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Alternative cognitive explanations of memory deficiencies in the elderly suggest certain conditions in which elderly might be expected to learn less than younger adults in a consumer information processing context. The authors investigated these conditions using the levels-of-processing framework for the study of memory. The results indicate greater difficulties on the part of the elderly in deeply processing information from print media and in realizing the learning benefits of television. These findings suggest that marketers face unique problems in reaching this increasingly attractive market segment.

Encoding and Media Effects on Consumer Learning Deficiencies in the Elderly

Despite the substantial amount of research on consumer information processing and the growth of the elderly segment of the consumer market, knowledge of elderly consumers' information processing tendencies is limited. In their useful review of information processing by the elderly, Phillips and Sternthal (1977) note the lack of focused research on the elderly in a consumer information context. They further point out that of the studies pertaining to the elderly very few include other age groups for comparison. The situation has changed little in the time since their review. Additional efforts to understand the elderly consumer have been primarily in the form of more literature reviews (e.g., Meadow, Cosmas, and Plotkin 1981; Ross 1982) or position statements specifying areas in which applied research on the elderly would be particularly relevant (e.g., Visvabharathy 1982).

Research in the general area of cognitive psychology and the specific areas of gerontology and developmental psychology shows important differences between aged and younger individuals in their information processing tendencies. Much of this research considers the relative learning capabilities of the elderly by examining differences between younger and older individuals in their memory for previously seen information. The general finding suggests memory deficiencies in the elderly in comparison with younger adults. However, the magni-

tude of the memory deficiency appears to vary across certain conditions related to the pace at which information is presented, how it is placed in memory (encoding), and how it is recovered from memory (retrieval). Burke and Light (1981) provide an effective review of this body of research.

The body of research on memory deficiencies in the elderly provides a useful structure for studying consumer information processing in the elderly. It suggests possible conditions leading to changes in the amount of the learning decrement experienced by elderly consumers. These conditions translate readily into specific conditions found in a consumer information processing context. The general purpose of our article is to report research that identifies conditions leading to larger or smaller differences between the elderly and younger consumers in the learning of consumer information. First, we further develop these conditions by summarizing alternative explanations of why elderly individuals have a memory deficit in comparison with younger individuals. We then describe the design and procedures of a laboratory experiment to determine certain information processing conditions leading to larger or smaller learning deficiencies in elderly consumers. Finally, we discuss the findings and their implications

EXPLANATIONS OF MEMORY DEFICIENCIES IN THE ELDERLY

Of the major explanations for memory deficiencies in the elderly, two center on encoding, the process by which information is placed in memory, and two center on re-

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trieval, how previously seen information is recovered from memory. Collectively, these explanations and the research based on them suggest several relevant consumer information processing conditions under which to study the elderly.

Encoding Deficiencies

The explanations with a common emphasis on the encoding stage are based on the levels-of-processing (LOP) framework for the study of memory (Craik and Tulving 1975). The essence of LOP is that information may be encoded at varying levels ranging from shallow to deep. Shallow processing occurs when the structural or sensory features of a stimulus are encoded, whereas deep processing involves a more elaborative, semantic-oriented form of encoding. According to LOP, a deeper level of processing at the encoding stage leads to improved memory performance in recalling the encoded information.

LOP has had a prominent role in memory research, but is not without criticism. The major criticism is the circularity of LOP: memory improves because of a deeper level of processing, but a deeper level of processing is defined by improved memory performance. There is no independent measure of processing level other than the dependent variable that level is posited to influence. Still, since its formulation, LOP has been the dominant paradigm used to study encoding explanations of reduced memory performance in the elderly. Furthermore, because of the variations in sensory-oriented versus semantic-oriented content in consumer information stimuli, LOP has strong intuitive appeal and has been used in a consumer research context (e.g., Childers and Houston 1984; Zeithaml 1982). Consequently, we used it in our research with an attempt to overcome its major criticism.

Production deficiency. This view of poorer memory performance by the elderly suggests that they do not spontaneously employ deep processes when encoding information to the same extent as younger adults. The position here is not that the elderly are unable to process deeply but that, for whatever reason, they simply do not. When they are induced to process at a semantic level through orienting tasks, their memory equates to that of younger adults (Craik and Simon 1980). Often implicated as a reason for the failure to encode spontaneously at a semantic level are the school-like tasks used in most psychological experiments on memory. Younger subjects are less removed from school settings and more inclined to adapt to the processing requirements of the situation (Baltes, Reese, and Lipsitt 1980).

Processing deficiency. Eysenck (1974) suggests that memory problems in the aged stem from more than just a failure to process at deeper levels. Rather, the elderly suffer from an *inability* to process deeply. He bases this conclusion on a study in which he found that older adults performed as well as younger adults in free recall when given nonsemantic encoding instructions, but performed

less well under semantic encoding instructions. Though the actual cause of processing deficiencies in the elderly is beyond the scope of our research, one explanation of Eysenck's findings may be that a slowdown of central nervous activity contributes to a decline in the rate of cognitive processing.

Memory Search Deficit

Research has been reported that points to retrieval deficits rather than encoding deficits as the source of poor memory performance by the aged. Evidence for such a view is provided by White (see Craik 1977). She conducted a study similar to that of Eysenck (1974), but with one important extension. The memory of elderly and younger adults was compared across semantic and nonsemantic instructions by using both a recall and a recognition test. The recall measure yielded the same results that Eysenck found: under semantic processing elderly subjects recalled less, but under nonsemantic processing there were no age differences. However, the recognition measure revealed no age differences under any processing condition, though recognition scores improved for both groups under semantic versus nonsemantic conditions. Craik (1977) interpreted these findings as supportive of a retrieval deficit rather than a processing deficit. He reasoned that encoding deficiencies should show up in both recall and recognition measures. This was not the case; only recall indicated poorer memory for the aged. Because recall requires retrieval processes but recognition bypasses the retrieval process, the explanation must be that the elderly encode information equally well but cannot retrieve it as well as younger adults. One or both of two specific aspects of retrieval, neither of which would show up in a recognition measure, may be the source of retrieval deficits in the elderly: organization and self-generated retrieval cues.

Organization. Organization of encoded information occurs when order and pattern, often through the use of categorization, characterize its storage in memory. Organization allows easier recall of the information from memory, presumably because an organizational scheme provides easier access to stored information (Lynch and Srull 1982), but it is not important for recognition. It may be that the elderly find it more difficult to utilize organization strategies spontaneously when processing new information.

Organization may be implicated as a source of retrieval deficits in the elderly by the frequent finding that the rate of presentation of a stimulus influences age differences in recall—more rapid pacing of information presentation leads to greater recall superiority of the young over the old. When self-pacing characterizes the rate of presentation, age differences in learning diminish or vanish (Phillips and Sternthal 1977). Self-pacing allows greater use of organization strategies, whereas increased rates of externally paced information presentation limit their use (Burke and Light 1981). If the elderly have greater dif-

faculties using organization strategies, these effects would be magnified for them.

Self-generated retrieval cues. A second potential source of retrieval deficits in the elderly may be in their ability to self-generate associative cues to aid retrieval. Such cues enhance recall but do not have a role in recognition (Lynch and Srull 1982). If the elderly are less able than the young to self-generate retrieval cues, their performance on free recall tests will be worse. In aided recall tests with externally provided retrieval cues (as in paired-associate learning tasks), the learning decrement of the elderly should be reduced but not as much as in a recognition test.

RESEARCH PROBLEM

Collectively, the preceding explanations indicate several conditions under which to examine consumer information processing differences between elderly and younger adults. The encoding-based explanations suggest the issue of whether aged consumers do or do not have the capability of extracting semantic content from information stimuli when encouraged to do so. Investigating this issue in the common, "everyday" context of consumer information helps to avoid the problem of whether the school-like tasks used in previous research account for a production deficiency

The retrieval-based explanations point to other issues and conditions relevant to consumer information processing by the aged. Both retrieval-based explanations suggest that recognition reduces, if not eliminates, the learning decrement in the elderly. Because recognition is most useful for in-store decision making (Bettman 1979), consumer behavior by the elderly and marketing efforts directed to them would be aided by increased marketing attention to packaging and other in-store displays that are consistent with advertising content. If the

specific source of the retrieval deficit is a greater difficulty on the part of the elderly in organizing information, further implications for advertising media are suggested. Because they allow self-pacing, print media would be more appropriate for the placement of advertising messages aimed at the elderly. These media would give the elderly a full opportunity to organize the information and enable them to recall it better. Less emphasis on in-store stimuli would be necessary.

We undertook an experiment in which the independent variables of age, level of processing, and media were manipulated to correspond to the various conditions. Memory effects were assessed by using free recall, aided recall in which an external retrieval cue is provided, and recognition. Table 1 summarizes the predicted results associated with each of the four explanations of age differences in memory. Such an experiment offers insights into the approaches by which marketing managers can reach the elderly consumer and contributes to the general literature on learning by the elderly.

DESIGN AND PROCEDURES

Overview

The effects of level of encoding, pacing, and age on memory were studied in a full $3 \times 2 \times 2$ factorial design. Level of encoding was manipulated at three levels by instructing subjects to process information at a sensory level, semantic level, or as they normally would. Pacing was manipulated at two levels by exposing subjects to material presented either through an externally paced medium (television) or self-paced medium (newspaper). Two levels of age were represented by including separate groups of young and old subjects. The young group included 131 subjects between 18 and 45 years (median = 32). The elderly group included 136 subjects between 60 and 91 years (median = 72). Members of each age group were assigned randomly to one of the six combinations of encoding level and medium and were exposed to the information contained in the medium. Memory for the information was tested after exposure through a series of free recall, aided recall, and recognition measures.

Subjects

The 267 subjects who participated in the study were recruited from various organizations, including church groups, drop-in senior centers, hot lunch centers, parent groups, and housing cooperatives. Subject payment consisted of a monetary donation to each organization based on the number of subjects recruited from it. Data were collected over a two-month period at meeting sites of the organizations.

Procedures

The procedures used in the experiment were pretested to ensure their smooth conduct and to establish the amount of instruction necessary for each age group to understand

Table 1
EMPIRICAL RESULTS PREDICTED BY EACH EXPLANATION

<i>Explanation</i>	<i>Major prediction</i>
<i>Encoding deficiencies</i>	
Production deficiency	Semantic encoding instructions will remove age differences in learning for both self- and externally paced information
Processing deficiency	Age differences in learning will be observed in all conditions
<i>Memory search deficit</i>	
Organization	There will be no age differences in learning when recognition is the dependent variable Age differences in recall will be largest when information is externally paced
Self-generated retrieval cues	Age differences in learning will be largest for recall tests, smaller for aided recall tests, absent for recognition tests.

and complete the measuring instruments. Procedures were administered to subjects in small groups, typically 7 to 12 people. All instructions were given to subjects both orally on an audiotape player and in written form. Depending on their media assignment, subjects were told that the study was concerned with how people formed impressions of different TV news shows or newspapers and that they would be evaluating three different shows/papers. Subjects were given a practice series of Likert-type items to familiarize them with the major type of measuring procedure used in the study. Subjects then were given instructions on how they should evaluate each show/paper and were exposed to the specific Likert-type items that they would use to provide their evaluations.

Exposure to the respective media followed. Each medium was divided into three parts, each part representing one of the three versions to be evaluated. Each part of the TV medium was 10 minutes long. Subjects exposed to newspapers spent as much time as they wanted with each part. After exposure to each part, subjects completed at their own pace a common set of evaluation items. After exposure to the entire media presentation, subjects completed a measure of which of the three shows/papers they preferred most and a thought-listing measure for the test message. A series of additional measures including unexpected tests of memory and a self-report measure of level of encoding followed. The memory tests included, in order, unaided recall, aided recall, and recognition. Subjects were allowed to complete these measures at their own pace. Each session ended with a debriefing and question-answer period. Most sessions were completed within 75 minutes.

Manipulation of Independent Variables

Level of encoding. With the LOP framework as a guide, level of encoding was induced by using two orienting tasks during the procedures. First, the sensory-oriented instructions given before exposure to the medium emphasized that subjects should focus on the *appearance* of each version of the medium when evaluating it. Semantic-oriented instructions emphasized that subjects should focus on the *content* of the material contained in the medium. The "normal" processing condition emphasized that subjects should examine the medium as they normally would when watching/reading it.

Second, level of encoding was reinforced through the specific items used to evaluate each part of the medium. Subjects in the sensory condition completed items on media attributes such as clutter, liveliness, professional appearance, drabness, and attractiveness. In the semantic condition the items provided for evaluations of attributes such as the blend of local and national news, objectivity, confusion in the stories, and how boring the content was. Subjects saw the evaluation items before exposure to the material to be evaluated and completed them for each part of the medium immediately after that part was presented. Thus, by completing the items immediately after each part, subjects were being reinforced

in the level of encoding to use when examining the next part.

In the normal processing conditions subjects responded to different lifestyle items after each part. These items were not linked to the media and pertained to such characteristics as attitudes toward risk-taking, self-confidence, and the desire for money.

Media conditions. The two media representing external pacing and self-pacing were developed to be as semantically equivalent as possible. The television material was developed first. Local news programs from three cities outside the test area were taped "off the air." Tapes of eight TV commercials for several brands not available in the test area were obtained. Each news show, edited to 7½-minute length, contained samples of traditional news, weather, and sports segments. Five 30-second commercials then were edited into each segment at various points to arrive at three distinct 10-minute segments of programming and commercials. Thus, a total of 15 commercials appeared during the entire 30-minute tape. Some of the individual commercials were repeated during the entire 30-minute tape.

Included within the repeated commercials was a test message used for one of the recognition measures. This message, created specifically for the study, promoted a device available from "your gas and electric company" that shuts off a water heater daily during peak demand periods. The content of the test message was entirely verbal with the words rolling by on the screen while being read by a male announcer. This message was repeated four times during the 30-minute tape. Product classes represented in the other commercials included gasohol and several food products.

The newspaper version of the media variable was adapted directly from the TV version. The news portions of each show were transcribed and typeset (with pictures and headlines added) into three distinct newspapers, each containing five to six 8½ × 11" pages of news, weather, and sports. The verbal content of each newspaper story was identical to that in the TV version.

Fifteen full-page print ads for the same brands used in the TV condition were incorporated into the newspaper version. Each ad was repeated the same number of times and appeared after the same news story or other ad as in the TV version. Though the content of many of the ads differed somewhat between TV and print versions, the content of the test message was identical in the two media conditions. The three newspapers were bound together in a single booklet but retained separate identities within the booklet.

Age. Different levels of age were achieved through the inclusion of the two age groups. The comparison of age-cohort groups is by far the most common approach used in research on the aged. Obviously, it does not allow random assignment on the age variable and therefore does not control for other differences between age groups (e.g., education, occupation). Unfortunately, analysis of covariance and matched samples do not overcome these

control problems (see Kausler 1982; Salthouse 1982). For example, individuals in different age groups with, say, 12th-grade education still cannot be equated on this variable. They remain different because of changes in the content of formal education and the recency of its completion. Our approach was to obtain age-cohort groups containing noninstitutionalized adults responsible for making purchases on their own.

Dependent Variables

Memory for various aspects of the presented material was tested through a series of unexpected recall and recognition measures. Separate measures were taken for the news and advertising contents of the material. In this way evidence about the potential uniqueness of the effects to advertising could be obtained.

Unaided recall. Free recall was tested by asking subjects to indicate the main ideas for as many news stories and advertisements as they could remember. Correct recall for a news story was determined by whether a specific story was identified in sufficient detail to indicate memory. For example, reference to "sports" was not deemed correct recall; however, reference to a "hockey game" (a specific story on one of the stations) was considered correct. Recall for a specific ad was considered correct if at least the product class was mentioned. Two separate measures of unaided recall were calculated.

1. News story recall—the number of specific news stories correctly recalled.
2. Advertising recall—the number of specific ads correctly recalled.

Aided recall. To determine whether the provision of an external cue reduces the memory decrement of the elderly, a measure of aided brand name recall was taken. The advertised product classes were given to each subject, who was asked to fill in the brand name. Minor spelling errors were ignored. Aided recall was represented by the number of correct brand names provided.

Recognition. Tests for recognition memory were taken for both news stories and advertisements to determine whether a person could remember exactly what had been said or printed. News story recognition was assessed by giving subjects a series of statements making claims about what was said in six of the news stories. Half of the claims were true. Subjects responded to each claim by indicating whether it was true or false. The number of correct responses (out of six) served as the measure of news claim recognition accuracy. Similarly, a series of eight statements (half true) was used to assess claim recognition for the test advertisement (water heater device). As an example of the claim recognition measures, one item for test-message claim recognition was: "The residential load management advertisement says 'Call your oil company today for more information.'" A correct response would be "false" because the ad stated: "Call your Gas and Electric Company today for more information."

Finally, brand name recognition for the seven other

advertised products was assessed. For each product class subjects were asked to indicate which of four brand names represented the brand advertised.

Analysis

Analysis of variance (ANOVA) was used to assess main and interaction effects on each dependent variable. Both claim recognition measures were analyzed by using d' from signal detection theory (Green and Swets 1966). The brand recognition measure was corrected for guessing effects by a correction factor proposed by Link (1982).

RESULTS

Manipulation Checks

The LOP framework for studying memory has been criticized because of the lack of a separate measure of encoding level. This situation presents difficulties when, as in our research, LOP is the source of a key experimental manipulation. Specifically, the absence of a separate, well-accepted measure of encoding level precludes the use of a standard procedure for establishing the success of a manipulation of encoding level. Problems with manipulation checks of encoding level are compounded in studies of the elderly. The failure of a manipulation check to confirm a semantic level of encoding in the elderly may not indicate the failure of the manipulation itself. If, as suggested by the processing deficit explanation, the elderly are unable to encode at deeper levels, it would be theoretically impossible for a separate, direct measure of encoding level to confirm the effectiveness of a semantic orienting task. As a result, many of the studies using the orienting-task paradigm have not included manipulation checks. Instead, the researchers have depended on encoding inductions that are strong in a face-valid sense. We attempted to use a combination of strong inductions and validating evidence.

Self-report measures of encoding level were incorporated into the procedures to serve as a partial manipulation check. Separate measures were developed for sensory and semantic levels and for each media condition. After purification, the sensory and semantic scales for the print condition consisted of five items and four items with internal consistency coefficients of .90 and .74, respectively. Sensory and semantic scales for the TV condition consisted of seven items and six items with internal consistency coefficients of .82 and .62, respectively. Each subject completed both sensory and semantic scales. The items in each scale asked subjects to indicate in agree-disagree terms the extent to which they thought about specific appearance (sensory) or content (semantic) features when viewing or reading the information.

Even if the elderly have a processing deficiency, these scales should confirm successful sensory-semantic inductions in the younger subjects and at least a sensory induction in the elderly. Table 2, the cell means for each scale in each experimental condition, approximates such

Table 2
CELL MEANS FOR SEMANTIC AND SENSORY MANIPULATION CHECK SCALES

	Elderly			Younger adults		
	N	SM	SN	N	SM	SN
<i>Semantic scale values</i>						
Print						
medium (4 items)	14.96 (n = 23)	14.27 (n = 22)	14.24 (n = 21)	16.74 (n = 23)	15.91 (n = 22)	10.54 (n = 24)
TV medium (6 items)	22.36 (n = 25)	22.24 (n = 21)	25.46 (n = 24)	20.95 (n = 21)	23.25 (n = 20)	20.43 (n = 21)
<i>Sensory scale values</i>						
Print						
medium (5 items)	17.61	17.18	21.00	18.48	18.00	22.54
TV medium (7 items)	25.88	24.38	29.92	24.67	26.10	27.90

N, no encoding instructions; SM, semantic instructions; SN, sensory instructions.

a pattern. In the print condition the mean score for younger adults on the semantic scale is significantly higher under semantic instructions than under sensory instructions ($t = 4.08, p < .01$). Similarly, the mean score on the sensory scale is significantly higher under sensory instructions than under semantic instructions ($t = 2.78, p < .01$). A reasonably similar pattern of results is seen for younger subjects in the TV condition. The semantic score is higher under semantic than under sensory conditions ($t = 2.16, p < .04$). The sensory score is higher under sensory than under semantic instructions, though not significantly so.

For elderly subjects the sensory scores are significantly higher under sensory than under semantic instructions in both print and TV conditions ($t = 2.42, p < .02$, and $t = 2.07, p < .05$, respectively). However, semantic scores do not have the appropriate pattern in either media condition.

The overall pattern of scores on the self-report measures of encoding could be interpreted as initial evidence of a processing deficiency in the elderly. However, it does not eliminate the possibility of a manipulation failure of the semantic instructions when given to the elderly. Younger subjects may have understood the encoding instructions given to them under both levels, whereas the elderly may have understood them only under sensory conditions and failed to process semantically not because of an inability to do so but because they did not realize they should. We turn to indirect evidence to assess this possibility.

The processing deficiency hypothesis does not suggest that the elderly cannot *think* at a semantic level, only that they are less able than the young to encode new information at a semantic level. Self-generated thoughts should be more semantic while one is attempting to encode at a semantic level than while one is attempting to encode at a sensory level. Thus, if the elderly understood the semantic instructions, self-generated thoughts should be more semantic than they were under sensory instructions.

Immediately after exposure to and evaluation of the three media parts, subjects completed a thought-listing

Table 3
PERCENTAGE OF THOUGHTS CODED AS SEMANTIC

	Elderly			Younger adults		
	N	SM	SN	N	SM	SN
Print	67	77	52	76	80	34
Television	22	65	42	70	79	72

N, no encoding instructions; SM, semantic instructions; SN, sensory instructions.

procedure for the test message that was the last element of the information presented. They were given the headline of the message ("Are you spending too much for hot water?") and asked to list the thoughts they had about this message at the time of exposure. This thought-listing procedure has been used successfully by Lutz and MacKenzie (1981). If these self-generated thoughts are more semantic under semantic than sensory instructions for both elderly and young subjects, we have indirect evidence that the elderly understood the semantic instructions.

Three independent judges blind to the treatment condition of each subject coded each thought as semantic or nonsemantic. Interjudge reliability was .90. Table 3 shows the percentage of total thoughts coded as semantic for each of the 12 cells. In all four comparisons between semantic and sensory manipulations, the percentage of semantic thoughts is highest in the semantic condition. Thus, we have indirect evidence that the semantic instructions resulted in at least a semantic orientation in both elderly and young subjects.¹

¹A subject's statement was classified as semantic if it focused on the information contained in the advertisement (e.g., "this service seems like a good idea"). A limitation of the cognitive response data is that they are only a reflection of thinking about the test message. However, subjects in the encoding conditions were instructed to think about all the material in the same way, so it seems reasonable to infer that the way they thought about the test message is the way they thought about all the material. In the no encoding instruction condition, this inference cannot be made because subjects received no special instructions.

Background Variables

Subjects were measured on several background variables to identify potential mediating variables not otherwise accounted for. Major differences between elderly and young subjects were found on two variables. First, not surprisingly, young subjects had completed more years of formal education than elderly subjects. However, any mediating effects of this variable may have been substantially offset by the fact that elderly subjects reported spending almost twice as many hours watching television and reading newspapers as did young subjects. Finally, the age groups did not differ significantly on a health index ($\alpha = .92$) based on eyesight, hearing, and mobility—important physical factors relating to the ability to see and hear information and engage in consumer behavior.

Memory Effects

In this section we report the key substantive findings about memory effects of the independent variables. The order of presentation of the dependent variables corresponds to the order of memory processes to which they are relevant. Recognition results are reported first because they reflect only encoding differences. Recall results then are discussed because, to the extent they differ from recognition findings, they reflect effects on retrieval. Cell means for the array of recognition and recall measures are reported in Tables 4 and 5, respectively.

Recognition. Consistent throughout each of the recognition measures is a significant effect of age, the nature of which reveals a significant learning decrement in elderly subjects. Furthermore, the consumer-oriented measures (brand recognition and claim recognition for the test message) show meaningful interaction effects. For each measure a significant media \times age interaction (brand $F = 5.07, p < .02$; claim $F = 4.74, p < .03$) occurs in which the learning decrement of the elderly is greater in the television condition. The interesting aspect

Table 4
CELL MEANS FOR RECOGNITION MEASURES

	Elderly			Younger adults		
	N	SM	SN	N	SM	SN
<i>News claim recognition</i> (maximum = 24)						
Print	14.68	14.20	14.00	16.88	17.32	15.87
Television	13.50	14.31	14.71	17.05	16.85	16.90
<i>Test message claim recognition</i> (maximum = 32)						
Print	21.68	20.65	20.87	25.05	25.59	23.09
Television	21.85	23.38	22.93	28.76	28.35	27.65
<i>Corrected brand name recognition</i> (maximum = 7)						
Print	.81	1.08	1.05	3.36	3.98	2.12
Television	1.63	1.87	1.40	4.66	4.94	5.48

N, no encoding instructions; SM, semantic instructions; SN, sensory instructions.

Table 5
CELL MEANS FOR RECALL MEASURES

	Elderly			Younger adults		
	N	SM	SN	N	SM	SN
<i>Recall for news stories</i>						
Print	3.74	2.60	2.67	7.86	6.27	4.96
Television	4.35	2.38	3.64	8.86	7.40	7.45
<i>Recall for advertisements</i>						
Print	1.21	1.50	.73	2.14	2.36	1.61
Television	1.60	.88	1.21	3.00	2.95	3.30
<i>Brand name recall</i>						
Print	.09	.14	.48	.87	1.27	.33
Television	.84	.90	.71	2.48	2.45	2.90

N, no encoding instructions; SM, semantic instructions; SN, sensory instructions.

of this interaction effect is that television increases learning over print to a greater extent for young subjects than for the elderly.

Differential encoding-level effects across age groups would provide evidence for encoding failures on the part of the elderly. The presence of the media manipulation suggests that such effects should be assessed for each medium. For each recognition measure, contrasts of means reveal that in the print medium semantic processing significantly improves ($p < .05$) memory over sensory processing for the young but not the elderly. In the television condition, processing level had no effect on recognition. Thus, evidence for a processing deficiency is found in the print condition. However, the fact that television generally boosted recognition in comparison with print suggests the basic principle of LOP (i.e., deeper semantic processing leads to improved memory) does not hold for television.

Aided brand recall. The pattern of results for aided recall of brand name conforms precisely to that for brand name recognition. Contrasts again show superior memory for the young in the print condition when semantic processing is induced, but not for the elderly. Furthermore, the boost in memory from television is much greater for the young.

Unaided recall. In free recall of advertisements and news stories, elderly subjects generally show inferior memory in comparison with young subjects. This finding is consistent with the recognition and aided recall findings.

For advertising recall, interesting media effects associated with encoding level and age are found. Semantic processing improves recall under the print condition but has a somewhat detrimental effect under television. This result deviates somewhat from preceding findings in that this pattern occurs in both age groups. However, in conformance with preceding findings, television boosts recall for the younger subjects to a greater extent than it does for elderly subjects. For news story recall only the three main effects are significant (all at $p < .01$).

DISCUSSION

Our findings lead to several important conclusions about information processing differences between elderly consumers and younger consumers. First, elderly consumers clearly have a general learning deficit. Elderly subjects consistently performed at a lower level on memory tests across all conditions of learning. Second, the source of this learning deficit appears to be associated with the encoding stage of information processing, that is, the point at which information is placed into memory. This conclusion is warranted because measures that aid or bypass the retrieval stage (aided and recognition recall) and measures that require retrieval (unaided recall) both indicate memory deficiencies in the elderly.

Third, the elderly consistently learn less than younger adults and the size of the learning decrement increases under certain conditions. Specifically, upon exposure to print material, the memory performance of younger subjects increases when they are instructed to process at a semantic level. This effect does not occur for elderly subjects. This pattern of results for both recognition and recall again points to a processing deficiency on the part of the elderly when exposed to print material. They are less capable of deep, semantic-level processing and, consequently, do not realize the increase in learning that the young do.

Another situation that increases the learning decrement of the elderly occurs within the television media condition. Initially, the inclusion of this manipulation was based on the expectation that, though its externally paced nature would affect memory negatively for both age groups by making memory organization more difficult, the decline in learning would be greater for the elderly. However, the observed increase in the learning deficit of the elderly occurs for opposite reasons. The television exposure increased memory performance for younger subjects and had little or no effect on that for elderly subjects. Furthermore, sensory processing yielded equivalent or, in some cases, superior performance in comparison with semantic processing. This pattern of effects is somewhat more pronounced for consumer-oriented than for news materials. This surprising result has implications for understanding not only consumer information processing by the elderly, but also general media effects on consumer information processing.

The appropriate source of a theoretical understanding of this result appears to be theories of encoding other than LOP. The focus on encoding is appropriate because the finding occurred in both recognition and recall tests. Strict adherence to LOP is inappropriate because its fundamental principle of improved memory in semantic processing did not hold. Still, any theoretical explanation must be consistent with the findings of a study that used LOP as a framework for studying memory. In this case it must be consistent with the finding that sensory processing can result in equivalent or superior memory relative to semantic processing.

Given the preceding criteria, a candidate for under-

standing the positive effects of television on memory is the theoretical notion of encoding distinctiveness, a recent modification of LOP (Jacoby and Craik 1979; Jacoby, Craik, and Begg 1979). Encoding distinctiveness refers to the tendency to discriminate one stimulus from another at encoding by focusing on the unique features of each stimulus. The result is greater contrastive value to what is encoded and retention of more stimuli within a given stream.

In comparison with newspapers, television offers the viewer greater opportunity for distinctively encoding individual items within the stream of presented material. Television makes use of more sensory-oriented stimulus components—nonverbal sound, voices, color, pictures, and motion. Thus, instructions to encode at a sensory level would promote the use of encoding distinctiveness and result in greater memory for television material than for newspaper material, in which fewer sensory codes are available to distinguish between stimuli and semantic processing must be induced to improve memory. Nelson, Reed, and Walling (1976) offer a similar explanation for the superiority of pictures over words in memory, thus making the encoding distinctiveness explanation a feasible one for findings showing that pictures improved memory for younger age groups but not the elderly (Winograd and Simon 1980). In our study the less pronounced positive effect of television on memory for news material is intuitively consistent with this explanation. News stories would tend to “run together” more in terms of their sensory features than would advertisements. In terms of understanding age effects on information processing, aged consumers appear to be less capable of distinctively encoding stimuli within a stream and form memory traces qualitatively inferior to those of younger consumers.

The proposed explanation for the positive effects of television is offered *post hoc*, not as a definitive explanation. Another explanation could be simply that TV has greater ability to motivate processing and retain attention than print, though such an explanation does not account for the effects of sensory encoding within the TV condition. Regardless of the explanation, the positive effects of television on memory do not suggest a general preference for television over print as an advertising medium. Print advertising allows the learning of a greater quantity of information within a single message. Our measures did not tap the quantity of learning from any one message. Instead, they assessed learning at the awareness level with respect to product class, brand, or a specific claim within a message.

More important to our study's purpose are the implications of the results for marketing to elderly consumers. The overall findings suggest that elderly consumers have encoding deficiencies when processing information from either print or television advertisements. Such deficiencies imply difficulties in promotional effort aimed at the elderly. With encoding as the source of information processing difficulties, the elderly would not benefit from promotional efforts to increase recognition. Thus, point-

of-purchase displays, for example, would not seem to be useful as promotional tactics to supplement advertising information, though they might stand on their own as in-store influences on purchase behavior by the elderly. Brand differentiation efforts aimed at the elderly should use sensory-oriented cues when presented in self-paced media, because semantic-based cues are less likely to be noted. Though learning deficits in the elderly relative to the young increase with television, the impact of television in comparison with print is still positive for the elderly. This effect and the greater tendency of the elderly to view television suggest that television should be a greater portion of the media mix for firms marketing to the elderly than for those marketing to younger consumers.

The conclusions and implications should be tempered somewhat because of potential weaknesses in the reported research. First, evidence supporting the success of the semantic manipulation in the elderly is equivocal. The direct manipulation check did not indicate a semantic induction in the elderly group, though it did in the young group. An indirect check, based on cognitive response data, provided evidence supportive of a successful semantic induction in both age groups. Second, studies of age differences in learning through comparisons of age-cohort groups necessarily lack complete control over age-related extraneous variables (education, occupation, etc.). Traditional approaches to reducing experimental error (matched groups, blocking, analysis of covariance) do not overcome inherent difficulties in determining equivalent operational levels of these extraneous variables. Still, our findings afford important theoretical insights into consumer information processing by the elderly which translate into meaningful marketing consequences, all of which warrant further research attention.

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