

The Effects of Physiological Arousal on Information Processing and Persuasion

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The effects of physiological arousal on persuasion are investigated. An exercise task was used to manipulate physiological arousal, and systolic blood pressure readings were taken to assess the effectiveness of this manipulation. The results indicate that endorser status (celebrity or noncelebrity) has a stronger influence on brand attitudes under high than under moderate levels of physiological arousal, whereas argument strength has a greater impact under moderate than under high arousal levels. The results are consistent with the Elaboration Likelihood Model of persuasion.

A consumer's state of physiological arousal varies frequently and considerably and is influenced by a variety of everyday events, including the presence of others, physical exertion, various task demands, incentives, performance feedback, alcohol or caffeine consumption, and exposure to emotionally-charged stimuli (e.g., fear-arousing ads, erotic ads, political or religious messages). However, the effects of variations in arousal on consumer information processing and persuasion are unclear.

Arousal is defined as the level of alertness or activation on a continuum ranging from extreme drowsiness to extreme wakefulness (Duffy 1962; Humphreys and Revelle 1984). Generally, high arousal levels have been found to disrupt information processing, particularly when the task is complex (Berlyne 1960; Zajonc 1965). Many researchers have used attentional mechanisms to explain arousal effects on task performance (Broadbent 1971; Easterbrook 1959; Eysenck 1982; Hasher and Zacks 1979; Kahneman 1973; Mandler 1975).

Easterbrook (1959), who proposed that heightened arousal leads to increased attentional selectivity, based his conclusions on research that tested the impact of various arousal-inducing manipulations on dual task performance (see Eysenck 1982 for a review). In these studies, subjects typically are required

to perform two tasks simultaneously under either high or moderate arousal levels. Bacon (1974), for example, had subjects simultaneously perform a pursuit rotor tracking task and an auditory signal detection task under shock or no shock conditions. Either instructions or explicit incentives are used to determine which task serves as the primary task and which serves as the secondary task. The usual outcome of these studies is that under high arousal levels, performance on the secondary task deteriorates whereas performance on the primary task typically is unaffected and in some instances augmented.¹ Easterbrook concluded that high arousal leads to a narrowing of attention toward the primary task cues and away from the secondary cues.

Mandler (1975) proposed a mechanism to explain why attention may be more selective under high arousal states. He suggested that during a state of high arousal, the proprioceptive feedback from the height-

¹In many of the dual task studies, distinguishing effects of the arousal inducing treatment from the effects of arousal itself is difficult. The majority of the dual task experiments on which much of the speculation about arousal has been based have involved shock, noise, anxiety, or incentives. The use of these treatments is understandable, because it was often these factors rather than arousal per se that was of interest to the investigators. However, from our viewpoint, it is difficult to know whether high arousal alone is responsible for the decreased secondary task performance that has been observed in the dual task studies. Some researchers have suggested that off-task processing instigated by the arousal-inducing treatments themselves rather than by high arousal may be responsible for some or all of the observed effects (see Naatanen 1973). However, note that arousal-inducing treatments that are not distracting (e.g., caffeine) also lead to suboptimal performance on secondary tasks (Humphreys and Revelle 1984). Furthermore, Easterbrook's hypothesis that heightened arousal reduces the range of cue utilization has been supported using treatments that are not in themselves distracting (Anderson and Revelle 1982).

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ened autonomic nervous system activity is highly salient and, thus, competes with other cues for the limited attentional capacity. The attentional demands of the internal cues characteristic of a high arousal state leave less capacity available for performing other tasks. In the dual task situation, subjects largely ignore the cues relevant to the secondary task and allocate their remaining resources toward processing the cues relevant to the primary task. Eysenck (1982) noted that the allocation of attentional resources to the primary task by a highly aroused individual is probably not an inevitable consequence, but an active coping strategy for dealing with capacity limitations imposed by high arousal levels.

In short, heightened arousal states reduce the amount of processing capacity available for performing cognitive tasks, and consequently, performance of these tasks is disrupted. Hasher and Zacks (1979) suggested that tasks that are "automatic"—that is, tasks that require little or no processing capacity (Shiffrin forthcoming)—are not disrupted by high arousal levels. Similarly, Humphreys and Revelle (1984) found that performance on simple arithmetic and vigilance tasks requiring little processing capacity is not disrupted by high arousal levels.

The Elaboration Likelihood Model of persuasion (Petty and Cacioppo 1981, 1983, 1986) provides a useful framework for investigating the effects of resource availability on persuasion (see also Chaiken 1980). As the amount of processing capacity available decreases, consumers are less able to diligently consider the attitudinal implications of the arguments presented in a persuasive message, and, subsequently they are more likely to process less complex information such as simple peripheral cues (e.g., source expertise/attractiveness, message length, background music).² Thus, any variable that affects the amount of cognitive capacity available for processing a persuasive message also influences the likelihood of consumers' elaborating upon the message. Several motivational variables, such as involvement (Batra and Ray 1986; Park and Young 1986; Petty, Cacioppo, and Schumann 1983; Swasy and Munch 1985; Yalch and Elmore-Yalch 1984) and need for cognition (Cacioppo et al. 1986), and several ability-related variables, such as message repetition (Batra and Ray 1986; Cacioppo and Petty 1985), time compression (Moore, Hausknecht, and Thamodaran 1986), and distraction (Petty, Wells, and Brock 1976), have been found to moderate elaboration likelihood.

²The peripheral cues investigated in tests of the Elaboration Likelihood Model should not be equated with the secondary task cues employed in the dual task paradigm. Processing peripheral cues may serve as a primary task in some situations (e.g., when capacity constraints do not permit more extensive processing), whereas secondary task cues are less important than primary task cues by definition. Further, peripheral cues use little processing capacity, whereas secondary tasks can require much effort.

Physiological arousal is another variable that may influence consumers' ability to elaborate upon a persuasive message. When the resources available for cognitive elaboration are reduced, the effect of message content on attitude favorability decreases (Kisielius and Sternthal 1984); consumers subsequently may focus on less complex information that requires relatively little cognitive processing capacity (e.g., peripheral cues). If high arousal levels decrease the amount of processing capacity available for elaborating upon a persuasive message, then peripheral cues (e.g., celebrity or noncelebrity endorser status) may have a strong impact on brand attitude favorability. In contrast, if arousal is moderate, then consumers may be more able and more likely to elaborate upon the persuasive message arguments; and, if these message arguments have favorable implications, more favorable brand attitudes may be formed when the message arguments are strong as opposed to weak.

H1: Endorser status (a peripheral cue) may have a greater impact on brand attitudes under high than under moderate arousal levels, whereas argument strength (a central cue) may have a greater influence on brand attitudes under moderate than under high arousal levels.

METHOD

Pretest

Subjects. Twenty-two undergraduates (11 males and 11 females), who received \$3 for participating, were asked to perform an exercise task. They were informed that participation was strictly voluntary and they should stop if they felt that the task might be harmful. In addition, subjects were screened for health problems. Subjects who had been recently ill or who had experienced serious health problems, such as fainting spells or breathing difficulties, were not permitted to participate.

Procedure. The Clark, Milberg, and Ross (1983) task was used to manipulate physiological arousal. Each subject was asked to step up and down a seven-inch high block for seven minutes. The pace was set by a metronome that emitted 55 beats per minute. Subjects were asked to take a full step with each beat.

Arousal levels were measured prior to, three minutes after, and seven minutes after performing the exercise task. The arousal index used was systolic blood pressure, the most reliable measure of sympathetic activity induced by physical exertion (Zillmann, Katcher, and Milavsky 1972). Systolic blood pressure was measured by the cuff method on a Pollenex BP 1500 machine.

Subjects were also asked to judge their own arousal levels that they were experiencing after the exercise

TABLE

SYSTOLIC BLOOD PRESSURE AND SUBJECTIVE AROUSAL AS A FUNCTION OF TIME OF MEASUREMENT

	Before exercise	3 minutes after exercise	7 minutes after exercise
Systolic blood pressure	113	126	114
Subjective arousal	-	46	11

task. Subjects were instructed to think of their arousal levels in numerical terms, with zero percent reflecting their physiological state before the exercise task and 100 percent reflecting their physiological state immediately after the exercise task (Cantor, Zillmann, and Bryant 1975). These measures were taken immediately after each instrument reading.

Results. Systolic blood pressure and subjective arousal as a function of time of measurement (before exercise, three minutes after exercise, seven minutes after exercise) are presented in the Table. No main effects and no interactions involving gender were found on either measure. Thus, gender was ignored in subsequent analyses. A one-way repeated measures analysis of variance performed on systolic blood pressure indicated that arousal levels varied significantly as a function of time of measurement, $F(2,42) = 15.41$, $p < 0.001$. Newman-Keuls tests revealed that arousal levels were higher three minutes after the exercise task than before the task or than seven minutes after the task ($p < 0.05$). Moreover, arousal levels did not differ before the task or seven minutes after the task, indicating that subjects' arousal levels returned to baseline levels seven minutes after exercise. In addition, all 22 subjects reported feeling more aroused three minutes following the exercise task than seven minutes following the exercise task. Seven minutes after exercise, subjects' perceived arousal levels ($M = 11$ percent) were close to preexercise levels.

The Main Experiment

Subjects. Subjects were 136 undergraduates (58 males and 78 females) who participated to partially fulfill a course requirement. Subjects were screened in the same manner as in the pretest. Subjects participated either individually or in pairs and were assigned randomly to one of eight conditions in a 2 (high or moderate arousal) \times 2 (strong or weak arguments) \times 2 (celebrity or noncelebrity endorser) factorial design.

Procedure. Subjects were directed to separate rooms and told that they would be participating in two brief but unrelated experiments. The first experiment was concerned with the "effect of arousal on memory." The experimenter was purportedly testing

the proposition that "arousal limits the type of information that is accessible to a person from memory." Each subject began the first experiment by engaging in a brief, one-minute free association task. The experimenter stated a word and the subject wrote down the first word that came to mind (the "memory" test). The subject was then asked to perform the Clark et al. (1983) exercise task. This task was followed by a second free association task. After performing this task, subjects were told that the first experiment was finished and they were led to another room for the second experiment. Separate rooms were used to bolster the "two-experiment" cover story.

Subjects were given a booklet containing six ads and a cover sheet explaining the purpose of the study. The second experiment was said to be a joint effort of the marketing and psychology departments. The researchers were purportedly interested in people's evaluations of newspaper and magazine ads. The subjects were told that the ads they would be examining were planned for future use in their area and that some of the ads may have already appeared in national or local periodicals.

The six ads always appeared in the same random order. The second ad was the target ad for the fictitious Dot Fine Writer and the remaining ads were fillers (four of the filler ads featured nationally-known products and one promoted an unfamiliar product). The execution of the target ad was similar to the filler ads, and all of the ads were presented as black-and-white photocopies. At the top of the target ad was a picture of either a celebrity or noncelebrity endorser. Embedded within the picture next to the endorser was the statement, "The Dot Fine Writer is a better pen." A list of product attributes was provided in the text below the picture. Subjects were given 20 seconds to read each ad (pretesting indicated that all subjects could read each ad within this period). Three minutes following exposure to the ads, subjects were asked to fill out a booklet containing the dependent measures. Hence, arousal levels varied at the time of exposure to the ads, but did not differ when the dependent measures were taken.

The Arousal, Endorser Status, and Argument Strength Manipulations. All subjects performed the Clark et al. (1983) exercise task. It was important to hold this experience constant for all subjects to ensure that it was the arousal induced by the exercise task and not other aspects of the task that influenced the dependent measures. In high arousal conditions, subjects read the target ad three minutes after performing the exercise task, whereas in moderate arousal conditions, subjects read the target ad seven minutes after performing the exercise task.

In celebrity endorser conditions, the ad featured a photograph of an average-looking, middle-aged, TV actor. In the noncelebrity endorser conditions, the ad

featured a photograph of an average-looking, middle-aged, noncelebrity male.

In strong argument conditions, the following statements were presented:

- Elegantly styled for comfort and control.
- In direct comparison tests, the Dot Fine Writer was more durable and longer lasting than all of the competitors' pens.
- Rugged tungsten ball-point pen.
- Ultra smooth, skip free, precision writing.
- Guaranteed to write every time.

In weak argument conditions, the following statements were presented:

- Styled for writing.
- In direct comparison tests, the Dot Fine Writer was as durable and long-lasting as some of the competitors' pens.
- Metal ball-point pen.
- Writes legibly with only an occasional skip.
- Guaranteed to write most of the time.

Brand Attitude, Purchase Intention, and Moderator Measures. Subjects were asked to recall the brand names of advertised products and to answer questions about the filler products. Next, subjects were asked to indicate their purchase intentions toward the target product on a four-point scale, where one indicated "I definitely would not buy it," and four indicated "I would definitely buy it." Subjects then evaluated the pen on three nine-point scales anchored by -4 and +4 (bad/good, unsatisfactory/satisfactory, and unfavorable/favorable). These ratings were averaged to form a single brand attitude score (Cronbach's alpha = 0.98, $p < 0.001$).

To assess the effectiveness of the endorser status manipulation, subjects were asked to indicate the degree to which they liked the endorser on a nine-point scale where one indicated "liked very little" and nine indicated "liked very much." A second pair of questions assessed the effectiveness of the argument strength manipulation. Subjects were asked to rate the reasons provided for using the pen on a nine-point scale, where one indicated "unpersuasive" and nine indicated "persuasive." In addition, subjects were asked to rate the reasons provided for using the pen on a nine-point scale, where one indicated "weak reasons" and nine indicated "strong reasons." These ratings were averaged to form a single argument strength index (Cronbach's alpha = 0.89, $p < 0.001$). Separate $2 \times 2 \times 2$ analyses of variance indicated that more favorable attitudes toward the endorser were formed in celebrity than in noncelebrity endorser conditions, $F(1,128) = 104.71$, $p < 0.001$, and that message arguments were judged to be stronger in strong than

in weak argument strength conditions, $F(1,128) = 29.76$, $p < 0.001$.³

RESULTS

Brand Attitudes

Brand attitudes as a function of arousal, endorser status, and argument strength are presented in the Figure. A $2 \times 2 \times 2$ (arousal \times endorser status \times argument strength) analysis of variance performed on brand attitudes indicated that the target product was better liked when the ad contained strong arguments ($M = 1.59$) as opposed to weak arguments ($M = -0.27$, $F(1,128) = 30.53$, $p < 0.001$). An omega-squared statistic was computed to determine how much of the reliable variance was accounted for by the argument strength manipulation (Hays 1981). This manipulation accounted for 17 percent of the reliable variance.

The results also indicated that the pen was better liked when the celebrity ($M = 1.03$) as opposed to the noncelebrity ($M = 0.29$) endorsed the pen, $F(1,128) = 4.76$, $p < 0.03$, $\omega^2 = 0.02$. There was no main effect of arousal on evaluation ($F < 1$).

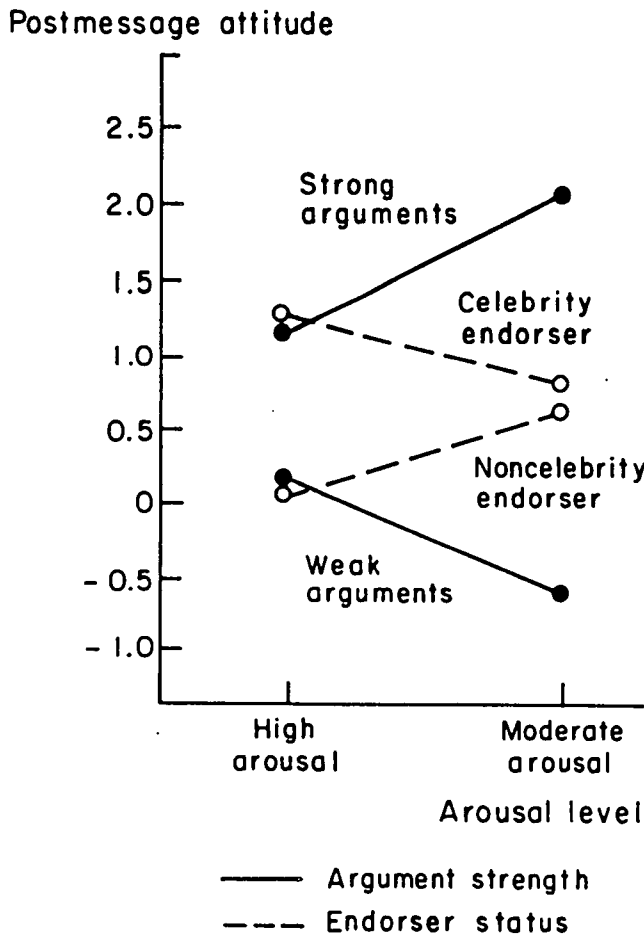
The effects of argument strength and endorser status were both moderated, however, by subjects' arousal state while they read the ad. As predicted, the arousal by argument strength interaction was significant, $F(1,128) = 6.25$, $p < 0.02$, $\omega^2 = 0.03$. Planned comparisons indicated that moderately aroused subjects evaluated the target product much more favorably when they were exposed to strong arguments ($M = 2.01$) as opposed to weak arguments ($M = -0.70$), $F(1,128) = 32.35$, $p < 0.001$. Highly aroused subjects also evaluated the target product more favorably in strong ($M = 1.18$) than in weak ($M = 0.16$) argument conditions, $F(1,128) = 4.58$, $p < 0.04$. The significant interaction, however, indicates that brand attitudes were less affected by argument strength when subjects were highly aroused.

The arousal by endorser status interaction was marginally significant, $F(1,128) = 2.56$, $p = 0.11$, $\omega^2 = 0.01$. Planned comparisons revealed that the evalu-

³The analyses also revealed that more favorable attitudes toward the endorser were formed when the endorser was associated with strong rather than with weak arguments, $F(1,128) = 7.01$, $p < 0.01$. Moreover, an arousal by endorser status interaction, $F(1,128) = 4.28$, $p < 0.05$, and an arousal by argument strength interaction, $F(1,128) = 10.33$, $p < 0.01$, were found on perceptions of argument strength. Arguments were judged to be stronger in celebrity than in noncelebrity conditions when arousal was high, but not when arousal was moderate. This finding implies that when high arousal levels interfere with an individual's ability to process arguments carefully, inferences about the endorser may influence judgments about the endorser's arguments. Further, perceived argument strength was greater in strong than in weak argument conditions, and this effect was more pronounced in moderate than in high arousal conditions.

FIGURE

BRAND ATTITUDE FAVORABILITY AS A FUNCTION OF AROUSAL, ARGUMENT STRENGTH AND ENDORSER STATUS



ations of high arousal subjects were much more favorable when the target product was endorsed by the celebrity ($M = 1.31$) as opposed to the noncelebrity ($M = 0.03$), $F(1,128) = 7.10, p < 0.01$. In contrast, the evaluations of moderately aroused subjects were not influenced by endorser status ($F < 1$). Thus, the data suggest that evaluations of the pen were more likely to be affected by peripheral cues in high than in moderate arousal conditions. No other main effects or interactions were found.

Purchase Intentions

A $2 \times 2 \times 2$ analysis of variance performed on purchase intentions revealed that subjects were more likely to buy the target product when it was described by strong arguments ($M = 2.15$) than by weak arguments ($M = 1.72$), $F(1,128) = 16.86, p < 0.01, \omega^2 = 0.10$. In addition, subjects who read the ad while highly aroused tended to be less willing to buy the target product ($M = 1.84$) than subjects who read the ad while moderately aroused ($M = 2.03$), $F(1,128)$

$= 3.39, p < 0.10, \omega^2 = 0.01$. Subjects exposed to the ad featuring the celebrity ($M = 1.99$) did not differ from subjects exposed to the ad featuring the noncelebrity ($M = 1.88$) in their willingness to buy the pen ($F < 1$).

The arousal by argument strength interaction was significant $F(1,128) = 7.24, p < 0.01, \omega^2 = 0.04$, thus paralleling the findings on the evaluation measures. Planned comparisons revealed that moderately aroused subjects were more willing to buy the target product when it was described by strong arguments ($M = 2.38$) as opposed to weak arguments ($M = 1.68$), $F(1,128) = 22.50, p < 0.001$. However, the purchase intentions of highly aroused subjects did not differ as a function of argument strength ($F = 1.03, ns$). No other interactions were found.

The absence of an arousal by endorser status interaction corroborates Petty et al.'s (1983) finding that attitudes formed on the basis of peripheral cues are not likely to have a strong impact on subsequent purchase intentions. However, an alternative interpretation is that a four-point intention scale may not be sufficiently sensitive to detect an arousal by endorser status interaction.

Additional analyses were performed to examine the degree of correlation between purchase intentions and brand attitudes in the high and moderate arousal conditions. Although both correlations were significantly greater than zero (both p values < 0.001), the correlation was significantly higher ($p < 0.01$) in moderate ($r = 0.85$) than in high arousal conditions ($r = 0.59$). Thus, brand attitudes are better predictors of subsequent purchase intentions under moderate than under high arousal levels.

DISCUSSION

The results of the present study indicate that contextual cues that are peripheral to the arguments in a persuasive message have a greater impact on brand attitudes in high than in moderate arousal conditions, whereas argument strength has a greater influence in moderate than in high arousal conditions. This finding suggests that high arousal levels reduce the amount of processing capacity available for elaborating on a persuasive message. Consequently, peripheral cues that require little processing capacity have a stronger effect on brand attitudes in high than in moderate arousal conditions. Conversely, information that requires a considerable amount of processing capacity, such as a set of arguments, has a greater effect on brand attitudes in moderate than in high arousal conditions.

It is important to note that the present experiment focused on the effects of "pure" (content-free) arousal on information processing and persuasion. It would be interesting to observe the effects on persuasion of

arousal induced by the ad itself (e.g., a fear-arousing ad) or by the context in which the ad is viewed (e.g., a commercial embedded in an action-packed program), but these manipulations confound arousal with content. Less content-free manipulations should also show that high arousal levels interfere with cognitive elaboration, decrease the use of central cues, and increase the use of peripheral cues. However, boundary conditions are likely to exist and should be identified. For example, high fear-arousing messages may motivate recipients to think carefully about an issue or may prompt recipients to avoid thinking about the threatening issue.

In addition to investigating boundary conditions, future research should examine the effects of low arousal levels on information processing and persuasion. Low arousal levels can be induced through a relaxation task (Clark et al. 1983). Given that an inverted U-shaped relationship between arousal and performance has been observed across a variety of cognitive tasks (Berlyne 1960; Zajonc 1965), a similar relationship may be found between arousal and elaboration likelihood. That is, message elaboration may be facilitated by moderate arousal levels and inhibited by either extremely low or extremely high arousal levels.

Since the time that Hovland et al. (1953) developed the classic message-learning approach toward studying persuasion, researchers have focused almost exclusively on the effects of source, message, and recipient variables (for recent reviews, see Chaiken and Stangor 1987; Cialdini, Petty, and Cacioppo 1981). Unfortunately, the effects of the environment in which the message is received have been neglected in persuasion research (for exceptions, see Kennedy 1971; Ray and Webb 1986; Soldow and Principe 1981; Webb 1979). The experiment presented here is an initial attempt to understand how environmental variables that influence physiological arousal moderate the effects of source and message variables on persuasion.

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