Understanding Program-Induced Mood Effects: Decoupling Arousal from Valence

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The role of mood on ad processing was examined by orthogonally manipulating valence (positive versus negative) and arousal (moderate versus high). Measures of signal detection were used to provide evidence of the level (deep versus shallow) and nature (schematic versus data-driven) of processing. Results indicate that the arousal and valence dimensions of mood differentially affect ad processing, with arousal affecting the level of processing and valence influencing the nature of processing. The processing level was more shallow when the arousal level was high rather than moderate. Positive valence was associated with the greater use of schematic processing, whereas negative valence was associated with the greater use of data-driven processing. These results were obtained even when covarying out the effect of arousal and valence at ad retrieval. Therefore, the effects are attributable to the impact of the two dimensions of mood at encoding (i.e., during ad processing) versus ad retrieval (i.e., when responding to the questionnaires).

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Considerable research has examined the effect of program-induced moods on consumer's processing of information from ads (e.g., Aylesworth and MacKenzie 1998; Batra and Stayman 1990; Batra and Stephens 1994; Goldberg and Gorn 1987; Innes and Ahrens 1991; Knowles, Grove, and Burroughs 1993; Lang, Newhagen, and Reeves 1996; Mathur and Chattopadhyay 1991; Schwarz 1990; Schwarz and Bless 1991, review; Worth and Mackie 1987). Understanding the effect of mood on information processing is theoretically important because the way, and to what extent, an ad is processed has profound implications for attitude formation and persuasion (MacInnis and Jaworski 1989). Understanding the effect of mood also has pragmatic implications, in that a mood-inducing program may affect subsequent ad processing (Aylesworth and MacKenzie 1998; Singh and Hitchon 1989).

Prior studies investigating the effect of mood on information processing typically have examined mood as a global feeling construct, for which researchers have examined the effects of positive compared with negative (e.g., Aylesworth and MacKenzie 1998; Fedorikhin and Cole 1999; Goldberg and Gorn 1987) or neutral (e.g., Batra and Stayman 1990; Innes and Ahrens 1991; Lee and Sternthal 1999; Mackie and Worth 1989; Murray et al. 1990) moods. However, feeling states can be described by their position on at least two fundamental dimensions: arousal and valence (Mehrabian and Russell 1974; Russell and Barrett 1999). The distinction between the arousal and valence dimensions is important because each may affect consumer behavior in different ways (Raghunathan and Pham 1999).

The bulk of prior research has examined valence, but because arousal levels have been neither examined nor systematically controlled, it is unclear whether effects observed in these studies are attributable to valence, arousal, or both. This distinction is important because mood induction procedures used in prior research have been found to inadvertently affect both arousal and valence (Gayle 1997; see also Clark 1982). A notable exception is Aylesworth and McKenzie (1998), who examine valence but controlled for arousal. Clark, Milberg, and Ross (1983) manipulate levels of arousal but only investigate a positive versus neutral valence condition, not a negative valence condition. To our knowledge, only one study (Gorn, Pham, and Sin

2001) has attempted an independent manipulation of valence and arousal; however, the authors were unable to obtain an orthogonal manipulation between the two variables. Their primary variable of interest also was ad attitude, not ad processing per se.

Prior mood studies claiming to investigate the effect of mood on information processing (an encoding phenomenon) rarely measure and control for the effect of mood during ad retrieval. Therefore, it is unclear whether the effects found in prior research are due to mood at encoding, mood at retrieval, or both. A study that measures and controls for mood at retrieval would help clarify mood-related processing effects.

The purpose of this paper is to better understand the effect of mood on information processing by independently manipulating the two primary dimensions of mood (valence and arousal) and controlling for mood at retrieval. The former enables us to determine whether the two dimensions have similar or different effects on information processing, whereas the latter provides evidence that these effects are attributable to mood at encoding versus retrieval. Because information processing is an important precursor to attitude change and persuasion, this paper focuses primarily on mood-related factors that affect ad processing, not on phenomena that result from that processing (i.e., attitudes).

Theory and Hypotheses

Mood and Its Dimensions

Researchers (Russell 1980; Russell and Barrett 1999) have suggested that feelings can be conceptualized by their position in a two-dimensional space characterized by valence (positive versus negative) and arousal (high versus low). Valence is defined in terms of pleasantness. Arousal is defined in either physiological terms, as degree of energization, activation, inner tension, or alertness, or psychological terms, as a state of wakefulness or action preparation (see Singh and Hitchon 1989). We consider the potential processing effects of each.

Effect of Valence on Ad Processing

Schwarz and Bless (1991) use a psycho-evolutionary model of emotion to explain how and why mood affects processing. A positive mood, triggered by a benign environment, facilitates the use of prior schemas or theories because the benign nature of the environment signals no need for detailed analysis of the environmental information. Attention paid to theory-based knowledge frees people to think creatively, form associations, relate activated knowledge from memory, and form broader categorizations in categorization tasks. Some evidence in psychology (e.g., Bless, Hamilton, and Mackie 1992; Isen and Daubman 1984; Isen, Daubman, and Gorgolione 1987) and marketing (Lee and Sternthal 1999) is consistent with these effects.

In contrast, a negative mood signals that the environment is not benign and must be processed so that adaptive responses can be considered and implemented. Reliance on general theories or schemas may be maladaptive; hence, processing should be analytical and externally focused with attention paid to detail. Some evidence is consistent with the notion that persons in a negative mood show greater detailed and analytical analysis of the data at hand and less reliance on general knowledge structures (see Schwarz 1990).

Prior research in marketing has studied consumers' processing of information as either schema or data driven (e.g., Broniarczyk and Alba 1994; Stayman, Alden, and Smith 1992; Sujan 1985) but has not linked the degree to which it is schema versus data driven to mood effects. A notable study by Bless and colleagues (1996; Experiment 1) supports the notion that valence may affect whether processing is schema or data driven, though not in the context of a program-induced mood. Subjects in a happy or sad mood were presented with a story that contained a "going out to dinner" script. Some of the story information was consistent with the script; other information was not. When later asked which of a set of items had been presented, happy subjects were more likely to judge a typical item as being presented than were sad subjects, even when the item had not been presented. Thus, subjects in a happy mood had more schema-consistent false alarms. Because that study did not control for or manipulate arousal, however, it is unclear whether valence (alone or in conjunction with arousal) produces these effects.

If these results are attributable to valence and if they generalize to a program-induced mood context for advertising, we would expect that valence affects whether processing is more schema driven or data driven. Those in the negative valence condition should process the data in the ad more than those in the positive valence condition and therefore show greater discrimination between non–schema-relevant information that is presented versus not presented in the ad. Conversely, those in the positive valence condition should show more processing of schema-consistent information relative to those in the negative valence condition. Consequently, they should have a

more difficult time discriminating between schema-relevant information that is presented versus not presented in the ad and a greater bias toward yea-saying (claiming to recognize schema-consistent information as having appeared in the ad, regardless of whether it actually did). Thus, we expect that

H1: Compared with consumers in the positive valence condition, those in the negative valence condition will process the data in a more analytical fashion and show greater ability to discern whether non–schema-relevant attributes were presented in the ad.

H2: Compared with consumers in the negative valence condition, those in the positive valence condition will exhibit evidence of schema-based processing and be more likely to yea-say with schema-consistent information.

Effect of Arousal on Ad Processing

Although research on the effect of the arousal dimension of program-induced mood on ad processing is limited, research elsewhere is suggestive of its impact. Two different theoretical perspectives on the effect of arousal can be identified. The first predicts that arousal interacts with valence, with high arousal heightening valence effects. The second posits that arousal works independently of valence and affects the level of ad processing in general (i.e., whether processing is deep or shallow), not the nature of ad processing (schema versus data driven). Competing hypotheses regarding both theories are presented subsequently.

Arousal Interacting with Valence. Some prior research suggests that arousal moderates the effect of valence, with higher levels of arousal heightening mood valence effects (Aylesworth and MacKenzie 1998; Clark 1982; Clark, Milberg, and Erber 1984; Clark, Milberg, and Ross 1983). Although this research has not orthogonally manipulated arousal and positive versus negative valence, it has examined the effect of one of these dimensions controlling for the other. For example, Clark, Milberg, and Ross (1983) find that student subjects in a positive mood had a more favorable attitude toward their university when they were in a state of high versus moderate arousal. They suggest that high arousal generates more intense valence-consistent memories during the completion of the attitude measures. Clark (1982, p. 271) contends that arousal by itself might not create mood effects because "arousal states accompanying positive and negative emotional states do differ." As evidence, Clark, Milberg, and Ross (1983) find no main effect of arousal for a neutral valence student control group's attitude toward the university. If this theory is correct, we would expect the effects in H1 and H2 to be moderated by arousal level. Specifically,

H3a: The amount of schema-based processing among those in a positive versus negative valence condition will be higher in conditions of high versus moderate arousal.

Arousal Working Independently of Valence. An alternative view is that highly arousing contexts distract people from processing subsequent material. Such distraction could interfere with accessing a schema or processing the data at hand. As such, it affects the level of processing, whether deep or shallow (MacInnis and Jaworski 1989; Petty and Cacioppo 1986). Processing level is distinct from whether processing is schema based or data driven in that it refers to how much consumers process, not the source from which their processing is derived (prior schemas or the data at hand).

According to Singh and Hitchon (1989, pp. 5-6), "an arousing context may serve as a distraction and result in decreased rather than increased memory for the focal material. In fact, high levels of program involvement do seem to result in reduced commercial learning" (Bryant and Comisky 1978; Kennedy 1971; Soldow and Principe 1981; Thorson, Reeves, Schleuder, Lang, and Rothchild 1985).

Relevant to program-induced mood, Pavelchak, Antil, and Munch (1988) examine the effect of the Super Bowl on ad recall and find that that fans in the winning and losing cities recalled fewer commercials than did consumers who were not from either city. Because the Super Bowl is likely to be a particularly arousing event for fans in the winning and losing cities, it is possible that game-induced arousal interfered with ad processing and lowered ad recall.

Relevant to advertising, Sonbonmatsu and Kardes (1988) induce high and low arousal states through exercise. Subjects were exposed to an ad utilizing a strong versus weak argument and a celebrity versus noncelebrity endorser. Consumers in the high arousal condition were more likely to rely on peripheral cues and less likely to rely on message argument strength than were consumers in the moderate arousal condition. These results suggest that high arousal interferes with ad encoding and increases reliance on easy-to-process persuasion cues.

Using the previously discussed results, this theory predicts that arousal will affect the level of ad processing, with higher levels of arousal interfering with ad processing. Specifically,

H3b: Compared with consumers in the moderate arousal condition, those in the high arousal condition will engage in shallower ad processing and show less ability to discriminate attributes presented in the ad from attributes not presented.

Method

Design

This study uses a 2 × 2 × 2 mixed factorial design, with arousal (high versus moderate) and valence (positive versus negative) as between-subjects factors and the extent to which attributes of the ad are relevant (very relevant versus less relevant) to a prior schema as a within-subject factor. We did not attempt to produce a low arousal condition. That an ad interrupts a program, by definition, creates a novel situation that is likely to enhance arousal levels. Furthermore, arousal may be artificially high by virtue of the lab context.

Subjects

Two hundred three undergraduate marketing students participated as part of a course requirement. An average of 10 subjects participated in each session. Sessions were randomly assigned to conditions that lasted approximately 45 minutes.

Stimulus Development

Arousal and Valence Induction Procedure. Excerpts from movies were chosen as an induction mechanism because prior research has demonstrated their ability to induce a wide range of feelings in a relatively short time frame (e.g., Gross and Levenson 1995; Philippot 1993). The use of movie clips has the added advantage of providing some external validity to research on program-induced moods.

Forty three to five minute movie clips were identified for pretesting valence and arousal levels. Each clip was rated by approximately 15 subjects. Valence was indicated by averaging two five-point items (1= strongly disagree; 5=strongly agree): "Currently, I am in a good mood" and "As I answer these questions, I feel cheerful" (r=.79) (Peterson and Sauber 1983). A six-item semantic differential scale indicated arousal (stimulated versus relaxed, excited versus calm, frenzied versus sluggish, jittery versus dull, wide awake versus sleepy, aroused versus unaroused); each item was anchored by a +4 to -4 rating (alpha=.87) (Mehrabian and Russell 1974). On the basis of the pretest results, two movie scenes were selected for each condition (see Appendix 1). The correlation between arousal and valence was .03 ($p>.80$), indicating that these constructs were manipulated orthogonally.

Ad Development. To determine whether ad processing is schematic and relies on general knowledge structures, we needed an advertisement in which some brand attributes were relevant to consumers' schema for the advertised product category and some were not. To begin, we developed a list of 30 attributes, half of which were thought be very relevant to the category of an "elegant restaurant" and half of which were thought to be nonrelevant to the category. Fifteen pretest subjects used two nine-point semantic differential scales to rate attribute relevance: "The attribute does not come to mind at all when I think of an elegant restaurant (1). The attribute comes to mind immediately when I think of an elegant restaurant (9)" and "The attribute is not closely associated with an elegant restaurant (1). The attribute is closely associated with an elegant restaurant (9)." A composite attribute relevancy index was calculated by averaging the two items (r=.68).

Twenty attributes were chosen for inclusion in the main experiment. Ten were highly relevant to the elegant restaurant schema ($\bar{X}$ = 8.2) and ten were less relevant to the elegant restaurant schema ($\bar{X}$= 4.9; t (14)=10.91, $p<.001$). Note that the latter were nonrelevant, not inconsistent, with the elegant restaurant schema. Hence, our manipulation differs from Sujan's (1985), who used schema-consistent and schema-inconsistent attributes. Five relevant and five nonrelevant attributes were randomly selected for inclusion in the ad. The remaining relevant and nonrelevant attributes were used as distractors in the subsequently discussed recognition test.

Radio was chosen as the medium for the ad because it allows for control of exposure duration, preserves consistency in medium with the mood induction procedure (both are in the broadcast area), and is a very natural medium for presenting advertising information. The ad script read:

> The Chalet is a truly elegant restaurant raves the National Restaurant Review. Gourmet Magazine remarks, "the epitome of elegance. We give the Chalet 4 stars." Indeed, recently renovated, the Chalet offers a truly remarkable dinning experience. From the **valet parking** to the **exceptional service**, we are sure you will agree that the Chalet is the restaurant of choice for that special occasion. As you meander up the path that leads to the restaurant and step inside, you will immediately appreciate the care and effort that went into mak-

ing the Chalet a place to remember. The **required formal attire**, mahogany tables for two, and **intimate lighting** create the perfect atmosphere. Allow us to seat you by one of the bay windows overlooking the countryside, or in our outdoor seating area, while our chef creates **French cuisine** that will delight even the most discriminating taste buds. Listed in the phone book, the Chalet is located at 24 Chestnut Way. For a memorable experience, choose the Chalet.

The first three sentences of the ad were designed to activate an elegant restaurant schema. The five attributes shown in bold-faced underline were identified in the pretest as highly relevant to the elegant restaurant schema, whereas the five remaining underlined attributes were identified as less relevant to that schema. Highly relevant and less relevant attributes were mixed throughout the ad to control for primacy and recency effects.

Procedure

Figure 1 summarizes the procedure. Subjects were seated at tables in front of a large projection screen and were told they would complete several studies, the first of which involved watching movie clips. Subjects were then assigned to one of two viewing orders (see Figure 1) to demonstrate more clearly the arousal and valence levels experienced while processing the ad. Many mood studies measure mood prior to as opposed to during ad exposure. The dashed arrows in Figure 1, however, indicate that arousal and valence measures taken in viewing order 1 (2) are taken at the same point in the experimental procedure that subjects in viewing order 2 (1) are listening to the radio ad. As such, these measures act as proxies for the arousal levels and valence of subjects in viewing order 2 (1).

Immediately after listening to the radio ad, subjects completed several questions regarding their opinion of the radio ad. This was done to complete the guise that subjects had been given previously that their opinions of the ad were being solicited and to decrease the possibility that they would continue to elaborate on the ad. In addition, to provide evidence as to whether a highly arousing context distracts from a subsequent task (Singh and Hitchon 1989), two five-point agreement items assessed subjects' ability to pay attention to the ad while it was playing: "I had a hard time concentrating on the radio ad" and "My mind wandered to other thoughts as the radio ad was playing" (1=strongly disagree/5=strongly agree). Because the correlation between these two items was low (r=.38), we examine each separately.

After exposure to the film clips, subjects completed a 20-minute distractor task designed to clear short-term memory and equate arousal and valence levels at retrieval. To ensure that any effects found for valence and arousal could be attributed to their effect at encoding rather than at retrieval, subjects completed a set of valence and arousal items (the same as those previously reported) at the end of the distractor task. Subjects then completed the dependent measure and manipulation check measures for attribute relevancy (see Figure 1).

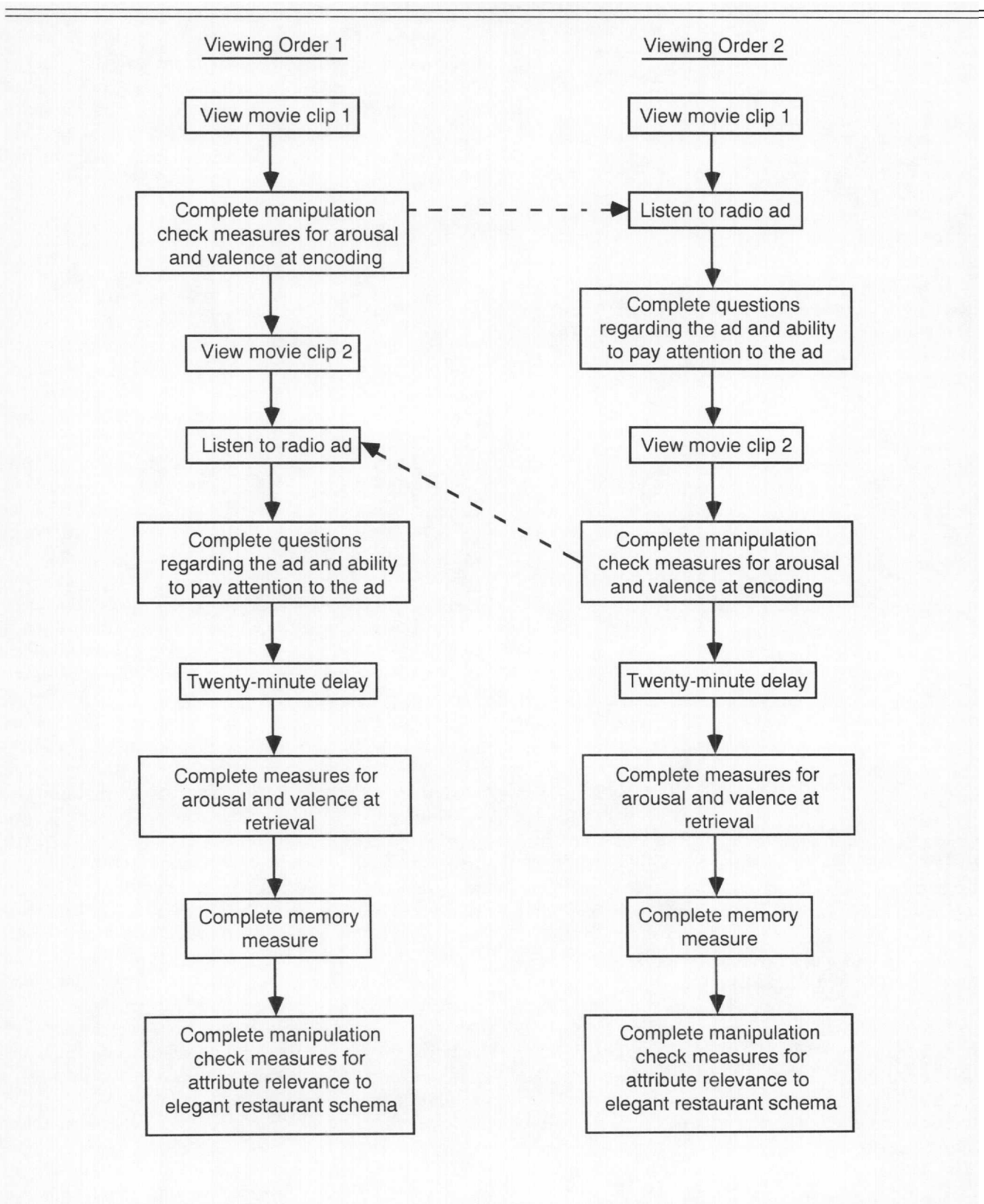
Measures

Dependent Measures. The effects of mood on processing are typically inferred by consumers' responsiveness to peripheral cues or their failure to respond to strong message arguments. Other studies measure processing level more directly using cognitive responses. Notably, though, cognitive responses are retrospective reports of thoughts of which consumers might have had little awareness at encoding (see Nisbett and Wilson 1977). As such, they may reflect salient memories about the ad reconstructed as thoughts rather than indicators of the elaboration of information at encoding. Furthermore, cognitive response measures typically use the number of thoughts as the unit of analysis. A single thought could, however, represent a summary statement of deep embellishments about the ad. Therefore, the number of thoughts may imperfectly assess the degree of elaboration or processing.

In light of these issues, we attempt a more rigorous methodology to indicate the nature and level of processing—signal detection theory (SDT)—that has been described as particularly helpful in accurately assessing differences in information processing (Lord 1985). Specifically, subjects were given a recognition task and asked to indicate which of 20 attributes, if any, had been mentioned in the radio ad. A seven-point scale was used to indicate how confident they were about each of their responses (1=not at all confident; 7=very confident); however, this measure provided no additional insight and is not discussed further. Of the 20 listed attributes, 10 were distractors, 5 schema relevant, and 5 non–schema relevant. Attributes designed to be highly schema relevant versus nonrelevant and shown versus not shown were randomly placed throughout the list.

A primary variable of interest is the sensitivity measure calculated from SDT. Sensitivity reflects the extent to which subjects can discriminate targets (advertised attributes) from distractors (nonadvertised

Figure 1
Experimental Procedure



attributes). Consumers who can clearly differentiate presented from nonpresented attributes, particularly non–schema-relevant attributes, have deeply processed the information in the ad; thus, sensitivity can be considered an indicator of the level of processing. The A' statistic, a nonparametric form of Swets D, was used as the measure of sensitivity. The measure varies from .5 to 1, with .5 meaning no ability to discriminate targets from distractors and 1 meaning perfect ability. Although A' is considered a better measure of sensitivity to yes/no task responses than is Swets D (Stanislaw and Todorov 1999), both measures yielded the same pattern of effects in this study.

A second measure, response bias, was used to assess whether processing was schema or data driven. Response bias assesses consumers' tendencies toward responding "yes" or "no" to queries about whether an attribute was presented in the ad. To the extent that processing is more schematic than data driven, we should see greater bias toward responding "yes" to schema-consistent attributes whether they were presented in the ad or not.

Manipulation Checks. The manipulation checks for arousal (alpha=.96), valence (r=.79), and attribute relevancy (average r=.59) were identical to those used in the pretests.

Results

Order of viewing was originally included as a covariate. However, because it had no effect on any of the analyses, the analyses were rerun without order of viewing.

Manipulation Checks

To assess the success of the manipulations, a MANOVA was conducted with measures of arousal and valence as dependent variables. The results revealed significant multivariate effects for the main effect of valence (F (2,197)=154.05, p<.001) and arousal (F (2,197)=101.45, p<.001). The multivariate test for the two-way interaction was nonsignificant (F<1).

The univariate test for the valence manipulation showed that subjects exposed to movie clips that were designed to promote positive valence reported feeling more positive ($\bar{X}$=4.07) than did those exposed to movie clips that were designed to promote negative valence ($\bar{X}$=2.46; F (1,198)=306.87, p<.001). Although the negative valence condition was not as negative as we would have liked it to be, it was significantly lower than a neutral rating of 3 (t (101)=7.72, p<.01). Arousal level was nonsignificant (F (1,198)=1.01, p>.30). Therefore, the valence manipulation was successful. The univariate test for the arousal manipulation showed that subjects exposed to highly arousing movie clips reported higher levels of arousal ($\bar{X}$=1.75) than did those exposed to the moderately arousing movie clips ($\bar{X}$=-.65; F (1,198)=203.05, p<.001). The effect of valence was nonsignificant (F (1,198)=2.18, p >.14). In summary, the orthogonal manipulations of arousal and valence appeared successful. The correlation between valence and arousal was nonsignificant (r=.04; p>.60).

Independent Variables at Retrieval. A MANOVA of the valence and arousal measures collected at retrieval revealed a significant multivariate test of valence (F (2,197)=16.97, p<.001), with those in the positive valence condition still feeling more positive ($\bar{X}$=3.61) than those in the negative valence condition ($\bar{X}$=3.05; F (1,198)=27.22, p<.001). To conclude that the observed effects are attributable to differences at the encoding of ad information and not retrieval factors, we control for the effects of valence and arousal at retrieval in subsequent analyses.

Attribute Relevancy. A planned comparison was conducted to determine if those attributes designed to be highly relevant versus nonrelevant to the "elegant restaurant" schema were perceived as such. As expected, the ten attributes designed to be highly relevant with the schema of an elegant restaurant (the five used in the ad plus the five distractors) were judged to be more schema relevant ($\bar{X}$=7.52) than were the ten designed to be relatively nonrelevant (the five used in the ad plus the five distractors; $\bar{X}$=3.96; t (187)=43.5, p<.001).

Test of the Hypotheses Using Signal Detection Theory

A measure of sensitivity (A') was calculated for the highly relevant and nonrelevant attributes. An ANOVA was conducted with valence and arousal as between-subjects factors and attribute relevancy as a within-subject factor. Recall that sensitivity measures consumers' abilities to discriminate target attributes (those presented in the ad) from distractors (those not presented in the ad) with values theoretically ranging from .5 (complete inability to discriminate targets from distractors) to 1.0 (perfect ability). ANOVA results are shown in Table 1, and cell means are presented in Table 2.

The results shown in Table 1 reveal the main effects of attribute relevancy (F(1,199)=79.94, p<.001) and arousal (F (1,199)=4.47, p=.04). An interaction between valence and attribute relevancy was also observed (F=10.07, p<.01). To determine whether

Table 1
ANOVA Results Using A' as a Measure of Sensitivity

Source	Degrees of Freedom	F	p
Between-Subjects Effects			
Arousal	1	4.47	.04
Valence	1	2.32	.13
Arousal × Valence	1	.00	.95
Within-Subject Effects			
Attribute relevancy	1	79.94	.00
Arousal × Attribute relevancy	1	.30	.58
Valence × Attribute relevancy	1	10.07	.01
Arousal × Valence × Attribute relevancy	1	.00	.99
Error	199		

Table 2
Mean Values Using A' as a Measure of Sensitivity

	Attributes Highly Relevant to an Elegant Restaurant	Attributes Less Relevant to an Elegant Restaurant
Negative Valence		
Moderate arousal	.593	.798
High arousal	.559	.746
Positive Valence		
Moderate arousal	.613	.715
High arousal	.581	.666

Notes: A'=.50 indicates a target can not be distinguished from a distractor; A'=1 indicates perfect performance in discriminating targets from distractors.

these results are due to the effects of mood at encoding, not retrieval, the ANOVA was rerun with a control for valence and arousal at retrieval. Neither valence nor arousal covariates at retrieval were significant (both ts<1) and including the covariates did not change the results. Therefore, the effects in Table 1 can be attributed to mood at encoding, not retrieval.

Effect of Valence on Ad Processing. We anticipated that valence might affect whether processing was data driven or schematic. Specifically, H1 and H2 predicted that consumers in the negative valence condition would engage in more processing of the data in the ad, whereas those in the positive valence condition would engage in more schematic processing.

Consistent with H1, the interaction between valence and attribute relevancy shows that subjects in the negative versus positive valence condition were better at processing the data in the ad because they were better able to discriminate non–schema-relevant attributes in the ad ($\bar{X}$=.77) than were subjects in the positive valence condition ($\bar{X}$=.69; see Table 3).

A second analysis was conducted using the response bias measure to determine how and whether valence influences whether processing is more schema or data driven. Recall that response bias assesses consumers' tendencies to respond "yes" or "no" to queries about whether an attribute was presented in the ad. The theoretical range for this variable runs from –1.0 to +1.0. Positive (negative) values indicate a bias toward responding "no" ("yes"). The closer the number is to zero, the less bias is evident.

Controlling for arousal and valence at retrieval (neither covariate was significant; ts<1), the results of an ANOVA reveal a main effect of attribute relevancy ($F(1,199)=309.55$, $p<.001$) and an interaction between valence and attribute relevancy ($F(1,199)=4.18$, $p<.04$). The main effect reveals a greater bias to respond "yes" to attributes that were highly schema relevant ($\bar{X}$=-.39) versus non–schema relevant ($\bar{X}$=.25). This effect is consistent with the main effect reported previously for the measure of sensitivity, which showed that all subjects appear to process schematically to some extent.

Table 3
Sensitivity Means for the Valence × Attribute Relevance Interaction

	Positive Valence	*Negative Valence*
Schema-relevant attributes	.60[a]	.58[a]
Non–schema-relevant attributes	.69[b]	.77[c]

Notes: Means with different letters are significantly different from one another, $p<.05$.

Table 4
Response Bias Means for the Valence × Attribute Relevance Interaction

	Positive Valence	*Negative Valence*
Schema-relevant attributes	-.48[a]	-.30[b]
Non–schema-relevant attributes	.23[c]	.26[c]

Notes: The theoretical range runs from –1.0 to +1.0. Positive numbers indicate a bias toward responding "no," and negative numbers indicate a bias toward responding "yes" in response to questions about whether a given attribute was included in the ad. Means with different letters are significantly different from one another, $p< .05$.

More relevant is the interaction in Table 4, which shows that subjects in the positive valence condition had a greater bias toward responding that they recognized highly schema-relevant attributes ($\bar{X}$ =-.48) than did those in the negative valence condition ($\bar{X}$= -.30; t (201)=2.79, $p<.01$), regardless of whether the attributes actually appeared in the ad. Positive versus negative valence subjects did not reveal any more response bias for attributes that were relatively nonrelevant to an elegant restaurant schema ($\bar{X}$=.23 and .26, respectively; t<1). Subjects in the positive valence condition appear to have a greater bias toward yea-saying, but only for attributes that are highly schema relevant. This result supports H2 and suggests that the positive valence induced by the movie clips is more likely to facilitate activation of other schema-relevant attributes at the time of ad processing than is a negatively valenced mood.

Effect of Arousal on Ad Processing. The results show tentative support for H3b rather than H3a. The previously mentioned significant main effect of arousal (F(1,199)=4.47, $p=.04$) and nonsignificant arousal × valence interaction (F(1,199)<1) with the measure of sensitivity (A') supports H3b and casts doubt on the competing H3a. As predicted by H3b, subjects in the moderate arousal condition were better able to discriminate target attributes from distractors ($\bar{X}$=.71) than were those in the high arousal condition ($\bar{X}$=.65).

To provide more evidence for the theory underlying H3b, ANOVAs were run on the two self-reported measures that assessed subjects' ability to pay attention to the radio ad. Results for the first measure ("I had a hard time concentrating on the radio ad") revealed only a main effect of arousal (F(1,197)=13.29, $p<.001$). Those in a high state of arousal reported having a more difficult time paying attention to the ad ($\bar{X}$=3.01) than did those in a moderate state of arousal ($\bar{X}$=2.36). Results for the second measure ("My mind wandered to other thoughts as the radio ad was playing") revealed similar effects. Only a main effect of arousal was observed (F(1,196)=4.71, $p<.05$), and subjects in the high (versus low) arousal condition reported having a harder time keeping their minds on the radio ad as it was playing ($\bar{X}$= 3.34 versus$\bar{X}$= 2.92). Combined, these results suggest that arousal works independently of valence, with heightened arousal acting to distract from the processing of subsequently presented information (i.e., the ad).

Additional Findings

The results also revealed several effects that are interesting, though not relevant to our hypotheses. Specifically, the main effect of attribute relevancy with the measure of sensitivity (A') reported in Table 1 shows that consumers' ability to discriminate attributes perceived as highly relevant to an elegant restaurant was worse ($\bar{X}$=.59) than was their ability to discriminate attributes perceived as nonrelevant ($\bar{X}$=.73). This result suggests that all subjects, regardless of valence condition, tend to engage in some degree of schematic processing. Perhaps this is not surprising, as activation of the schema likely interferes with all subjects' discrimination of schema-relevant attributes at retrieval. Consistent with this main effect, the significant interaction between va-

lence and attribute relevancy reported in Table 1 reveals relatively poor discrimination for schema-relevant attributes for both positive ($\bar{X}$=.60) and negative ($\bar{X}$=.58) valence subjects (see Table 3). Poor discrimination suggests that, once a schema is activated, all consumers likely use that schema as a retrieval cue, which interferes with discrimination.

Discussion

Summary and Conclusions

We have indicated that prior research examining program-induced mood has not orthogonally manipulated and separately examined the impact of two dimensions of mood: arousal and valence. By orthogonally manipulating valence and arousal in a single study, we show that these two dimensions have different effects on processing.

Valence was found to affect whether processing is schema or data driven; those in a positive valence mood had a greater tendency to confuse schema-relevant attributes that were presented versus not presented. Compared with those in the negative valence condition, these subjects were more likely to focus and elaborate on schema-consistent attributes. Conversely, the greater ability of those in the negative valence condition to discriminate presented attributes from schema-irrelevant distractors suggests that negative valence stimulates processing of the data.

Two competing theories were proposed for the effect of arousal on ad processing; one suggested that arousal interacts with valence and the other suggested a main effect of arousal, with heightened arousal distracting from ad processing. The latter was supported; subjects in the high arousal condition showed less ability to discriminate attributes presented versus not presented in the ad and reported more difficulty focusing on ad content at encoding. Thus, the arousal dimension of mood appears to influence whether processing is deep or shallow, with high arousal producing shallower processing.

Future studies focusing on the valence dimension of mood should consider the impact of valence in terms of schema versus data-driven processing as opposed to shallow versus deep processing. We found no evidence that valence affects whether processing is shallow or deep. Moreover, an ANOVA on the total number of attributes correctly recognized (i.e., total number of hits), regardless of attribute relevancy, reveals only a main effect of arousal ($F(1,202)=10.29$, $p=.002$), not valence (nor was the arousal × valence interaction significant; both $Fs<1$). Instead, valence seems to affect only the total number of correct hits when it is allowed to interact with attribute relevancy ($F(1,199)=12.22$, $p=.001$). This interaction suggests that valence affects whether processing is schema versus data driven, not deep versus shallow.

Our research also attempted to resolve a nagging issue that pervades research on mood effects on memory. Specifically, prior research makes it unclear whether mood effects on memory are attributable to mood at encoding or mood at retrieval. By measuring and covarying mood at retrieval, we can attribute the results observed here to mood effects at encoding.

Limitations

Although the results of this study shed additional light on the effects of mood on information processing, certain elements of our study weaken our ability to make strong conclusive statements about the independent effects of arousal and valence on ad processing. First, a study that uses three levels of arousal (high, neutral, and low) and three levels of valence (positive, neutral, and negative) could provide greater insight into the effects of each dimension on ad processing. Second, the negative valence condition used in this study was not as negative as we would have liked. Third, without the use of a control group, it is difficult to make conclusive statements as to whether negative valence leads to greater amounts of data-driven processing than positive valence or whether the results found in this study are simply attributable to the effects of positive valence. Fourth, the conclusions drawn from this research are based on a single study that relies almost exclusively on results from a single recognition task. Additional research that incorporates multiple studies using a variety of measures (e.g., free recall, attitude) is warranted. Fifth, similar to most controlled experiments on mood, our study is limited by the use of a forced exposure context, student subjects, and a lab context. Assessing the generalizability of our findings to more naturalistic contexts is clearly a research priority.

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Appendix 1
Pretest and Manipulation Check Results for Arousal and Valence Levels of Movie Clips

	High Arousal (-4= low arousal; +4= high arousal)		Moderate Arousal (-4= low arousal; +4= high arousal)	
	Pretest	*Manipulation Check*	*Pretest*	*Manipulation Check*
Positive Valence (1= negative valence; 5= positive valence)	Final scene from *Rocky III*	A=+2.27 V= 3.95	A=+1.76 V= 4.13	"Magic Carpet Ride" Song from *Aladdin*	A= –.18 V= 3.90	A= –.64 V= 3.93
	Zipper scene from *There's Something About Mary*	A=+2.35 V= 4.50	A=+1.68 V= 4.15	"Hakuna Matata" song from *The Lion King*	A= +.38 V= 3.95	A= –.75 V= 4.03
	Pretest	*Manipulation Check*	*Pretest*	*Manipulation Check*
Negative Valence (1= negative valence; 5= positive valence)	Suicide scene from *Full Metal Jacket*	A=+2.28 V= 2.10	A=+1.96 V= 2.68	Death of Mufasa in *The Lion King*	A= +.42 V= 2.30	A= –.24 V= 2.25
	Hitchhiker picked up in *The Hitcher*	A=+2.37 V= 2.19	A=+1.75 V= 2.39	Mother with sick child in *Cry Ethiopia Cry*	A= –.83 V= 1.85	A= –.86 V= 2.50