ABSTRACT

A debate has arisen in this journal regarding the utility of psychophysiological measures in general; and of electroencephalographic measures in particular, for evaluating the specific effects of advertising executions. We briefly summarize the positions and replies that have been set forth. Although each is found to have something to contribute, it is also clear that additional basic research using complex persuasion materials in consumer settings is necessary before specific cognitive, emotional, and behavioral advertising effects can be inferred from psychophysiological data. This raises general questions regarding the goal and value of the psychophysiological enterprise. It is suggested that a psychophysiological approach is potentially informative, especially when studying theoretical issues regarding processes underlying social behavior. Research on yet another physiological response system, electromyographic activity recorded over the muscles of facial expression, is discussed for purposes of illustration. It is concluded that research has not and is not likely to demonstrate invariant psychophysiological links nor has it revealed so little about social processes and behavior that physiological responses and systems can be disregarded. An alternative conception of the psychophysiological enterprise is outlined.

Physiological Responses and Advertising Effects:

Is the Cup Half Full or Half Empty?

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In the inaugural issue of *Psychology and Marketing,* a debate emerged regarding psychophysiological analyses of advertising. Weinstein, Weinstein, and Drozdenko (1984) surveyed ten years of work from their laboratory on electroencepha-

require much ingenuity to arrange a pressure gauge with an index and dial to indicate changes in stress. . . . I have made some crude experiments, but being busy with other matters, have not carried them on (p. 184).

PHYSIOLOGICAL MEASUREMENT OF ADVERTISING EFFECTS?

Weinstein et al. (1984) clearly view their Brain Wave Analysis to be an advance over verbal measures alone when assessing specific advertising effects:

> For the most part, Brain Wave Analysis does not give an absolute index identifying whether the commercial is "good" or "bad." It does tell us, however, how the viewer responded to the commercial. . . . There are also times when Brain Wave Analysis can point directly to flaws in an ad (Weinstein et al., 1984, p. 29).

Weinstein et al. (1984) claim that EEG measures can be used to assess, among other effects, viewers' attention to the advertisement at specific points in time, the intensity of the emotional reactions elicited by specific aspects of the advertisement, and their comprehension and retention of the advertisement. To assess these specific communication effects, they extract measures of what they termed "arousal" and "interest," and specific advertising effects are inferred from these measures (and their derivatives) given the particular context in which the EEG was recorded. For instance, two arousal-scores, one for brain wave activity over each hemisphere, is determined for each individual every five seconds using the ratio of beta to alpha wave activity recorded over the parietal regions. A third score, based on the ratio of arousal scores obtained over the right and left parietal lobes is used as an index of changes in logical versus emotional processing.

There are several reasons to view the work by Weinstein and his colleagues' as hypothesis-generation rather than hypothesis-testing. Numerous details regarding the specific experimental design, materials, and procedure were undisclosed, presumably due to clients' proprietary rights (Weinstein et al., 1984, p. 24), making it impossible to replicate exactly or evaluate fully the studies in the Weinstein et al. report. Second, because most studies were conducted to contrast specific advertisements provided by clients, rigorous experimental controls such as independently varying the features of an advertisement and the product advertised were not included. Indeed, Weinstein et al. (1984) acknowledged that:

> Examining consistency and differences of ad content across a number of studies can only be considered exploratory because of the post hoc nature of these analyses (Weinstein et al., 1984, p. 18).

Third, although the conceptualization of hemispheric functioning presented by Weinstein et al. is simplified for didactic purposes (e.g., see Weinstein et al., 1984, p. 22), the presentation may have left a misleading impression regarding

In contrast to Weinstein et al.'s suggestion that relative EEG activation recorded over the parietal lobes indexes emotional processing, however, we found *no* evidence that the relative alpha abundance over the parietal lobes was related to attitudes or to the total number of emotional thoughts expressed by subjects. This led us to reinterpret their empirical observations. That is, our studies suggested that the EEG data reported by Weinstein and his colleagues were not artifactual, but our research also called into question the interpretation Weinstein et al. (in press) suggest we supported.

Finally, Weinstein and his colleagues have been inconsistent in the conclusions they have drawn regarding the significance of their research thus far. At one point, they indicate that their Brain Wave Analysis has a wide range of application:

> In its current state, Brain Wave Analysis has been applied in the evaluation of the effectiveness of a number of types of communication. As with many new technologies, there is a constant development of new potential applications. At the time this paper is being written, several new applications are being explored (Weinstein et al., 1984, p. 38).

In their concluding statement, however, Weinstein et al. indicate that by their own design they have presented an interesting set of hypotheses regarding EEG activity and advertising effects, and that this is all they intended to do:

> In the present paper, an attempt has been made, through applied research examples, to point out possible circumstances in which brain wave technology may be employed for marketing research studies (Weinstein et al., 1984, p. 41).

Then, again in the abstract to their rebuttal, Weinstein et al. (in press) suggest that they have not offered hypotheses, but tested propositions:

> Evidence is presented from both basic and applied EEG methods as evaluators of advertising effectiveness.

We share both the sentiment expressed by Weinstein et al. (1984) in their closing comments (see above) and Stewart's (1984) concern regarding the validity of the Brain Wave Analysis. What is needed now in our view are not more speculations regarding new applications of EEG technology, but carefully controlled experiments using complex advertising materials in naturalistic (e.g., social) settings. What exactly the psychophysiological enterprise entails might also be reconsidered—a task to which we turn later in this article.

A PROMISE UNFULFILLED?

The Weinstein et al. (1984) article was accompanied by a companion article by Stewart (1984), entitled, "Physiological measurement of advertising effects: An unfulfilled promise." In it, Stewart contended that:

> bitrarily selected, performance measure. When such functions are found they are of use to the extent that it is possible to address issues of theoretical import by employing psychophysiological measures as a source of data about the organism (Donchin, 1982, p. 457–458).

This alternative view of the psychophysiological enterprise makes no pretense of demonstrating invariant physiological correlates of psychological events. Instead, what is known about the physiological system from which measures are obtained, and the social psychological context in which the measures are obtained, is used to derive specific hypotheses with limited ranges of construct validity and application.

To illustrate, consider the somatic nervous system, which is the ultimate mechanism through which people react to, interact with, and modify their environments. Of particular interest here are the muscles of facial expression, which are peculiar even for somatic effectors. The muscles of facial expression are innervated by the 7th cranial nerve, and these muscles are linked to connective tissue and fascia rather than to skeletal structures. One interesting suggestion that has been advanced based on this peculiar structure is that the neural activation of the facial muscles of expression often exerts indirect influences on the physical and social environment, effects which are mediated by the construction of facial configurations (Rinn, 1984). Indeed, there is now a growing literature within psychology on these facial configurations emphasizing: (a) their evolutionary history and adaptive utility; (b) their power as social stimuli in interspecies and intraspecies communication of information (e.g., language), misinformation (e.g., deception), and emotion (e.g., threat); and (c) the associated movements accompanying intrapersonal processers such as silent language processing and emotion (e.g., Cacioppo & Petty, 1981; Darwin, 1872/1904; Ekman & Friesen, 1975; Izard, 1971; Zuckerman, DePaulo, & Rosenthal, 1981).

Of course, not all interpersonal and intrapersonal processes are accompanied by visually or socially perceptible expressive facial actions. The possibility that events too fleeting or subtle to evoke an overt expression can nevertheless be tracked exists, however, because the neural innervation of the striated muscles results in muscle action potentials (MAPs) which can be detected using electromyography (EMG) even when there are no perceptible muscle contractions. Love (1970), for instance, videotaped peoples' facial expressions while they were exposed to a proattitudinal or counterattitudinal appeal and reported detecting no differences in overt expression. We subsequently replicated the observation regarding the absence of distinctive overt facial expression during a persuasive communication while also demonstrating that the mean amplitude of integrated EMG activity recorded over selected muscle regions of facial expression (e.g., zygomatic major) differentiated subjects who were exposed to the proattitudinal appeal from those exposed to the counterattitudinal appeal (Cacioppo & Petty, 1979).

Studies of emotional imagery have provided further evidence that positive and negative affective processing can lead to localized changes in EMG activity

controls. Only after a series of careful studies using these psychophysiological measures in applied research settings—that is, only after uninteresting antecedents are identified, appropriate controls are devised, and a series of rather unspectacular claims have been documented—may these assessments be useful to address and resolve specific theoretical questions that have practical significance to the manager or decision maker in an applied area.

THE PROMISE OF PSYCHOPHYSIOLOGY REVISITED

Verbal, nonverbal, and physiological measures have different attributes, distinctive utilities and disutilities, and only partially overlapping ranges of validity. All are potentially useful in limited contexts as episodic markers, and none is "purer" than any other. (1) For instance, facial EMG responses, like verbal reports, are controllable but not always controlled. The fact that the ranges of application for these measures are not identical makes each worthwhile. Research on theoretical processes and products in consumer behavior has traditionally relied on people's self-reports to assess the efficacy of the experimental manipulations or blocking variables, the effects of these variables on verbal or overt behavior, and the operation of the assumed intervening process. This is a great deal to ask of any single measurement strategy. Inferences regarding the timing, nature, and intensity of the underlying consumer processes based solely on verbal measures can be called into question, since these measures: (a) may occur at various points after the events constituting the posited process, (b) may be unrepresentative of all but the material which can be easily remembered at the time of measurement (e.g., material in short-term memory and highly accessible information in long-term memory), and/or (c) may be colored by the cognitive strategy by which responses are requested (e.g., coherent verbal reports or ratings).

These limits in verbal data correspond with potential strengths in psychophysiological assessments—strengths that have been realized in several areas of psychology (cf. Coles, Donchin, & Porges, in press). But for a physiological reaction to serve as a marker for a psychological process, it should be shown that, *within a given experimental context,* the physiological reaction: (a) can be measured reliably and is stable across time; (b) occurs infrequently in the absence of the psychological process of interest; and (c) generally emerges at the onset and returns to basal levels at the offset of the psychological process of interest (although reliable time-lags between the two levels can be accommodated). The research on affective processing and facial EMG activity is a case in point.

In sum, when the regions of validity between specific verbal and physiological measures diverge, each may provide information about behavior that is not attainable from the other. In additon, the overlapping regions of validity for psy-

1. The term episodic marker refers simply to a temporally stable indicator of the presence of a particular psychological process (cf. Iacono, 1983).

Cacioppo, J. T., Petty, R. E., & Marshall-Goodell, B., (1984). Electromyographic specificity during simple physical and attitudinal tasks: Location and topographical features of integrated EMG responses. *Biological Psychology, 18,* 85–121.

Capioppo, J. T., Petty, R. E., & Quintanar, L. (1982). Individual differences and relative hemispheric alpha abundance and cognitive responses to persuasive communication. *Journal of Personality and Social Psychology, 43,* 615–628.

Coles, M. G. H., Donchin, E., & Porges, S. (Eds.) (1985). *Psychophysiology: Systems, Processes, and Applications.* New York: Guilford Press.

Darwin, C. (1904). *The expression of the emotions in man and animals.* London: Murray. (Originally published, 1872).

Davidson, R. J. (1984). Cerebral asymmetry and emotion. *Psychophysiology, 21,* 564.

Davidson, R. J., & Fox, N. A. (1982). Asymmetrical brain activity discriminates between positive and negative affective stimuli in human infants. *Science, 218,* 1235–1237.

Davidson, R. J., Schwartz, G. E., Saron, C., Bennett, J., & Goleman, D. J. (1979). Frontal versus parietal EEG asymmetry during positive and negative affect. *Psychophysiology, 16,* 202–203 (Abstract).

Donochin, E. (1979). Event-related brain potentials: A tool in the study of human information processing. In H. Begleiter (Ed.), *Evoked potentials and behavior.* New York: Plenum Press. Pp. 13–75.

Donochin, E. (1981). Surprise! . . . Surprise? *Psychophysiology, 18,* 493–513.

Duffy, F. H., Bartels, P. H., & Burchfiel, J. L. (1981). Significance probability mapping: An aid in the topographic analysis of brain electrical activity. *Electroencephalography and Clinical Neurophysiology, 51,* 455–462.

Ekman, P. (1979). About brows: Emotional and conversational signals. In M. Von Cranach, K. Foppa, W. Lepenies, & D. Ploog (Eds.), *Human ethology.* Cambridge: Cambridge University Press.

Ekman, P., & Friesen, W. V. (1975). *Unmasking the face.* Englewood Cliffs, NJ: Prentice-Hall.

Englis, B. G., Vaughan, K. B., & Lanzetta, J. T. (1982). Conditioning of counter-empathic emotional responses. *Journal of Experimental Social Psychology, 18,* 375–391.

Fridlund, A. J., & Izard, C. E. (1983). Electromyographic studies of facial expressions of emotions and patterns of emotion. In J. T. Cacioppo & R. E. Petty (Eds.), *Social psychophysiology: A sourcebook.* New York: Guilford Press.

Galton, F. (1884). Measurement of character. *Fortnightly Review, 42,* 179–185.

Izard, C. E. (1971). *The face of emotion.* New York: Appleton-Century-Crofts.

Krugman, H. E. (1980). Point of view: Sustained viewing of television. *Journal of Advertising Research, 20,* 65–68.

Lacey, J. I. (1967). Somatic response patterning and stress: Some revisions of activation theory. In M. H. Appley & R. Trumbull (Eds.), *Psychological stress: Issues in research.* New York: Appleton-Century-Crofts.

Love, R. E. (1972). Unobtrusive measurement of cognitive reactions to persuasive communications. Unpublished doctoral dissertation, Ohio State University.

Nevid, J. S. (1984). Methodological considerations in the use of electroencephalographic techniques in advertising research. *Psychology and Marketing, 1*(2), 5–19.

Petty, R. E., & Cacioppo, J. T. (1983). The role of bodily responses in attitude measurement and change. In J. T. Cacioppo & R. E. Petty (Eds.), *Social psychophysiology: A sourcebook.* New York: Guilford Press.

Rankin, R. E., & Campbell, D. T. (1955). Galvanic skin response to Negro and white experimenters. *Journal of Abnormal and Social Psychology, 51,* 30–33.

Ray, W. C., & Olson, J. C. (1983). Perspectives on psychophysiological assessment of psychological response to advertising. In L. Percy and A. G. Woodside (Eds.), *Advertising and consumer psychology.* Lexington, MA: D. C. Heath, pp. 253–269.

Rinn, W. E. (1984). The neuropsychology of facial expression: A review of the neurological and psychological mechanisms for producing facial expression. *Psychological Bulletin, 95,* 52–77.

Rothschild, M. L., & Thorson, E. (1983). Electroencephalographic activity as a response to complex stimuli: A review of relevant psychophysiology and advertising literature. In L. Percy & A. G. Woodside (Eds.), *Advertising and consumer psychology.* Lexington, MA: D. C. Heath, pp. 239–251.