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 Drozdzenko (1984) surveyed ten years of work from their laboratory on electroencepha-
lographic (EEG) activity as a function of advertising stimuli. Weinstein et al. (1984) suggested that their technique for analyzing EEG activity provided a relatively unbiased means for evaluating specific effects of advertisements. Stewart (1984), on the other hand, contended history has shown repeatedly that physiological assessments are employed prematurely to study advertising effects in the false hope that these assessments would provide "purer" measures of specific psychological processes or behavioral inclinations. Moreover, Stewart suggested the work of Weinstein and his colleagues may be subject to this criticism. Since the appearance of these articles, a rebuttal by Weinstein, Drozdenko, and Weinstein (1984), a review of the methodological issues involved when using EEG activity to study the effects of advertising (Nevid, 1984), and a reply to Weinstein et al.'s (in press) rebuttal (Stewart, in press) have appeared. Our goals in the present article are to comment on the various positions that have been set forth and to suggest more fruitful directions for research.

THE PROMISE OF PSYCHOPHYSIOLOGY

The lure of using physiological measures by advertising researchers has been noted by Weinstein et al. (1984) and Stewart (1984). Traditional assessments such as self-report measures of attitudes or purchase inclinations require several sometimes dubious assumptions—that people are able to determine their attitudes or behavioral inclinations toward stimuli and that they are willing to disclose this information truthfully to another person (e.g., Rankin, 1955; Westie & DeFleur, 1959; see recent reviews by Petty & Cacioppo, 1983; Stewart & Furse, 1982). Part of the attraction of physiological measures in this area apparently derives from the fact that these measures have some of the attributes one would want in a "valid" index. A continuous record of physiological activity can be collected while individuals do nothing more than act naturally as they are exposed to various control and advertising stimuli. Moreover, several physiological response indices such as cardiovascular and neocortical responses, are difficult for novices to control (though they are not difficult for novices to affect). And although there are individual differences in physiological responding, variations in social situations and stimuli can also be shown to have a clear and powerful effect across individuals (Cacioppo & Petty, 1983; Waid, 1984). These attributes are not sufficient to view physiological measures as valid indices of psychological states, but high expectations regarding their validity are raised by anecdotes regarding what can be learned about an individual's feelings and inclinations if only one scrutinizes another's bodily responses sufficiently closely. Sir Francis Galton (1884), who was never known for his interest or research in psychophysiology, wrote:

When two persons have an "inclination" to one another, they visibly incline or slope together when sitting side by side, as at a dinner table, and they then throw the stress of their weights on the near legs of their chairs. It does not
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
the support from basic research for their specific interpretations. The view of hemispheric specialization as a property of the entire hemisphere is implicitly endorsed, and it is assumed that hemispheric specialization manifests as asymmetries in activation. But, evidence now exists indicating that EEG activity differs considerably across sites within each hemisphere (e.g., Duffy, Bartels, & Burchfield, 1981). In an interesting series of studies, Davidson and his colleagues (e.g., Davidson, 1984; Davidson & Fox, 1982; Davidson, Schwartz, Saron, Bennett, & Goleman, 1979), have found that the presentation of unpleasant or noxious stimuli results in a relative increase in EEG activity over the right (in contrast to left) frontal region, and that this asymmetrical activation is unrelated to the EEG activity in the central and posterior cortical regions.

It is also possible that regions within the two hemispheres are differentially specialized for the performance of a particular task and do not show differences in activation. Weinstein et al. (in press) noted that the causal picture is highly complex and that no single factor or measure can be expected to account for a high proportion of variance across applications. We would only add that whenever there are multiple manifestations of and influences on variables (e.g., hemispheric EEG activation), disappointing results are likely if conceptual and methodological limitations are not emphasized.

Fourth, since Weinstein and his colleagues felt they could not disclose the details of their studies, they referred readers to basic research conducted by others to support their assertions. However, simpler stimuli and different measures and/or analytic procedures were used in a number of studies cited. One might reasonably have reservations regarding the generalizability of these research findings until more basic research is conducted using complex persuasion materials in social settings (see reviews by Nevid, 1984; Ray & Olson, 1983; Rothschild & Thorson, 1983). Moreover, in their rebuttal to Stewart (1984), Weinstein et al. (in press) cited a series of studies we conducted as providing independent evidence for their findings. This suggestion is only partially correct, however. The research to which they referred (Cacioppo, Petty, & Quintanar, 1982) showed that individuals showing relative left hemispheric alpha abundance over the parietal lobes also produced a more affectively polarized profile of cognitive responses, and we noted that:

It is particularly interesting in regard to the reliability of these findings that conceptually similar results apparently have been obtained inadvertently in a recent study of advertising. Appel, Weinstein, and Weinstein (1979) recorded alpha activity while subjects were exposed to television advertisements three successive times. Krugman (1980) reanalyzed Appel et al.'s data for reasons unrelated to the present article. Krugman reported that alpha activity over the left hemisphere increased with repetition of the advertisement, whereas alpha activity over the right hemisphere remained fairly constant. This pattern, of course, yields a shifting of relative interhemispheric alpha abundance from the right to the left hemisphere, as was observed in Experiment 3 (Cacioppo et al., 1982, p. 633).
In contrast to Weinstein et al.ʼs 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 Stewartʼs (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:
Every application of a physiological measure to marketing problems has begun with some modest empirical evidence and many heroic assumptions. The Weinstein et al. paper is only the most recent. With time, as the case of pupillometrics has clearly demonstrated, these assumptions have tended to prove untenable. There is little reason to believe EEG measures will be different (Stewart, 1984, p. 45).

Despite this pessimistic forecast, Stewart's (1984) concluding comments indicate that he can conceive of physiological measures and analyses as having utility, but that simplistic assumptions regarding and premature applications of these measures can lead to the termination of an otherwise promising line of inquiry:

It is not that the physiological measures have been demonstrated invalid for marketing applications. It is validation that is lacking. Systematic, long-term, well-documented, and controlled studies will be required before any verdict is possible (Stewart, 1984, p. 47).

But what constitutes validation? Although he adopts a more moderate position in his rebuttal to Weinstein et al., Stewart's (1984) position appears to be that the goal is to demonstrate an invariant physiological correlate of a psychological entity. Stewart (1984) correctly asserts, for instance, that if a physiological response could be shown necessary and sufficient to produce a particular psychological event, then one could confidently use measures of this physiological response to determine the presence of the psychological event. It is further implied, however, that physiological measures derive their values from the degree to which it can be demonstrated that changes in the measured variables are linearly and invariantly correlated with changes in some measurable psychological variable. Weinstein et al. (1984) suggest they have evidence for such a correlation, while Stewart (1984) suggests that circumstances will invariably be found in which such a correlation does not hold, thereby invalidating the physiological index of the specific psychological event of interest.

**THE PSYCHOPHYSIOLOGICAL ENTERPRISE RECONSIDERED**

The principal problem with the conception of psychophysiology as a search for linear or invariant "correlates," is its misconstrual of the psychophysiological enterprise. As Donchin (1979, 1981) has noted, if the original investigation was designed to demonstrate invariant correlates, the establishment of a dissociation invalidates the enterprise. However:

... it is more sensible to view the psychophysiological measures as manifestations of processes evoked, or invoked, in the organism. Such processes may, or may not, be part of some information processing activity. When they are, their attributes may, or may not, be monotonic functions of some, ar-
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 interpersonal processors 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.
over selected facial muscle regions in the absence of overt facial movements. Schwartz, Fair, Salt, Mandel, and Klerman (1976), for example, asked subjects to imagine positive or negative events in their lives. Results revealed that people generally showed more EMG activity over the corrugator supercilii (brow) muscle region and less EMG activity over the zygomatic major (cheek) muscle region when imagining sad as compared to happy events (see reviews by Fridlund & Izard, 1983; Petty & Cacioppo, 1983). We recently found the same facial EMG patterning when subjects imagined reading an editorial with which they agreed or disagreed, and no evidence for the operation of experimental demands was found in postexperimental interviews or when the effects of the attitudinal tasks were contrasted with those of physical (control) tasks (Cacioppo, Petty, & Marshall-Goodell, 1984). Finally, in two studies which we have just completed, subjects were exposed to slides of photographs which varied in terms of their pleasantness (Cacioppo, Petty, Losch, & Kim, in press). Results of both experiments revealed that EMG activity over the zygomatic major muscle region varied as a function of the valence of the photographs, and that EMG activity over the corrugator supercilii region varied as a function of the valence and intensity of the photographs.

This research does not imply that distinctive and naturally occurring incipient facial expressions are invariably linked to low level emotional states, but rather it supports the existence of this relationship under limited circumstances. Striated muscle activity is clearly controllable, and facial movements serve communicative, deceptive, and emotionally expressive functions with admirable facility. In addition, the muscles of facial expression are affected by a host of factors having nothing to do with emotion. Visual concentration and cognitive disturbances can increase the EMG activity over the corrugator supercilii region, and articulation and mastication can influence EMG activity in the muscles of the lower face (e.g., see Ekman, 1979). Nevertheless, contrived conditions can be established in research settings that maximize the likelihood of observing spontaneous, task-related somatic responses, while minimizing the likelihood that these responses would be altered or masked by display rules or theoretically uninteresting antecedents (e.g., anxiety, chewing). Subjects in our research, for instance, are progressively relaxed prior to the onset of the experimental trials and are unaware that somatic responses, much less facial expressions, are being monitored (cf. Cacioppo et al., 1984). Using these highly controlled laboratory settings, the psychophysiological research on incipient somatic responding is beginning to advance understanding of how the human organism reacts to pleasant and unpleasant stimuli, and how people's thoughts and feelings alter attitudes and action potentials (e.g., Cacioppo & Petty, 1981, in press; Englis, Lanzetta, and Vaughan, 1982; Schwartz, 1975; Zajonc & Markus, 1982).

On the other hand, we would strongly agree with Stewart's (1984) argument that it would be premature at present to use this technology to infer unequivocally people's reactions to advertisements in research or applied settings. The range of construct validity of the facial EMG measures is limited and is unlikely to extend to a broad range of applications without the introduction of additional experimental
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 addition, 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).
Psychophysiological and verbal variables are valuable, for they define the contexts and means for assessing the construct validity of simple, inexpensive, self-report measures. Given the results from a variety of measurement strategies identify a specific context in which people are willing and able to report accurately regarding their feelings or attitudes toward a stimulus, one could reasonably employ economical verbal indices as long as these measurements were secured within the clearly prescribed measurement context.

Finally, an ancillary benefit of extending psychophysiology to applied problems is the fresh perspective it brings to questions regarding the factors which affect behavior. It is obvious that people's consumer behavior changes in response to changes in their physiological state. People who are ill respond differently to medicine than people who are healthy, and people who are hungry respond differently to food than people who are sated. Few models of consumer behavior, however, accommodate changes in physiological states. Moreover, knowledge of the limits of the physiological systems from which behavior emanates affords a theoretical realism when specifying abstract constructs and processes governing consumer behavior. Just as theoretical models of consumer behavior that contain the construct of extrasensory perception are suspect because there is no known physiological mechanism capable of responding to "extrasensory" stimuli, models which appeal to constructs that are contraindicated by physiological research are likely to be unsatisfactory. For instance, the once popular psychological construct of arousal, defined as correlated autonomic, somatic, electrocortical, and behavioral changes in activation, is now suspect, given that within the normal ranges of physiological functioning to which most consumer models refer, there is increasing evidence for physiological specificity and against the occurrence of general and diffuse physiological reactions (cf. Lacey, 1967; Cacioppo & Petty, in press).

In sum, the promise of the physiological assessments is not that it will reveal the "ultimate" perspective, but rather that the psychophysiological enterprise offers a complementing and heretofore underutilized perspective on consumer behavior.

REFERENCES

PSYCHOPHYSIOLOGICAL ANALYSIS


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