Effects of Biofeedback on the Discrimination of Electrodermal Activity

J. Michael Lacroix
Glendon College, York University

Twenty-four subjects were tested on their ability to discriminate between the presence and absence of negative skin potential responses before and after training to control skin potential. Training consisted of 52 discrete 30-second trials during which subjects were asked either to increase or to inhibit palmar sweating. Subjects in groups N and P were provided with analogue feedback on their skin potential activity. Group N was correctly informed that increases in sweating were indicated by increases in the negativity of skin potential; group P was misinformed that these were indicated by increases in the positivity of skin potential. Subjects in the control (C) group received no feedback. Reliable evidence of discrimination was obtained only in groups N and P, following training. However, reliable evidence of control was obtained only in group N. Thus, training to control skin potential led to an ability to identify afferentation associated with the more common (i.e., negative) skin potential responses, even though biofeedback training appeared unsuccessful in the case of group P. These findings are discussed in the context of "discrimination" or "awareness" accounts of the process of acquiring control of internal responses.

While considerable evidence indicates that a number of autonomic responses can be brought under "self-control" or "voluntary" control as a consequence of biofeedback training, the process by which subjects learn to produce appropriate changes in these responses remains unclear. The nature of this acquisition process is now beginning to generate speculation, however, and has been the focus of much recent discussion by Brener (1974a, b, in press; see also Black, Cott, & Pavloski, in press; Roberts, in press).

1This work was supported by grants from York University and from Glendon College.
2Address all correspondence to Dr. J. Michael Lacroix, Department of Psychology, Glendon College, York University, 2275 Bayview Avenue, Toronto, Ontario, Canada M4N 3M6.
Briefly, Brener views the process of acquiring "voluntary" control of a response essentially as a process of learned discrimination: subjects must learn to discriminate and to identify changes in interoceptive afferentation related to changes in the target autonomic response in order to be able to produce changes in that response. With respect to most autonomic responses, this learning to discriminate changes in interoceptive afferentation requires that exteroceptive feedback be provided contingent upon changes in the target response. Exteroceptive feedback, which is readily discriminable, is correlated with feedback from interoceptive sources and serves to identify this interoceptive feedback. The development of "voluntary" control is viewed as a consequence of this discrimination process.

This "discrimination" or "awareness" account of the acquisition process predicts that subjects should be unable to discriminate changes in a response that they cannot control, but that they should be able to discriminate changes in the same response following successful feedback training to control that response. These predictions were examined in the present experiment, with the electrodermal system. This system seemed particularly suited to such an investigation in view of evidence that provision of exteroceptive feedback appears essential to the development of electrodermal control (Lacroix & Roberts, 1976).

The question of whether or not subjects can discriminate electrodermal activity prior to and following biofeedback training has been addressed in previous experiments by Baron (1966), Stern (1972), and Diekhoff (1976). Baron's and Stern's results suggest that subjects cannot discriminate electrodermal responses in the absence of training with exteroceptive feedback. On the other hand, Diekhoff observed that subjects could discriminate successfully between the presence and the absence of electrodermal responses in the absence of feedback training, but that they tended to label the two response states incorrectly. However, successful discrimination performance in that experiment may have resulted from a feedback contingency that was implicit in the discrimination task, as Roberts (in press) has noted. Diekhoff's subjects apparently received up to several hundred discrimination trials, over 3 days, and thus had considerable opportunity to learn to discriminate between afferentation associated with response and nonresponse states on the basis of the "feedback" provided by the discrimination probe. In fact, the discrimination performance of Diekhoff's subjects improved over days, in keeping with this interpretation. Thus, whether or not subjects can discriminate electrodermal responses in the absence of biofeedback training remains uncertain. Whether or not subjects can discriminate electrodermal responses following feedback training to control electrodermal activity also remains unclear. In Diekhoff's experiment, some subjects were provided with training to discriminate, not to