Wait! Don't Turn That Dial! More Excitement to Come! The Effects of Story Length and Production Pacing in Local Television News on Channel Changing Behavior and Information Processing in a Free Choice Environment

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This article investigates whether news story length and production pacing affect channel changing behavior in younger and older adults. Viewers used a remote control device to choose among four local news programs that varied systematically by story length and pacing. In general, pacing and length have greater effects on younger viewers. Fast pacing increased viewers' evaluations of the newscasts, but when combined with long stories, decreased younger viewers' time spent on channel. Viewers' cognitive effort, physiological arousal, and recognition all decreased before and increased after a channel change. Frequent channel changing was associated with lower cognitive effort and recognition.

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The goal of this study is to test predictions derived from both implicit assumptions made by professional news producers and theoretical predictions derived from the limited capacity model of mediated message processing (LCMMMP) about how the effects of production pacing and the length of television news stories affect news viewers' channel changing behavior and their processing of the news in a free choice viewing context.

Production Changes in a Multichannel Remote Control Environment

In recent years, in order to keep viewers on channel in the multichannel remote control environment, television producers have changed the structure and content of their messages (Bellamy & Walker, 1996). One common change has been to make messages shorter and faster (Bellamy & Walker, 1996; Eastman & Newton, 1995). As Bollier (1989) and Eastman and Neal-Lunsford (1993) noted, practitioners are using more cutting, shorter scenes, faster-paced shows, and more shorthand visual techniques. "Pregrazed" programs like *Short Attention Span Theater* (Comedy Central) and *The Edge* (FOX) were designed assuming that if the program itself is changing, the viewer need not change the channel (Bellamy & Walker, 1996).

Changes in Audience Viewing Behavior

Research on channel changing behavior has provided descriptive data on who changes, how often, when, and why. Some viewers rarely change while others change constantly. Ferguson (1994) measured channel changing with college students using an electronic counting device and found that the number of changes ranged from 3 to 396 times per hour, with a mean of 107. Kaye and Sapolsky (1997), also using a mechanical counter, reported a channel changing range of 1.23 to 178, with an average of 36.6. When self-report methods are used, the average frequency of channel changing is much lower but still suggests that many viewers change channels frequently and that long periods of single channel viewing is not the norm (Ferguson, 1992).

Channel changing behavior differs as a function of age and sex. Previous studies have found that younger viewers change channels more often than older viewers (Eastman & Newton, 1995; Greenberg, Heeter, & Sipes, 1988) and males change more than females (Copeland & Schweitzer, 1993; Eastman & Newton, 1995; Heeter, 1985). Ferguson and Perse (1993) found that age and gender interact. Older women change less than older men but younger men and women do not differ significantly.

Research suggests that viewers change channels for many reasons, and the reasons may be related to channel changing frequency (Ainslie, 1988; Ferguson, 1992; Walker & Bellamy, 1991). For example, Heeter and Greenberg (1985a, 1985b, 1988) identified four types of channel changers: those who change rarely, those who change between programs, those who change during commercials, and those who change at all times. Perse (1990) found that 1.8% of adults say they never change, 23.5% report

changing between programs, 44.3% change during commercials, and 30.4% change during programs. Moriarty and Everett (1994) also found that most viewers change during program and commercial breaks, but some change at all times.

Walker and Bellamy (1991) report that viewers change channels to see what is on other channels and to avoid commercials. Perse (1998) found channel changing is associated with ritualistic viewing, low attention, and engagement. Eastman and Newton (1995) found that viewers change most during sports and the least during pay-cable movies but that some viewers change channels regardless of genres or content.

Production Pacing, Story Length, and Program Choice

Research in this area has been primarily descriptive, asking what people do and when they do it. Theories about how television's structure and content affect channel changing behavior or about why people change channels have rarely been tested and often reflect the implicit theories or assumptions that appear to be operating in a professional world. The literature argues that producers assume that younger viewers prefer faster-paced television production and that fast pacing will hold viewers on channel. Alfstad (1991) argues that young viewers have been "programmed" to switch their attention rapidly from topic to topic and image to image (p. 20), and Bellamy and Walker (1996) characterize younger viewers as "raised on a collage of rapidly shifting images, able to absorb visual information quickly, fascinated with new technology, and easily bored" (p. 96). Greenberg et al. (1988) found that younger viewers are more likely to watch short segments, change channels frequently, view multiple programs simultaneously, and carry out orienting searches.

Research looking at the older viewers, on the other hand, suggests that older viewers may have more trouble processing fast-paced messages and be turned off by fast-paced production (Lang, Schwartz, & Snyder, 1999). The first hypothesis tests this prediction:

H_1: Younger viewers will prefer fast-paced programming and short stories, whereas older viewers will prefer slow-paced programming and long stories.

Production Pacing and Cognitive Effort

Although both research and practice suggest that increasing production pacing may affect channel preference, we know that, at least in the laboratory, in a forced viewing situation, production pacing has a significant effect on how viewers process the information presented in a news story. A great deal of research has been done—in laboratories—to learn how increased production pacing affects the information processing of mediated messages (e.g., Geiger & Reeves, 1993; Lang, 1990, 1991, 1994; Lang, Bolls, Potter, & Kawahara, 1999; Lang, Geiger, Strickwerda, & Sumner, 1993; Lang, Zhou, Schwartz, Bolls, & Potter, 2000). One theory that has frequently been used to explicate how production pacing affects how viewers process messages is the

LCMMMP (Lang, 2000). The hypotheses put forward in this article about how production pacing will affect channel changing behavior and the processing of mediated messages are derived from that model. Previous tests of these hypotheses have all been done in a forced viewing environment where participants were instructed to play close attention to a message and were not given the opportunity to change channels or do anything else. In this experiment, participants were instructed to watch television as they would at home, were provided with a remote control device, and were told they could change channels at will. Hence, if hypotheses derived from the LCMMMP are supported, it will be possible to begin the process of generalizing predictions made by the theory from the forced choice viewing, high attention environment to a free choice environment.

LCMMMP defines attention as the allocation of processing resources to a message. How many resources are allocated to a message is determined by a combination of controlled and automatic allocation mechanisms (Shiffrin & Schneider, 1977). Television viewers can allocate their processing resources to a message in response to their goals and motivations using controlled allocation mechanisms. Viewers allocate more resources to relevant, interesting, and involving messages. If viewers do not like a message, they are likely to decrease their cognitive effort. Thus, if older viewers prefer slow-paced messages to fast-paced messages, as predicted, they should exert less cognitive effort during fast-paced messages compared to slow-paced messages, whereas younger viewers should show the reverse pattern. Thus:

H_2: Fast pacing will elicit greater cognitive effort in younger viewers and less cognitive effort in older viewers.

Production Pacing and Memory

Of course, controlled resource allocation does not tell the whole story about how messages are being processed and whether they will be remembered because, according to LCMMMP, resources are also being automatically allocated to processing in response to structural and content features of the message (Lang, 2000). Production techniques like fast pacing, novel visuals, and video graphics elicit automatic attention in television viewers (Fox et al., 2002; Lang, 2000). The combination of controlled and automatic resource allocation determines overall resource allocation. How well the message is processed depends on whether sufficient resources are allocated to the message processing task.

Prior research demonstrates that creating messages that increase resource allocation (either automatic or controlled) does not automatically increase memory for the message. Instead, research shows that introducing structural features that automatically elicit processing resources will increase memory up to a point. After that point, however, memory has been shown to decline. LCMMMP defines that point as the point of cognitive overload (Lang, 2000), which occurs when the viewer's limited ca-

pacity of processing resources has been completely allocated and that allocation is insufficient to fully process the message. When resource requirements exceed the viewer's capacity, then fewer resources will be allocated than are required, and the job of processing the message will be performed less thoroughly. Content difficulty, familiarity, and viewers' age have all been shown to affect the point at which cognitive overload occurs in the forced choice environment. Older viewers are more easily overloaded by pacing than younger adults (Lang, Bolls, et al., 1999; Lang, Schwartz, et al., 1999). On the other hand, older adults both expend more cognitive effort on and remember slow-paced messages better than younger adults. Thus, we predict that, in a free choice environment:

H_3: Both older and younger viewers will have better recognition for slow-paced, compared to fast-paced, stories. However, younger viewers will recognize fast messages better, and older viewers will recognize slow messages better.

Production Pacing, Arousal, and Memory

According to LCMMMP, fast pacing, in addition to eliciting resource allocation, also elicits arousal in viewers. This is important because arousal plays an important role in message processing and has been found to influence memory (e.g., Lang, Dhillon, & Dong, 1995), learning (Cantor & Zillmann, 1973; Zillmann, 1981) and behavior (Bryant & Zillmann, 1979; Donnerstein, Donnerstein, & Barrett, 1976). LCMMMP conceptualizes arousal both as an emotional experience and as a physiological response. The theory predicts, and research in a forced viewing situation has supported the prediction, that increased production pacing increases both emotional arousal (Hitchon, Thorson, & Duckler, 1994; Lang, Bolls, et al., 1999; Lang, Schwartz, et al., 1999; Lang et al., 2000; Reeves, Thorson, & Schleuder, 1986; Thorson, Reeves, & Schleuder, 1985) and physiological arousal (Lang, Bolls, et al., 1999; Lang, Schwartz, et al., 1999; Lang et al., 2000). Thus, we predict that, in a free viewing situation:

H_4: There will be a main effect of production pacing on arousal such that fast-paced stories will elicit greater physiological arousal than slow-paced stories.

Channel Changing Behavior and Information Processing

Little research has been done on how channel changing affects message processing. Are there differences in how the information is processed before and after a channel change? Two different theories exist in the literature (Ferguson & Perse, 1993). The first argues that frequent channel changing indicates an active viewer who is constantly evaluating what he or she is viewing (e.g., Eastman & Newton, 1995; Heeter, 1985; Walker & Bellamy, 1991). The second argues that channel changing reflects detached, low-involvement, low-attention viewing (Moriarty, 1991; Perse, 1990, 1998).

In general, research supports the second view. Perse (1990) found a significant negative correlation between channel changing and self-reported attention and elaboration. Moriarty concluded that "channel changing, particularly grazing and flipping, starts because interest in what is on the channel wanes" (p. 220). Perse (1998) found that channel changing was predicted by passing time, habit, companionship, escape, low involvement, and negative affective reactions to the program. This second theory would predict that viewers' levels of cognitive effort should decline prior to a channel change and increase postchange. However, no research has tested cognitive effort over time in a free choice environment. Further, LCMMMP theorizes that as viewers become less involved and less interested, they will allocate fewer controlled resources, which reduces their cognitive effort. Thus, they become less aroused and, as a result, allocate fewer resources to message processing and encode less information. Thus, we make the following three predictions:

H_5: Cognitive effort will decrease over time up to the moment of a channel change and increase following the channel change.

H_6: Physiological arousal will decline prior to a channel change and increase after it.

H_7: Recognition memory will decline preceding a channel change and then increase following a channel change.

Finally, this article directly tests the question of whether channel changing is a result of viewers being more or less involved and active by investigating whether viewers process messages differently during periods of frequent channel changing compared to periods of infrequent channel changing. If channel changing is a function of decreased effort and arousal, then:

H_8: During periods of infrequent channel changing, viewers will exhibit greater cognitive effort than during periods of frequent channel changing.

H_9: During periods of infrequent channel changing, viewers will remember messages better than during periods of frequent channel changing.

To test these hypotheses, a study was designed in which older and younger viewers watched television for about 15 min in a lab. The participants were given four channel choices, all of which carried local television news, including commercials, bumpers, and teasers, which varied by production pacing and story length.

Method

Design

The overall study design was a Production Pacing × Story Length × Age (2 × 2 × 2) mixed design. Age was the only between-subject factor. Production pacing and story length were within-subject factors. Production pacing has two levels, slow and fast,

and story length also has two levels, short and long. In addition to the overall study design, certain hypotheses were analyzed using other within-subject factors. For some analyses, the channel changing frequency factor with two levels, frequent and infrequent, was created and, for others, a time factor with two levels, before and after the channel change, was constructed.

Stimulus Materials

To design the stimulus tapes, local newscasts were recorded from the four network affiliates (ABC, CBS, NBC, and FOX) in Phoenix, Arizona. The newscasts were edited by news professionals at the NewsLab to exemplify the four treatment conditions. The final newscasts ranged from 15 min 36 s to 15 min 40 s.

Independent Variables

Story Length. Story Length was operationalized as the average duration of each news story. Two newscasts were comprised of short stories (15 stories for one and 16 for the other), and two had seven or eight relatively long stories. The short stories ranged from 15 s to 83 s in length ($M = 43.3$ s). The long stories lasted from 40 s to 185 s ($M = 101.2$ s). The difference was significant, $t(46) = 5.93$, $p < .001$.

Production Pacing. Production Pacing was operationalized as camera changes per story. The fast-paced newscasts had significantly more camera changes than the medium-paced newscasts ($M = 6.96$ vs. 4.48 per 30 s), $t(13) = 3.69$, $p = .003$.

Channel Changing Frequency. The channel changing frequency factor was constructed as a within-subject factor. Two viewing periods with frequent channel changes and two viewing periods with infrequent changes were randomly selected from time periods identified as containing frequent or infrequent channel changes for each subject. During frequent channel changing periods, channel changes occurred at least once every 30 s. During infrequent channel changing periods, channel changes were at least 120 s apart.

Time. For some hypotheses, a time factor was constructed. This factor included the time period immediately before a channel change and immediately following a channel change. For the heart rate and skin conductance analysis, this time period was 10 s before and 10 s after a channel change. For the recognition analysis, this time period was the three questions about material before and after the channel.

Dependent Variables

Channel Preference/Choice. Participants' channel preference was indexed by the amount of time they spent on each newscast and their postviewing evaluation of each newscast. A computer automatically recorded the time spent on each channel. Following viewing, participants were asked to evaluate each of the four newscasts on a seven-point semantic differential scale anchored by *informative/not informative, believable/not believable, interesting/not interesting, understandable/not understandable, enjoyable/not enjoyable,* and *engaging/not engaging*. The polarity of the scales was randomized. Because these participants were not familiar with these stations' channel numbers and names, the evaluation questions were accompanied by screen shots of the anchors, reporters, and station.

Cognitive Effort. Participants' heart rates were recorded as a measure of cognitive effort. In the methodological model associated with LCMMMP, changes in cognitive effort (i.e., resources allocated to an external stimulus) are indexed by tonic change in baseline heart rate. Psychophysiological research has shown that when people make an effort to attend to an external stimulus, this results in an increase in activation of the parasympathetic nervous system, which in turn results in a decrease in baseline heart rate (Cacioppo, Tassinary, & Berntson, 2000; Stern, Ray, & Quigley, 2001). Several studies have used heart rate as a measure of cognitive effort during television viewing (e.g., Lang, 1990, 1991, 1994; Lang, Bolls, et al., 1999; Lang et al., 1993; Lang, Schwartz, et al., 1999; Lang et al., 2000). Heart rate was collected as milliseconds between beats and converted into average heart rate per appropriate time period—depending on the analysis.

Encoding. Encoding of the television news broadcasts was indexed using audio recognition. For each 15-s segment of each news story, one forced-choice, four-alternative multiple choice question was written for information presented in the audio track. A customized recognition test was prepared for each participant based on what channels the participant actually viewed. The questions were presented in random order.

Arousal. Arousal was measured by recording skin conductance, which is a measure of activation in the sympathetic nervous system (Hopkins & Fletcher, 1994).

Apparatus

The experiment was controlled by a Zenith 386 computer with a Labmaster A/D D/A board. Heart rate was recorded using a Coulbourn bio-amplifier with filters connected to two Beckman mini AG/AGCL electrodes placed on the participant's forearms and a ground electrode on the nondominant forearm. Data were collected as milliseconds between beats and converted into beats per minute for analysis.

Skin conductance was recorded by a Coulbourn SC module sampling at 20 Hz connected to two Beckman standard AG/AGCL electrodes on the participant's nondominant palm after cleansing the skin with distilled water to control hydration. Data were averaged over 5-s intervals and change scores were calculated.

Participants

Forty-seven undergraduate students at a large Midwestern university (M = 20.4 years old, SD = 1.07, range = 18–22) participated in this experiment for course credit. Sixty-three adults (M = 44.4 years old, SD = 13.8, range = 25–81) were recruited and received a monetary token. Participants were randomly assigned to one of four orders based on a Latin-square design to randomize and counterbalance newscast and channel.

Procedure

Participants were greeted and completed an informed consent document. Participants were seated in a comfortable chair about 3 ft from a 19-in. television. Experimenters explained the procedure and attached the electrodes. Participants were told that there was a different newscast on each of the four channels and that they were free to change channels as often as they liked. The experimenter gave the participants the remote control device and explained how it worked. Because of the physiological recording, participants were encouraged to use only one hand to change the channel and to avoid unnecessary and excessive arm movement. After participants confirmed that they understood the procedure, the experimenter left the room and started all four newscasts simultaneously using a single remote control device.

Following viewing, the experimenter removed the electrodes. While the participant watched a 10-min videotape to clear short-term memory, the experimenter constructed the customized recognition test. After the video, participants completed the recognition test, evaluation scales, media usage questions, and demographic questionnaire on a computer running MediaLab software (Jarvis, 2002). Participants were debriefed and thanked.

Results

Hypothesis 1

The first hypothesis predicted that younger viewers, compared to older viewers, would prefer channels with fast-paced programming and short stories. We tested this hypothesis by looking at the Age × Length × Pacing interaction on the time spent on channel and evaluation data. For the time on channel data, this interaction was signif-

icant, $F(1, 108) = 3.70$, $p < .057$, $\eta^2 = .03$, and is shown in Figure 1. Neither pacing nor story length had much effect on how long older viewers watched a channel. For younger viewers, however, pacing did affect choice. For short stories, younger viewers spent more time on fast-paced compared to slow-paced stories, but for long stories, younger viewers spent more time on slow compared to fast ones.

There was a significant pacing main effect in the evaluation data, $F(1, 106) = 11.99$, $p < .001$, $\eta^2 = .10$. Participants preferred fast stories ($M = 5.67$, $SE = 0.16$) to slow stories ($M = 5.25$, $SE = 0.24$). There was also a significant Pacing × Length interaction, $F(1, 106) = 4.95$, $p < .03$, $\eta^2 = .05$, shown in Figure 2. Fast pacing led to more positive evaluations for both long and short stories, but the effect was much greater for long stories. The predicted Age × Pacing × Length interaction approached significance, $F(1, 106) = 2.17$, $p < .14$, $\eta^2 = .02$, and is shown in Figure 3. Fast pacing always resulted in more positive evaluations for younger viewers. For older viewers, fast pacing produced more positive evaluations only for long stories.

Hypothesis 2

This hypothesis predicted that fast pacing would elicit greater cognitive effort, indicated by slower heart rate, in younger viewers compared to older viewers. However, neither the main effect of pacing nor the Age × Pacing interaction were significant. Instead, there was a significant Length × Age interaction, $F(1, 89) = 5.02$, $p < .03$, $\eta^2 = .05$, shown in Figure 4. Younger viewers had slower heart rate for short stories compared to long stories, but there was no effect of length of story on older viewers' cognitive effort.

Figure 1
Effects of Age, Story Length, and Production Pacing on Time on Channel

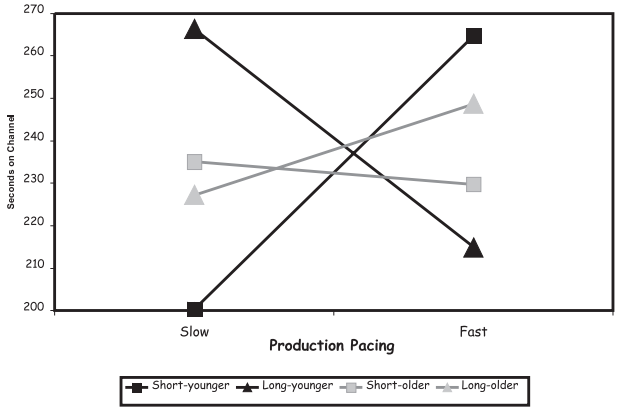


Figure 2
Effects of Production Pacing and Length on the Evaluation Data

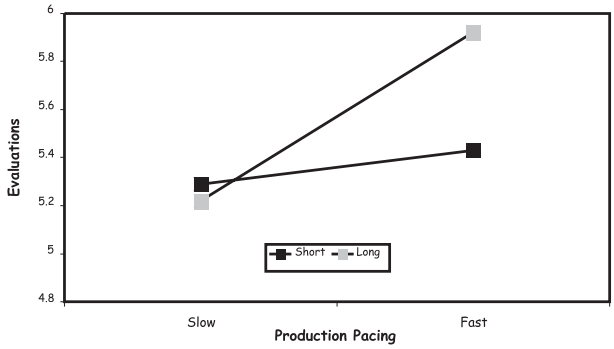
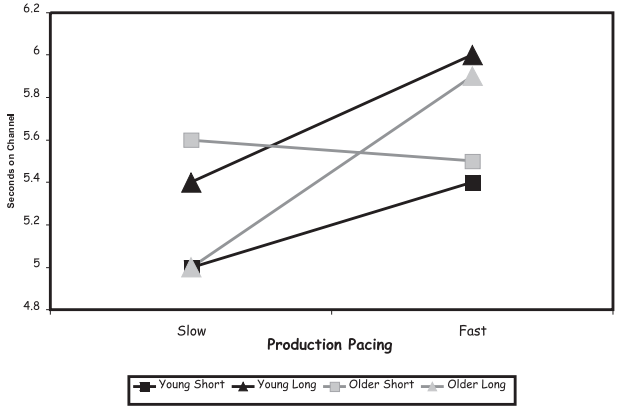


Figure 3
Effects of Age, Production Pacing, and Story Length on the Evaluation Data



Hypothesis 3

This hypothesis predicted that both older and younger viewers would have better recognition for slow- compared to fast-paced stories. However, it was predicted that younger viewers would recognize fast-paced messages better than older viewers, whereas older viewers would recognize slow-paced messages better than younger viewers. The prediction here was for a main effect for pacing and an Age × Pacing interaction. Neither of these effects was significant. Instead, there is a significant Pacing × Length interaction, $F(1, 76) = 8.41$, $p < .01$, $\eta^2 = .10$, shown in Figure 5. Faster pacing led to better recognition for long stories and worse recognition for short stories for both age groups.

Figure 4
Effects of Story Length and Age on Heart Rate

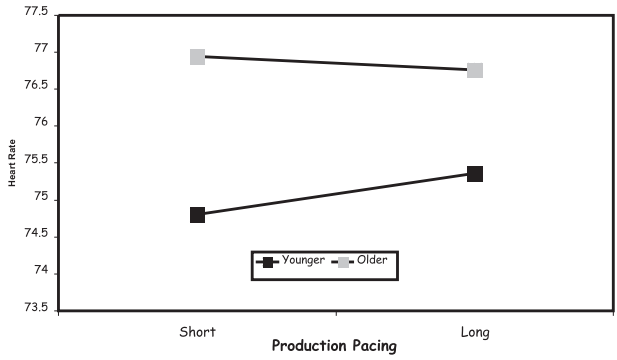
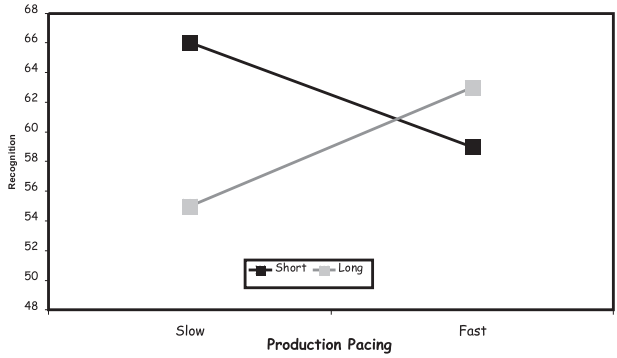


Figure 5
Effects of Production Pacing and Story Length on Recognition



Hypothesis 4

This hypothesis predicted a main effect of production pacing on arousal such that fast-paced stories would elicit greater physiological arousal than slow-paced stories. This effect was not significant. Instead, there was a significant Pacing × Length interaction, $F(1, 90) = 3.76$, $p < .05$, $\eta^2 = .04$, shown in Figure 6. Fast pacing increases arousal, as expected, for long stories but had little effect on arousal for short stories.

Hypothesis 5

This hypothesis predicted that cognitive effort would decrease up to the moment of a channel change and then increase after the change. This effect is carried in the Time

× Seconds Interaction tested on the heart rate data. This interaction, shown in Figure 7, was significant and was in the direction predicted, $F(9, 594) = 5.00$, $p < .001$, $\eta^2 = .07$. Trend analysis finds a significant interaction of the linear component of the Time × Seconds interaction, $F(1, 66) = 10.14$, $p < .002$, supporting the interpretation that heart rate is increasing prior to channel change and decreasing after the change. There are no effects of age.

Hypothesis 6

Hypothesis 6 predicted that arousal would decline up to the channel change, after which point it would increase. This is supported by the significant Time × Seconds interaction, $F(9, 666) = 4.21$, $p < .00$, $\eta^2 = .08$, on the skin conductance level data. There is also a significant Time × Seconds × Age interaction, $F(9, 666) = 6.57$, $p < .000$, $\eta^2 = .08$, which is shown in Figure 8. Trend analysis finds a significant interaction of the quadratic component of the Time × Seconds interaction, $F(1, 74) = 6.29$, $p < .014$, confirming that the apparent change in direction on either side of the channel change is indeed significant. The effect is larger for younger viewers than for older viewers.

Hypothesis 7

Hypothesis 7 also predicted that recognition memory would show a pattern of decline before a channel change and improvement after the change. Comparison of the three recognition questions immediately preceding and immediately following a channel change does indeed show this effect. The Time × Question interaction on the recognition data was significant, $F(2, 186) = 7.41$, $p < .001$, $\eta^2 = .074$, and is shown in

Figure 6
Effects of Production Pacing and Story Length on Physiological Arousal

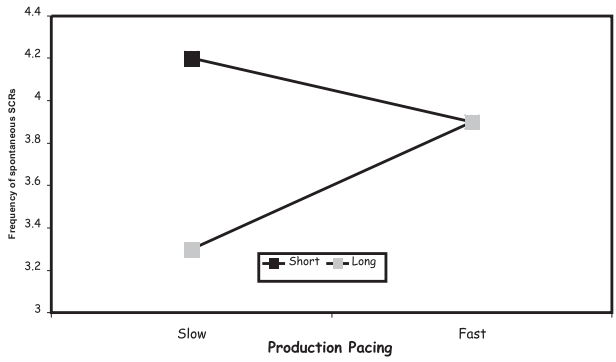


Figure 7
Change in Cognitive Effort Before and After Channel Changes

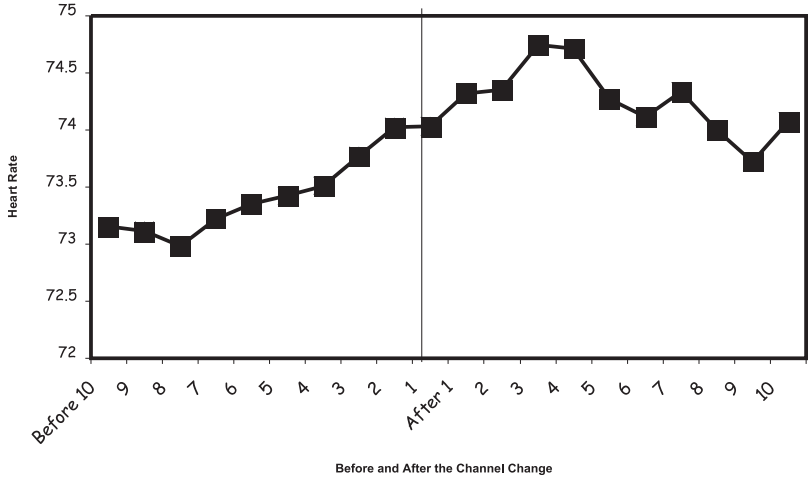


Figure 8
Change in Physiological Arousal Before and After Channel Changes

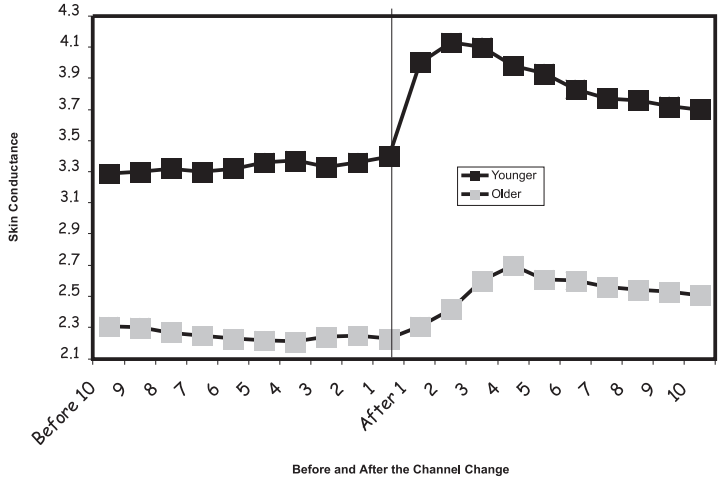
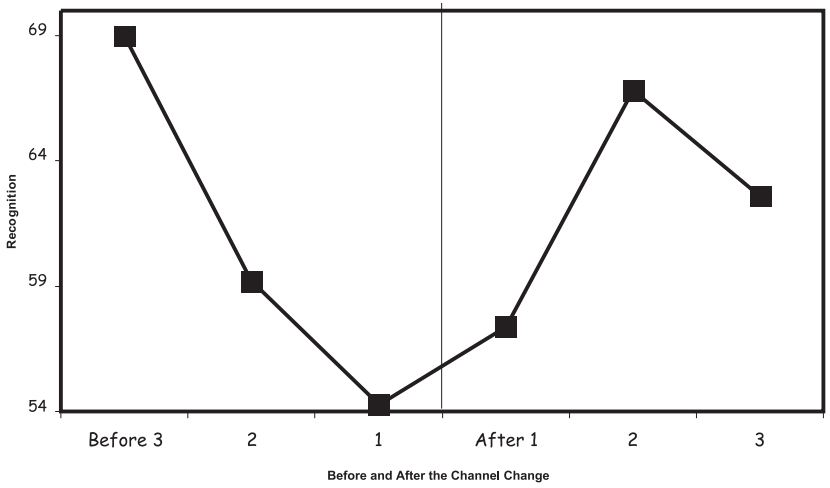


Figure 9. Recognition declined steadily before a channel change and increased following a channel change. There was also a main effect for Age, $F(1, 93) = 7.76$, $p < .006$, $\eta^2 = .077$. Overall, older viewers had higher recognition ($M = 65.6$, $SE = 1.9$) than did younger viewers ($M = 57.5$, $SE = 2.2$).

Figure 9
Change in Recognition Before and After Channel Changes



Hypotheses 8

This hypothesis predicted that during periods of frequent channel changing, viewers would exhibit less cognitive effort than during periods of infrequent changing. This hypothesis is supported by the significant main effect of channel change frequency on heart rate, $F(1, 63) = 22.11$, $p < .001$, $\eta^2 = .26$. During periods of infrequent changing, viewers had significantly slower heart rate, indicating greater cognitive effort ($M = 76.92$, $SE = 1.47$) than during periods of frequent changing ($M = 78.38$, $SE = 1.47$). There was no interaction with age.

Hypothesis 9

This hypothesis predicted greater recognition for content during periods of infrequent compared to frequent channel changing. This hypothesis was supported by the significant main effect of channel change frequency, $F(1, 69) = 16.47$, $p < .001$, $\eta^2 = .19$, on recognition. People had greater recognition during periods of infrequent changing ($M = 63\%$, $SE = 1.6$) compared to frequent changing ($M = 53\%$, $SE = 2.3$). There were no effects of age.

Discussion

The results of this study are important for two reasons. First, hypotheses derived from LCMMMP that have previously been tested only in forced viewing environments

were tested in a free choice viewing environment, and second, insight was gained into how well television producers' attempts to keep viewers on channel by decreasing length of story and increasing production pacing work.

First, what did we learn about the LCMMMP? Did the two aspects of production pacing manipulated here, story length and number of cuts and edits in a story, have the same effect on viewers' cognitive effort, physiological arousal, and recognition in a free viewing environment that they did in a forced viewing environment? The results show that, in general, production pacing increased both cognitive effort and arousal as was predicted. However, somewhat unexpectedly, it was found that story length and the speed of pacing within a story had independent and somewhat interactive effects. In previous tests of hypotheses about production pacing, only number of cuts and edits was manipulated–story length was constant. The results of this study suggest that story length is a structural feature that adds uniquely to the overall speed of production of a channel. All viewers expended more cognitive effort while viewing short stories compared to long stories, and physiological arousal was increased both by short stories and by fast pacing. Viewers had significantly higher physiological arousal during all short stories and during fast-paced long stories. Arousal was quite a bit lower during long, slow-paced stories. In addition, the combination of low arousal and low cognitive effort predicted recognition fairly well. Long, slow-paced stories, which had the least cognitive effort and the least physiological arousal, also produced the lowest recognition. Adding fast pacing to a long story, however, increased physiological arousal and resulted in an increase in recognition memory. On the other hand, when stories were short and production pacing was fast, recognition was lowest for both older and younger viewers, suggesting, as might have been predicted by the LCMMMP, that using both production techniques to speed up messages overloads cognitive processing. In other words, cognitive overload may occur at a slower rate of cuts and edits for short stories than it does for long stories. This may be because in a free viewing situation, length of story mediates the effects of within-story pacing. Processing the news story, according to LCMMMP, requires viewers to orient initially to the story, determine the general topic, and access information in long-term memory needed to understand the story, while simultaneously encoding incoming information from the story. Thus, speed of production within a story that might be insufficient to overload viewers in a long story may overload viewers in a short story. This interpretation is further supported by the finding that in the free viewing environment, short stories, regardless of internal production pacing, increased physiological arousal.

In addition to these processing predictions, we also tested the hypothesis that, in general, viewers change channels as a result of declining interest and arousal, not because they are highly active and involved. The results clearly support this prediction about the motivations behind channel changing. Both older and younger participants viewers exhibited decreasing cognitive effort, physiological arousal, and encoding prior to a channel change, followed by increases in all three variables after the change.

Additional support was provided by the finding that viewers processed messages differently during periods when they were changing channels frequently compared to periods when they were changing channels infrequently. During periods of frequent channel changing, viewers exerted less cognitive effort and remembered less information from the newscasts compared to periods of frequent channel changing.

Overall, then, the results of this study suggest that viewers do indeed change channels as a result of decreasing interest and physiological arousal. Short stories and fast pacing do seem to increase cognitive effort and physiological arousal and, therefore, may indeed function to combat channel changing. Unfortunately, when combined, they do not help viewers to learn information. Recognition is best when messages are either long and fast or short and slow.

Finally, what do these findings tell us about the success of the industry practice of speeding up production and shortening stories to attract (in particular, younger) viewers? Both story length and internal production pacing have effects on channel changing and evaluation. In addition, when there are differences between the age groups, the differentiation tends to be that story length and production pacing affect younger viewers' behavior but have little effect on older viewers.

Perhaps of primary importance is the answer to the question of whether viewers—and in particular, younger viewers—change channels less frequently when viewing programs with shorter stories and faster pacing. This was most directly addressed by the time on channel data. These data suggest that the length of the story and the speed of production pacing have very little effect on older viewers' channel changing behavior. However, they do effect younger viewers' channel changing behavior. Younger viewers spent the most time on channels where the two production variables matched, that is, when both were slow or both were fast. Thus, they spent the most time on the channels that had short, fast-paced stories or long, slow-paced stories.

Surprisingly, the evaluation data did not line up with the behavioral data. In other words, people's ratings of which newscasts were superior did not necessarily predict which newscasts they watched. Instead, for both older and younger viewers we find that fast pacing improved evaluations. For younger viewers, fast pacing improved evaluations for both short and long stories. For older viewers, this improvement was seen only for long stories.

In general, this would seem to suggest that fast pacing will improve viewers' evaluations of programming. Further, it may increase the time that some viewers spend on channel. However, at least in these data, there is some suggestion that younger viewers will be more likely to change the channel during a long story, even if it is fast paced. One possible explanation for this is that fast pacing may segment the story and provide more opportunities to break away.

Perhaps the finding with the most utility is that the practice of shortening stories and increasing production pacing may indeed function to attract younger viewers but not—as might have been feared—at the expense of older viewers. Although fast pacing was definitely preferred by younger viewers, compared to older viewers, it did not, at least in this study, keep them on channel. However, it did increase their cogni-

tive effort and arousal, which may prevent channel changing behavior. On the other hand, fast pacing and story length had virtually no effect on older viewers' channel changing behavior (although it did affect their evaluations). This means that if you want to decrease story length and increase pacing, you may indeed attract younger viewers without losing your older viewers, at least during the course of one viewing session. On the other hand, because both these variables do affect evaluations, the decrease in evaluations might affect future decisions to tune into your newscast.

Naturally, there are many limitations to this study. First, it is a single study performed in a laboratory. Future studies should attempt to further explicate and replicate the results reported here. Of particular interest in the future would be investigating whether declining cognitive effort and physiological arousal predict channel changing with other genres of programming. In addition, it would seem to be important to better understand why fast pacing and long stories elicit the most channel changing in younger viewers despite the fact that these are also the stories where they exerted the most cognitive effort and had the highest recognition.

Finally, it should be noted that differences between the age groups in this study are not necessarily a result of age per se. In other words, exactly why older and younger viewers respond differently, whether it is due to cognitive aging, differences in ability to process news, developmental experiences with television, differences in cultural preferences or style, or any of the myriad of other variables that differ between groups of young and old people is not known. However, what is clear is that the two groups do appear to have somewhat different tastes in television news production and process those different styles in somewhat different ways.

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