The Influence of Classical Conditioning Procedures on Subsequent Attention to the Conditioned Brand

Chris Janiszewski; Luk Warlop

The Journal of Consumer Research, Vol. 20, No. 2 (Sep., 1993), 171-189.

Stable URL:
http://links.jstor.org/sici?sici=0093-5301%28199309%2920%3A2%3C171%3ATIOCCP%3E2.0.CO%3B2-S

The Journal of Consumer Research is currently published by Journal of Consumer Research Inc..

The Influence of Classical Conditioning Procedures on Subsequent Attention to the Conditioned Brand

CHRIS JANISZEWSKI
LUK WARLOP*

Three experiments are used to investigate the influence of conditioning procedures on attention to a conditioned stimulus. In experiment 1, scenes presented in a sequence that is consistent with prescribed conditioning procedures are shown to encourage attention to the advertised brands in subsequent product displays. Experiment 2 suggests that differential attention to conditioned brands can be attributed to the signaling properties the brand acquires as a consequence of conditioning. Evidence from a third experiment raises the possibility that semantic conditioning may be responsible for the effects observed in experiments 1 and 2. The findings suggest that current prescriptions on the use of conditioning procedures may need to be updated.

Consumer research involving classical conditioning techniques has focused primarily on the transfer of affective responses (Allen and Janiszewski 1989; Allen and Madden 1985; Bierley, McSweeney, and Vannieuwkerk 1985; Gorn 1982; Shimp, Stuart, and Engle 1991; Stuart, Shimp, and Engle 1987). The emphasis on affective responses can be attributed to the cognitive orientation of consumer research and the dominance of the attitude construct within the discipline (Shimp 1991). The emphasis on the transfer of responses can be attributed to the tendency of consumer researchers to view conditioning as a learning process, similar to that proposed by Pavlov (1927).

It is quite natural that consumer research should focus on affective learning, given the historic interest the field has exhibited in attitude formation and change. However, interest in affective responses comes at the expense of other responses that are of comparable importance to the understanding of consumer behavior. Particularly relevant is the possibility that conditioning procedures can influence attention and approach behavior. As first shown by Brown and Jenkins (1968), successful conditioning can be accompanied by a secondary behavior that consists of the subject approaching the conditioned stimulus. Similarly, McSweeney and Bierley (1984) conclude that "a US [unconditioned stimulus] that evokes approach need not be found before classical conditioning can be used to move people closer to displays in supermarkets. *Any* reinforcer may be used as the US to condition this (approach) behavior" (p. 621; emphasis added). Thus, the desire to approach a conditioned stimulus may be a natural by-product of the conditioning procedure.

To appreciate how conditioning might encourage attention, approach behavior, and an affective response simultaneously, one must view conditioning as a procedure, not a process. When viewed as a process, conditioning is theoretically constrained to explaining all learning as a response transfer between the unconditioned stimulus and the conditioned stimulus (Pavlov 1927). Thus, when multiple responses result from conditioning there must be multiple transfers, a prediction that is at odds with Pavlovian explanations of conditioning processes.

In contrast, viewing conditioning as a procedure provides the flexibility to consider the impact of conditioning on multiple learning systems. A conditioning procedure can encourage perceptual, attentional, and conceptual systems to inductively learn about covariations in the environment. At the most basic level, a conditioning procedure can help the perceptual system isolate potentially important event covariations. Once hypotheses about the paired events have been generated,

*Chris Janiszewski is associate professor of marketing and Luk Warlop is a graduate student at the College of Business, University of Florida, Gainesville, FL 32611. The authors would like to thank Joseph Alba, Chris Allen, Joel Cohen, Richard Lutz, Alan Sawyer, and the three reviewers for their helpful comments on the manuscript. The authors would also like to thank the William Cook Agency and Anthony Bouton for their assistance in stimulus development and Derek Abraham, Dasha Baez, Sharon Brackett, Cheryl Cox, Susan Craft, Lori Giardino, Laura Jacobson, John Kubs, Michael Leone, Joel McCall, Andrew Mirman, Tim O'Sullivan, Gladys Reyna, Stephen Stark, Thomas Thurston, and Karen Yureka for their assistance in eye-tracking data collection and analysis.

the perceptual system can encourage higher-order learning centers to allocate attention to information about these events. There can be implicit learning of the association between a conditioned stimulus and an unconditioned stimulus, and, with further testing, a conscious awareness of the contingency between the events. Thus, covariation assessment, attention, implicit associative learning, and contingency awareness become natural by-products of learning via a conditioning procedure. Conditioning procedures can be used to encourage consumers to implicitly learn about covariations between the brand and meaningful events, to establish or reinforce associations between the brand and significant attributes, and to establish associations between a brand and affectively charged events.

We begin by investigating the influence of conditioning procedures on the allocation of attention. In the first section, we will review evidence on the potential for conditioning procedures to influence attention to a conditioned stimulus and the reasons contingency awareness may not be necessary for this effect. Experiment 1 will demonstrate that conditioning procedures can be used to encourage attention to a conditioned brand, but that this effect does not seem to depend on contingency awareness. Experiment 2 will differentiate between two possible explanations for the influence of conditioning procedures on the allocation of attention, concluding that subjects attend to the conditioned stimulus because it is potentially informative (Brown and Jenkins 1968; Hall and Channell 1985). Experiment 3 will demonstrate that conditioning procedures can be used to reinforce associations between a conditioned and an unconditioned stimulus. The final section will discuss the implications of the conditioning procedure on the allocation of attention and associative learning.

BACKGROUND

Conditioning and Attention

Evidence for a relationship between conditioning and attention was originally provided by investigations into the orienting response (see Lynn [1966] and Razran [1961] for review). An orienting response is the normal bodily reaction to a novel stimulus, or to a change in a stimulus, and consists of changes in visceral, somatic, cognitive, and neural systems (Sokolov 1963). Fully developed orienting responses, such as those observed in humans, often involve a "specific molar reaction of 'turning' toward the source of the stimulation" (Razran 1961, p. 113; Spinks and Siddle 1983).

Early researchers experienced a difficult time describing the role of the orienting response in conditioning because the orienting response to the conditioned stimulus (CS) and to the unconditioned stimulus (US) closely resembled the unconditioned responses (UR) researchers hoped to condition (e.g., electrodermal responses, heart rate changes, vasoconstriction; Razran 1961). This difficulty led some researchers to conclude that an orienting response to the US was in fact being directly transferred to the CS (Razran 1961). Concurrently, however, others concluded that the orienting response to a CS was a necessary precondition to successful classical conditioning, assisting the subject in learning an association between the CS and US (Vinogradova 1959).

Subsequent investigations into the role of the orienting response in conditioning has continued to emphasize its impact on learning during conditioning trials, but the definition of the orienting response has expanded to include voluntary responses (e.g., attention, approach, and contact). Whereas Sokolov (1963) saw the orienting response as a general readiness to respond, later theorists saw the orienting response as a mechanism that directed attention to arousing stimuli (e.g., the CS and US). For example, Öhman (1979) viewed the orienting response as a "call for processing capacity in a central, limited capacity channel" (p. 444). According to his model, either of two characteristics of a stimulus could be identified by the preattentive processing mechanisms that are responsible for directing attention. First, attention could be allocated when there was a mismatch between a stimulus and expectations created by working memory. Second, attention could be allocated when there was a match between a stimulus and a preattentively primed memory representation that was deemed significant.

Öhman's theory (1979) is instrumental to current explanations of the role of the orienting response in learning and conditioned responding. Pearce and Hall (1992) review animal evidence and conclude that conditioning procedures are most effective when a subject attends (orients) to the CS and the US during initial pairings (Kaye and Pearce 1984). During the course of conditioning trials, the orienting response to the CS will decline as the subject learns that the CS predicts the US, since further attention to the CS is not relevant once the association has been learned (Kaye and Pearce 1984). When the CS is presented in a new context, the CS suddenly takes on renewed significance (Pearce and Hall 1992). The subject will once again orient to the CS, since there is a need to determine whether the CS will continue to predict the US in the novel context (Hall and Channell 1985). In other words, the CS is interesting because it is potentially relevant to the learning of the CS-US association. If we generalize to the consumer domain, these findings suggest that an ad that more successfully associates a CS and a US may encourage attention (orienting) to the brand at the point of purchase (i.e., in a novel context) because this attention may further assist in the learning of the CS-US association.

Contingency Awareness and Associative Learning

The hypothesis that subjects will allocate attention to a CS in novel contexts is intriguing but troubling,

given our current understanding of the role of awareness in human associative learning. In studies investigating affective responses it has been found that contingency awareness, awareness of the CS-US pairing, often accompanies associative learning (Allen and Janiszewski 1989; Shimp et al. 1991b). Subjects use awareness of the CS-US pairing to respond to the CS during test trials (i.e., in their attitudes expressed on an affective-response scale). Yet, once subjects are aware of the CS-US association, they should no longer engage in attempts to confirm the association. In other words, once contingency awareness accompanies associative learning, there should not be increased attention to the CS in a subsequent context because the association has already been learned. Therefore, increased attention to a CS in a novel context should occur only when prior CS-US pairing suggests an association but the association has not yet become strong enough to result in contingency awareness. In effect, attention to the CS in a novel context would be a form of hypothesis testing, a testing of an association that is not yet strong enough to have created contingency awareness.

The hypothesis that associative learning in the absence of contingency awareness will promote attention to the CS in a novel context is compatible with contemporary explanations of associative learning systems. Associative learning theorists propose a two-stage learning system in which a perceptual system selects features and feature combinations that can be investigated and subsequently incorporated into rules in a second, higher-order system (Hall 1991; Holyoak, Koh, and Nisbett 1989). The perceptual system is nonconscious, parallel, and has the ability to select from large arrays of data, identifying potential covariations for subsequent learning by the higher-order system (Holyoak et al. 1989). In effect, the perceptual system is an information-generation device that selects and creates the small array of information the higher-order system will process. As a person learns a CS-US association, the perceptual system will gather information on these stimuli to assist the higher-order system in assessing the strength of this relationship. As the higher-order system devotes resources to assessing the strength of this relationship, confirmations will often be accompanied by contingency awareness.

The goal of this article is not to explicate the role of contingency awareness in an associative learning process, although the results will indirectly comment on this issue. Instead, we wish to demonstrate that a conditioning procedure can promote associative learning and that a consequence of the process of learning is increased attention to the CS. Attention to the CS should be particularly strong when prior pairings of the CS and US have encouraged the formation of an association hypothesis but pairings have been insufficient to allow for contingency awareness. In experiment 1, a conditioning procedure is shown to encourage attention to a CS in a novel context, but this effect occurs in the absence of contingency awareness.

EXPERIMENT 1

Experiment 1 used television commercials to investigate whether the allocation of attention to brand choices could be influenced by a conditioning procedure. We expected that commercials organized to be consistent with a forward conditioning sequence would encourage consumers to attend to a brand sooner than commercials organized with a random conditioning sequence. Attention to the brands would be assessed in the context of a product display.

Stimuli

The stimuli were constructed with two 30-second television commercials, a Mountain Dew commercial featuring white-water surfing and a Canada Dry commercial featuring scenes of couples having fun. The original version of each commercial consisted of a sequence of approximately 18 segments arranged to catchy jingles. For each commercial, the 18 segments were divided into three groups: six segments showing the product only (CS), six segments that were interesting or fun (US), and six segments of the product being consumed (filler segments). The CS segments prominently displayed the product package and lasted from one to two and one-half seconds. The US segments were four to eight seconds long, often consisting of multiple cuts of a similar scene. The filler segments showed actors consuming or enjoying the product and often included a nonprominent display of part or all of the product package. The filler segments lasted between one and three seconds. These segment lengths were dictated by the composition of the original ads.

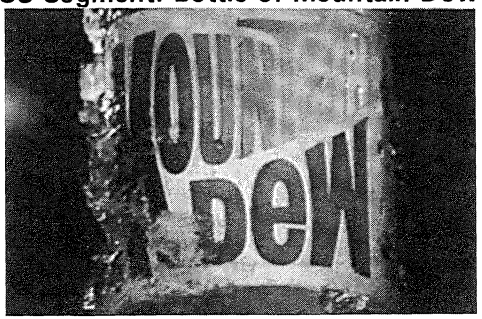
Two experimental commercials were made from each original. The forward conditioning version of each commercial consisted of six trials. Each trial consisted of a product segment (CS), followed by an entertaining segment (US), followed by a product-consumption segment (filler). Figure 1 shows scenes from the six trials (18 segments) of the Mountain Dew commercial. Trial 1 begins with a segment showing ice hitting a bottle of Mountain Dew (CS segment), followed by a segment showing teenagers jumping into a mountain stream (US segment), and ending with a segment showing a woman consuming a bottle of Mountain Dew (filler segment). Trials 2–6 followed an identical pattern. Each segment began immediately after the other as did each trial (e.g., a filler segment was immediately followed by a CS product segment).

The random conditioning versions of the experimental commercials consisted of a random ordering of the six trials representing the six possible orders of a CS, a US, and filler segments (e.g., CS → US → filler; CS → filler → US; US → CS → filler; US → filler →

FIGURE 1

SEQUENCE OF SEGMENTS FOR MOUNTAIN DEW COMMERCIAL: EXPERIMENT 1

1. CS Segment: Bottle of Mountain Dew



Time: 1.5 Sec. Random: # 2

2. US Segment: Surfers Jump into River

Time: 5.0 Sec. Random: # 3

3. Filler Segment: Consume Product

Time: 1.3 Sec. Random: # 1

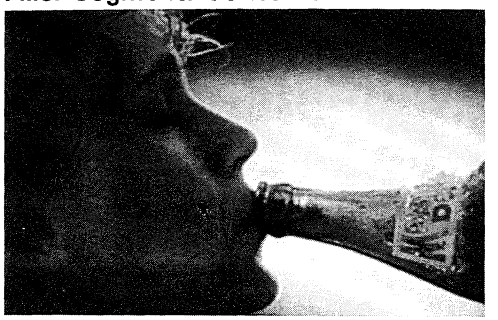
4. CS Segment: Can of Mountain Dew

Time: 0.3 Sec. Random: # 4

5. US Segment: Surfing

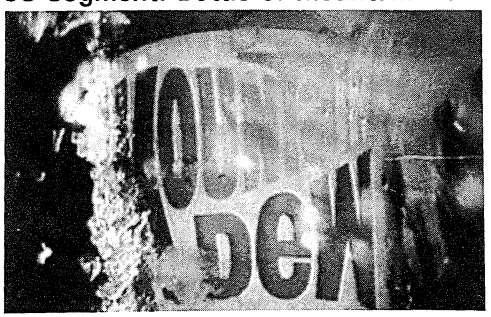
Time: 4.7 Sec. Random: # 5

6. Filler Segment: Consume Product



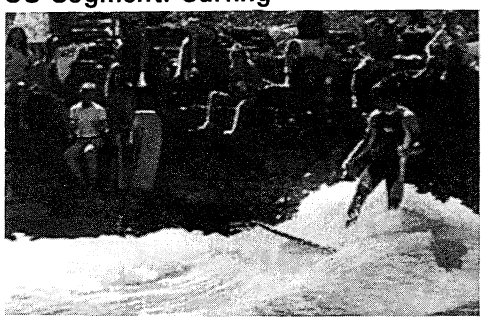
Time: 1.5 Sec. Random: # 6

7. CS Segment: Bottle of Mountain Dew



Time: 0.5 Sec. Random: # 7

8. US Segment: Surfing

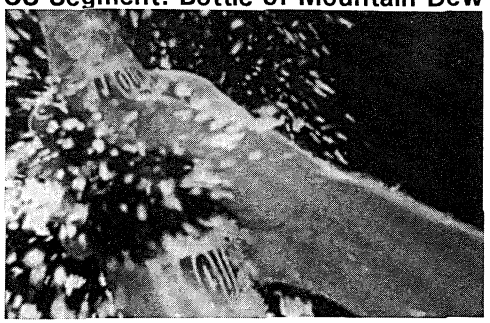


Time: 3.0 Sec. Random: # 9

9. Filler Segment: Consume Product

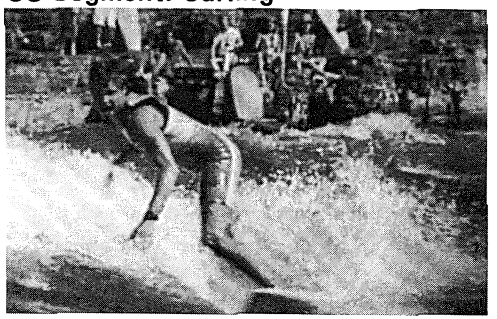
Time: 1.0 Sec. Random: # 8

10. CS Segment: Bottle of Mountain Dew



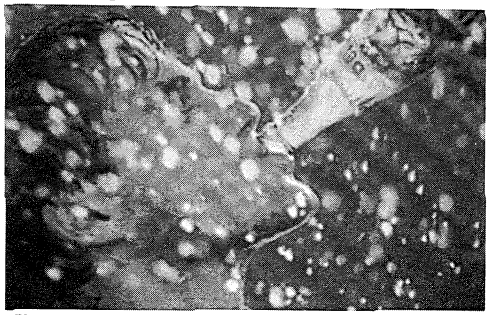
Time: 0.5 Sec. Random: # 12

11. US Segment: Surfing



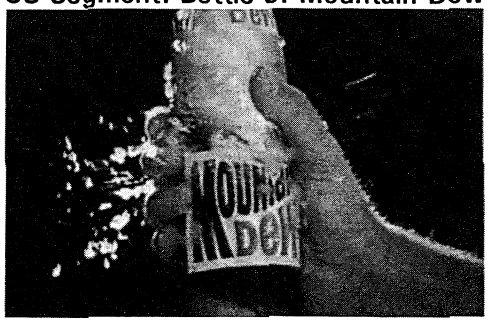
Time: 4.3 Sec. Random: # 10

12. Filler Segment: Consume Product



Time: 0.3 Sec. Random: # 11

13. CS Segment: Bottle of Mountain Dew



Time: 0.7 Sec. Random: # 15

14. US Segment: Surfing

Time: 3.0 Sec. Random: # 14

15. Filler Segment: Crowd Cheering

Time: 2.0 Sec. Random: # 13

16. CS Segment: Can of Mountain Dew

Time: 0.3 Sec. Random: # 17

17. US Segment: Surfing

Time: 2.7 Sec. Random: # 16

18. Filler Segment: Crowd Cheering

Time: 1.0 Sec. Random: # 18

CS; filler → CS → US; filler → US → CS). The lower right-hand corner of each scene in Figure 1 includes the key word "Random" and a number indicating the order in which this scene appeared in the random conditioning version of the commercial.

Design

The experiment was a between-subjects manipulation of the conditioning procedure (forward, random) with a stimulus replication.[1] One treatment group received 18 forward conditioning trials for brand A (Mountain Dew) and 18 random conditioning trials for brand B (Canada Dry). A second treatment group received 18 forward conditioning trials for brand B (Canada Dry) and 18 random conditioning trials for brand A (Mountain Dew). The conditioning trials for both groups were accomplished by embedding three presentations of forward and random conditioning commercials within a sequence of six filler ads. Filler ads were all for moderately known brands to allow for the observation of a conditioning influence (Shimp et al. 1991b).

Procedure

Subjects. Subjects were 54 undergraduate juniors and seniors enrolled in the senior author's consumer behavior course (28 women, 26 men). Subjects participated in the experiment eight weeks prior to the class discussion of the conditioning literature.

Stimulus Presentation. Subjects were invited into the laboratory one at a time. Upon arriving, the subject was placed in a private room containing a television and VCR and given the following instruction:

> In this first experiment you will watch a series of *12* commercials. All of the commercials are for soft drinks. Some of the commercials will be repeated because you often see a commercial more than once during a session of television viewing. Please pay careful attention to the commercials. The experimenter will stop the tape when it is done.

The experimenter then started the tape and left the room.

The experimental commercials were presented as part of a series of commercials for eight different soft drinks. Each of the two experimental tapes consisted of 12 commercials, each commercial separated by five seconds of black space. The Canada Dry commercial occupied the second, sixth, and tenth positions in the sequence of ads. The Mountain Dew commercial occupied the fourth, eighth, and twelfth positions in the sequence of ads. The other commercials were for Minute Maid (first position), Sunkist (third), Slice (fifth), Schweppes ginger ale (seventh), Orange Crush (ninth), and Seven-Up (eleventh). The filler commercials were selected to be inconsistent with conditioning procedures.

Dependent-Measure Stimuli. Dependent-measure stimuli consisted of 12 computer-generated video slides, each consisting of a diamond-shaped arrangement of four of the eight brands. Each soft drink container was digitized with a color scanner, touched up with a high-resolution paint package, and then arranged into a video presentation slide with Microsoft Corporation's Powerpoint presentation package. The containers for the target brands (i.e., Mountain Dew and Canada Dry) appeared on the third, sixth, ninth, and twelfth stimulus slides, hereafter called the first, second, third, and fourth test presentation. The test stimuli were presented with a 20-inch Multisync 5D monitor equipped with a Video Seven high-resolution graphics card (256 colors at 800 × 600 resolution).

The test presentations of interest were the second and third in the sequence. Limiting the emphasis to the second and third presentation was a consequence of the computer presentation software and the characteristics of the conditioned stimuli. First, to present the stimuli at a resolution and a color that made them look realistic, a commercial computer presentation package had to be used (Powerpoint). Like most computer presentation software, Powerpoint writes to the video screen line-by-line, beginning with the upper left-hand corner and ending with the lower right-hand corner. The roll-down effect on the screen was noticeable and had the potential to influence attention (all pretest subjects mentioned this problem). Second, the Mountain Dew ad used a bottle as a CS, whereas the Canada Dry commercial and all the filler ads but one used cans as the pictured brands. Pretesting demonstrated that subjects were highly sensitive to the nonconforming shape of the bottle, even though it had been sized to the height of the cans (all pretest subjects stated that the bottle influenced their attention because it was different). To reduce the shape bias, the first test presentation consisted of a display with the Mountain Dew bottle at the top of the scene and the Canada Dry can at the bottom of the scene (Seven-Up on the left, Schweppes on the right).

The second presentation had the Mountain Dew bottle placed on the left point of the diamond and the Canada Dry can placed on the right point of the diamond, in effect removing the roll-down bias. A Schweppes ginger ale container was at the top of the diamond, and a Seven-Up container was placed at the bottom of the diamond. The third presentation reversed the positions of the Canada Dry and Mountain Dew containers, with the Canada Dry can to the left and the Mountain Dew bottle to the right, a counterbalancing procedure that controlled for any left-to-right scanning bias. The Seven-Up container was at the top and the Schweppes ginger ale container at the bottom of this slide. The fourth

[1] A random control group was not used in this design because of resource constraints associated with the eye-tracking procedure. A random control group was used in experiments 2 and 3.

presentation had the Canada Dry can on the top and the Mountain Dew bottle on the bottom (Seven-Up on the right, Schweppes on the left) and thus was also susceptible to roll-down effects. The target experimental brands did not appear in any of the other presentations.

Attention Monitoring Apparatus. After viewing the experimental tape the subject was led into a second room containing an Applied Science Laboratory corneal-reflection eye-tracking system (Young and Sheena 1975). The subject was seated in front of a stimulus presentation monitor. The monitor screen was located approximately 34 inches from the subject (the horizontal plane of the eyes varied by the height of the subject). The eye-monitoring camera was located directly below the computer screen and was also approximately 34 inches from the subject's eyes. The distance and angle from the eye to the computer screen and camera were determined by a factory calibration of the eye-tracking system.

After being seated, the eye-tracking system was explained to the subject. Then, the subject was asked to place his/her chin on a chin rest. At this point an eye calibration was performed by having the subject look at a video display of nine numbers arranged in a 3 × 3 grid and then recording the characteristics of the eye as it looked at each position.[2] After the calibration was completed, the subject took a short break and then received instructions about viewing the soft drink displays.

Measuring Conditioned Attention. After returning to the eye-tracking station, the subject was told that s/he would see a series of 24 slides, every second slide being a diamond arrangement of soft drink containers. Subjects were informed that filler slides that had an "X" in the middle of the slide would appear prior to each soft drink slide. The subject was asked to look at the "X" until a stimulus slide appeared, then let his/her eye look at the soda containers in any fashion s/he pleased. Once the subject understood all of the instructions, the presentation was started. Slides were then presented at five-second intervals. In a typical procedure, the time between the end of the commercial presentation and the beginning of the test stimulus presentation was approximately 10 minutes.

Analysis

Data Preparation. The eye-tracking system recorded the distance between the center of the pupil and the corneal reflection every sixtieth of a second. This distance was converted into an x, y coordinate that corresponded to a location in the viewing area. These raw data were then parsed into fixations by identifying sequences of observations in which there was limited displacement of focus. Fixations were identified with an algorithm that identified sequences of data points that represented less than a degree of movement within a 117-millisecond time period. This manufacturer-defined algorithm for identifying fixations is a well-accepted standard in eye-fixation research (Stark and Ellis 1981).

A subject's fixation data were then combined with files specifying the location of each object in each display. Thus, a summary of each subject's pattern of attention to each slide was constructed. The resulting summary files contained information on the sequence of fixations, the timing of fixations, and the number of fixations on each soda container in the display.

Data Analysis and Results. Each brand of soda had a sequence score (1, 2, 3, or 4) associated with the order in which it was viewed. Nonviewed brands were assigned a score of 4. We a priori limited our interest to the second and third presentation but provide all data for completeness.

Table 1 reports means that were used in the analysis. The analysis looked at the average order of viewing the Mountain Dew container relative to the Canada Dry container (see, e.g., difference scores in column 3 of Table 1). A repeated-measures analysis of viewing orders in the second and third presentation showed a significant influence of the conditioning procedure manipulation on the order of attention to Mountain Dew and Canada Dry. Across the two presentations, Mountain Dew was viewed 0.81 brands sooner ([−0.79 + −0.83]/2) than Canada Dry by the Mountain Dew forward conditioning group but 0.24 ([0.42 + 0.05]/2) brands later than Canada Dry by the Canada Dry forward conditioning group, a significant difference

TABLE 1

AVERAGING VIEWING ORDER OF SOFT DRINK CONTAINERS: EXPERIMENT 1

	Mountain Dew	Canada Dry	Difference (SD)
First presentation:			
Mountain Dew forward	1.46	3.21	−1.75 (1.45)
Canada Dry forward	1.79	3.00	−1.21 (1.61)
Second presentation:[a]			
Mountain Dew forward	2.13	2.91	−.79 (1.74)
Canada Dry forward	2.75	2.33	.42 (2.10)
Third presentation:[a]			
Mountain Dew forward	1.92	2.75	−.83 (1.71)
Canada Dry forward	2.50	2.45	.05 (1.97)
Fourth presentation:			
Mountain Dew forward	2.87	2.33	.54 (2.06)
Canada Dry forward	3.00	2.13	.87 (1.92)

NOTE.—There were 24 subjects per condition.
[a]Repeated-measures analysis used data from the second and third presentation.

[2]A description of the eye-tracking system and calibration methodology can be found in Young and Sheena (1975).

($F(2,45) = 3.33, p < .05, \omega^2 = .05$).[3] On average, Mountain Dew was seen sooner ($\bar{X} = 2.13$, $\bar{X} = 1.92$) than Canada Dry ($\bar{X} = 2.75$, $\bar{X} = 2.50$) by Mountain Dew forward conditioning group subjects ($F(2,45) = 3.19, p < .05, \omega^2 = .05$) but later ($\bar{X} = 2.91$, $\bar{X} = 2.75$) than Canada Dry ($\bar{X} = 2.33$, $\bar{X} = 2.45$) by Canada Dry forward conditioning group subjects ($F(2,45) = 1.60, p = .10, \omega^2 = .02$).[4]

These results suggest that the conditioning procedure was effective at getting the subject to look at the brand presented with a forward conditioning procedure sooner. Although the effect sizes may seem small, varying the order of attention to brands could have a significant influence on market share, when one considers the impact of consideration set size on brand choice (Nedungadi 1990; Urban, Johnson, and Hauser 1985).

Contingency and Demand Awareness

No attempt was made to assess contingency or demand awareness during the study.[5] Instead, independent assessments of contingency and demand awareness were made with unique groups of subjects drawn from a subject pool equivalent to that used for experiment 1. For awareness to have influenced the order of attention to the brands, the subject had to be able to (1) identify the treatment brand during training (a possible consequence of contingency awareness) and (2) use this knowledge to direct attention to the treatment brand during testing.

Our first test investigated whether subjects were able to acquire information during the training session that would allow them to identify the treatment brand. Two groups of subjects were tested. Twenty-six (27) subjects were exposed to the sequence of 12 commercials containing the Mountain Dew (Canada Dry) forward conditioning commercial. Subjects were run in groups of three or fewer to encourage attention and to allow for random assignment. Immediately after viewing the commercials, subjects were asked to complete the contingency-awareness questionnaire.

The first question on the instrument asked subjects which commercial they liked more (see Appendix, question 1) in an effort to indirectly assess whether subjects were aware that one of the brands was being paired with a more positive US. The mean difference in liking did not differ by experimental condition ($F = 1.27, p > .10$; see Table 2). Subjects were then asked to select the ad that did a better job of holding their attention, a question that indirectly assessed whether they could identify the brand that was being paired with a more interesting US (i.e., a form of contingency awareness that might later influence attention). Again, the mean difference did not vary by condition ($F = .09, p > .10$).

Next, a more focused measure of contingency awareness was administered. Subjects were asked to consider the forward conditioning commercial. Subjects were reminded of the type of scenes that had been in the commercial and then asked to recall any pattern in the sequence of the scenes, an open-ended measure of contingency awareness (question 3). Two questions later, subjects were also asked to express any contingency awareness about the random scene sequence commercial, so as to have a comparative control (question 5). For each question, subjects were explicitly prompted to discuss whether some types of scenes always preceded or followed other types of scenes. As shown in Table 2, the stated contingency awareness expressed for the forward conditioning commercial was comparable to the pseudo-contingency-awareness for the random conditioning commercial (in parentheses).

Finally, subjects were told that there was a 50-50 chance that there was a pattern to the scenes they saw in the commercial. They were asked to indicate whether the pairing was (1) fun, active scenes predicted consumption scenes (US → filler), (2) fun, active scenes predicted pictures of the product package (US → CS), (3) pictures of the product package predicted consumption scenes (CS → filler), (4) pictures of the product package predicted fun, active scenes (CS → US), (5) consumption scenes predicted fun, active scenes (filler → US), (6) consumption scenes predicted product package scenes (filler → CS), (7) random order, or (8) don't know. Subjects were asked this question with appropriate labels (e.g., "Surfing scenes always came before soda drinking scenes") and were asked to select as many answers as applied. Again, this question was asked about the forward (question 4) and the random (question 6) conditioning commercials. Responses are shown in Table 2 with the responses for the random conditioning commercial in parentheses.

The pattern of responses suggests that subjects were not aware of the contingency between the CS and the US. Levels of contingency awareness were 8 percent for the Mountain Dew forward commercial subjects (11 percent for the Canada Dry random commercial subjects) and 19 percent for the Canada Dry forward commercial subjects (15 percent for the Mountain Dew random commercial subjects; all $Z < 1$). Thus, reports of contingency awareness seem to be at a chance level. Perhaps the most interesting aspect of the data was the large number of subjects that reported that interesting scenes (US) were followed by consumption (filler). Re-

[3]The analysis with the initial viewing time means provided parallel results.

[4]The analysis could have been performed with the times at which each soft drink container was first viewed. The results of that analysis are similar to those presented. The only difference is that the Canada Dry, instead of the Mountain Dew, means are significantly different in the ninth presentation. We used the order of viewing data because they were less sensitive to subject idiosyncracies (i.e., the length of individual fixations varies widely by subjects).

[5]The eye-tracking data collection procedure involved collecting data for six projects at once. The data reported in this article were the first data to be collected. A contingency- or demand-awareness instrument would have biased data collection for the other five projects.

TABLE 2

RESULTS OF CONTINGENCY- AND DEMAND-AWARENESS TESTS: EXPERIMENT 1

	Mountain Dew forward		Canada Dry forward	
Contingency-awareness test:				
Liking:				
Mountain Dew (1)–Canada Dry (9)[a]	2.74 (2.26)[b]		2.12 (1.73)[b]	
Interest:				
Mountain Dew (1)–Canada Dry (9)[a]	2.74 (1.76)[b]		2.57 (2.10)[b]	
	Mountain Dew forward[c]		Canada Dry forward[c]	
	Mountain Dew (%)	Canada Dry (%)	Mountain Dew (%)	Canada Dry (%)
Stated contingency:				
Mountain Dew	11	(4)		
Canada Dry			(8)	18
Recognized contingency:				
US → filler	55	(59)	(50)	46
US → CS	11	(19)	(15)	19
CS → US	8	(11)	(19)	15
CS → filler	8	(0)	(4)	19
Filler → US	15	(11)	(4)	35
Filler → CS	4	(4)	(8)	8
Random order	15	(8)	(27)	4
Don't know	15	(19)	(15)	8
	Mountain Dew forward (%)		Canada Dry forward (%)	
Demand-awareness test:				
Was there a brand we wanted you to look at?				
No	55		42	
Yes	45		58	
Mountain Dew	35		47	
Canada Dry	0		5	
Other	10		5	
Did you make a conscious effort to look at one of the brands first?				
No	70		64	
Yes	30		36	
Mountain Dew	15		26	
Canada Dry	0		5	
Other	15		5	
Choose the brand we wanted you to look at first:				
Mountain Dew	55		58	
Canada Dry	0		11	
Other	45		31	
Forced-choice contingency ID:				
Mountain Dew	55		58	
Canada Dry	45		42	

[a]Item was a nine-point bipolar scale assessing the liking of or interest in the Mountain Dew commercial relative to the Canada Dry commercial. Scale end points were labeled Mountain Dew (1) and Canada Dry (9).

[b]SD.

[c]Pseudo-contingency-awareness values for the random conditioning commercial appear in parentheses.

ports of this contingency were equivalent among the experimental and random control groups, which suggests that subjects expected this format in soda commercials (i.e., "You engage in an activity and then you have a soda").

Even if subjects could not reliably differentiate between the treatment and test tapes directly after the training session, differences in the commercials may have become more apparent in the course of the eye-tracking procedure. Our second test investigated the possibility that demand awareness influenced the order in which consumers attended to the brands. Subjects (n = 39) were put through the procedure used in experiment 1 (19 viewing the Canada Dry forward tape, 20 viewing the Mountain Dew forward tape) but were interrupted after viewing the presentation of the Canada Dry and Mountain Dew containers that had provided the strongest evidence for conditioning effects (the second presentation). Immediately after viewing this slide, the subject filled out an instrument with the following questions: (1) "As you were looking at the last slide, did you think there was a brand that we wanted you to look at?"; (1a) "If so, which brand?"; (2) "When you were looking at the last slide, did you make a conscious effort to look at one of the brands first?"; (2a) "If so, which brand?"; (3) "If you had to guess which brand we wanted you to look at first, which brand would you choose?"; (3a) "How confident are you about this choice?"; (4) "Either the Mountain Dew or the Canada Dry commercial was organized so that interesting scenes always followed a picture of the product package. Which commercial was organized in this way?"; and (4a) "How confident are you about this choice?" All questions were answered while the critical test slide was present.

If some subjects were demand aware, we would expect them to be able to select Mountain Dew (Canada Dry) as the brand we wanted them to look at or look at first in the Mountain Dew (Canada Dry) forward condition (Table 2). Regardless of experimental condition, an equal proportion of subjects selected Mountain Dew as the brand they thought we wanted them to look at and the brand we wanted them to look at first (both $Z < 1.0$). Even when subjects were forced to guess the identity of the brand we wanted them to view first, there were no differences between conditions (both chi-square nonsignificant at $\alpha = .10$).[6]

Discussion

The first experiment provides evidence that attention can be influenced by a conditioning procedure. Subjects

[6]We performed a demand-awareness analysis. No subjects identified the conditioned brand as the brand we wanted them to look at (question 1a) or stated that they tried to look at this brand first (2a). Two subjects identified the conditioned brand (1a) and guessed with confidence that this was the brand we wanted them to look at first (3 and 3a).

receiving forward conditioning presentations of the Mountain Dew commercial looked at the Mountain Dew container earlier than subjects presented with the random control version of the same commercial. Subjects receiving forward conditioning presentations of the Canada Dry commercial looked at the Canada Dry container sooner than the subjects that viewed the random control version of the commercial. Differential preference for the two versions of each ad (forward and random) did not seem to account for the results, nor did contingency awareness of the CS-US pairing. Subjects seemed to be aware that US and filler scenes were being paired but had little awareness of the CS-US contingency and were just as likely to identify the random control commercial as having contingent CS and US scenes. Yet the first study did not investigate the mechanisms responsible for the influence of the conditioning procedure on attention, nor did it include measures of associative learning. We will address the issue of the underlying mechanism first, leaving measurement of associative learning to experiment 3.

There are two competing viewpoints that may offer a plausible explanation of how conditioning procedures might have influenced attention to a CS. The view advanced thus far is that a basic learning system, a system we call the perceptual learning system, identifies potential covariations within the environment and encourages a higher-order system to test these hypothesized associations by attending to these stimuli. This association hypothesis has a parallel in the animal learning literature. The signaling hypothesis assumes that the pairing of the CS and US allows an animal to learn about the predictive value of the CS, especially when the US has positive or negative consequences (Hall and Channell 1985; Hearst and Jenkins 1974). When the CS is presented in a novel context, subjects attend to the CS to determine whether the previously learned contingency will hold (i.e., to assess the strength of the relationship; Pearce and Hall 1992). In effect, animals actively gather information to test a CS-US association hypothesis. Similarly, we expect that subjects in experiment 1 developed a perceptual "hypothesis" about a CS-US association that encouraged attention to the CS in the subsequent product display.

An alternative explanation for the results observed in experiment 1 relies on traditional Pavlovian conditioning theory, as opposed to associative learning theory, to explain the effects of the CS-US pairing. The results of experiment 1 could be attributed to the direct response transfer of the attention (UR) associated with the entertaining scenes (US) to the product (CS) that preceded those scenes. The transfer of the orienting response from the US to the CS could have occurred in the same way a reflex response is transferred—as a pure consequence of the pairing.

Developing a test to differentiate between these two views is difficult. For example, direct support for the associative learning explanation requires that one monitor the orienting response in two situations (Hall and Channell 1985). First, as associative learning progresses, attention to the CS during conditioning trials should decline because the information becomes redundant—the hypothesis has been generated and the pairing in that context provides no further information. Second, the subject should once again attend to the CS during test trials, because an assessment of the veracity of the association is warranted. Although experiment 1 provided evidence for this second prediction, evidence of declining attention during training would be difficult to generate in a laboratory setting. The heightened attention associated with the laboratory environment would make it difficult to observe a lack of attention to the CS (i.e., it is the only stimulus on the screen).

One possible strategy for differentiating between the associative learning explanation and the response transfer explanation of the differential attention to the CS in experiment 1 is to investigate ancillary predictions associated with each viewpoint. For example, the associative learning explanation suggests that conditioning should be strongest when alternative forms of the CS are used for each trial during training. Alternative forms of the CS should encourage the perceptual system to orient to the CS at each presentation of the CS, thus increasing the likelihood that the perceptual system will begin to learn the association between the CS and the US (Pearce and Hall 1992). Maintenance of the orienting response should speed associative learning because attention is instrumental in learning the CS-US contingency (Öhman 1979; Vinogradova 1965). In operational terms, a commercial employing unique versions of a product scene (CS) in each of the six trials should result in quicker associative learning than a commercial employing the same product scene.

In contrast, the response-transfer view predicts that conditioning will be quicker when the CS is identical during all training trials (McSweeney and Bierley 1984; Pavlov 1927). An identical product scene (CS) will increase the likelihood that the orienting response to the US, the more interesting of the two stimuli, will directly transfer to the CS. This prediction can be traced to Pavlov's definition of the CS as the sense organ stimulation resulting from contact with the CS (Kimble 1961; Pavlov 1927). In effect, a constant CS allows the subject to link the orienting response associated with the US to a consistent sensory representation, thus speeding the rate at which conditioning occurs. In operational terms, conditioning should be quicker when an identical product scene is used for each of the six trials. These alternative predictions were investigated in experiment 2.

EXPERIMENT 2

The procedures used in experiment 2 were similar to those used in experiment 1. The primary differences consisted of a change in the experimental design and a

modification of the experimental materials. The experiment used a 2 (consistency of CS—varied vs. constant) × 2 (brand) design with an independent control group. The two tapes used in experiment 1 served as the varied CS tapes. Both commercials featured five unique CS scenes in the six CS positions. One CS scene was used twice in each commercial because the original commercials contained only five presentations of the brand.

The two constant CS tapes were constructed by replacing the unique CS scenes in the varied CS versions of the test commercials with an identical CS scene. To do this, the longest CS scene from each varied CS commercial was copied and then spliced over the five remaining CS scenes. In this way, all CS scenes in newly created constant CS versions of the test commercials began and proceeded in an identical manner. Differential lengths of the CS slots meant that there was some variability in the length of each CS presentation, but these lengths were identical to those found in the varied CS commercials. Fortuitously, the constant CS scenes were also the cleanest pictures of the products. They filled the entire screen and looked quite similar to the test trial stimuli. The only potential problem was that the Canada Dry CS scene had ice cubes falling in front of the container display (all Canada Dry CS scenes had this characteristic). This movement may have heightened attention, but it also decreased the similarity between the training and test CS. Again, this was an accepted artifact resulting from the use of existing commercials as stimuli.

A fifth condition consisted of a control tape containing the random version of the Mountain Dew and Canada Dry commercials used in experiment 1. This random control would be used to provide a baseline to assess the direction of movement associated with the conditioning procedure. In experiment 1, the sequence of commercials shown to treatment group 2 included a random version of the forward conditioning commercial shown to treatment group 1, and vice versa. This combining of treatment and control conditions resulted in an overstating of the strength of the conditioning manipulation in experiment 1. A control group containing no treatment commercials would be a more conservative comparison group for assessing the strength of the conditioning procedure because it would provide attention measures that were unbiased by conditioning associated with other brands. This fifth condition was such a random control.

Method

Subjects. Subjects were 58 undergraduate juniors and seniors enrolled in the senior author's Consumer Behavior course and 120 undergraduate sophomores, juniors, and seniors from a Principles of Marketing subject pool (64 women, 104 men). Consumer Behavior course subjects participated in the experiment eight weeks prior to the class discussion of the conditioning literature. Conditioning material was not included in the Principles of Marketing course.

TABLE 3

AVERAGE VIEWING ORDER OF SODA CONTAINERS: EXPERIMENT 2

	n	Mountain Dew	Canada Dry	Difference (SD)
First presentation:				
Random control	33	1.54	3.36	−1.81 (1.53)
Varied CS:				
Mountain Dew forward	33	1.88	3.15	−1.27 (1.64)
Canada Dry forward	33	1.33	3.33	−2.00 (1.54)
Constant CS:				
Mountain Dew forward	31	1.45	3.32	−1.87 (1.28)
Canada Dry forward	30	1.36	3.17	−1.80 (1.35)
Second presentation:[a]				
Random control	32	2.22	2.84	−.62 (1.58)
Varied CS:				
Mountain Dew forward	33	1.61	3.18	−1.58 (.93)
Canada Dry forward	33	2.42	2.51	−.09 (2.00)
Constant CS:				
Mountain Dew forward	31	1.94	3.00	−1.06 (1.82)
Canada Dry forward	30	2.37	2.70	−.33 (1.71)
Third presentation:[a]				
Random control	32	2.50	2.43	.06 (1.98)
Varied CS:				
Mountain Dew forward	33	1.91	2.76	−.85 (1.79)
Canada Dry forward	32	2.84	2.10	.75 (1.48)
Constant CS:				
Mountain Dew forward	31	2.29	2.84	−.55 (2.01)
Canada Dry forward	30	2.63	2.37	.27 (1.76)
Fourth presentation:				
Random control	31	3.19	2.03	1.16 (1.81)
Varied CS:				
Mountain Dew forward	32	2.72	2.47	.25 (2.31)
Canada Dry forward	32	2.75	2.19	.56 (1.86)
Constant CS:				
Mountain Dew forward	30	3.00	2.10	.90 (2.00)
Canada Dry forward	30	2.87	2.30	.57 (2.21)

[a]Repeated-measures analysis used data from the second and third presentation.

Procedures. All experimental procedures and analysis techniques were identical to those used in experiment 1. Missing subjects can be attributed to failures in the presentation software (one subject), data lost because of machine or operator failure during eye-tracking (seven subjects), and data lost because of subject movement during recording (variable). Every effort was made to salvage data, hence the number of observations varies for individual test presentations.

Analysis and Results

Data preparation was identical to that in experiment 1. Each brand of soda was assigned a sequence score (1, 2, 3, or 4) associated with the order in which it was viewed. As in experiment 1, we were interested primarily in attention to the brands presented on the second and third presentations, although the means of all data are presented for completeness. Table 3 reports the average rank order of attention to brands by condition and the difference between the rank order of at-

tention to the Mountain Dew container and the Canada Dry container.

The use of a random control design allowed for more conservative tests of conditioning than were performed in experiment 1. In experiment 1, two treatment groups were compared, with the conditioning procedure manipulation having an independent influence in each group. In experiment 2, a unique random control group removed any bias that might have occurred by presenting treatment and control commercials to the same subjects. A priori planned contrasts involved comparing each of the treatment groups' difference scores to the random control group's difference score.

A repeated-measures analysis of viewing orders in the second and third presentation showed a significant influence of the varied CS commercials on the order of attention to Mountain Dew and Canada Dry. Across the two presentations, Mountain Dew was viewed 0.93 brands sooner ([0.94 + 0.91]/2) than Canada Dry by the Mountain Dew varied CS conditioning group, as compared with the random control group ($F(2, 153) = 5.32$, $p < .01$, $\omega^2 = .03$). Canada Dry was viewed 0.61 brands sooner ([−0.53 + −0.69]/2) than Mountain Dew by the Canada Dry varied CS conditioning group, as compared with the random control group ($F(2, 153) = 2.18$, $p = .05$, $\omega^2 = .01$). On average, Mountain Dew was seen sooner by the Mountain Dew varied CS conditioning group subjects ($\bar{X} = 1.61$, $\bar{X} = 1.91$) than by the random control subjects ($\bar{X} = 2.22$, $\bar{X} = 2.50$; $F(2,45) = 5.17$, $p < .05$, $\omega^2 = .05$). On average, Canada Dry was seen sooner by the Canada Dry varied CS conditioning group subjects ($\bar{X} = 2.51$, $\bar{X} = 2.10$) than by the random control subjects ($\bar{X} = 2.84$, $\bar{X} = 2.43$; $F(2,45) = 1.83$, $p < .10$, $\omega^2 = .01$).

A repeated-measures analysis of viewing orders in the second and third presentation showed an insignificant influence of the constant CS commercials on the order of attention to Mountain Dew and Canada Dry. Across the two presentations, Mountain Dew was viewed 0.52 brands sooner ([0.44 + 0.61]/2) than Canada Dry by the Mountain Dew constant CS conditioning group, as compared with the random control group ($F(2, 153) = 1.62$, $p > .10$, $\omega^2 < .01$). Canada Dry was viewed 0.25 brands sooner ([−0.29 + −0.21]/2) than Mountain Dew by the Canada Dry constant CS conditioning group, as compared with the random control group ($F(2, 153) = 0.37$, $p > .05$, $\omega^2 < .01$).

Discussion

The results of experiment 2 suggest that the associative learning hypothesis may provide a better explanation of the influence of the conditioning procedure on attention to conditioned stimuli. The use of varied CS scenes during training supposedly increased attention to the conditioned stimuli, which increased the likelihood a CS-US association would develop. As a consequence, subjects were more likely to attend to the conditioned brand during the presentation of the product displays. The associative learning view would attribute attention to the CS to the subject's attempt to more confidently learn the CS-US contingency—a consequence of gathering more information on this association hypothesis in a novel context (Pearce and Hall 1992). In contrast, the response transfer view would have predicted that the constant CS would have allowed for quicker conditioning. Although the constant CS means were in the proper direction, these differences did not reach significance.

Admittedly, the results of the second experiment cannot be considered overwhelming evidence for the associative learning explanation of the role of attention in conditioning. First, the influence of the varied CS conditioning procedure on attention was small, with ω^2 approaching only .03 in the most conservative tests. Second, a significant influence of the conditioning procedure on attention was limited to Mountain Dew, one of two of the brands studied, although the tests for Canada Dry did approach significance. Third, the manipulation was not a direct test of the associative learning and response transfer hypotheses but an indirect test of ancillary predictions of each explanation of the relationship between conditioning procedures and attention.

Despite these limitations, one must keep in mind that experiment 2 was an empirical test of two competing viewpoints in a domain in which stimulus materials, procedures, and contexts all influence the strength of the effects. Admittedly, the laboratory environment provided controls that would not have been available in the natural environment, but there were also constraints that limited the size of the conditioning effects. First, the treatment commercials employed weak unconditioned stimuli, as is usually the case with ad material, and moderately familiar brands, a potential latent inhibition problem. Second, the experimental manipulation consisted of only 18 trials embedded in three commercials, a small fraction of the number of repetitions consumers encounter in a typical ad campaign. Third, the test materials provided for control in measurement but used only four brands. When one accounts for the roll-down bias, it was often the case that the subject was making a decision on whether to attend to one of two brands (i.e., the left or right side of the diamond), effectively placing a ceiling on the size of the treatment effect. Thus, it is quite difficult to determine whether the effect sizes observed in experiment 2 are representative of the relationship between conditioning procedures and attention in the marketplace.

Although it is difficult to determine the robustness of the influence of conditioning procedures on attention, it is possible to provide further support for the associative learning hypothesis. The associative learning explanation assumes attention is being allocated to the CS because some form of associative learning has taken place, even though this learning is proposed to be oc-

curring in a basic, perceptual system. In contrast, the response transfer hypothesis predicts that the orienting response to the US will block other unconditioned responses from transferring to the CS (Öhman 1983; Pavlov 1927). Thus, finding evidence for a second response that is influenced by the conditioning procedure would provide additional support for the associative learning hypothesis and evidence against the response transfer hypothesis.

In attempting to find support for a CR, a broad view of potential conditioned responses was considered. Traditionally, consumer researchers have concentrated on affective conditioning, an interest that can be traced to Staats and Staats' original studies on associative learning (Staats and Staats 1957, 1959). Yet, one must remember that Staats and Staats viewed the affective dimension as one of many meaning dimensions that could serve as a conditioned response (Osgood, Succi, and Tannenbaum 1957; Staats 1968). Staats and others were able to show that the dimensions of affect, activity, potency, angularity, and roundness were all viable conditioned responses (e.g., see Staats [1968] for review). Hence, a broad view of potential conditioned responses need not be limited to affective responses alone.

Given our uncertainty about the CR in experiments 1 and 2 and our desire to view conditioning as a procedure that could provide inputs into subsequent choice processes, the focus of the third study was to investigate whether repeated pairing of the brands and the US scenes would result in an association of the meaning of the US to the CS. We made no a priori judgments about the specific meaning that would become associated with the CS. Instead, we selected a procedure that allowed us to assess whether any meaning had been associated.

EXPERIMENT 3

In attempting to provide evidence of a semantic CR, it was important to recognize that there was uncertainty associated with the underlying meaning dimension that would be associated because of the CS-US pairing. The solution to this problem was to use a set of multidimensional scaling measures. A multidimensional scaling solution provides for a subject-driven assessment of meaning association. Thus, a multidimensional scaling instrument would provide for an unconstrained assessment of the ability of conditioning procedures to associate semantic responses. There was no attempt to predict the direction of the movement on the map, although it was understood that any movement should have face validity (e.g., the pairing of a brand with scenes of young people should encourage them to view the brand as younger).

Stimuli and Design

The stimuli were the Mountain Dew and Canada Dry commercials used in experiment 1. Condition 1 consisted of two repetitions of the forward conditioning version of the Canada Dry commercial and two repetitions of the random version of the Mountain Dew commercial. Condition 2 consisted of two repetitions of the forward conditioning version of the Mountain Dew commercial and two repetitions of the random version of the Canada Dry commercial. The control condition consisted of two repetitions of the random version of the Mountain Dew and the Canada Dry commercials.[7] As in experiment 1, the target commercials were embedded in a series of commercials for eight different soft drinks, two experimental and six filler.

Procedure

Stimulus Presentation. Subjects were 52 students in the first author's class and were recruited prior to their exposure to classical conditioning subject matter. The experiment was run during the second half of a regularly scheduled lecture. Subjects were randomly assigned to experimental conditions and then led into one of three rooms containing video screens. Subjects viewed a tape appropriate to their experimental condition then returned to the classroom.

Dependent Measure. After returning to the classroom, the subjects were handed a dependent-measure questionnaire containing 28 similarity scales. Subjects used a nine-point scale anchored with "rarely" and "always" to decide the likelihood that pairs of soft drinks were consumed by the same person. This similarity measure was one of many that could have been used and was selected because it was a good measure for substitutability, a reasonable goal for a moderately known soft drink. Subjects saw all possible pairs of the eight soft drinks. The order of the pairs was randomly determined but constant for all subjects.

Analysis and Results

Each subject's similarity data were submitted to a metric multidimensional scaling analysis to generate individualized sets of two-dimension coordinates for the eight brands. Each subject's multidimensional scaling solution was then submitted to Procrustes Individual Difference Scaling (PINDIS), a technique that allows one to combine individual perceptual maps and to compare combined maps. This technique (Borg and Lingoes 1987) is similar to the more commonly used Individual Differences Scaling (INDSCAL) in that it allows for the derivation of a uniquely rotated, unit-scaled common perceptual space from which an individual subject's perceptual spaces can be derived via a simple transformation. The common unit scale places

[7]This experiment was run prior to experiment 1 and 2. The initial design also included two backward conditioning (US → CS) treatment groups. These conditions are not pertinent to the key empirical issue in experiment 3 and were not included in the analysis.

all maps, individual and combined, in the same metric, so that commonly used ANOVA statistics can be used to test the influence of the experimental manipulations. The brand location coordinates from individual perceptual spaces serve as input into the statistical tests.

Figure 2 presents the common perceptual map derived from PINDIS. The location for each brand in each of the three conditions is represented on the map. The positions of the brands in the perceptual map derived from the control condition are shown in regular typeface. Brand positions for the perceptual map derived from the Canada Dry forward condition are underlined. Brand positions for the perceptual map derived from the Mountain Dew forward condition are in bold. A legend assigning brand names to numbers appears below the perceptual map.

Perceptions of the positions of brands 1–6, the nonconditioned control brands, are almost identical among the three conditions. Univariate ANOVA tests confirmed that there were no differences in the representation of these brands in perceptual space (all $F < 1$). In other words, the positions of Crush, Minute Maid, Seven-Up, Slice, Schweppes, and Sunkist did not vary between treatment and control groups. Canada Dry and Mountain Dew were influenced by the experimental manipulations, primarily along the horizontal axis. Two-tail, univariate grand mean tests confirmed that there was a statistically significant difference in the representation of Canada Dry ($F(2,49) = 3.49$, $p = .04$, mean square error [*mse*] = 0.028) and Mountain Dew ($F(2,49) = 4.46$, $p = .02$, $mse = 0.035$). Thus, the position of Mountain Dew and Canada Dry did vary between treatment and control conditions.

Between-subject tests of the influence of the conditioning procedure were conducted to determine whether the distance between Canada Dry and Mountain Dew varied by experimental condition. Scores representing the distances between Canada Dry and Mountain Dew along the horizontal axis were computed for the individuals in each condition. The difference between Canada Dry and Mountain Dew was less than in the control condition, when subjects viewed the Canada Dry forward commercials (two-tail $F(1,49) = 4.43$, $p = .04$). The difference between Canada Dry and Mountain Dew was greater than in the control condition, when subjects viewed the Mountain Dew forward commercials (two-tail $F(1,49) = 2.94$, $p = .09$). Given the relative stability of the representations of the nonconditioned brands, these results can be viewed as evidence that the conditioning procedures influenced perceptions of the target brands. A discussion of this influence is presented below.

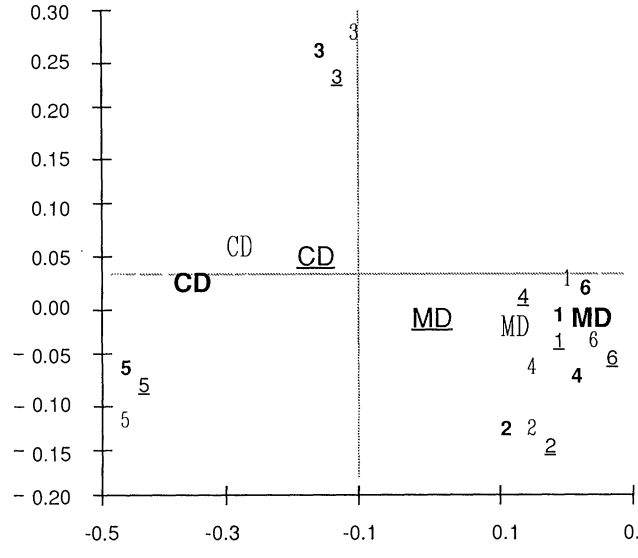
Discussion

The results suggest that the conditioning procedure influenced subjects' perceptions of the target consumers of the soft drinks. As shown in Figure 2, forward conditioning presentations were able to alter subjects' perceptions of the users of Mountain Dew and Canada Dry on a perceptual map. Admittedly, there was no prediction about the expected direction of the brand movement on the map, since there could be no a priori prediction of the dimensional space. Yet the map, and the movement of the target brands on the map, does have a fair amount face validity. The *X*-axis could be interpreted as maturity, with Schweppes Ginger Ale and Canada Dry representing the most mature soft drinks, Seven-Up a moderately mature soft drink, and Mountain Dew and the four fruit sodas the least mature soft drinks. Presenting Canada Dry scenes prior to pictures of young couples having fun encouraged consumers to perceive it to be more like Mountain Dew and the other flavored soft drinks, as illustrated by the Canada Dry forward conditioning map (underlined typeface). Presenting Mountain Dew scenes prior to scenes of teenage actors having fun encouraged consumers to perceive it to be less like Canada Dry and more like the other flavored soft drinks, as illustrated by the Mountain Dew forward conditioning map (bold typeface).

The results of experiment 3 can be taken as evidence that semantic meaning that accompanies perception of the US (e.g., couples in their twenties or teenagers) has the potential to associate to the CS. The visual material presented in each of the experimental conditions was identical, the only difference between the treatment and control conditions being the order of the scene sequencing. Hence, differences in the representation of the brands on the perceptual map can be directly at-

FIGURE 2

COMBINED PERCEPTUAL MAPS FROM EXPERIMENT 3



NOTE.—Experimental conditions: regular typeface, control; underlined typeface, Canada Dry forward; bold typeface, Mountain Dew forward. Soft drinks: *1*, Crush; *2*, Minute Maid; *3*, Seven-Up; *4*, Slice; *5*, Schweppes; *6*, Sunkist; *CD*, Canada Dry; *MD*, Mountain Dew.

tributed to the conditioning procedure. And, even though these effects were subtle, it may be that the semantic conditioning occurred with little contingency awareness. As the postexperimental inquiry results provided after experiment 1 illustrate, the conditioning procedures used in the television commercials were in no way transparent.

The successful conditioning of a semantic response in experiment 3 provides additional support for the associative learning explanation of the influence of conditioning procedures on attention to the CS during subsequent exposure. The associative learning explanation of the differential attention to the conditioned stimuli in experiments 1 and 2 assumed that there was some form of associative learning during the presentation of the ads. The formation of an associative hypothesis during the training session encouraged the subjects to attend to the CS during subsequent exposure, an apparent attempt to increase their confidence in the CS-US contingency. This associative hypothesis was also able to influence responses on a multidimensional scaling measure of meaning association. Thus, the conditioning procedure has multiple benefits, a finding consistent with the associative learning explanation but inconsistent with the direct response transfer explanation of the influence of a conditioning procedure.

GENERAL DISCUSSION

The results of the three studies suggest that conditioning procedures may be appropriate for generating multiple responses. Experiment 3 provides evidence that conditioning procedures can be used to associate meaning with brands, and experiments 1 and 2 illustrate that, to the extent consumers begin to learn an association between a CS and a US, their attention to the CS will be enhanced during subsequent exposure. Together, the three experiments provide evidence for McSweeney and Bierley's (1984) prediction that successful conditioning procedures encourage approach behavior, regardless of the CR, because they encourage a person to gather additional information on the association that is being learned. Thus, it seems possible to use the sequence of scenes in an ad to encourage attention to a CS, then allow for the CR to serve as an input into a choice behavior. Furthermore, this strategy is likely to operate when involvement is sufficient to encourage attention to the CS and US during ad exposure but insufficient to promote the conscious awareness of a CS/US contingency (see Allen and Janiszewski 1989).

If we view conditioning as a multiple benefit procedure that has the potential to influence attention, affective responses and product perceptions provide a strategy for using conditioning procedures to benefit lesser-known brands. For many moderately known brands, part-list cuing interference limits the likelihood the brand will enter the consumer's consideration set via memory retrieval (Alba and Chattopadhyay 1986). Even when the consumer confronts the display and attempts to update his/her awareness and consideration set, shelf allocation constraints discourage attention to the moderately known brands. Thus, to have a realistic chance at being purchased for purposes of trial or variety seeking, the moderately known brand must first capture the consumer's attention. But capturing attention is not sufficient to motivate selection of a brand. The evidence provided above suggests that conditioning procedures may encourage a consumer to attend to a brand and, at the same time, make semantic information available for comparing choice alternatives. Hence, simple associative learning techniques have the potential to influence brand choice in a low-involvement purchase via attention and semantic associations to the brand package.

Even though conditioning is a multiple-benefits procedure, one must keep in mind that it is a procedure, not a process. As a procedure, it creates a learning environment, but it does not exclude one or another process from operating. Thus, there is no reason to assume the processes and mechanisms supporting "conditioned" reflexive, attentive, affective, and semantic responses are in any way equivalent. For example, Pavlov's original work (1927) investigated the reflex responses associated with the direct stimulation of muscles and glands. His procedures investigated the direct transfer of a physiological response. As such, contingency awareness was not a consideration. In contrast, consumer researchers have often investigated affective responses associated with the activation of memory, an associative learning procedure in which contingency awareness is difficult to avoid (Allen and Janiszewski 1989; Shimp et al. 1991b). Consumer researchers often use a simple, two-stimulus learning environment, a procedure that encourages the higher-order learning system to become aware of the CS-US contingency.

In this article, a conditioning procedure is used to influence an associative learning process that is hypothesized to rely on a basic perceptual learning system, a system that can selectively choose stimuli from a complex environment, form hypotheses about their relationships, then act to gather the information that will allow higher-order learning systems to become aware of and confirm these relationships (Holyoak et al. 1989). This perceptual system can learn and respond to simple associations, covariations, and fluency cues but does not rely on conscious control mechanisms for this learning (see Bruner 1992; Hall 1991; Holyoak et al. 1989; Reber 1989). In other words, until the perceptual system has provided enough information for the higher-order system to recognize a contingency, awareness will remain limited but learning will proceed. Therefore, people can begin to learn a CS-US contingency and respond in a manner that is consistent with this learning but still not be contingency aware. It is this type of learning that is most likely to occur during the low-involvement processing of ads.

Viewing conditioning as a procedure, not a process, that has the potential to affect a variety of learning mechanisms suggests that we should begin to question the generalizability of conditioning findings across stimuli, procedures, contexts, and subject populations (Shimp, Hyatt, and Snyder 1991). For example, consider the possibility that animals have a perceptual system that is far less successful at selecting and organizing information within the environment. One method of compensating for a system that has difficulty recognizing CS/US associations is to organize the learning environment so that these associations are obvious. In fact, animals do require constant stimuli, similar training and test environments, previously nonpredictive conditioned stimuli, and tight conditioning procedures. These procedural conventions replace the perceptual screening and organization system that allows the organism to identify the salient stimuli within the environment and to recognize the associations between them.

In contrast to animals, humans have a perceptual system that is efficient at selecting and organizing information within the environment and a higher-order processing system that is quick to test and confirm hypotheses (Bruner 1992). The efficiency of the perceptual learning system suggests that procedural consistencies that motivate associative learning are likely to be of less value than procedural variance that encourages generalizability of the learned covariation. Thus, the use of a varied CS (experiment 2) may be quite beneficial from a generalizability perspective but not at all detrimental from an associative learning perspective. The human perceptual system is designed to handle variability in stimuli and may learn more efficiently and effectively when this variability is present (Pribram and McGuinness 1975).

Our discussion of the apparent disparity between animal and human conditioning results is not meant to imply that the animal literature does not provide numerous insights into the potential role of conditioning principles in human learning. Instead, it is meant to serve as a reminder that there are functional learning differences in species populations and that these differences need to be recognized prior to developing a conditioning program to influence consumers (Bitterman 1965). These differences may relate to differences in sensory, motor, or motivational factors, but they may also relate to differences in response to context changes, procedural constraints, and CS-US characteristics. For example, conventional wisdom is that established brands are more difficult to condition because of latent inhibition (McSweeney and Bierley 1984). Yet, Shimp et al. (1991b) were able to condition affective responses to moderately familiar brands, and our results provide similar evidence concerning semantic responses. Given the context-dependent learning capabilities of humans, latent inhibition may not constrain conditioning to the extent it does with animal subjects (see Swartzentruber and Bouton 1992).

It is because of the flexibility in human learning mechanisms that we find inconsistencies in the consumer conditioning literature. Humans are highly sensitive to the procedures used to communicate information and the measures of the impact of these communications. Slight changes in procedure can often have a significant influence on the learning that is achieved in a session, quite possibly a consequence of differential participation by alternative learning systems (see e.g., Gorn 1982; Kellaris and Cox 1989; cf. Shimp et al. 1991a). One example of the consequences of alternative learning systems is the apparent necessity of contingency awareness for successful conditioning in the procedures used by Allen and Janiszewski (1989) and Shimp et al. (1991b) but the apparent irrelevance of contingency awareness for successful conditioning in the procedures of Baeyens, Eelen, and Van den Bergh (1990) and the above studies. The conditioning literature is an empiricist literature in which procedural caveats (e.g., CS preexposure, US preexposure, UR strength, interstimulus interval, intertrial interval, temporal priority, number of trials, training environment, test environment, and CS consistency) often dominate practical goals (e.g., a measurable change in a significant behavior). As the research focus shifts from an emphasis on procedure to an emphasis on learning systems, many of the apparent inconsistencies within the literature may be resolved.

If the conclusions drawn from behavioral studies are dependent on the procedures used to produce these effects, then we have identified the limitation and benefits of the studies reported within this article, as well as of the consumer conditioning literature in general. Behavioral research findings are by definition context- and procedure-dependent, a bias that is likely to be magnified by the complexity and flexibility of human learning mechanisms. Thus, our findings are dependent on the selection of the conditioned stimuli (moderately known), the selection of the US scenes (dynamic, arousing, entertaining), UR strength (relatively limited), interstimulus interval (none), intertrial interval (variable, approximately five seconds), temporal priority (CS → US), number of trials (12 or 18), training environment (dynamic, involving, laboratory), test environment (static, involving, laboratory), test distractors (other moderately popular brands), CS consistency (varied), and subject pool (college students, target market). All of these procedural parameters are constraints on the generalizability of the results. Yet, unlike many past conditioning studies, we have tried to be explicit about the learning mechanisms that are being influenced by the conditioning procedure and the boundaries for which we expect these results to hold. Familiar brands, actual commercials, an absence of intertrial intervals, and novel test environments are all virtually unavoidable in the natural marketplace; thus, it is ad-

vantageous that our studies incorporated these characteristics.

The procedural constraints on our findings, and those investigating consumer conditioning in general, would seem to imply that the generalizability of all behavioral findings within consumer research is limited. This conclusion is valid, but we offer three qualifications. First, as conditioning procedures become more ecologically valid and procedures converge on those observed in the marketplace, confidence in the generalizability of the conditioning results will be enhanced (Lynch 1982). Second, as a diversity of procedures are used to provide additional evidence for a conditioned response, as is the case with affective conditioning, confidence in the generalizability of the effect should increase (Calder, Philips, and Tybout 1982). Of course, this assumes that replications represent the use of alternative methods, measures, and procedures—a necessary prerequisite if classical conditioning, and associative learning mechanisms in general, is to be integrated into the cognitive learning paradigm. Finally, as researchers begin to explicate the learning systems or processes that are sensitive to the conditioning procedure, the conditioning literature will be able to establish a link to cognitive learning findings. Mechanisms and processes that support covariation learning, associative learning, attitude formation, memory formation, and the allocation of attention are all influenced by conditioning procedures. Perhaps it is time that conditioning researchers begin to recognize these relationships and to isolate the advantages of a conditioning procedure relative to a more cognitively based learning program.

APPENDIX

Contingency Awareness Assessment Instrument

The series of commercials you just saw included two commercials that were repeated three times each (Mountain Dew and Canada Dry). We would like to know your impression of these advertisements.

1. Which commercial did you like more? If you liked the Mountain Dew commercial much more than the Canada Dry commercial, circle '1'. If you liked the Canada Dry Commercial much more than the Mountain Dew commercial, circle '9'. If you liked each commercial about the same, circle '5'. Other values represent opinions between these extremes.

   Liked Mountain Dew more than Canada Dry — Liked them equally well — Liked Canada Dry more than Mountain Dew

   1 2 3 4 5 6 7 8 9

2. Which commercial was better at holding your interest?

   Mountain Dew — Both did well — Canada Dry

   1 2 3 4 5 6 7 8 9

3. We would now like you to think of the Mountain Dew ad. Recall that the commercial consisted of a fast paced sequence of scenes (by 'scenes' we mean surfing scenes, pictures of teenagers drinking Mountain Dew, pictures of the product, etc.). Did you notice a pattern to the scenes? If so, describe it.

   If you did notice a pattern to the scenes in the Mountain Dew ad, was it the case that some type of scene always followed or came before another type of scene? If so, please describe?

4. Depending on your experimental condition, there is a 50-50 chance that there was a pattern to the scenes you saw in the Mountain Dew commercial. Please indicate your best guess about this pattern by circling the appropriate response (you may circle more than one).
   a. Surfing scenes always came before soda drinking scenes.
   b. Surfing scenes always came before pictures of the product.
   c. Pictures of the product always came before surfing scenes.
   d. Pictures of the product always came before soda drinking scenes.
   e. Soda drinking scenes always came before surfing scenes.
   f. Soda drinking scenes always came before pictures of the product.
   g. I think the scenes I saw were random in their order.
   h. I honestly don't know.

5. We would now like you to think of the Canada Dry ad. Recall that the commercial consisted of a fast paced sequence of scenes (by 'scenes' we mean pictures of people having fun, pictures of people drinking Canada Dry, pictures of the product, etc.). Did you notice a pattern to the scenes? If so, describe it.

   If you did notice a pattern to the scenes in the Canada Dry ad, was it the case that some type of scene always followed or came before another type of scene? If so, please describe?

6. Depending on your experimental condition, there is a 50-50 chance that there was a pattern to the scenes you saw in the Canada Dry commercial. Please indicate your best guess about this pattern by circling the appropriate response (you may circle more than one).
   a. People-having-fun scenes always came before soda drinking scenes.
   b. People-having-fun scenes always came before pictures of the product.
   c. Pictures of the product always came before people-having-fun scenes.
   d. Pictures of the product always came before soda drinking scenes.
   e. Soda drinking scenes always came before people-having-fun scenes.

f. Soda drinking scenes always came before pictures of the product.
g. I think the scenes I saw were random in their order.
h. I honestly don't know.

[*Received July 1992. Revised October 1992.*]

REFERENCES

Alba, Joseph W. and Amitava Chattopadhyay (1986), "Salience Effects in Brand Recall," *Journal of Marketing Research,* 23 (November), 363–369.

Allen, Chris T. and Chris A. Janiszewski (1989), "Assessing the Role of Contingency Awareness in Attitudinal Conditioning with Implications for Advertising Research," *Journal of Marketing Research,* 26 (February), 30–43.

——— and Thomas J. Madden (1985), "A Closer Look at Classical Conditioning," *Journal of Consumer Research,* 12 (December), 301–315.

Baeyens, Frank, Paul Eelen, and Omer van den Bergh (1990), "Contingency Awareness in Evaluative Conditioning: A Case for Unaware Affective-Evaluative Learning," *Cognition and Emotion,* 4 (1), 3–18.

Bierley, Calvin, Frances K. McSweeney, and Renee Vannieuwkerk (1985), "Classical Conditioning of Preferences for Stimuli," *Journal of Consumer Research,* 12 (December), 316–323.

Bitterman, M. E. (1965), "Phyletic Differences in Learning," *American Psychologist,* 30 (June), 396–410.

Borg, Ingwer and James C. Lingoes (1987), *Multidimensional Similarity Structure Analysis,* New York: Springer.

Brown, Paul L. and Herbert M. Jenkins (1968), "Auto-shaping of the Pigeon's Key-Peck," *Journal of the Experimental Analysis of Behavior,* 11 (January), 1–8.

Bruner, Jerome (1992), "Another Look at New Look 1," *American Psychologist,* 47 (June), 780–783.

Calder, Bobby J., Lynn W. Philips, and Alice M. Tybout (1982), "The Concept of External Validity," *Journal of Consumer Research,* 9 (December), 240–244.

Hall, Geoffrey (1991), *Perceptual and Associative Learning,* Oxford: Clarendon.

——— and Stephen Channell (1985), "Differential Effects of Contextual Change on Latent Inhibition and on the Habituation of an Orienting Response," *Journal of Experimental Psychology: Animal Behavior Processes,* 11 (June), 470–481.

Hearst, Eliot and Herbert M. Jenkins (1974), *Sign-Tracking: The Stimulus-Reinforcer Relation and Directed Attention,* Austin, TX: Psychonomic Society.

Holyoak, Keith J., Kyunghee Koh, and Richard E. Nisbett (1989), "A Theory of Conditioning: Inductive Learning within Rule-based Default Hierarchies," *Psychological Review,* 96 (April), 315–340.

Kaye, Helen and John M. Pearce (1984), "The Strength of the Orienting Response during Blocking," *Quarterly Journal of Experimental Psychology,* 36B (May), 131–144.

Kellaris, James J. and Anthony D. Cox (1989), "The Effects of Background Music in Advertising: A Reassessment," *Journal of Consumer Research,* 16 (June), 113–118.

Kimble, Gregory A. (1961), *Conditioning and Learning,* New York: Appleton-Century-Crofts.

Lynch, John G., Jr. (1982), "On the External Validity of Experiments in Consumer Research," *Journal of Consumer Research,* 9 (December), 225–239.

Lynn, Richard (1966), *Attention, Arousal and the Orientation Reaction,* Oxford: Pergamon.

McSweeney, Frances K. and Calvin Bierley (1984), "Recent Developments in Classical Conditioning," *Journal of Consumer Research,* 11 (September), 619–631.

Nedungadi, Prakash (1990), "Recall and Consumer Consideration Sets: Influencing Choice without Altering Brand Evaluations," *Journal of Consumer Research,* 17 (December), 263–276.

Öhman, Arne (1979), "The Orienting Response, Attention, and Learning: An Information Processing Perspective," in *The Orienting Reflex in Humans,* ed. H. D. Kimble et al., Hillsdale, NJ: Erlbaum, 443–471.

——— (1983), "The Orienting Response during Pavlovian Conditioning," in *Orienting and Habituation: Perspectives in Human Research,* ed. David Siddle, New York: Wiley, 315–369.

Osgood, Charles E., George J. Succi, and Percy H. Tannenbaum (1957), *The Measurement of Meaning,* Urbana: University of Illinois Press.

Pavlov, Ivan P. (1927), *Conditioned Reflexes,* Oxford: Oxford University Press.

Pearce, John M. and Geoffrey Hall (1992), "Stimulus Significance, Conditionability, and the Orienting Response in Rats," in *Attention and Information Processing in Infants and Adults: Perspectives from Human and Animal Research,* ed. Byron A. Campbell et al., Hillsdale, NJ: Erlbaum, 137–162.

Pribram, Karl H. and Diane McGuinness (1975), "Arousal, Activation, and Effort in the Control of Attention," *Psychological Review,* 82 (March), 116–149.

Razran, Gregory (1961), "The Observable Unconscious and the Inferable Conscious in Current Soviet Psychophysiology: Interoceptive Conditioning, Semantic Conditioning, and the Orienting Reflex," *Psychological Review,* 68 (March), 81–147.

Reber, Arthur S. (1989), "Implicit Learning and Tacit Knowledge," *Journal of Experimental Psychology: General,* 118 (September), 219–235.

Shimp, Terence A. (1991), "Neo-Pavlovian Conditioning and Its Implications for Consumer Theory and Research," in *Handbook of Consumer Behavior,* ed. Thomas S. Robertson and Harold H. Kassarjian, Englewood Cliffs, NJ: Prentice Hall, 162–187.

——— Eva M. Hyatt, and David J. Snyder (1991a), "A Critical Appraisal of Demand Artifacts in Consumer Research," *Journal of Consumer Research,* 18 (December), 273–283.

——— Elnora W. Stuart, and Randall W. Engle (1991b), "A Program of Classical Conditioning Experiments Testing Variations in the Conditioned Stimulus and Context," *Journal of Consumer Research,* 18 (June), 1–12.

Sokolov, Evgenni N. (1963), *Perception and the Conditioned Reflex,* Oxford: Pergamon.

Spinks, John A. and David Siddle (1983), "The Functional Significance of the Orienting Response," in *Orienting and Habituation: Perspectives in Human Research,* ed. David Siddle, Chichester: Wiley, 237–313.

Staats, Arthur W. (1968), *Learning, Language and Cognition,* New York: Holt, Rinehart & Winston.

——— and Carolyn K. Staats (1959), "Effect of Number of Trials on the Language Conditioning of Meaning," *Journal of General Psychology,* 61 (October), 211–223.

Staats, Carolyn K. and Arthur W. Staats (1957), "Meaning Established by Classical Conditioning," *Journal of Experimental Psychology,* 54 (July), 74–80.

Stark, Lawrence and Stephen R. Ellis (1981), "Scanpaths Revisited: Cognitive Models Direct Active Looking," in *Eye Movements: Cognition and Visual Perception,* ed. Dennis F. Fisher et al., Hillsdale, NJ: Erlbaum, 193–226.

Stuart, Elnora W., Terence A. Shimp, and Randall W. Engle (1987), "Classical Conditioning of Consumer Attitudes: Four Experiments in an Advertising Context," *Journal of Consumer Research,* 14 (December), 334–349.

Swartzentruber, Dale and Mark E. Bouton (1992), "Context Sensitivity of Conditioned Suppression Following Preexposure to the Conditioned Stimulus," *Animal Learning and Behavior,* 20 (2), 97–108.

Urban, Joel L., Philip L. Johnson, and John R. Hauser (1985), "Testing Competitive Market Structures," *Marketing Science,* 3 (Spring), 83–112.

Vinogradova, O. S. (1959), "The Role of the Orienting Reflex in the Formation of Conditioned Connections in Man," in *The Orienting Reflex and Problems of Higher Nervous Activity,* ed. Evgenni N. Sokolov, Moscow: Akademiia Pedagogicheskikh Nauk, 86–160.

——— (1965), "On the Dynamics of the Orienting Reflex in the Course of Closure of a Conditioned Connection," in *The Orienting Reflex and Exploratory Behavior,* ed. L. G. Voronin et al., Moscow: Akademiia Pedagogicheskikh Nauk RSFSR, 45–53.

Young, Laurence R. and David Sheena (1975), "Eye-Movement Measurement Techniques," *American Psychologist,* 30 (March), 315–330.