

Emotional Response to Television Commercials: Facial EMG vs. Self-Report



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*We wish to thank Dr. Rudolf
Hoehn-Saric for his support and
Colleen Hayes and Pam Kowal-
ski for their invaluable technical
assistance throughout this
project.*

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As television commercials increasingly contain emotional elements designed both to get the viewer's attention and to communicate the advertising message, copy pretesting is challenged to evaluate the potential effectiveness of these emotionally stimulating commercials and their success at eliciting the intended emotional responses. Standard copy measures, however, do not yield such informative results about emotional responses to commercials. In order to meet this challenge for copy pretesting, we measured the emotional responses to a series of television commercials of both females and males using self-report and facial EMG, a validated emotion measure used in academic research. We hypothesized that facial EMG, as compared to self-report, would be a more sensitive discriminator between commercials, would be more strongly related to recall, and peaks in facial EMG responses elicited during the commercial would be temporally related to specific emotion-congruent events in the commercial. The results strongly supported all of our hypotheses and illustrated the promise of facial EMG measures in advertising research and copy pretesting in particular. Facial EMG measures can reflect a qualitative richness and complexity of the viewer's emotional response that self-report measures cannot and, at the same time, offer precise and continuous quantitative data.

CREATORS OF TELEVISION COMMERCIALS today are enlisting a staggering array of sensory- and sensual-rich images and computer graphics, as well as popular music, humor, drama, and more—all designed to elicit an emotional response in the viewer that both grabs their attention and helps communicate the advertising message (Bruzzone and Tallyn, 1997; Peterson and Malhorta, 1998). Advertisers have become increasingly concerned about capturing the TV viewer's attention and interest as the proliferation of cable channels has multiplied the viewer's choices, and the viewer has become more adept at using their remote for channel-surfing and commercial zapping (Olney, Batra, and Holbrook, 1990). Research and marketplace findings over the last 10 to 15 years have identified that the consumer's emotional response toward the brand and/or the ad can be a powerful motivator of consumption behavior (Allen, Machleit, and Kleine, 1992; Erevelles, 1998; Haley and Baldinger, 1991) and can substantially influence post-exposure attitudes and recall (Park and Thorson, 1990).

With this shift to more emotionally stimulating commercials, copy pretesting is challenged to not just evaluate a commercial on how well it communicated the main selling points but to evaluate how well it elicited the intended emotional response in the viewer and to measure the commercial's potential effectiveness based on that emotional response. However, as many have noted (e.g., Agres, 1990; Haley, Staffaroni, and Fox,

1994), standard copy measures do not yield such informative results for emotionally stimulating commercials, and there is a need for the development and use of alternative measures better suited for measuring emotional responses to advertisements. Recent advances in academic research into the nature and measurement of emotion (National Institute of Health, 1994) may be able to help address this need in advertising research and copy pretesting in particular. The purpose of this paper is to report on our effort in applying basic science to this practical application. We review the relevant literature and report on an investigation that we conducted into the emotional responses to TV commercials using research methods and techniques previously used by the first author in basic emotion research.

The importance of emotion in producing advertising effects

In the last few years advertising researchers have demonstrated the important role that the viewer's emotional response plays in mediating the impact of television commercials as well as ads in general (Park and Thorson, 1990). The emotional response of the viewer has been shown to influence attitude toward the ad and the brand (Batra and Ray, 1986; Edell and Burke, 1987; Derbaix, 1995), increased attention to the ad (Olney, Holbrook, and Batra, 1991), and increased ad, message, and brand recall (Englis, 1990; Page, Thorson, and Heide, 1990; Stayman and Batra, 1991). Stayman and Batra

(1991) found that under low-involvement conditions brand-associated affect also influenced brand choice. The ARF Copy Research Validity Project (Haley and Baldinger, 1991) found that likability of the commercial was more strongly associated with split cable sales results than a number of other copy testing measures such as persuasion and recall (though there has been disagreement with these findings, e.g., Rossiter and Eagelson, 1994). Kover, Goldberg, and James (1995) found that the most important characteristic of creative and effective advertising was that it elicited positive feelings in the viewer related to their self-image.

The nature of emotion and information processing

Emotion has been conceptualized as occurring in the context of particular eliciting situations, and the existence of an emotional state in an individual can be inferred from the available output channels of physiological response, overt behavior, and verbal report (Lang, 1968; Ohman, 1986). Affect is a related term to emotion and is used more broadly, referring to any valenced feeling state (Cohen and Areni, 1991). Affect, therefore, encompasses both emotion, which is affect of a higher intensity and associated with a stimulus object or event, and mood, which is usually of lower intensity and not associated with a stimulus. Most major theories of emotion posit three aspects to emotion: the expressive, the experiential or subjective, and the physiological (Izard, Kagan, and Zajonc, 1984). There is not, however, always a one to one correspondence between these three systems, and, in particular, the expression of emotion is often influenced considerably by social motivations and is not just reflective of emotional state and subjective emotion (Hinde, 1985).

Multivariate research into emotional judgments, behavior, and word meanings

has found that emotional phenomena can best be organized into two overall dimensions (Lang, Greenwald, Bradley, and Hamm, 1993; Osgood, Suci, and Tannenbaum, 1957; Russell, 1980). One dimension is valence (positive/negative or pleasant/unpleasant) and the other, intensity (low or high arousal). The various discrete emotions such as joy, fear, sadness, anger, etc., fall into the emotional space described by these two dimensions. The relationship of the person and the emotional situation or stimulus can be characterized by positive or negative valence at some level of intensity. As stated above, emotion occurs in the context of an environmental situation or stimulus, and one way of conceptualizing emotion is that it serves the purpose of organizing a person's response to that environmental stimulus. Positive emotion or pleasantness is associated with consummatory behaviors directed at some goal or reward, and negative emotion is associated with withdrawal or defensive behaviors directed toward threatening or aversive stimuli (Schnieirla, 1959).

Psychological (Zajonc, 1980) and neurophysiological studies (LeDoux, 1989) have debunked the cognitive psychologist's notion that cognition is primary to emotion. Sensory inputs are transmitted directly to the amygdala, the emotional center of the brain, as well as indirectly from associational areas in the neocortex, where more complex cognition occurs. The pathway directly to the amygdala is shorter and quicker and allows emotional stimuli to be evaluated preconsciously and reacted to before one begins to think about how one feels, if one does at all. Neurophysiologists now believe that mental information processing takes place largely outside of conscious awareness, with only the end products reaching consciousness (LeDoux, 1989).

Advertising research, however, has of-

ten focused on conscious, deliberate, and rational processing of product information, though in actuality the consumer is often unaware of what elements of an ad or attributes of a brand influenced their choice (see Crimmins, 1997). Most processing of advertising messages is subconscious, implicit, and intuitive (Crimmins, 1997; Haley et al., 1994). Consumers usually do not engage in extensive cognitive and deliberate processing of product information even for expensive purchases or if one is a first-time buyer (Hoyer, 1984; Olshavsky and Granbois, 1979). The import of these research and marketplace findings is that emotion is a primary motivator of consumption behavior and that the affect attached to the ad or brand may play a more critical role in an ad's effectiveness than the attitude or thoughts about the brand (Allen et al., 1992; Ervelles, 1998; Hirschman and Holbrook, 1982).

Measuring the emotional response to an ad

As mentioned earlier, standard copy tests have not done well in testing commercials that use emotion to achieve their advertising goals, as standard copy tests are excessively rational and verbal (Haley et al., 1994) and do not tap the qualities and values important in emotional advertising (Agres, 1990; Kover, 1995). A number of approaches have been tried in the attempt to do a better job of measuring emotional responses to ads. The simplest and easiest approach are verbal checklists, and a number have been developed that attempt to tap a full range of emotional responses to ads (Edell and Burke, 1987; Holbrook and Batra, 1987; Zeitlin and Westwood, 1986). A more recent example is the emotional response battery developed at N. W. Ayer that measures 18 sets of emotions (Kover and Abruzzo, 1993). Besides the comprehensive approach to measur-

ing emotional response, there are briefer approaches such as only measuring the specific set of emotions important to the particular ad (Russo and Stephens, 1990), as well as a simple overall rating of ad likability (e.g., Haley and Baldinger, 1991).

A number of researchers have investigated emotional responses to ads by focusing on the higher-order dimensions of emotional space. In an application of Die-ner and Larsen's (1993) work to advertising research, Pieters and de Klerk-Warmerdam (1996) conducted multivariate analyses of emotion word responses to ads and found that unpleasant feelings and low-intensity pleasant feelings affected attitude toward the ad, while high-intensity pleasant feelings affected ad recall. In an extension of cognitive response analysis, Stephens and Russo (1997) had subjects code their listed thoughts on a 7-point emotional valence scale and found that the valence variable was superior to the full 14-category cognitive response model in predicting post-exposure attitudes. The dynamic change in the valence and intensity of the viewer's emotions while watching TV commercials has also been conceptualized as important to the commercial's impact. This change in the viewer's emotions while watching the commercial has been termed emotional flow and found to influence attention, ad liking, and brand liking (Thorson, 1991).

Many researchers (e.g., Agres, 1990; Haley et al., 1994) have felt, however, that these verbal measures of emotion are limited in their ability to tap a person's emotional experience. Emotion is not primarily a language-based experience, and cognitive effort is required to put experience into words. Also, these verbal measures are retrospective in that respondents have to think back to remember what they felt, and as well the reporting is susceptible to social demand influences. Because of these limitations people may not be able

to put into words their complete and accurate emotional response to an ad. There have been various nonverbal methods employed to try and overcome these measurement limitations. Haley et al. (1994) proposed a content analysis of the commercial and has developed equations to help rank-order commercials on nonverbal elements. Agres (1990) described the development and use of a photodeck of facial expressions where respondents select which expression matches their emotional response to the ad. Morris (1995) applied the Self-Assessment Manikin (SAM) developed by Lang, Greenwald, Bradley, and Hamm (1988) to measure ad responses. This is a nonlanguage self-rating system that shows a manikin that varies on the three dimensions of valence, arousal, and dominance of experience (Meharabian and Russell, 1974). A recent method to measure ad-related affect was developed by Peterson and Malhorta (1998), who developed scale items consisting of descriptions of affect-related situations that respondents used to rate their response to an advertisement.

Even though these nonverbal methods avoid dependence on language, they still require memory. This may be a particular problem for television commercials as they can elicit a range of emotional responses that change as the commercial unfolds over time. Real-time or continuous response measurement (CRM) has been used in order to avoid reliance on memory and to trace emotional response over time. Systems for measuring respondents' continuous responses to commercials and programming have been used for decades (e.g., Peterman's "Program Analyzer," Peterman, 1940). Aaker, Stayman, and Hagerly (1986) proposed the "Warmth Monitor," a paper-and-pencil measure that had the respondent moving his arm while tracing with a pencil to indicate warmth. With the advent of the microprocessor,

more technologically and methodologically advanced systems have been developed. For example, Hughes' (1992) "Speedback" system consists of a dial respondents turn to record how favorable they felt toward the commercial at that moment. Researchers have found various CRM measures such as peak emotion to be related to ad liking, brand liking, and brand recall (Baumgartner, Sujan, and Padgett, 1997). Reliability of CRM has also been demonstrated (Fenwick and Rice, 1991; Hughes, 1992). It is still an open question though on what exactly respondents are reporting with these techniques (Baumgartner et al., 1997). As Baumgartner et al. (1997) point out, subjects using CRM could be integrating on-line so that the affect traces are not true reflections of the moment to moment emotional response but more a factor of their overall response. Though researchers have gone to lengths in instructional sets to attempt to ensure that the respondent's emotional response is truly emotional, this concern cannot be completely eliminated. This is because respondents must use cognitive effort to assess and then indicate behaviorally their level of emotion. Respondents must divide their attention and processing resources between the commercial, read-outs of their dial position, changes in their subjective feelings, and sending neuromuscular commands. Turning a dial is not a natural emotion behavior, and cognitive processing capacity must be allocated to the task. This task involvement takes attention away from the commercial, which may diminish responses, or cause cues to be missed that might have elicited emotion. Conversely, just at the moment when the commercial grabs the subject's attention through emotional stimuli their attention would be taken away from their task of monitoring subjective feelings and dial turning.

In attempts to eliminate self-report bias

and the need for cognitive effort in the measurement of emotion, researchers and practitioners in advertising have sometimes turned to physiological measurement methods. However, the two methods that have usually been tried, galvanic skin response and EEG measurement, have not been fruitful. The major problem with these measures is that they are only able to indicate arousal and do not reflect emotional valence. Though some authors have promoted the measurement of arousal by skin conductance as useful for evaluating the effectiveness of an ad (e.g., LaBarbera and Tucciarone, 1995), most researchers and practitioners in advertising have not found it useful in copy testing (Percy and Rossiter, 1997).

Facial expressions as natural emotion behaviors

Emotion researchers have attempted to overcome these stumbling blocks to the measurement of emotion for many years and, as the influential emotion theorist Silvan Tomkins wrote, the task of measuring the primary affects may not be that difficult, as they . . . "seem to be innately related in a one-to-one fashion with an organ system which is extraordinarily visible" (Tomkins, 1962). Tomkins was of course referring to the face. Facial expressions are by far the most visible and distinctive of the emotion behaviors. Since Darwin (1872), human facial displays have been thought to both reflect the individual's current emotional state and to be a means of communicating emotional information. Certain configurations of facial muscle movements have been identified with the expression of specific emotions across disparate cultures (Ekman and Friesen, 1975). In order to measure changes in facial expressions that reflects emotional experience, Ekman and Friesen (1978) developed the Facial Action Coding System (FACS), which codes observable

facial muscle movements. There have been several attempts to measure viewers' emotional responses to television commercials using this system. Graham (1980) had his subjects watch television commercials while their facial expressions were video-taped and coded but found that they displayed "too few content-related facial expressions" to make scoring worthwhile. Derbaix (1995) found verbal affective reports to be related to attitude to the ad but that FACS scores of subjects' facial expressions were not. These results reflect the findings in emotion research at large: mild to moderate emotional stimuli are often not accompanied by visually observable changes in facial expressions.

There is, however, a much more precise and sensitive method to measure changes in facial expressions than visual observation. Electromyography (EMG) measures minute changes in the electrical activity of muscles, which reflects minute muscle movements. Electromyographic techniques have been applied to certain facial muscles, and facial EMG has been shown to be capable of measuring facial muscle activity to weakly evocative emotional stimuli even when no changes in facial displays have been observed with the FACS system (Cacioppo, Petty, Losch, and Kim, 1986). Even when subjects are instructed to inhibit their emotional expression, facial EMG can still register the response (Cacioppo, Bush, and Tassinari, 1992). Facial EMG studies have found that activity of the corrugator muscle, which lowers the eyebrow and is involved in producing frowns, varies inversely with the emotional valence of presented stimuli and reports of mood state; and activity of the zygomatic muscle, which controls smiling, is positively associated with positive emotional stimuli and positive mood state (Cacioppo et al., 1986; Dimberg, 1990; Lang et al., 1993; Schwartz et al., 1979; Sirota and Schwartz, 1982). Ca-

cioppo, Martzke, Petty, and Tassinari (1988) sought to validate that changes in corrugator EMG were indicators of changes in the emotional state of the subject. Their hypothesis was supported: corrugator EMG changes covaried with subtle variations in emotion during an interview, and corrugator muscle activity was found to predict emotional state (Cacioppo et al., 1988). As negative affect is also related to aversive events, corrugator EMG activity has been found related to evaluations of motivational incongruence and the perception of goal obstacles (Pope and Smith, 1994).

Design

In previous psychophysiological investigations of emotion, the first author has used slides of social and emotional stimuli, often lifted from advertisements, that have produced significant changes in facial EMG and emotional response according to the social-emotional attributes of the stimulus (Hazlett and Hoehn-Saric, 1998; Hazlett, Guarda, Heinberg, and Hoehn-Saric, 1998). This methodology appeared to us to hold promise in advertising research and copy testing by offering a precise, quantitative, and valid measure of emotional responses to advertisements. In order to investigate this possibility, we ran a small-scale study of facial EMG responses to a series of 30-second television commercials. We were interested in comparing commercials from the same product category on measures of facial EMG and self-report. Our first hypothesis was that facial EMG would be a more sensitive discriminator between commercials and would be more strongly related to recall than self-report measures. We were also interested in examining continuous measures of facial EMG for individual commercials. Our second hypothesis was that significant elevations above the overall mean for corrugator and zygomatic

EMG would be temporally related to specific emotion-congruent events in the commercial.

Because of the preliminary nature of this investigation, our subject sample was a clinical one and limited in size and scope, and the results we found may not generalize to other samples. However, our hypotheses were tested with within-subject comparisons, and the sample sizes we used have been found adequate to detect condition effects in other within-subject psychophysiological investigations of facial EMG responses (e.g., Cacioppo et al., 1988; Cacioppo et al., 1992). By the same token our selection of commercials was not comprehensive, and the results of this study may not generalize to other commercials. Our purpose in this investigation was to explore the potential of this methodology in the field of advertising, and further investigations would be needed to test hypotheses concerning other demographic samples and commercials.

METHODS

Subjects

Subjects were 25 females; 24 males were used as a control and comparison group to the females. Subjects were a mix of hospital employees, working professionals, and graduate and undergraduate students. The females ranged in age from 20 to 53 (mean = 31) years, and there were 7 blacks and 18 whites, with 18 single or divorced and 7 married. Median household income for the females was \$34,000, with a range from \$10,000 to \$80,000. They had a median number of years of schooling of 16 years, with a range of 12 to 18 years. The males ranged in age from 18 to 63 (mean = 35) years, and there were 2 blacks and 22 whites, with 13 single or divorced and 11 married. Median household income was \$57,000, with a range

from \$20,000 to \$150,000. The males had a median number of years of schooling of 14, with a range of 12 to 20 years. Subjects were monetarily compensated for their participation.

Apparatus and EMG response measurement

Experimental events and data collection were controlled by means of a Coulbourn Instruments (Lehigh Valley, PA) Lablinc Interface System, a Modular Instruments (Malvern, PA) Processing Center, and a 386 IBM-compatible computer. Facial EMG activity was recorded and the data processed as reported in Hazlett and Hoehn-Saric (1998) and Hazlett, McLeod, and Hoehn-Saric (1994).

Self-report measures

The subjects rated each commercial after viewing with paper-and-pencil bipolar visual analogue scales (1 to 20 scale) on the dimensions of felt pleasure (affect valence), arousal (affect intensity), and likability. The instructions for these rating measures were based on the instructions to the Self Assessment Manikin (SAM) scales (Lang et al., 1988) and asked the subjects to rate how they felt while watching the commercials. Subjects also indicated frequency of prior exposure to the commercial. Relevancy of the product shown was measured by asking how much the subject agreed that the product is for "someone like me" (Agres, 1990). Persuasion was measured using the exact question for Overall Brand Rating from the ARF Copy Research Validity Project (Haley and Baldinger, 1991) with the same 6-point response format. Brand recall was measured four to five days after subjects participated in the psychophysiological assessment session by telephoning subjects and asking them what brands they remembered for each product category shown.

Stimuli

Seventeen 30-second commercials from six product categories were presented to the subjects with a VCR and television. The commercials were taped from prime-time TV programming and were selected to represent a variety of products and executions. The categories of commercials shown were automobiles, beauty products, telecommunication companies, soft drinks, food, and movies. Each category had two or three commercials in it, and the commercials' executions were representative of their category. There were two practice commercials at the beginning of the series that were not analyzed. The commercials were presented in a quasi-random order with no two commercials of the same category shown in sequence.

Procedure

The subjects filled out questionnaires on demographic data and individual differences, and the psychophysiological assessment then began with attachment of the sensors. The commercial rating procedure was explained, and the subjects practiced while viewing one 30-second TV commercial. The subjects were told that this was a study of emotion and that sweat gland activity was being measured. Subjects were not informed that facial muscle movements were being measured. Subjects were told to attend to the commercial the entire time it was presented, and only to begin filling out the rating scales at the end of each commercial. The experimenter then left the subject room, and there was a 5-minute rest period after which each commercial was presented for the 30 seconds. There was a quasi-random interval (range 30 to 45 seconds) between trials, during which the subjects rated each commercial as described. Each subject had the same order of presentation and same length of inter-trial interval. Four to five days later subjects were called

and asked about which brands they remembered for each product category.

Data analysis

Within-category comparison of commercials In order to avoid violations of univariate assumptions of sphericity, we followed current recommendations for psychophysiological repeated-measures data (Jennings, 1987; Vasey and Thayer, 1987) and employed the multivariate test statistic (Wilks' lambda) and then post-hoc paired contrasts for categories with three commercials. For categories with only two examples, univariate ANCOVAs were used for the EMG variables and ANOVAs for the rating variables. Analyses of variance and paired contrasts for the EMG variables used the pre-commercial onset EMG level as a covariate to control for differences in baseline levels. We conducted the analyses separately for each sex, since females have been found to be generally more facially expressive than males (Lang et al., 1993), and also sex differences in subcutaneous facial fat deposits differentially affects the strength of the EMG signal, confounding direct comparisons between the sexes. Comparing the sexes on differences in within-subject comparisons can best discover differences between the sexes in their emotional response to the commercials.

Continuous EMG measurement Commercials were analyzed across the 30 seconds for the two facial EMG measures. In order to aggregate across subjects, z scores were created for each subject using the 30 one-second data points for each commercial.

RESULTS AND DISCUSSION

Within-category comparison of commercials

We conducted statistical comparisons for both female and male subjects to test

whether the different types of commercials within each product category resulted in discernible differences in emotional responses. Brand recall was successfully obtained from 22 of the 25 female subjects and from all 24 of the male subjects.

Automobile commercials This category consisted of commercials for Nissan, BMW, and Mustang. The Nissan commercial had a traffic cop about ready to give the car a parking ticket, and then the car, using various parts such as hand brake and windshield wipers, flips a quarter into the meter just in time. The BMW commercial played out the drama of a daring rescue of an attractive female by a handsome BMW driver from a seemingly out of control truck, with the girl's mother popping up in the truck at the end. The Mustang commercial was a series of images, sometimes abrupt, of attractive twenty-somethings with an upbeat message and song throughout the commercial.

For the female subjects repeated-measure MANCOVAs with follow-up tests found (see Table 1) that both the corrugator EMG and the zygomatic EMG response to the Nissan and the BMW commercials were significantly greater than to the Mustang commercial. Neither the arousal ratings nor the degree of persuasion were significantly different between these commercials, but ratings of pleasure, liking, and exposure were significant, and post-hoc pair contrasts indicated that, as with the facial EMG measures, both the Nissan and the BMW commercials were higher on these measures. The male subjects' results were essentially the same with facial EMG and self-report indicating that both the Nissan and the BMW commercial evoked a greater emotional response than the Mustang commercial (Table 1). As there was both

drama and humor in these commercials, the facial EMG reflected greater negative and positive emotion experienced during the commercials, while self-report just indicated greater positive valence and liking. The one difference between the sexes was that the males responded more to the BMW commercial than to the Nissan commercial, which perhaps was related to the finding that the females indicated they found the BMW commercial less relevant. The repeated-measure ANOVAs and follow-up tests for recall found that the brand in the commercial that evoked the greatest emotional response—the Nissan commercial for the females and the BMW commercial for the males—was recalled significantly more than the least-evoking commercial, the Mustang commercial. These results are congruent with other studies that have found greater recall for commercials that evoked greater emotion (Stayman and Batra, 1991).

Beauty-product commercials This category consisted of commercials for Maybelline mascara, Dove moisturizing body wash, and L'Oreal hair coloring. These commercials were quite different in approach and execution. The Maybelline commercial focused on a very attractive female who demonstrated using the product and struck fetching poses and facial expressions, and at the end paired off with an attractive male. The Dove commercial, on the other hand, focused on a number of women of all ages and the product. Sexual attractiveness was de-emphasized—no males were seen in the commercial—while wholesome female beauty of all ages was the theme. The L'Oreal commercial used a well-known model as spokesperson, who in contrast to the model in the Maybelline commercial, was casually dressed in nonprovocative slacks and promoted the product in a mostly informa-

TABLE 1
Analysis of Variance for EMG and Self-Report Measures
by Category

Variable	Females		Males	
	Automobiles		Beauty Products	
Corrugator	4.90 (2,21)**	3.90 (2,20)**	5.34 (2,21)**	4.70 (2,20)**
Zygomatic	7.49 (2,21)***	3.42 (2,20)**	5.77 (2,21)***	0.32 (2,20)
Pleasure	4.16 (2,23)**	7.43 (2,22)***	12.48 (2,23)***	3.85 (2,22)**
Arousal	1.82 (2,23)	3.48 (2,22)**	1.00 (2,23)	2.29 (2,22)
Liking	6.26 (2,23)***	7.25 (2,22)***	13.49 (2,23)***	4.26 (2,22)**
Persuasion	0.68 (2,23)	1.79 (2,22)	5.24 (2,23)**	1.58 (2,22)
Exposure	8.73 (2,23)***	3.13 (2,22)*	2.30 (2,23)	0.49 (2,22)*
Relevance	8.24 (2,23)***	0.58 (2,22)	11.67 (2,23)***	6.40 (2,22)**
Recall	2.62 (2,20)*	3.89 (2,22)**	6.92 (2,20)***	0.17 (2,22)
	Telecommunication		Food	
Corrugator	5.48 (1,23)**	12.28 (1,22)***	1.36 (1,23)	2.51 (1,22)
Zygomatic	4.92 (1,23)**	4.00 (1,22)**	4.53 (1,23)**	8.25 (1,22)***
Pleasure	1.27 (1,24)	3.52 (1,23)**	8.70 (1,24)	2.57 (1,23)
Arousal	1.90 (1,24)	0.45 (1,23)	3.57 (1,24)*	5.54 (1,23)***
Liking	0.90 (1,24)	6.83 (1,23)***	4.92 (1,24)**	4.10 (1,23)**
Persuasion	1.56 (1,24)	5.69 (1,23)***	2.07 (1,24)	0.12 (1,23)
Exposure	2.07 (1,24)	5.42 (1,23)**	12.53 (1,24)***	6.78 (1,23)***
Relevance	12.53 (1,24)***	2.49 (1,23)	0.07 (1,24)	0.24 (1,23)
Recall	3.16 (1,21)*	0.48 (1,23)	1.29 (1,21)	3.06 (1,23)*
	Soft Drinks		Movies	
Corrugator	8.90 (1,23)***	5.55 (1,22)**	2.79 (2,21)*	2.85 (2,20)*
Zygomatic	3.63 (1,23)*	6.44 (1,22)**	2.58 (2,21)*	1.39 (2,20)
Pleasure	19.09 (1,24)***	19.48 (1,23)***	1.41 (2,23)	0.72 (2,22)
Arousal	0.42 (1,24)	2.70 (1,23)	1.60 (2,23)	2.92 (2,22)*
Liking	16.00 (1,24)***	29.78 (1,23)***	1.26 (2,23)	1.77 (2,22)
Persuasion	20.97 (1,24)***	27.71 (1,23)***	0.62 (2,23)	1.96 (2,22)
Exposure	31.13 (1,24)***	1.00 (1,23)	0.71 (2,23)	3.82 (2,22)**
Relevance	6.60 (1,24)**	2.49 (1,23)*	0.09 (2,23)	2.57 (2,22)*
Recall	—	—	5.59 (2,20)**	0.31 (2,22)

Note: * $p < .10$. ** $p < .05$. *** $p < .01$.

tional and rational fashion, though her presentation was at times playful.

The female subjects' MANCOVAs for corrugator EMG and zygomatic EMG were significant and follow-up tests revealed that both facial EMG responses to the Maybelline commercial were significantly greater than for the other two commercials, which were not different from each other. The arousal ratings were not significantly different between these commercials, but pleasure, likability, relevance, and persuasion ratings were all significantly different. In contrast to the facial EMG responses, post-hoc tests found the Dove commercial rated higher on all these self-report measures.

There are several points of interest about the pattern of responses the female subjects had to the beauty commercials that require explanation and are particularly revealing about the differences between these commercials. The facial EMG data indicates that there was both a greater negative as well as greater positive emotional response to the Maybelline commercial. Unlike the automobile commercials, there was not any drama to this commercial, and the negative emotion displayed by the facial EMG to the Maybelline commercial warrants some other explanation. Results from other studies suggest that the higher intensity emotion evoked during this commercial could reflect a conflicted or mixed emotional response with a greater internal tension stimulated by elements of the commercial. This mixed emotional response has been found in other populations to stimuli that evoke such internal tension (e.g., hi-calorie foods for females with eating disorders, Hazlett et al., 1998). Also, viewing attractive females is not necessarily a positive emotional experience for the viewing female, as attractive female models have been found to evoke greater corrugator EMG in females (Hazlett and Hoehn-

Saric, 1998) as well as greater reports of negative emotion (Kenrick, Montello, Gutierrez, and Trost, 1993). Therefore, it is not surprising that the Maybelline commercial evoked greater negative emotion; it is in fact a credit to the creators of that commercial that it also evoked greater positive emotion.

When one looks at the self-report data, however, none of this internal conflict or emotional intensity is found. The Dove commercial, the noncompetitive, wholesome female beauty presentation wins all around on self-report. But tellingly, when subjects were asked about which beauty product brand they remembered, nine subjects remembered the Maybelline brand while *none* remembered the Dove brand, and only one remembered L'Oreal hair coloring. This difference in recall was highly significant (see Table 1). Differences in prior exposure cannot explain this difference, as exposure ratings were not significantly different between commercials (see Table 1). These results illustrate that even though these females say they liked the noncompetitive, wholesome commercial better, and that they were more persuaded by it, in reality they remembered the commercial that evoked a more intense and conflicted emotional experience.

The pattern of results for the males was different and supportive of the above interpretation of the females' responses. Male corrugator EMG was greater for the Dove commercial, while the sexually provocative Maybelline commercial elicited only greater pleasure and liking in these males and not the negative emotion seen with the females. Interestingly, the males appeared to identify with the cleansing message in the Dove commercial as they rated the Dove body wash product as more relevant to them than the mascara or hair color products.

Telecommunication commercials This category consisted of commercials for MCI and AT&T. The MCI commercial presented a series of short scenes of a variety of everyday people of all types, with the theme of learning and equality through the use of the Internet. The AT&T commercial, on the other hand, had professionals in business suits surfing down a city street and emphasized business advantage to using the Internet. Again, the commercials we were comparing took different approaches, and even though they were aired at the same prime-time slots during similar shows, the target audiences may have been somewhat different.

Both the corrugator EMG and the zygomatic EMG responses to the MCI commercial were significantly greater than the responses to the AT&T commercial for both females and males. The comparisons between commercials for the pleasure, liking, and persuasion ratings were not significant for the females, but contrary to the facial measures, were greater for the AT&T commercial for the males. Unlike the females, however, who did not indicate differences in prior exposure to these two commercials, the males indicated that they had substantial and significantly greater prior exposure to the AT&T commercial, which clouds the interpretation of the males' EMG and self-report differences. There was a trend for greater brand recall for females to the MCI commercial; the commercial facial measures indicated it was more emotionally stimulating for them. The females also found the MCI commercial to be more relevant for them than the business-oriented AT&T commercial, which may well be the basis for the greater emotional response and recall for the MCI commercial.

Food commercials This category consisted of commercials for Kellogg's corn flakes and Old El Paso taco sauce. The

Kellogg's commercial used images of children and adults playing and having fun and enjoying the wholesome good country life with a positive emotion background song. The Old El Paso commercial used a Hawaiian-shirted overweight male who danced with a frying pan and displayed the product to a popular rock tune. These two commercials were selected for this category because they were examples of two distinctly different yet popular approaches to evoking positive emotion.

The zygomatic EMG, arousal, and liking ratings were greater for the Old El Paso commercial for both females and males, while pleasure ratings were greater only for females. Persuasion ratings and relevance ratings were not different between commercials. Brand recall was greater for the Old El Paso commercial for the males, though prior exposure may have influenced recall as the males as well as females indicated they had greater prior exposure to this commercial. For this set of commercials the facial EMG and self-report measures were congruent, though with facial EMG more discriminating than self-report for the males, indicating the humorous Old El Paso commercial evoked greater positive emotion.

Soft-drink commercials This category consisted of two Pepsi commercials. One was a "Next Generation" collage of sometimes bizarre and punkish images with loud rock music, and the other was a humorous one of Darth Vader on the movie screen dueling with an elderly usher. We were interested in this category in comparing commercials for the same brand and product that used very different approaches to capture the viewer's attention.

The corrugator EMG was significantly greater for the Next Generation commercial and the zygomatic greater for the Star Wars commercial for both sexes. Pleasure, liking, persuasion, and relevance ratings

were all significantly greater for the Star Wars commercial. It was not possible to compare brand recall, as the brand was the same for both. As measured by both facial EMG and self-report, the humorous approach of Star Wars was very successful in generating positive emotion as compared to the Next Generation commercial. Greater relevance is a very interesting finding, as obviously both commercials were for the same product and brand.

Movie commercials These commercials were for the movies *The Saint*, *The Devil's Own*, and *Men in Black* and consisted of a number of short footage clips from the movies. Both the female subjects' MANCOVAs for corrugator and zygomatic EMG means indicated trends, and follow-up tests revealed that there was a greater corrugator EMG response to *The Saint* than the other two movies and greater zygomatic response to *Men in Black*. The males showed the same pattern of corrugator EMG response but did not show significant differences between commercials for zygomatic EMG. Self-reported ratings did not find any differences between these movies, with the one exception that the males showed a trend for arousal ratings to be lower for *The Devil's Own* than the other two movies. Prior exposure was measured by whether the respondent had seen the movie, and the males indicated that they had seen *Men in Black* more often. Only females showed a significant difference between these movies on recall of movie title, with *Men in Black* being the most-recalled movie. Though the differences in responses between these commercials were not as striking or as significant as several of the other categories, these comparisons do again illustrate the greater sensitivity of facial EMG measures, as compared to self-report to find differences between the commercials, and that the brand or title in

. . . for the female subjects these product category comparisons found facial EMG to discriminate between commercials for all six categories, . . .

the commercial that evoked the greatest emotional response (in this instance positive emotion for the females) was better recalled.

In sum, for the female subjects these product category comparisons found facial EMG to discriminate between commercials for all six categories, while self-report valence measures discriminated similarly for three categories and found disparate results for one category as compared to facial EMG. Female brand recall was better for the commercial that evoked the greater emotional response as measured by EMG for four out of five categories, while self-report only correctly predicted recall for one category and actually predicted the wrong commercial for one category. The males' responses to these commercials were similar to the females for four of the six categories. There was a notable difference between the sexes in emotional responses to the beauty and telecom categories, and these differences can be explained by significant differences in relevance of the commercials within the category as well as relevance of the beauty products category itself. In considering the males' responses to the commercials overall, they had both more frequent within-category differences in relevance and prior exposure to these commercials and weaker differences in brand recall between commercials than did the females, which afforded less of an opportunity for comparing male facial EMG and self-report. Four categories had male EMG and self-report responses congruent, one found only EMG discriminating between the commercials, and one category found

EMG and self-report not congruent. Of the two categories that had significant brand-recall differences, both facial EMG and self-report indicated the commercial that elicited the greater emotional response had the greater recall.

Continuous EMG measure of selected commercials

As it would be prohibitive for reasons of space to present the analyses from all the commercials used in this study, we selected a few commercials that seemed most likely to illustrate the potential of continuous facial EMG measurement. The commercials that were selected had one or more of the following aspects: (1) the commercial had elicited a strong overall emotional response; (2) there were substantial changes in emotional tone during the commercial; or (3) the commercial elicited a substantial mixed (both positive and negative) emotional response from subjects. We established these selection criteria so we would increase our chances of examining responses to commercials that had elicited emotional flow (Thorson, 1991) in these subjects and to test our hypothesis that significant facial EMG responses would be related to specific emotion-congruent events in the commercial. For space and simplicity's sake the three figures illustrate these results with the female responses, which we found sufficient to show the emotional flow patterns of the commercials.

Humorous commercials First we will examine two commercials that used humor to affect the emotion of the viewer: the

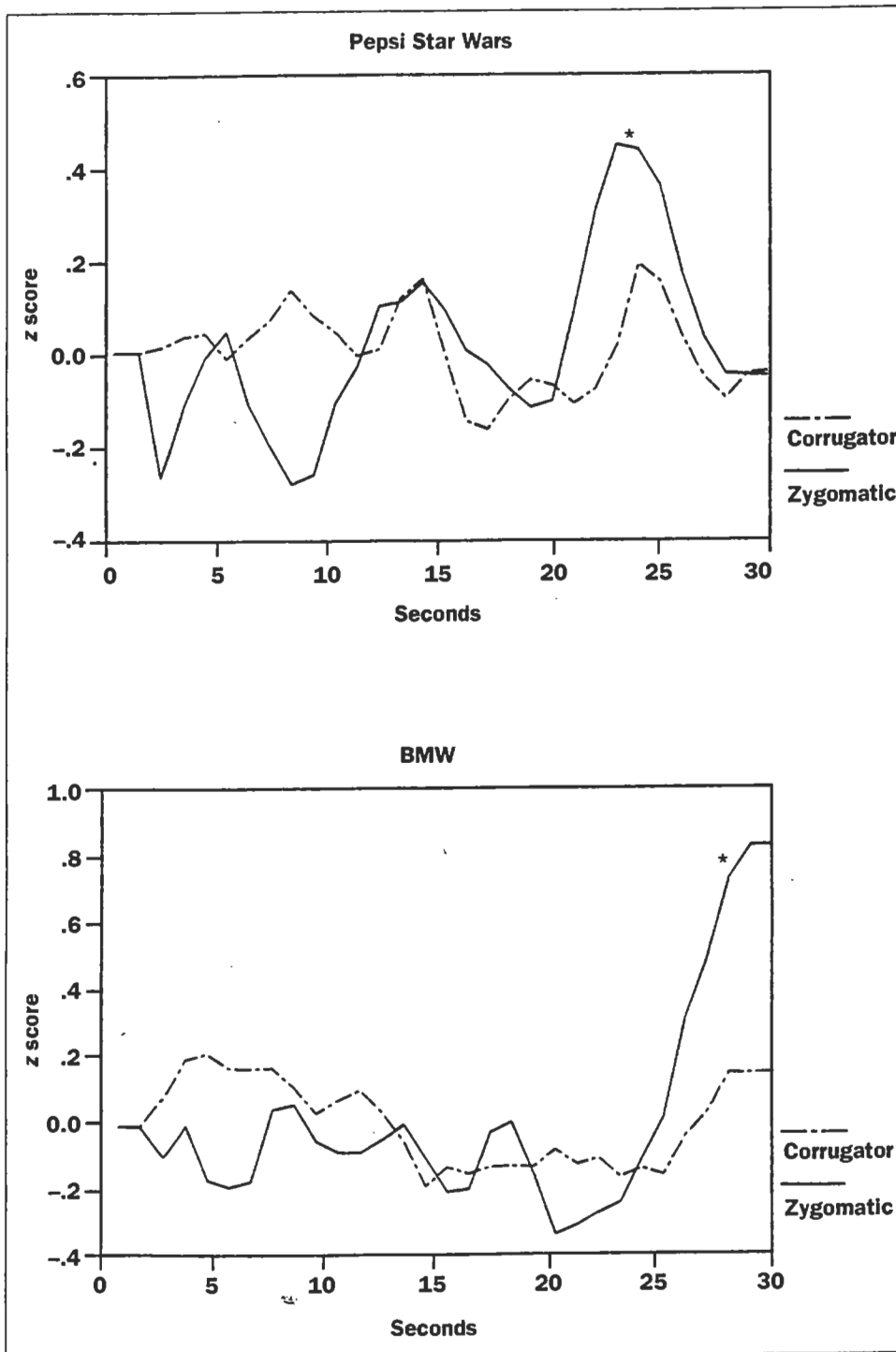


Figure 1 Pepsi Star Wars Commercial and BMW Commercial Mean facial EMG responses for females across time to selected Humorous Commercials.

* indicates significant elevation above the mean.

Pepsi Star Wars commercial and the BMW commercial. The female subjects' mean 1-second z-scores are presented in Figure 1. You can see that in the Pepsi commercial there is a large increase in the zygomatic EMG beginning at about 20 seconds, which is significantly greater than the mean ($F(1,24) = 5.07, p < .034$). The males exhibit a similar significant peak at about 25 seconds ($F(1,23) = 6.54, p < 0.19$), and this is the only significant peak for zygomatic or corrugator EMG for either sex. When we review the commercial, we find that the usher and Darth Vader begin dueling at 19 seconds and continue until 24 seconds, with a number of humorous events occurring meanwhile, such as people getting their hair cut off by the laser beams. As we see, the zygomatic peak occurs at the end of this humorous segment, and the brand is then displayed and mentioned until the commercial finishes. If one makes the assumption that it is valuable to have brand stimuli exhibited during high positive emotion to enhance positive feelings being associated with the brand, then the creators of this commercial were fairly successful, catching the tail end of the positive emotion peak.

The BMW commercial data also demonstrates a successful execution of a joke. The large increase in zygomatic EMG that occurs beginning at about 24 seconds (see Figure 1) is significant for the females ($F(1,24) = 12.08, p < .002$) and the males ($F(1,23) = 12.44, p < .001$) and coincides with the mother popping up to reveal that the daring rescue of her daughter by the BMW driver was a scheme, presumably to marry her off. The BMW commercial had drama and excitement until the punch line, and, as with all successful punch lines, it caused an abrupt shift in emotion to the positive.

Movie commercials The facial EMG responses to the commercial for the movie

The Saint are more complex and illustrate a dramatic unfolding of events. For the first 16 seconds of the commercial there is a setting of the stage as one catches glimpses of the main character and others while the plot is alluded to. Then at approximately 16 seconds one of the villains in the movie states "too bad we will have to kill him," referring to the Saint. The next 8 to 10 seconds consists of action and escape scenes, and the buildup in corrugator EMG for the females (seen in Figure 2) that coincides with these events is significant ($F(1,24) = 6.11, p < .021$), while the corrugator EMG for the males peaks (less strongly) at the end of this action scene at 25 seconds ($F(1,23) = 3.13, p < .091$). At about 22 seconds one begins to see brief glimpses of the hero and heroine engaged in what might be described as high-intensity relationship development, with the heroine putting her trust in the Saint and then apparently successfully escaping together, though of course nothing is revealed for certain. The romantic and exciting pairing-off elicits positive emotion in both sexes, with the females exhibiting a significant zygomatic peak at 25 seconds ($F(1,24) = 5.56, p < .027$) and the males at 26 seconds ($F(1,23) = 6.16, p < .021$). The movie's title is displayed and mentioned beginning at 25 seconds, so this commercial is also successful at pairing positive emotion with brand name or, in this case, title of product. This commercial illustrates how there can be negative emotion experienced in a commercial that has a high likability rating. The tension and drama that evoke negative affect does not detract from liking the commercial, but the likability rating does not reveal the complexity of emotional response.

The corrugator EMG response (see Figure 2) to *Men in Black* is significantly elevated above the mean at 3 to 5 seconds into the commercial for the females

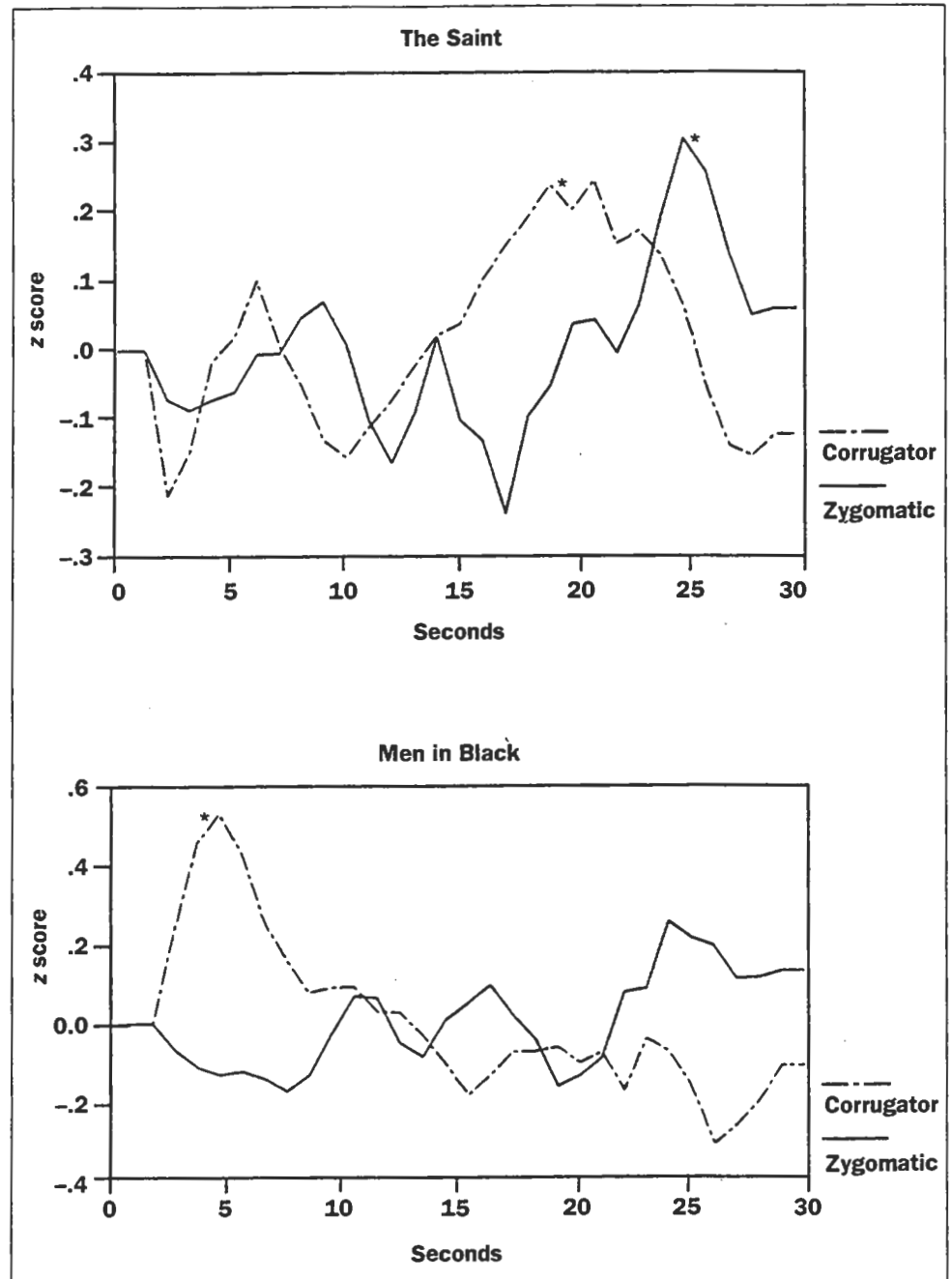


Figure 2 *The Saint* and *Men in Black* Commercials Mean facial EMG responses for females across time to selected Movie Commercials.

* indicates significant elevation above the mean.

($F(1,24) = 7.60, p < .011$) and the males ($F(1,23) = 10.25, p < .005$). At the beginning of this commercial there is a rapid succession of scenes culminating at about 4 to 5 seconds with the dramatic view of a spaceship crashing to the ground in front

of the protagonists' feet. The corrugator response is likely a reaction to this buildup and dramatic scene.

Beauty-product commercials Lastly, we will examine the facial EMG responses to

two of the beauty commercials. The L'Oreal commercial began with an informational presentation by the spokesmodel as the camera slowly closes in on the model, starting at a full-length shot of her and the surrounding room and ending at about 9 to 10 seconds with a head shot. At

this point in the commercial the model begins to be more playful and less serious, smiling at the viewer and tossing her hair. The commercial then becomes more focused on the rewards of using the product, and visually several scenes are shown of the model playing with a dog by the

pool-side and fluffing and showing off her hair playfully. This increased playfulness is accompanied by a significant climb for the females in zygomatic EMG ($F(1,24) = 4.93, p < .036$) that peaks at about 22 seconds when the product is being displayed (see Figure 3). This commercial is an example of a very successful pairing of the product and positive emotion for the female audience, as the product is displayed during the peak positive emotion that the creators of the commercial had built up over the last few seconds. The males also had one significant peak in zygomatic EMG ($F(1,23) = 4.40, p < .047$), but theirs was briefer and earlier, occurring at 10 to 11 seconds when the camera first achieves its close head shot and the model first smiles and becomes less serious. This was actually a low point for the females in facial EMG, and their positive response took several seconds to begin building as the commercial's focus expanded to more than just the model's face and smile. These results indicate that the females appeared to get involved in the commercial's product message, while the males only briefly responded to the model herself, which is congruent with the fact that the males indicated less relevance for this beauty product.

The female facial EMG responses to the Maybelline commercial offer an intriguing example of significant positive and negative emotional responses in the same commercial. One might have expected that the negative emotion had been elicited at one moment during the commercial, and the positive emotion at another. However, as we can see from Figure 3, there is only one significant peak for both the corrugator ($F(1,24) = 7.48, p < .012$) and zygomatic ($F(1,24) = 4.16, p < .053$), and they both occur from approximately 12 to 15 seconds. The product itself is shown from 10 to 12 seconds, and then there is a closeup of the very attractive female using the product

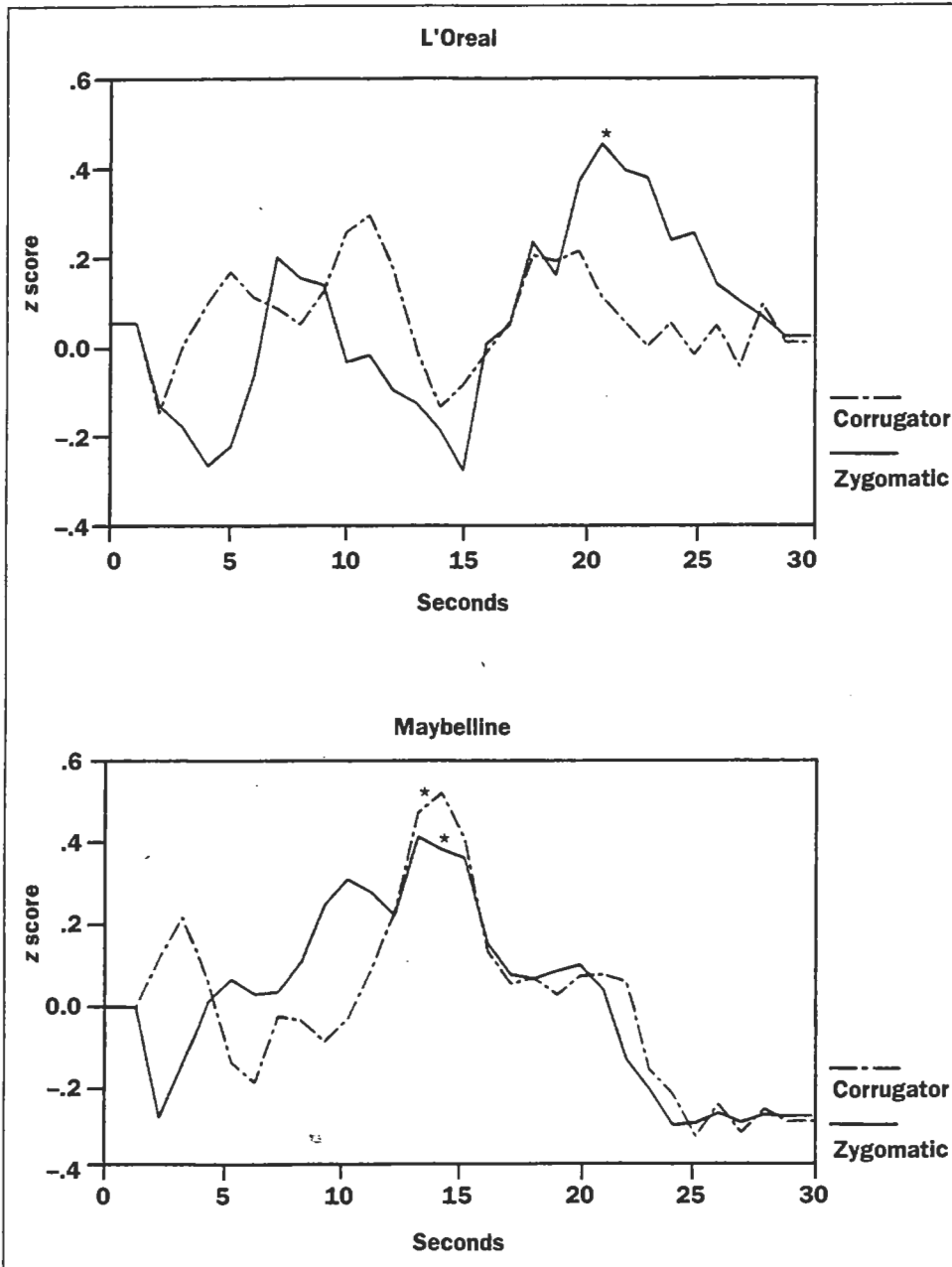


Figure 3 L'Oreal and Maybelline Commercials Mean facial EMG responses for females across time to selected Beauty Commercials.

* indicates significant elevation above the mean.

until about 16 seconds. One explanation for this simultaneous elevation is that at that moment, for many of the female viewers, the commercial had elicited a strong emotional response that had both positive and negative elements. Other research indicates that when females view attractive females there can occur a self-critical comparison process which results in lowered self-esteem and negative emotion (Cash, Cash, and Butters, 1983; Heinberg and Thompson, 1995). Attractiveness, however, also can elicit positive emotion and an emulation process, and it is possible that a competitive response as well as an identification response occurs for these females. These are tentative explanations to this very interesting finding, and further research will be needed to answer this question more completely. Perhaps a combination of facial EMG and cognitive response analysis would be most revealing here.

The males had a very different response to the Maybelline commercial, and their response pattern lends support for the differential impact of viewing same-sex and opposite-sex attractive targets. The males had only one facial EMG peak that approached significance ($F(1,23) = 3.49$, $p < .080$), and that was for the corrugator muscle at 10 to 12 seconds, which coincides exactly with the time period when the attractive opposite-sex model is removed from the screen and is replaced with a detailed full-screen view of an eye liner brush. Since this commercial elicited high overall means for positive emotion and liking measures for the males, this response pattern likely reflects that the males' enjoyment while viewing the attractive female was abruptly interrupted when she was replaced with the view of an irrelevant product, which elicited a burst in negative emotion that disappeared as soon as the female model reappeared.

Facial EMG measures were a more sensitive discriminator between commercials and were more strongly related to measures of recall than self-report measures.

GENERAL DISCUSSION

The results of this study support both of our hypotheses. Facial EMG measures were a more sensitive discriminator between commercials and were more strongly related to measures of recall than self-report measures (see Table 2). Significant elevations in the continuous EMG measures were related to specific emotion-congruent events in the commercial. These results affirm the usefulness of facial EMG in measuring emotional responses to advertising and that facial EMG could play a valuable and unique role in copy testing. Facial EMG measures can reflect a qualitative richness and complexity of the viewer's emotional response that self-report measures cannot and, at the same time, offer precise and continuous quantitative data.

The results of this study illustrate the susceptibility of self-report to distortion by extraneous influences. The self-report to the Pepsi commercials indicated that the more positive emotion commercial, the Star Wars commercial, was about a more relevant product than the Next Generation commercial, even though both commercials were about the same product. The difference in emotional response to the two commercials may have influenced how relevant the soft drink was viewed, or the respondents may have actually answered the question "how relevant did one find the commercial?" Whichever it may be, these findings illustrate how little self-report may have to do with the question asked. Social demand or political correctness likely drove the Dove commercial's self-report ratings higher

than the female respondents truly felt and would have resulted in inaccurate and incomplete conclusions being formed if the beauty product commercials were compared solely on self-report.

The commercials we used were lifted off the air from prime-time TV programming, and we were not able to control for prior exposure and brand effects to the extent we would have liked. This made some of our comparisons tenuous or even not possible, particularly for the males. Also, the conclusions we drew from our continuous-measures analyses were post-hoc and open to interpretation. Though this study was an encouraging beginning in the use of facial EMG methods in advertising research, the next phase of this research program needs to control for the above limiting factors better and as well employ stronger advertising effectiveness measures. The focus of this next phase will be to use facial EMG measures to test a priori hypotheses about the ability of different elements of the ad to elicit the intended emotional responses, as well as the ad's effectiveness. We have already begun to work with advertisers and their agencies to test ads at a much earlier stage of development than we were able to do in this study and to relate the facial EMG measures we have developed to sales data and other indicators of advertising effectiveness.

CONCLUSION

Facial EMG measurement offers the practitioner as well as the academic in advertising research an opportunity to get beyond the limitations and biases that often

TABLE 2

Summary of Overall Results Comparing Facial EMG and Self-Report Emotion Measures

Comparison	Sex	Emotional Valence Measure			
		Facial EMG		Self-Report	
Discriminated between commercials	Females	6	100%	3	50%
	Males	6	100%	4	66%
Highest emotion commercial was best recalled	Females	4	80%	1	20%
	Males	2	100%	2	100%

Note: Number is how many of the 6 product categories. Percentage for recall is based on the total number of categories that had significant recall differences between commercials.

plague self-report. Both theory testing and measuring advertising effectiveness could benefit from a more accurate and sensitive measure. Facial EMG measurement is an individual assessment method and group data collection is not possible, but the technique is not too time consuming and is comparable to other individual assessment methods such as cognitive response analysis: hooking up the sensors only requires several minutes with the right equipment and an experienced technician, and then the commercial viewing time would be similar to any other measurement method. **JAR**

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