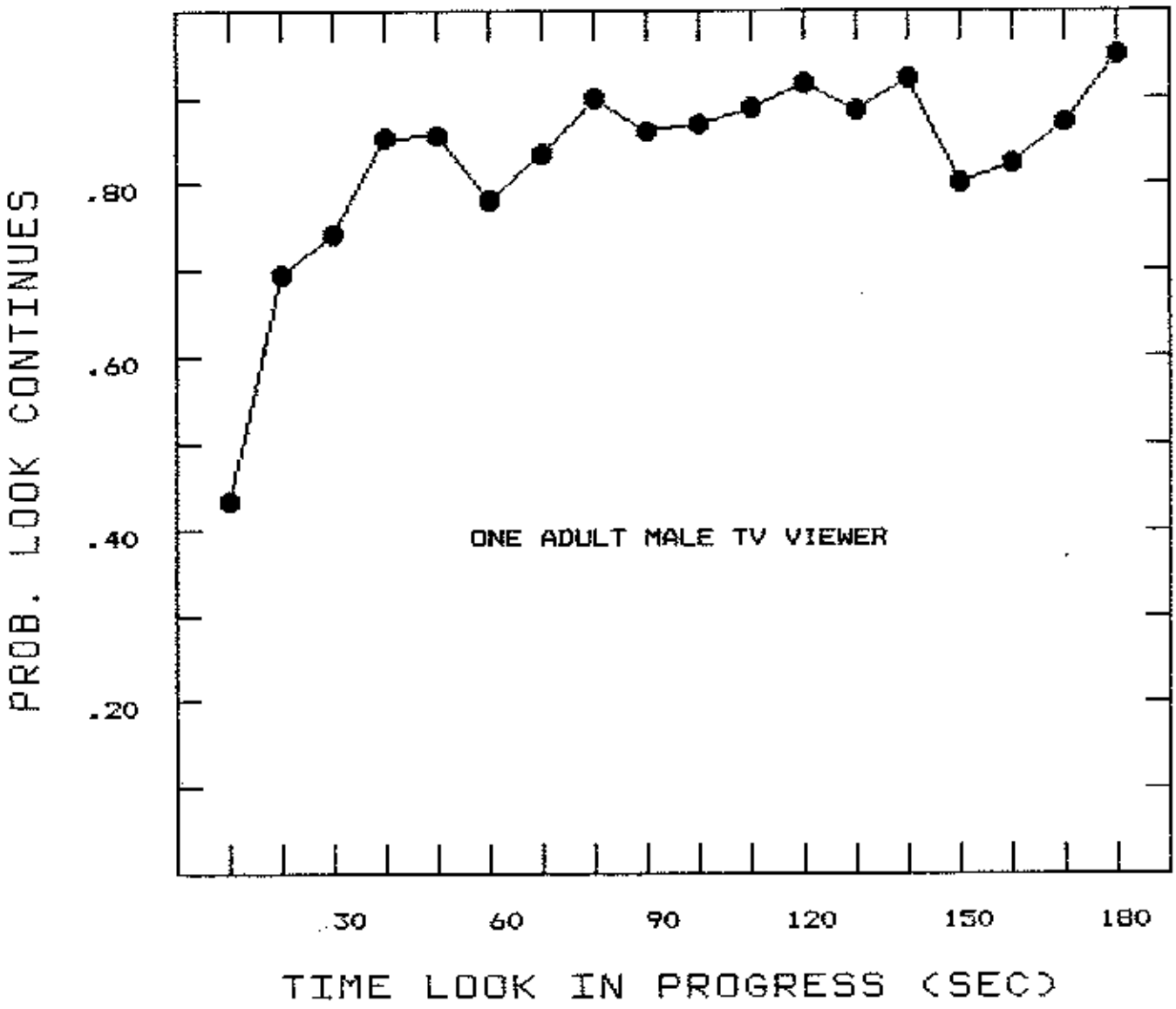


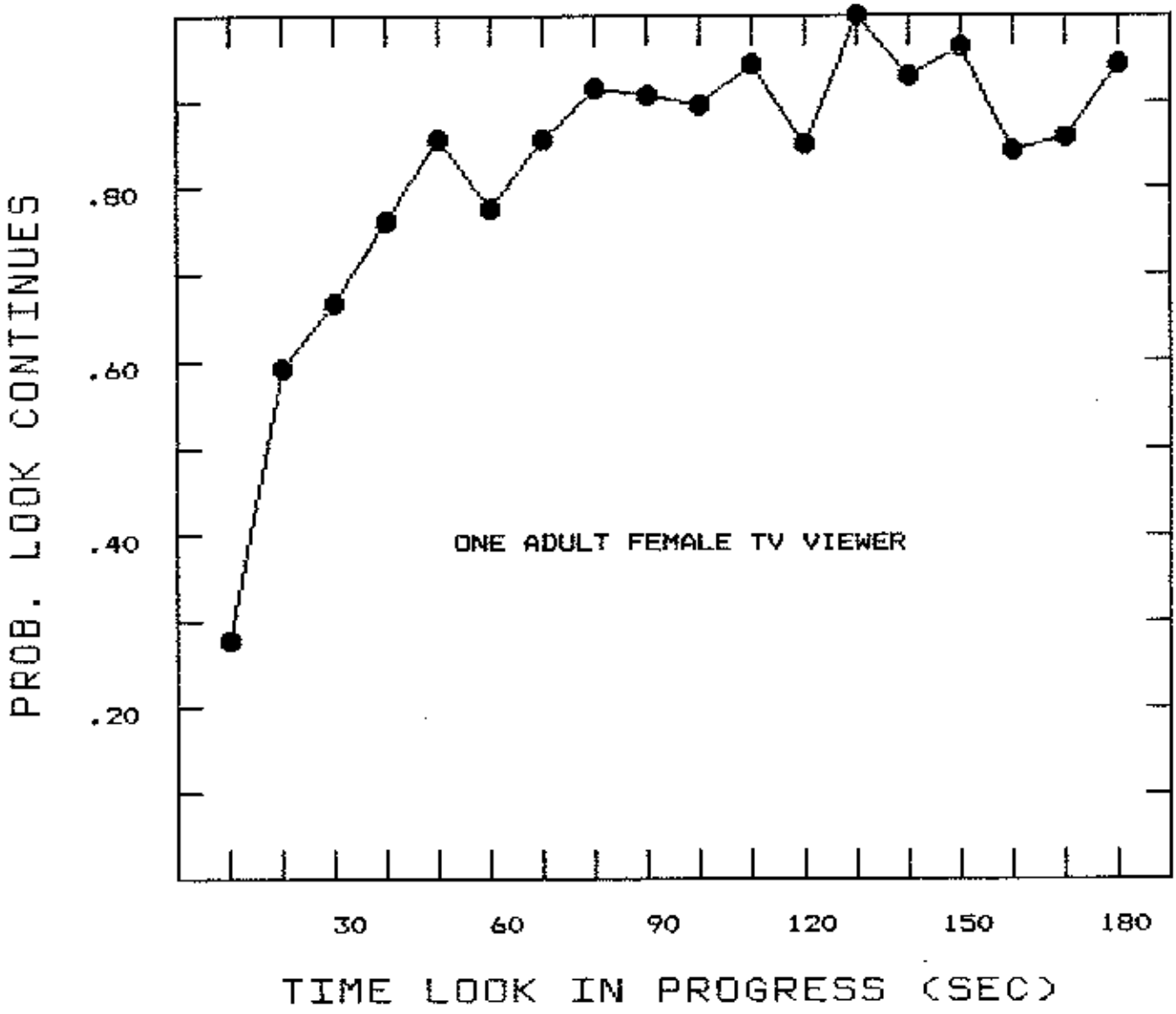
CORRELATION OF DIARY AND OBSERVATION

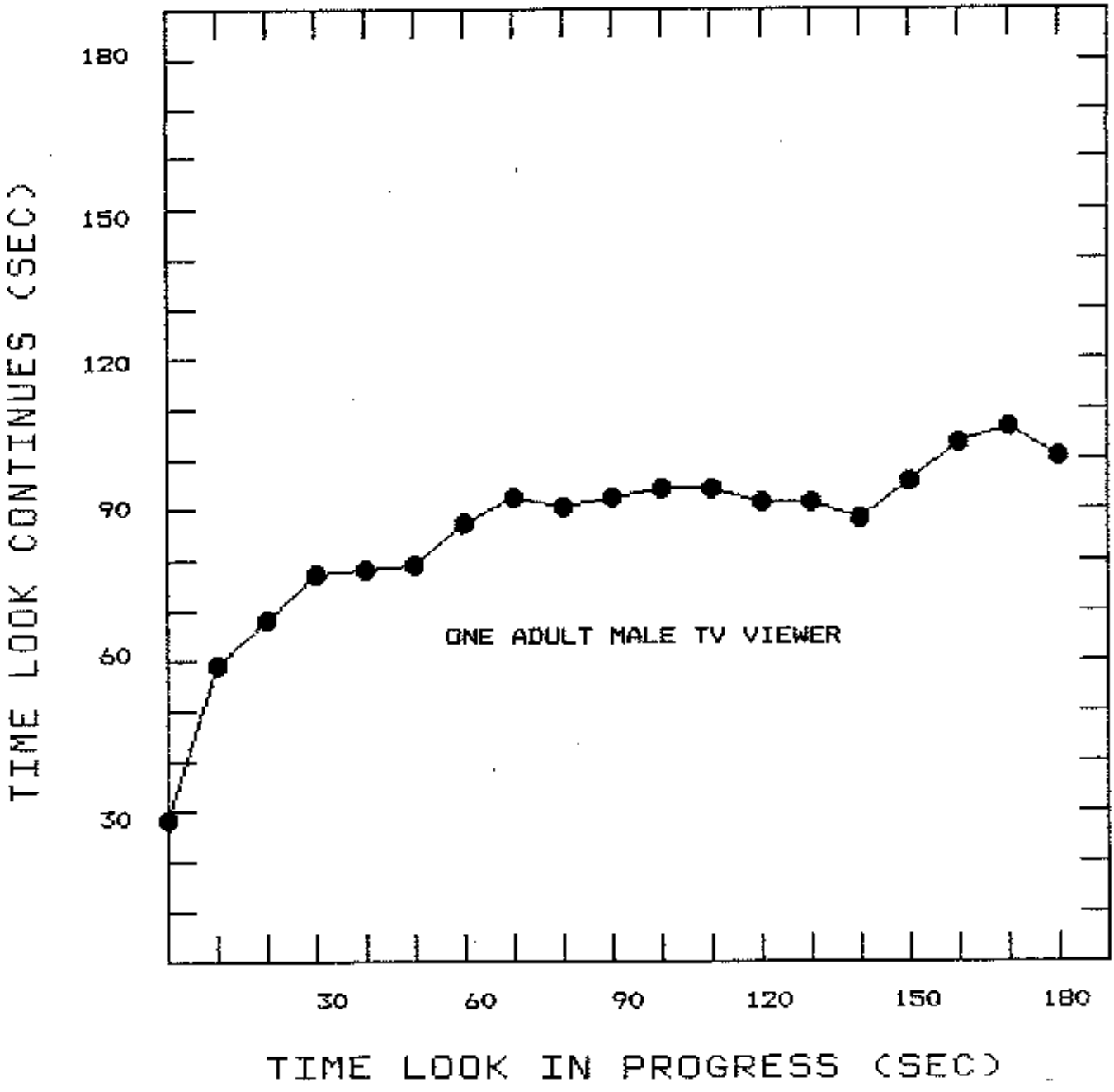

PCT VISUAL ATTENTION
20
40
60
80
5
10
15
ADULT
AGE (YEARS)
MEN
WOMEN

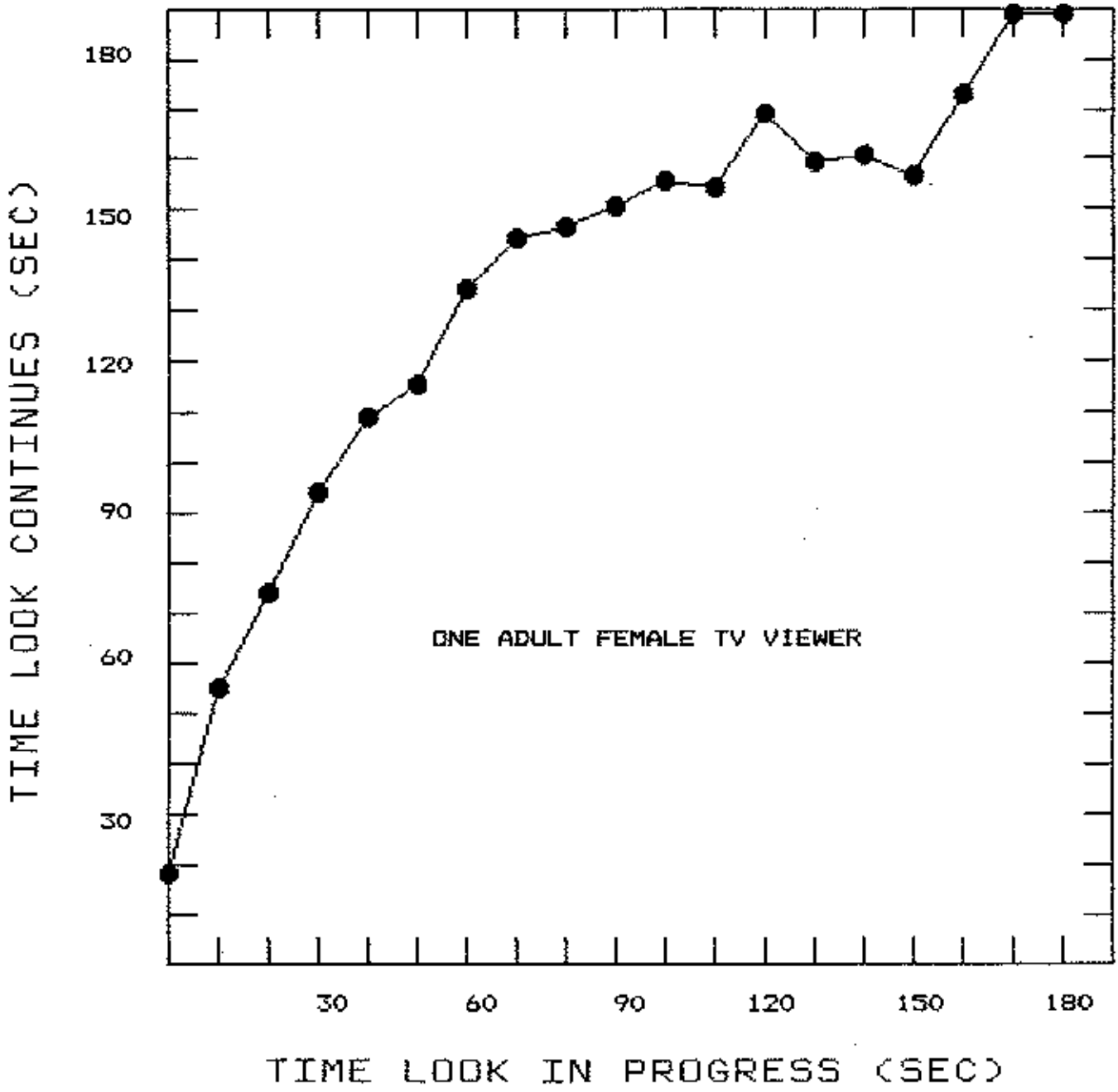

RELATIVE FREQUENCY
.80
.60
.40
.20
ONE ADULT MALE TV VIEWER
30
60
90
120
150
180
LOOK LENGTH (SEC)

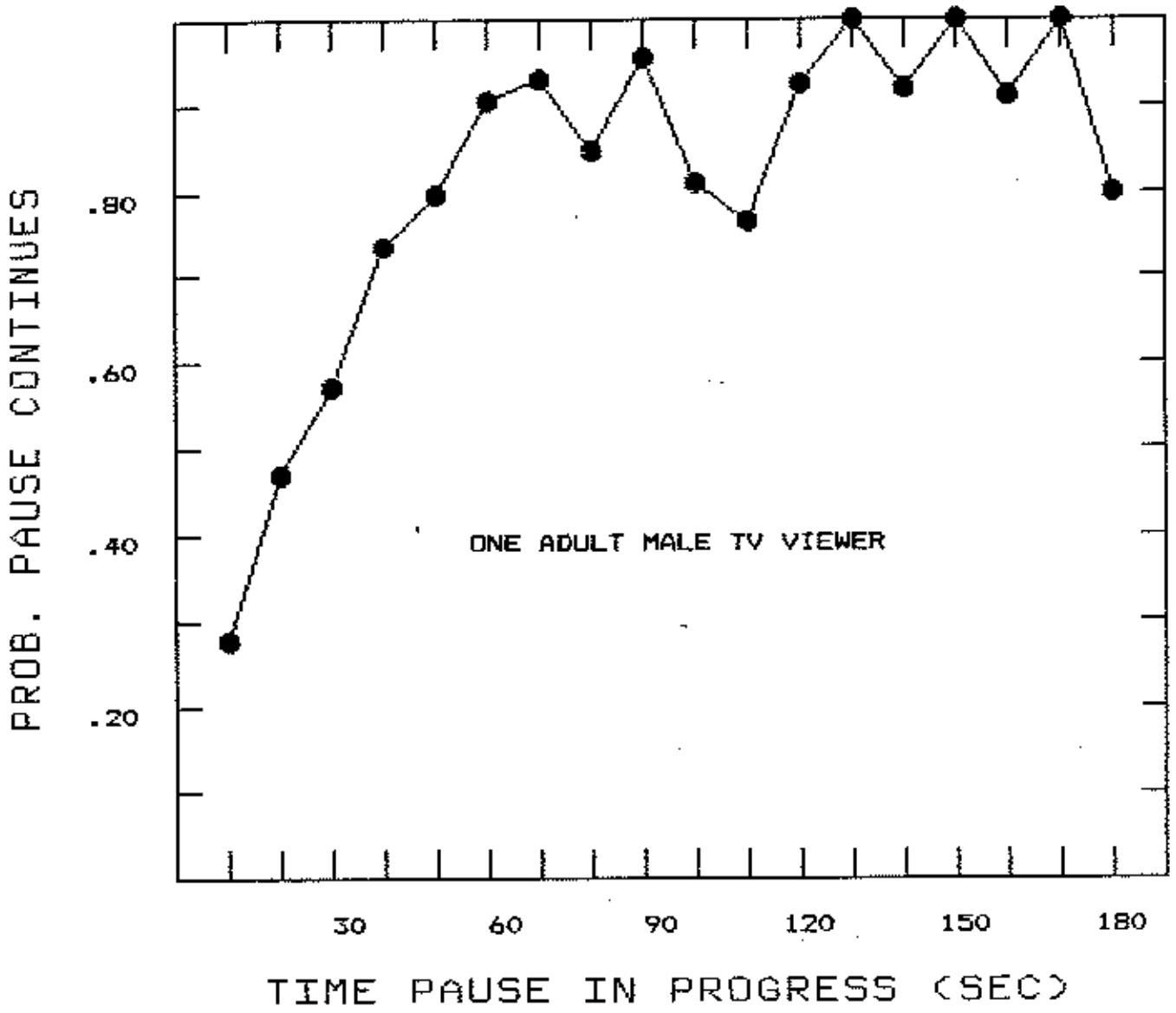

RELATIVE FREQUENCY
.80
.60
.40
.20
ONE ADULT FEMALE TV VIEWER
30
60
90
120
150
180
LOOK LENGTH (SEC)

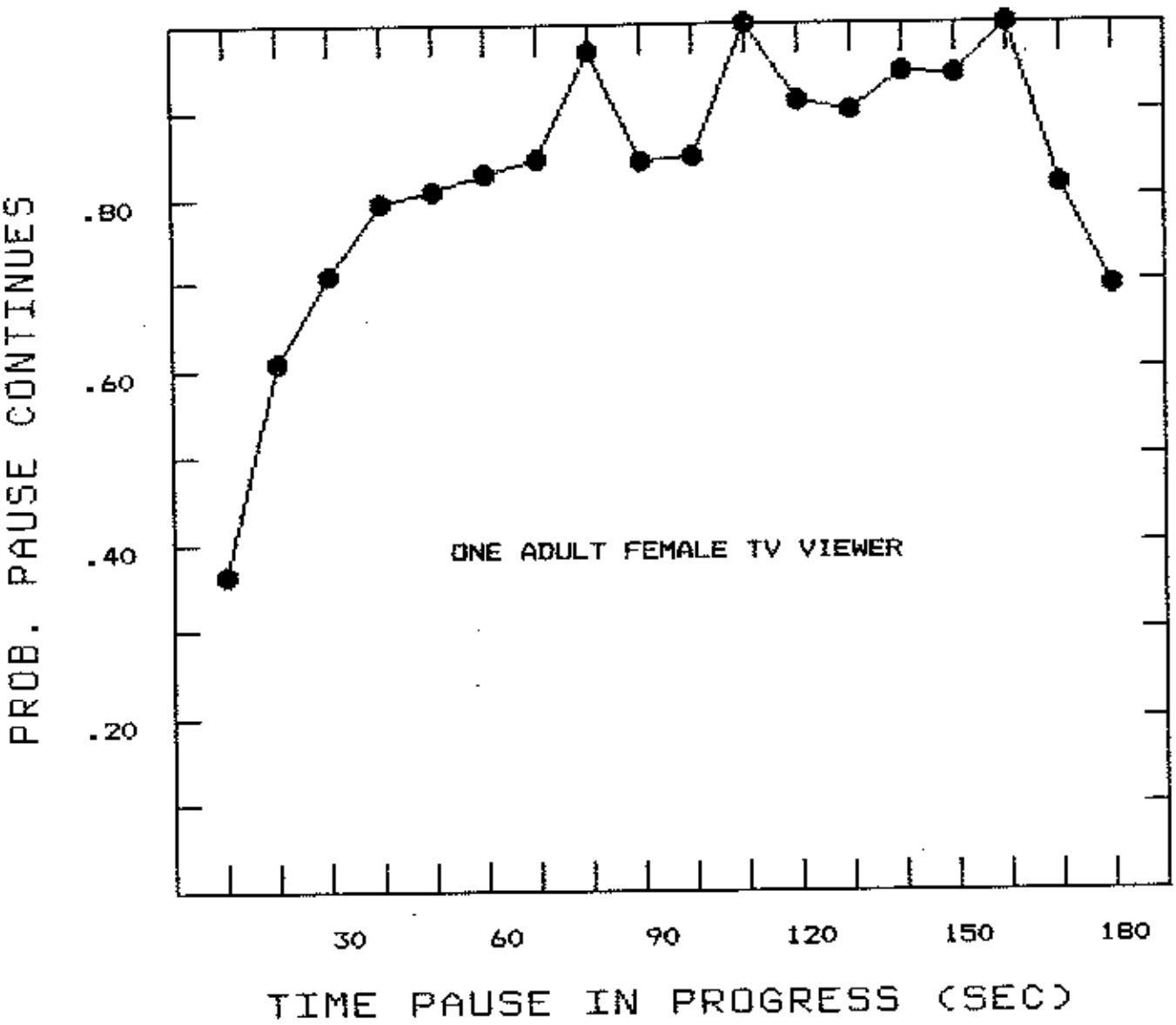

PROB. LOOK CONTINUES
.80
.60
.40
.20
ONE ADULT MALE TV VIEWER
30
60
90
120
150
180
TIME LOOK IN PROGRESS (SEC)


PROB. LOOK CONTINUES
.80
.60
.40
.20
ONE ADULT FEMALE TV VIEWER
30
60
90
120
150
180
TIME LOOK IN PROGRESS (SEC)


TIME LOOK CONTINUES (SEC)
180
150
120
90
60
30
ONE ADULT MALE TV VIEWER
30
60
90
120
150
180
TIME LOOK IN PROGRESS (SEC)


TIME LOOK CONTINUES (SEC)
180
150
120
90
60
30
ONE ADULT FEMALE TV VIEWER
30
60
90
120
150
180
TIME LOOK IN PROGRESS (SEC)


PROB. PAUSE CONTINUES
.80
.60
.40
.20
ONE ADULT MALE TV VIEWER
30
60
90
120
150
180
TIME PAUSE IN PROGRESS (SEC)


PROB. PAUSE CONTINUES
.80
.60
.40
.20
ONE ADULT FEMALE TV VIEWER
30
60
90
120
150
180
TIME PAUSE IN PROGRESS (SEC)