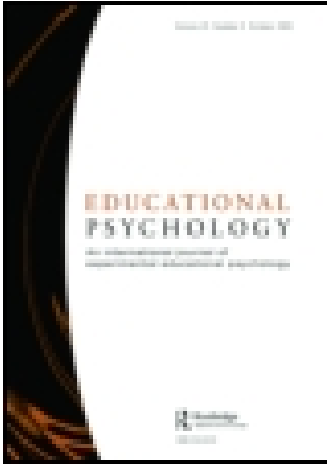


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Distraction Effects of Background Soap Operas on Homework Performance: An experimental study enriched with observational data

MARINA M. POOL, CEES M. KOOLSTRA, & TOM H. A. VAN DER VOORT, *Leiden University, The Netherlands*

ABSTRACT *An experiment was conducted to examine the impact of background soap operas on homework performance and time. Students in grade eight (aged 14) (n = 192) did paper-and-pencil and memorisation assignments with two types of soap opera episodes in the background, or the soundtrack of soap operas, or no medium. In each condition, half of the students were observed. Results indicated that students in the television conditions performed worse and used more time than students in the control condition. No significant differences were found between the audio-only and control conditions. Observational data showed that the extension of time in the television conditions was completely due to the fact that students used time to look at the screen. Although the television did not reduce time spent looking at the task, performance did decrease, probably because the alternation of resources between homework and television led to less thorough processing of the assignments.*

There is ample evidence that regularly assigned homework enhances school achievement (Cooper, Lindsay, Nye, & Greathouse, 1998; Keith, Reimers, Fehrmann, Pottebaum, & Aubey, 1986; Walberg, Paschal, & Weinstein, 1985). Homework has been shown to improve achievement in a variety of subject areas (Cooper, 1989) and to be efficient for elementary school (Paschal, Weinstein, & Walberg, 1984), high school (Cooper, 1989; Keith et al., 1986), and college students (Polachek, Kniesner, & Harwood, 1978). Highest achievement gains were found for high school students (Cooper, 1989). In view of the positive effects homework may have on high school students' achievement, it seems important to determine factors that can enhance or inhibit homework performance. Factors affecting students' homework performance include the manner in which teachers address homework assignments (Coulter, 1985; Paschal et al., 1984; Thomas, Bol, Warkentin, & Wilson, 1993), the attitude students have towards homework (Keith, 1982; On & Watkins, 1994; Tymms & Fitz-Gibbon,

1992), and factors in students' home environment, including parents' interest and involvement in homework (Epstein, 1984; Miller & Kelley, 1991).

The present study was focused on one important element in the students' home study environment that may influence homework performance, namely, the presence of background television while high school students are doing their homework. An American study (Patton, Stinard, & Routh, 1983) reported that about 30% of the students in grades 5 to 9 occasionally do their homework while the television is on. A more recent Dutch study indicated that over 50% of the students in grades eight and 10 every so often combine their homework with watching television (Beentjes, Koolstra, & van der Voort, 1996). The higher percentage found in the latter study may be due to the fact that in the past few decades the opportunities for students to combine homework with watching television have strongly grown due to the increasing number of students who have access to a television set in their own room (van der Voort et al., 1998).

According to limited capacity theories, it is likely that background television inhibits homework performance. Limited capacity theories argue that people have only a limited pool of mental resources for processing information (Basil, 1994; Kahneman, 1973; Lang, 2000). When doing homework (the primary task) is combined with watching television (the secondary task), the student is charged with two tasks that compete for limited information processing resources. Combining homework and television, therefore, may lead to an overload of information that exceeds attentional capacity or resources, with the result that only part of the information can be processed and homework performance decreases.

Limited capacity theorists hold two alternative positions when explaining capacity interference between two concurrent tasks (Bourke, Duncan, & Nimmo-Smith, 1996). One group of theorists argue that interference occurs when the general attentional capacity is exceeded. In this view, performance on difficult homework assignments that draw heavily on the students' total attentional capacity may particularly suffer when homework is combined with watching television. However, other theorists argue that interference occurs when two tasks compete for the same information processing resources and the capacity of those specific resources is exceeded, a phenomenon called "structural interference" (Bourke et al., 1996). According to this view, tasks may interfere with one another even if the total attentional capacity is not exceeded. Structural interference may arise, for example, when verbal assignments are combined with watching a talk show, because both activities require the processing of linguistic information.

When homework is combined with background television, there is an extra reason to assume that capacity limits may be exceeded and that homework performance deteriorates, because many elements in the structure and content of television can elicit orienting responses (Lang, 2000). An orienting response involves an automatic allocation of processing resources to the television program as a reaction to novel or interesting stimuli, including sound effects, visual complexity, movement, cuts, and zooms (Anderson & Lorch, 1983; Lang, 2000). While looking at the homework task, auditory features of the television can elicit orienting responses, resulting in a decrease in the amount of resources available for the assignments. As a consequence, the homework can be processed less thoroughly and performance deteriorates. Interference due to orienting responses is especially detrimental to homework assignments that demand continuous attention, for example acquiring the basic ideas of a study text (Armstrong & Greenberg, 1990).

Several experimental studies on the effect of background television on cognitive test performance have shown that television can indeed interfere with performance, especially on difficult tasks that demand ongoing attention (Armstrong, 1993, 1997; Armstrong, Boiarsky, & Mares, 1991; Armstrong & Greenberg, 1990; Armstrong & Sopory, 1997; Furnham, Gunter, & Peterson, 1994). However, these findings cannot simply be generalised to the homework situation of high school students for four reasons. First, the cognitive tests used were different from homework assignments, because (a) the tests often required general cognitive skills whereas homework also requires knowledge of a subject with a specific content, and (b) brief tasks were usually used, lasting only a few minutes, whereas homework assignments usually take more time. Second, the students participating in previous studies were university students whose study skills may be more advanced than those of high school students. Third, the background television programs used often differed from the programs high school students frequently watch while doing homework. Finally, the time available for completing the tasks was limited, whereas students at home generally have as much time as they need to finish homework assignments. There is evidence that tasks conducted under time pressure demand more processing resources and therefore are more likely to exceed capacity limits than tasks without a time limit (Kahneman, 1973).

To examine the impact of background media on regular homework performance, a limited number of experiments have been conducted that resembled the homework situation more closely. In one study (Cool, Yarbrough, Patton, Runde, & Keith, 1994), mathematics and reading assignments were used instead of cognitive tests. In addition, students could choose their favourite background programs. Contrary to previous studies with short-term tasks and a strict time limit, students in this study were given 30 minutes to complete the assignments, a time limit that was not very strict because students were allowed to stop before the 30 minutes had passed. Although the presence of background television significantly reduced the number of maths problems students attempted to solve, no significant performance differences were found between students studying in silence and students studying with background radio or television. However, the failure to find significant differences in students' homework performance may have resulted from the small number of subjects employed in this study, which restricted the statistical power for detecting significant differences. An additional reason to doubt whether the findings can directly be generalised to the home study situation of high school students is that the study involved students from grade six instead of high school students. Moreover, although the time limit was not very strict, students were instructed that they would have a 30-minute maximum in which to complete the tasks.

In the Netherlands, Pool and colleagues (Pool, Koolstra, & van der Voort, 2003; Pool, van der Voort, Beentjes, & Koolstra, 2000) conducted three studies that were designed to resemble the home study conditions of high school students more closely. Pool et al.'s studies were conducted with high school students, and with unrestricted time to complete the assignments. Because students had no time limit, the interference of background television could be examined not only in terms of performance scores but also in terms of time used to complete the assignments. In the study to be presented here, the distraction effects of background television have also been assessed in terms of both homework performance and time. Throughout this text, we will therefore use the term "distraction effects" to refer not only to a media-induced decrease in the quality of homework performance but also to a media-induced increase in the time used to complete the assignments.

As in the study of Cool et al. (1994), the assignments used in the studies of Pool et

al. (2000, 2003) resembled actual homework administered at school. Students were given both easy and difficult paper-and-pencil assignments in the first two studies (Pool et al., 2000) whereas difficult paper-and-pencil and memorisation assignments were used in the third study (Pool et al., 2003). The background programs shown were those that Dutch high school students frequently watch while doing homework, that is, English-language music videos and Dutch-language soap operas (Beentjes et al., 1996). All three studies found that background music videos did not lead to distraction effects. Background soap operas also did not lead to distraction effects, as far as easy paper-and-pencil tasks were concerned. However, students doing difficult paper-and-pencil or memorisation assignments in combination with soap operas did have lower performance scores or used more time to complete the assignments than students in the control condition. The distraction effects invoked by the soap operas were about equally strong for difficult paper-and-pencil and memorisation assignments.

However, Pool et al.'s (2000, 2003) studies may have underestimated the strength of the distraction effects students experience in the home study setting, because the studies used old soap opera episodes that had been broadcast before. As a consequence, the episodes may have been less interesting and less distracting than new episodes that have not been broadcast previously—the type of program that students usually watch at home. One goal of the study to be presented here, therefore, was to examine whether distraction effects are stronger for new episodes than for old episodes. A second goal of the present study was to examine to what extent television-induced distraction effects are due to the auditory or audiovisual components of television. To this end, a comparison was made between the distraction effects of background television and of the soundtrack of the background television programs used. To our knowledge, previous research on the impact of background media on homework performance did not investigate what actually happens when students combine doing homework with watching television. Therefore, the third goal of the present study was to explore what students actually do when they combine doing homework with watching television by observing how they divide their visual attention between the homework task and the television screen.

Hypotheses

To test whether new episodes of soap operas are more distracting than the old episodes used in previous studies, a comparison was made between students who did homework with old episodes, new episodes, and no medium (control condition) in the background. The old episodes were videotapes of programs broadcast previously, whereas the new episodes were shown at the moment they were actually broadcast on television. Although we expected new episodes to invoke stronger distraction effects than old episodes, in agreement with previous studies (Pool et al., 2000, 2003) we also expected old episodes to invoke distraction effects. Therefore, it was hypothesised that:

H1: Students doing homework with either old or new episodes of soap operas will perform worse or use more time to complete the assignments than students in the control condition.

H2: New episodes of soap operas will lead to stronger distraction effects than old episodes of soap operas.

In each condition, students did both paper-and-pencil and memorisation assignments. In common with the findings of Pool et al. (2003), we expected to find that:

H3: Distraction effects of soap operas are equally strong for difficult paper-and-pencil and memorisation assignments.

To understand better the nature of television distraction, the present study included an audio-only condition in which students listened to the soundtrack of the episodes used in the new episodes television condition. Because the only difference between the audio-only and television conditions was the presence or absence of television images, this meant that we could examine the extent to which the distraction effects of background television are due to the auditory versus the audiovisual component of background programs. To establish the extent to which the auditory part of background programs is responsible for distraction effects, a comparison was made between students doing homework with the soundtrack of soap operas and students doing homework in silence. Although Pool et al. (2003) found no indication that background radio music invoked distraction effects on homework performance, we did expect to find distraction effects for the audio-only condition used in the present study, because the audiotrack of a soap opera contains mainly dialogue. Studies on the effect of background speech have shown that background speech interferes with performance on cognitive tests (Banbury & Berry, 1997; Colle & Welsh, 1976; Hale & Stevenson, 1974; Kaltsounis, 1973; Martin, Wogalter, & Forlano, 1988; Salamé & Baddeley, 1989). To our knowledge, the impact of background speech on homework performance has not been studied before. In agreement with the findings obtained in studies conducted with cognitive tests, we expected to find that background speech would interfere with homework performance:

H4: Students doing homework with the soundtrack of a soap opera in the background will perform worse or use more time to complete the assignments than students in the control condition.

If students are presented not only with the auditory part of soap operas but also with the accompanying images, we expected to find a further increase in distraction effects, because orienting responses may induce students to look up regularly from their homework toward the screen. As it takes time to look at the screen, we expected to find that the time students need to complete their homework would be prolonged. In addition, processing the visual television information and allocating processing resources back and forth from the homework to the television is likely to result in a loss of processing capacity for studying homework. Therefore, we expected that distraction effects in terms of performance also would be stronger for students presented with television images and sound than for students who only heard the auditory parts of the program. We therefore hypothesised that:

H5: Background soap operas will lead to stronger distraction effects than the soundtrack of soap operas.

The third goal of the present study was to establish, through observation, how students divide their time and attention between homework and television. At one extreme, students may use the television as a background radio and keep their eyes focused on their homework assignments. At the other extreme, students may use most of their time to look at the television screen and hardly spend any time on the homework material. In the case that students with background television spend more

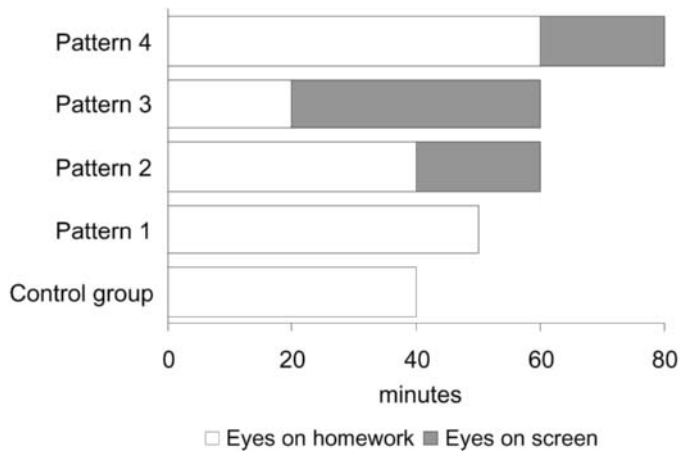


FIG. 1. Four possible patterns for the division of time between homework and background television.

time doing homework than students in the control condition, there are four possible patterns of how students divide their time between homework and television. These patterns are shown in Fig. 1.

In Pattern 1, students in the television conditions do not spend time looking at the television, but they do spend more time looking at the homework tasks than students in the control condition. Hence, the television is used as a background radio. The students may listen to the auditory information presented by the television, but they do not look at the screen. Therefore, the extension of time used to complete assignments is solely due to the fact that television's auditory information impedes students' processing of the information presented in the homework task.

In Pattern 2, students in the television conditions use the same amount of time to look at the assignments as students in the control condition, but they use additional time to look at the screen. Therefore, the extension of time used to complete the assignments is caused only by taking time to look at the television program.

Pattern 3 illustrates that students in the television conditions take less time to look at their assignment than students in the control condition, and they take a lot of time to look at the screen. The extension of the total amount of time used to complete the assignments is caused by the fact that television displaces part of the time students look at their homework.

Finally, in Pattern 4 students in the television conditions use time to look at the television, and they also use more time to look at the homework tasks than students in the control condition. One reason why students need more time to look at their homework may be that they are distracted by the auditory stimuli of the television. However, the amount of time spent looking at the homework may also have increased because it takes time to allocate processing resources back and forth from the television to the homework task.

Because how students divide their time between homework tasks and background television has never been studied before, we refrained from formulating hypotheses. The observational part of the study was designed to explore:

RQ 1: How do students divide their time between homework and television?

Although observational data cannot provide a direct explanation for distraction effects in terms of performance scores, they may indicate which explanation of a performance decrement is most plausible. If Pattern 1 is found, the explanation is clear. Because students do not visually orient toward the television, a performance decrement must be caused by the auditory stimuli of the television programs. Pattern 3 also seems to provide a clear explanation: because the presence of television induces students to spend less time on the homework assignments, performance will deteriorate. In Patterns 2 and 4, two reasons can account for a performance decrement, namely auditory distraction and a reallocation of resources. Auditory distraction takes place when the student is visually oriented toward the homework but the auditory stimuli prevent the homework information from being thoroughly processed (as in Pattern 1). Reallocating resources can cause a performance decrement because information processing capacity is used for alternating the students' focus between homework and television, leaving fewer resources to process the homework.

We realise that the use of systematic observation may complicate a study that is designed to examine the distraction effects of the presence of background media, because the observation may itself function as an extra distraction factor. It has been shown, for example, that the presence of an experimenter can induce students to suppress the stimuli presented by background television (Pool et al., 2000). Therefore, in the present study, the utmost care was taken to ensure that the observation method used did not lead to additional distraction effects. The first precaution was that the participants were observed with an unobtrusive, small camera, which reduced the likelihood of students realising that they were being observed. Second, to prevent students' tendency to suppress their viewing behavior, we did not point out the actual reason for the observation to the students. Instead, the students were told that fellow researchers were interested in their sitting posture while doing homework. Because half of the students in each condition were observed and the other half were not, we were able to check whether the observation indeed did not lead to additional distraction effects.

Method

Participants

The study was conducted with a sample of 192 students from grade eight (92 girls, 100 boys, mean age 14 years 1 month) out of five schools in the urban district of Leiden, the Netherlands. The participants attended a school for general secondary education preparing for intermediate or higher vocational education but not for university education. The IQ of the students who attend this type of secondary school generally lies between 90 and 120. Participants came from both lower and middle class families. All participants were proficient in Dutch.

Prior to the selection of the participants, a standardised reading comprehension test (van Kan & Aarnoutse, 1993) was administered to 382 students in their classrooms. At the end of the test, the students were asked to participate in the experiment for a payment of 20 guilders (about eight dollars) at a future date. Of these 382 students, 296 (78%) were willing to participate, and out of this group 192 participants were randomly selected for the experiment.

Design

Four background media conditions were utilised, namely; televised new soap opera episodes; televised old soap opera episodes; soundtrack of new soap opera episodes (audio-only); and no background medium. In addition, in each condition half of the students were observed and the other half were not. In all, there were thus four (background condition) \times two (observation condition) conditions. The decision was made to keep the number of participants even over cells and to match students on their scores on the reading comprehension test administered at school. Matching on this variable was done to improve the power of the study (Kirk, 1982), because reading comprehension and homework performance have been shown to be correlated (Pool et al., 2000). In addition, students' rating of their viewing frequency of soap operas on a five-point scale was used as a matching variable. Prior to the assignment of the participants to the eight conditions of the study, 24 subgroups of eight students with an identical or almost identical score on the reading comprehension test and the same viewing frequency of soap operas were formed. The eight students in each subgroup were randomly assigned to one of the eight conditions. All participants received both paper-and-pencil and memorisation assignments. The order of presentation of the two types of assignments was systematically varied.

Including the type of assignment, the overall design was a four (background condition: new episodes vs. old episodes vs. audio-only vs. silence) \times two (observation vs. no observation) \times two (homework assignment: paper-and-pencil vs. memorisation) factorial design, with background condition and observation as between-subjects factors and type of homework as a within-subjects factor.

Materials

Background Programs. The television programs shown were taken from three highly popular Dutch soap operas, called *Goudkust (Gold Coast)*, *Onderweg naar Morgen (Going to Tomorrow)* and *Goede Tijden, Slechte Tijden (Good Times, Bad Times)*. Apart from the language used, these soap operas are comparable with American and British soap operas; relationships, love, and romance are among the main themes, and the storyline develops slowly.

In the audio-only and the new episodes television condition, episodes were used that were broadcast for the first time at the time of the experiment. As a consequence, the students involved in these conditions were presented with different episodes with new content each day. Each of the three episodes shown lasted about 30 minutes. The shows were interrupted by commercials, and contained replays of extracts from previous episodes, the leaders and credits. In the audio-only condition, students were presented with the soundtrack of the same episodes that were used in the new episodes television condition.

In the old episodes television condition, a videotape was used that contained earlier episodes of the same three Dutch-language soap opera serials. The episodes had been broadcast about one year prior to the experiment. They also contained commercials, replays of extracts from previous episodes, leaders and credits. The videotape lasted about 90 minutes.

Homework Assignments. The paper-and-pencil and memorisation assignments used were adopted from Pool et al. (2003). The paper-and-pencil assignment consisted of a

Dutch reading comprehension task, containing five texts and a total of 25 corresponding multiple choice questions. The questions asked the students to identify the central theme of a text, to link different parts of a text, and to draw inferences from the information provided in the text. The text was available while answering the questions.

In addition, all participants received a memorisation assignment, containing a geographical and a history task. In the geography assignment, a map with the names of 22 African countries had to be studied. Recall questions required students to name 15 African countries shown on an unmarked map. In addition, the names of the capitals of eight of these African countries had to be memorized. Recall questions asked for the capitals of seven given countries. In the history task, a text on the history of an imaginary African island had to be studied. The recall test consisted of 16 questions that assessed students' factual knowledge about the history of the island. The study material was not available when students answered the questions.

Dependent Measures

Experimental Measures. The homework performance and time were established by means of four dependent measures: the proportion of correct answers in the paper-and-pencil assignment; the proportion of correct answers in the memorisation assignment; the total amount of time students spent on the paper-and-pencil assignment; and the total amount of time students spent on studying the learning material.

Observational Measures. For half of the participants in each condition, a camera recorded where the students' eyes were focused while doing the homework assignments. In the content analysis of the videotapes, three categories were distinguished: eyes on screen (Thorson, 1994), eyes on homework, and eyes on another point in the room. During analysis of the observation tapes, one of three buttons of a small device was pressed at a look onset and released when the eyes changed direction. The push-button device was connected to a computer that recorded the duration and frequency with which each button was pressed. To determine intercoder reliability, 10 (10%) of the 96 videotapes were analysed by two independent coders.

In the data analysis five observational measures were used: the total amount of time used to complete the assignments (intercoder reliability $r = 1.00$, $P = 0.000$); the total amount of time the eyes were focused on the homework assignments ($r = 0.962$, $P = 0.000$); the total amount of time the eyes were focused on the television screen ($r = 0.981$, $P = 0.000$); the total amount of time the eyes were focused on another point in the room ($r = 0.971$, $P = 0.000$); and the frequency with which students looked up from their homework toward the television ($r = 0.999$, $P = 0.000$).

The observational measure of the total amount of time taken to complete the assignments was highly correlated ($r = 0.927$, $P = 0.000$) with the self-report measure obtained during the experiment (the participants recorded the time at the beginning and end of each assignment).

Procedure

The experiment was conducted four evenings a week over a period of seven weeks. Each evening, eight participants—one in each condition—were tested. The experiment was conducted in a university building. Because the new soap operas were shown while they were broadcast on television, the students had to be at the university building by

7 p.m. The last soap opera episode ended at 8.30 p.m. For the safety of the students, the experimenters picked them up at their houses by car and drove them to the university building. After the experiment the participants were driven back home. After their arrival at the university building, the experimenter took the participant to one of eight experimental rooms. Each participant was tested individually.

Setting. Each room contained a writing desk with a desk chair, a small table with some comfortable chairs, a cupboard and some posters to make it resemble a study. On the table was a digital clock, a pen and something to drink for the student.

In all conditions, a television set with a 23 inch screen was present in the room. The television was placed in front of the participant at a distance of approximately 10 feet. In the media conditions the audio information was played through separate speakers on top of the television set. The intensity of the sound was set at a level of about 60–70 decibels. In the television conditions, both the television and sound were turned on, whereas in the audio-only condition only the sound was turned on. The three different new soap operas were broadcast on three different television channels. The channels were switched in a separate room. In the old episodes television condition, a VCR was used to play the videotape with old episodes. In the control condition, the television set was not turned on.

In the conditions in which students were observed, a small camera was placed in the room. It was situated about 10 inches below the television set, on top of an extra VCR. The camera was placed in front of the student in order to get a good view of the student's direction of view. The camera was hardly visible; it was built into a small box that did not look like a camera and the student could only see a small lens.

Instructions. After the participant had been seated at the writing desk, the experimenter explained the purpose of the experiment: "We are interested in knowing how high school students do their homework." We refrained from explaining explicitly that the study was designed to study the impact of background media on homework, in order to avoid students doing their best to prove that they could do their homework well with a medium in the background. The experimenter continued explaining the procedure of the experiment: "Here, I have number of booklets for you. One with a paper-and-pencil assignment, one with memorisation assignments, and one with questions about the memorisation material. I'll give you one booklet at a time. At the beginning and end of each booklet you have to write down the time indicated on the clock." Thereafter, the experimenter explained the task in the first booklet. Because the participant was left alone while doing the homework, the experimenter showed where the participant could come to get her when the assignment in the booklet was finished. In the control condition the experimenter concluded by saying: "You can begin with the first task. Do not forget to write down the time". Thereafter, the experimenter left the room.

In the television conditions the students received an additional instruction: "A lot of students do their homework in front of the television. Therefore, we'll also turn on the television here. Do the homework just as you do it at home. It is no problem if you want to watch television every so often." A dual-task instruction was chosen to maximise resemblance to the normal homework situation. Students in the audio condition received a similar dual-task instruction. The experimenter told them that students in the home situation often listen to the radio while doing homework and, therefore, the radio would also be turned on during the experiment. The experimenter indicated that the students were allowed to listen to the radio every so often. After this instruction, the

media used in the experimental conditions were turned on and the experimenter said: "You can start this assignment now. Don't forget to write down the time." Subsequently, the experimenter left the room.

Students in the observation conditions received an additional instruction explaining that a camera would be turned on during the experiment. To stimulate students to watch the television or listen to the radio as they would do at home, it was decided not to tell them that their viewing behavior was of interest. Instead, they received the following instruction: "Oh by the way, fellow researchers are doing a study on how people sit while working. They would also like to know students' posture while doing homework. Therefore, we have a camera here that records your sitting position. You don't have to sit in a special or neat way, they are just interested in how you sit usually. Okay?" Then the students were told not to pay too much attention to the camera, because no one else would see the tape.

In all conditions, the experimenter explained the tasks in the second booklet after the student had finished the assignment in the first booklet. For half of the students, the first task was the paper-and-pencil assignment. For the other half, the first booklet contained the memorisation material. After the participants studied the memorisation material, this booklet was collected and a booklet with questions was given. While answering these questions the television or radio was turned off, because students normally do tests or examinations at school without media playing in the background.

When the student had finished all homework assignments, he or she received the payment for participation and was taken back home by one of the experimenters.

Results

Experimental Data

Initial data checks showed that the distributions of the dependent variables (that is, the proportion of correct answers and the mean amount of time spent on the homework assignments) satisfied the assumptions underlying analysis of variance. An analysis of outliers using Cook's distances (1977) yielded no data points for which Cook's distance was greater than one (Cook & Weisberg, 1982). Therefore, the scores of all 192 participants were included in the analyses. An alpha level of 0.05 was used for all statistical tests.

Performance

A four (background condition: new episodes vs. old episodes vs. audio-only vs. silence) \times two (observation vs. no observation) \times two (assignment: paper-and-pencil vs. memorisation) analysis of variance was performed on the homework performance scores (proportion of correctly answered questions). Table I presents the homework performance scores as a function of observation condition. Analysis of variance revealed that the presence of an observation camera did not affect students' homework performance scores. There was no statistically significant main effect for observation condition [$F(1, 184) = 0.91, MSE = 0.03, P = 0.343$], nor were interactions with the observation condition significant ($P > 0.154$).

Table II presents the homework performance scores for paper-and-pencil and memorisation assignments as a function of background condition. A statistically significant main effect was found for type of assignment [$F(1, 184) = 56.20, MSE = 0.02,$

TABLE I. Proportion of correct answers on the homework assignments as a function of observation condition ($n = 192$)

	Observation		No observation	
	Mean	SD	Mean	SD
Television				
Old episodes	0.55	0.17	0.63	0.11
New episodes	0.64	0.12	0.60	0.14
Audio-only	0.64	0.12	0.66	0.14
Control group	0.66	0.14	0.70	0.11
Total	0.62	0.14	0.65	0.13

$P = 0.000$, $\eta^2 = 0.23$, using $\eta^2 = \text{SS}_{\text{effect}} / (\text{SS}_{\text{effect}} + \text{SS}_{\text{error}})$ (Tabachnick & Fidell, 1989)]. Students on average performed better on paper-and-pencil than on memorisation tasks. Furthermore, a statistically significant main effect was found for background condition [$F(3, 184) = 4.75$, $MSE = 0.03$, $P = 0.003$, $\eta^2 = 0.72$]. As anticipated in H1, post hoc comparisons showed that both students presented with new episodes [$t(94) = -2.41$, $P = 0.018$] and students who received old episodes [$t(94) = -3.24$, $P = 0.002$] performed significantly less well than students in the control condition did. However, contrary to H2, no differential distraction effect was found between the old and new episodes conditions [$t(94) = 0.96$, $P = 0.338$]. Unlike H4, students in the audio-only condition did not perform worse than those studying in silence [$t(94) = -1.17$, $P = 0.246$]. H5 was partly confirmed: students in the audio-only condition did perform significantly better than students in the old episodes condition [$t(94) = 2.15$, $P = 0.034$], but they did not perform significantly better than students in the new episodes condition [$t(94) = -1.25$, $P = 0.215$]. Finally, as anticipated in H3, the interaction between type of assignment and background condition was not significant [$F(3, 184) = 0.36$, $MSE = 0.02$, $P = 0.784$], indicating that the background programs did not lead to differential distraction effects on memorisation and paper-and-pencil assignments.

Time

A four (background condition: new episodes vs. old episodes vs. audio-only vs.

TABLE II. Proportion of correct answers on paper-and-pencil and memorisation assignments as a function of background condition ($n = 192$)

	Paper-and-pencil		Memorisation		Total	
	Mean	SD	Mean	SD	Mean	SD
Television						
Old episodes	0.65	0.15	0.55	0.18	0.59	0.15
New episodes	0.67	0.14	0.58	0.17	0.62	0.13
Audio-only	0.70	0.13	0.62	0.18	0.65	0.13
Control group	0.75	0.11	0.63	0.16	0.68	0.13
Total	0.69	0.14	0.60	0.17	0.64	0.14

TABLE III. Mean number of minutes spent completing the homework assignments as a function of observation condition ($n = 192$)

	Observation		No observation	
	Mean	SD	Mean	SD
Television				
Old episodes	61.57	19.41	63.25	23.65
New episodes	62.58	18.13	57.67	12.23
Audio-only	54.08	16.88	53.08	15.28
Control group	49.71	10.26	46.58	12.66
Total	56.94	17.11	55.15	17.46

silence) \times two (observation vs. no observation) \times two (homework assignment: paper-and-pencil vs. memorisation) analysis of variance was performed on homework time (mean number of minutes needed to do the homework). Table III shows the homework time as a function of observation condition. No statistically significant main effect was found for the observation condition [$F(1, 183) = 0.59, MSE = 137.13, P = 0.444$], nor were any interaction effects with observation condition significant ($P > 0.244$), indicating that the presence of an observation camera did not affect the amount of time used to complete the assignments.

Table IV presents the amount of time spent on completing the paper-and-pencil and memorisation assignments as a function of background condition. A statistically significant main effect for type of assignment was found [$F(1, 183) = 74.72, MSE = 90.95, P = 0.000, \eta^2 = 0.29$], indicating that students on average used more time to complete the memorisation assignments than the paper-and-pencil assignments. Also, a significant main effect was found for background condition [$F(3, 183) = 7.28, MSE = 137.13, P = 0.000, \eta^2 = 0.11$]. Post hoc t -tests confirmed H1: relative to the control condition, completion of the homework assignments took significantly more time in both the new episodes condition [$t(94) = 4.30, P = 0.000$] and the old episodes condition [$t(93) = 4.05, P = 0.000$]. However, contrary to H2, students presented with new episodes did not use significantly more time to complete the assignments than did students who received old episodes [$t(93) = -0.60, P = 0.55$]. In addition, contrary to H4, students in the audio-only condition did not use more time to complete the assignments than students in the control condition [$t(94) = -1.92, P = 0.058$]. As anticipated in H5, students in the audio-only condition used significantly less time than students in both the new episodes condition [$t(94) = 2.04, P = 0.000$] and the old episodes television condition [$t(93) = -2.28, P = 0.025$]. In agreement with H3, no significant interaction emerged between type of assignment and background condition [$F(3, 183) = 0.65, MSE = 90.95, P = 0.583$], indicating that the distraction effects of the background programs were about equally strong for the paper-and-pencil and memorising assignments.

Observational Data

The observational data provided three scores for the television and control conditions, namely, the amount of time students' eyes were focused on the homework tasks, the amount of time their eyes were focused on the screen, and the amount of time their eyes

TABLE IV. Mean number of minutes spent completing the paper-and-pencil and memorisation assignments as a function of background condition ($n = 192$)

	Paper-and-pencil		Memorization		Total	
	Mean	SD	Mean	SD	Mean	SD
Television						
Old episodes	25.79	8.74	37.08	18.37	62.43	21.46
New episodes	26.13	7.53	34.00	11.90	60.13	15.50
Audio-only	22.85	7.04	30.73	11.25	53.58	15.94
Control group	20.46	4.67	27.69	10.12	48.15	11.51
Total	23.80	7.45	32.38	13.67	56.04	17.27

were focused on another point in the room. Because the mean amount of time students spent looking at another point in the room was found to be about equal for students in the control and television conditions [$F(2, 71) = 2.93$, $MSE = 3.29$, $P = 0.060$], the “eyes on another point” measure was omitted from further analyses.

The first two columns of Table V present the mean amount of time students’ eyes were focused on homework and television as a function of background condition. A multivariate analysis of variance was performed with the eyes on homework and eyes on screen measures as dependent variables and background condition (new episodes vs. old episodes vs. silence) as independent variable. Observational time data confirmed the finding from the self-report time measure obtained during the experiment that students in the television conditions on average used more time to complete the assignments than students in the control condition [$F(2, 71) = 4.11$, $MSE = 310.89$, $P = 0.021$]. A univariate analysis of variance showed that students in the control condition and television conditions on average spent the same amount of time looking at the homework task [$F(2, 68) = 0.53$, $MSE = 99.60$, $P = 0.594$]. However, relative to students in the control condition, students in the television conditions spent additional time looking at the screen [$F(2, 68) = 16.96$, $MSE = 99.60$, $P = 0.000$, $\eta^2 = 0.33$]. As shown in Fig. 2, students in the control and television conditions on average spent about 47 minutes looking at the homework tasks, and students in the television conditions also spent an additional 15 minutes looking at the screen. The mean amount

TABLE V. Mean amount of minutes students’ eyes were focused on homework and the television screen, and the mean number of times students looked up from the homework toward the screen, as a function of background condition ($n = 71$)

	Eyes on homework (minutes)		Eyes on screen (minutes)		Looking up from homework to screen (frequency)	
	Mean	SD	Mean	SD	Mean	SD
Television						
Old episodes	44.64	13.62	15.27	14.06	169	75
New episodes	48.24	15.71	14.14	9.83	146	72
Control group	47.77	9.37	0	0	0	0
Total	46.87	13.13	9.94	12.04	107	96

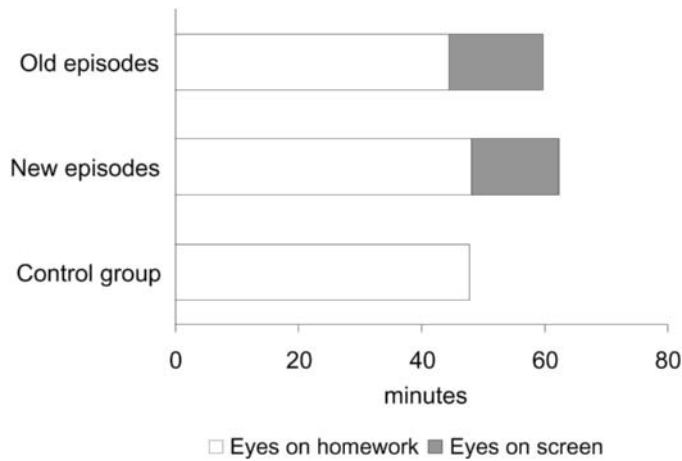


FIG. 2. Total time spent on looking at the homework task and the screen in the television and control conditions.

of time students looked at the screen was about equal for students presented with old and new episodes [$t(46) = -0.32, P = 0.748$].

The third column of Table V presents the frequency with which students looked up from their homework toward the screen as a function of background condition. A univariate analysis of variance was performed with the frequency of looking up as the dependent variable and background condition (new episodes vs. old episodes vs. silence) as the independent variable. A significant main effect was found for background condition [$F(2, 68) = 53.92, MSE = 3650.98, P = 0.000, \eta^2 = 0.61$]. Post hoc t -tests showed that students in the two television conditions looked up significantly more often from their homework toward the screen than students in the control condition [new episodes condition $t(45) = 9.71, P = 0.000$; old episodes condition $t(45) = 10.86, P = 0.000$]. However, students in the two television conditions on average looked up about equally often from their homework toward the television [$t(46) = -1.10, P = 0.277$].

Discussion

As anticipated in Hypothesis 1, the findings from the present study clearly show that background soap operas interfere with high school students' homework performance and extend the time used to complete the homework assignments. However, contrary to Hypothesis 2, the distraction effects of new episodes, which students usually watch during home study, were no stronger than those observed for old episodes in previous studies. Therefore, our concern that the results of the studies of Pool et al. (2000, 2003) would not fully apply to the home study situation because old episodes of soap operas were used, proved not to hold true. Old and new episodes turned out to interfere equally strongly with homework performance and the amount of time needed to complete assignments. Therefore, there is no reason to assume that the fact that old episodes were used in the studies of Pool et al. restricts the generalisability of the findings from these studies to the home study situation.

Our expectation that new episodes would lead to stronger distraction effects than old

episodes was based on the assumption that new episodes would attract more attention, because students are likely to be interested in the continuation of episodes watched on previous days and be eager to know further developments in the serial. However, the observational data collected in our study provided no indication whatsoever that students paid more attention to new episodes than to old episodes. Students in the old and new episodes conditions used the same amount of time to look at the screen and equally often looked up from their homework toward the screen, which suggests that students were just as interested in the old episodes as in the new ones. One reason why the old episodes attracted as much attention as the new episodes could be that the stories told in old episodes may have been new to some students, who did not watch these episodes when they were broadcast. Students who had seen the old episodes before may have found these stories appealing because they took pleasure in seeing former characters, actors and storylines again.

The finding that distraction effects emerged only in the television conditions, and not in the audio-only condition, indicates that television-induced distraction effects occur only when students are presented with both sound and images. Therefore, the fact that television adds images to auditory information proves to be responsible for television's detrimental effects on students' execution of homework. The important role played by television images is confirmed by our observational data, which clearly showed that students did not use the television as a background radio, but very regularly shifted attention from their homework to the television screen (on average no less than 2.5 times per minute).

Using the self-report measure of time, the study showed that students in the television conditions used about 13 minutes (28%) more time to complete the assignments than students in the control condition. The observational data showed that these additional 13 minutes were fully spent watching television. Therefore, of the four time-division patterns distinguished earlier, Pattern 2 was found: students in the television and control conditions spent the same amount of time looking at their homework and students in the television conditions used extra time to look at the screen. Because the presence of background television did not alter the amount of time students spent looking at the homework tasks, the detrimental effects on students' homework performance observed for soap operas cannot be ascribed to a television-induced reduction in the amount of time spent doing homework. However, as was discussed in the introduction, two other reasons could account for this television-induced performance decrement. First, students could have been distracted by the auditory stimuli while looking at the homework task. This explanation is not plausible, however, because the study showed that no distraction effects in the audio-only condition. The second explanation, that the performance decrement in the television conditions is caused by allocation of information-processing resources to switch attention back and forth from the homework to the television, is more plausible. When looking at the task is frequently interrupted by looking at the screen, processing resources may partly be used to process the information just seen on television or to check where to continue with the task, leaving fewer resources to process the homework. Therefore, frequent alternation of attentional resources in the television conditions may have led to less adequate processing of the homework information, with the result that students' homework performance declined.

The finding that the soundtrack of soap operas did not lead to distraction effects was surprising, because interference of background speech with task performance has been found in several studies (Banbury & Berry, 1997; Colle & Welsh, 1976; Hale &

Stevenson, 1974; Kaltsounis, 1973; Martin et al., 1988; Salamé & Baddeley, 1989). One reason why, unlike in the present study, distraction effects were found in previous studies, may be that earlier research employed cognitive tests, rather than homework assignments, that had to be done under time restrictions. As noted before, tests with a time limit demand more resources than homework assignments without time pressure (Kahneman, 1973). An extra reason why background speech proved not to interfere with homework performance in the present study may be that the background speech consisted of soap opera dialogue. Because students in the audio-only condition were presented with these dialogues without the accompanying images, part of the dialogue may have been less understandable than speech that is meant to be understandable without accompanying images. As a consequence, students' interest in the dialogues may have decreased. The findings of the present study, therefore, cannot be directly generalised to the effects of background speech students are generally presented with when they combine doing homework with listening to radio programs. It may very well be that speech in background radio programs does hinder students' homework performance.

In accordance with previous findings (Pool et al., 2003), no differential distraction effects of soap operas were found for difficult paper-and-pencil and memorisation assignments. This finding contradicts the belief held by many students that background television leads to stronger distraction effects on memorisation assignments than on paper-and-pencil assignments (Beentjes et al., 1996). The present study suggests that background television not only leads to distraction effects when memorisation assignments are involved, but also—and to the same extent—when difficult paper-and-pencil assignments are done. Possibly, students tend to believe that distraction effects are strongest for memorisation assignments because memorisation assignments are often more difficult than paper-and-pencil assignments. In the present study, students indeed performed better on the paper-and-pencil assignments than on the memorisation assignments, but this difference in level of difficulty did not result in differential distraction effects. Therefore, the present study did not support the idea that memorisation assignments are more likely to suffer from background television than are paper-and-pencil assignments.

The present and previous studies (Pool et al., 2000, 2003) investigated the impact of background music videos and/or soap operas on students' homework performance and time. Further research should address the distraction effects invoked by other program types, especially program types that may be suspected of evoking strong orienting responses. One type of program may have a high potential for drawing students' attention to the screen: talk shows like *Jerry Springer*, which contain many auditory stimuli (such as quarrelling noisily and fighting), may arouse the students' curiosity. In addition, quiz programs are likely to evoke many orienting responses because they may challenge the viewer to compete against the contestants (Gunter & McAleer, 1997). Further research should systematically examine which program types are most likely to lead to distraction effects on homework performance.

Further research should also investigate which program characteristics co-determine the impact of background television programs on homework performance. The findings of the present study suggest that future research on program characteristics should address two areas. First, because allocation of processing resources back and forth from homework to television may hinder homework performance, research should establish which auditory program attributes induce students to look up from their homework task toward the television. As far as we know, studies investigating which auditory

characteristics attract viewers' attention have only been conducted with young children as participants (Anderson & Levin, 1976). Audio attributes that tended to elicit a look from young children playing with toys included auditory change, sound effects, laughter, women's voices, children's voices, peculiar voices, and instrumental music. Further research should examine which types of auditory cues invoke look onsets in high school students.

Second, as the present study showed that the amount of time used to complete homework was extended by exactly the number of minutes students spent looking at the screen, it should be examined which audiovisual program attributes maintain students' attention when they are already looking at the screen. It has been shown that the longer a viewer looks at television, the more likely it becomes that he or she will continue to do so, a phenomenon called attentional inertia (Anderson, Alwitt, Lorch, & Levin, 1979). Anderson and Lorch (1983) argued that the duration of visual attention is a function of the nature of the viewing environment and ongoing involvement in specific program content. Other research showed that specific structural features of television (such as cuts, videographics, edits, zooms, and movement) may modulate an attentive viewer's level of attention (Geiger & Reeves, 1993; Lang, 1990; Lang, Geiger, Strickwerda, & Summer, 1993; Thorson & Lang, 1992; Reeves et al., 1985). Future research should explore which other audiovisual program characteristics are likely to maintain the viewer's visual attention.

A question related to the ecological validity of the present study is to what extent the findings of a study conducted in a university building can be generalised to the home study situation. A university setting was selected for testing (rather than a home or recreational setting) so that the distraction could be controlled, tasks could be carefully monitored, and the observed differences between the experimental groups could be confidently attributed to the manipulated variables. Doing homework while alone in a university room may be quite dissimilar from home study if it takes place in the living room, because often in a living room other people are present who may add to the distraction. The experimental setting of the present study more closely resembled home study in the student's bedroom. Therefore, the findings of the present study are less likely to apply to doing homework in the living room than to doing homework in the bedroom. However, this conclusion hardly seems to limit the generalisability of our findings; about 80% of high school students indicate they usually do their homework in their bedroom (Beentjes et al., 1996).

The practical implication that can be drawn from the findings of our study is that students should be recommended to avoid watching soap operas on television when they are doing homework. The present study suggests that a combination of homework with background soap operas may lead to a performance decrement of 12% compared with students studying in silence. In addition, participants studying with background television proved to use 28% more time to complete their assignments than those studying without background television. If students have enough time to do their homework, the extension of time needed to complete assignments need not be a cause for great concern. However, the finding that homework performance may deteriorate does give reason to avoid combining homework with watching soap operas on television.

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