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CARDIAC ACTIVITY AND EVALUATION

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ABSTRACT. Thirty-eight paid male undergraduate volunteers participated in an experimental procedure structured around the viewing of 12 slides which were rated on a semantic differential rating scale. Heart rate (HR) and heart rate variability (HRV) were related to factor scores derived in principal component analysis of the ratings. In contrast to the results of a previous experiment relating cardiac activity to attitude, HRV was not found to be significantly associated with measures of evaluation but HR was.

RESUMEN. Treinta y ocho estudiantes masculinos, todos voluntarios pagados, participaron en un procedimiento experimental estructurado alrededor de la evaluación de 12 diapositivas en una escala semántica diferencia. La tasa del latido de corazón (HR) y la variabilidad de la tasa del latido de corazón (HRV) se relacionaron con escores factoriales derivados del análisis de componentes principales de las valuaciones. En contraste con los resultados de un experimento anterior relacionando actividad cardiaca con actitud, no se encontró que el HRV estuviera significantemente asociado con medidas de evaluación, mas se encontró que el HR si lo estaba.

The importance of psychophysiological investigation in social psychology was referred to in an earlier report (Burdick, 1972). In the experiment, subjects listened to pro-French Canadian and anti-French Canadian positions while cardiac activity was monitored. Heart rate (HR) change was not significant, but change in heart rate variability (HRV) was. Attitudes were rated on 7-point semantic differential checklist scales and scores on the first (evaluative) factor derived in principal and component analysis of the checklist data showed that all but two of 21 subjects rated the anti-French position as "better." Difference in HRV was negatively correlated with difference in evaluation.

The present investigation followed upon the previous one. Here the mode of presentation was visual rather than auditory, and there were a greater number of experimental conditions. The findings were not consistent with those of the earlier experiment.

METHOD

Thirty-eight paid male undergraduate volunteers from an introductory psychology course at the University of Manitoba served as subjects.

Subjects were told that the experiment had two objectives: the first, "to

develop a new method of collecting brain waves and heart rate to facilitate computer analysis of the data," and the second, "to serve as judges of emotions evoked by slides so that another experimentor could use those slides that evoked the most uniform emotions in a future study."

Stimulus slides consisted of 3 color photographs from the Sierra Club 1968 "Wilderness Calendar" (W), 3 color photographs from *Psychedelic Art*, 1968 (P), 3 color photographs of "pinup" type females from a popular magazine (F), and 3 black and white somatype male nudes from *Behaviour and Physique*, 1958 (M). The 12 slides were projected in a darkened room on a white wall seven feet from the subject for 30-second intervals. Subjects had two minutes after each slide to rate the picture shown on a checklist composed of 20 items in the form of the Osgood and Suci (1955) semantic differential.

The analog EKG was converted electronically and on line to pulse form and recorded on a D.C. channel or a Hewlett Packard 3600 tape recorder, while the stimulus pulse was recorded on another D.C. Channel. These taped EKG data were processed by a CDC 1700 computer at the Health Sciences Computer Centre (University of Manitoba) the data card output being HR as beats per minute for each R-to-R interval. These punched computer cards were edited and became the input for the calculation of HR and HRV (coefficient of temporal variability; Burdick, 1968) for each 30-second stimulus period.

Principal component analysis was carried out on the data from the checklist scales (12 for each individual). Factor scores for each questionnaire were then computed for the first three factors.

A two-way analysis of variance (38 subjects x 12 treatments) was performed on the factor score data and on HR and HRV. The 11 *df* between treatments were further partitioned to estimate variations between and within treatment groups.

The relationships among the three factors and the two physiologic measurements were studied through an examination of the correlation coefficients within subjects (pooled within subjects correlations) and between subjects (between subjects mean scores). A final evaluation of the within (pooled) correlative data was performed on cardiac labiles and cardiac stabiles (those who were above the median mean HRV and those below the median HRV, respectively) separately and the correlational relationships were compared.

RESULTS

The first three factors produced by the principal component analysis accounted for 59% of the total variation among the 20 items. The first two

factors had a clear evaluative element. The first included the descriptions of rough, bitter, cruel, tense, rugged, agitation, foul, ferocious, ugly, loud and bad. The second was characterized by soft, bad, weak, passive and unacceptable. The third factor was described by the adjectives fat, hot, confident and base. Analysis of variance showed that scores on all three factors changed significantly among all 12 stimuli, across groups of stimuli (W, P, F and M) and within all groups except F. Thus the experimental manipulation resulted in appreciable changes in the measures of evaluation.

HR systematically decreased over the first 4 stimuli; when HR for the last 8 stimuli was analysed HR was found to vary significantly across stimuli only.

HRV showed no time trend and was little effected by the different experimental conditions.

The correlational analysis demonstrated associations between factor scores and cardiac activity only in the within subjects analysis. Table 1 shows the correlation matrix for all subjects. Changes in Factors I and III

TABLE 1

Correlations among measures of appraisal of the stimuli, and of cardiac activity: within subjects analysis.

	FI	FII	FIII	HR	HRV
Factor I					
Factor II	-0.02				
Factor III	-0.03	+0.04			
HR	0.18**	0.05	0.14*		
HRV	-0.00	-0.04	-0.01	-0.00	-----

* $p < .01$ (df = 380)
** $p < .001$ (df = 380)

showed small but significant associations with HR. In further analysis cardiac labiles and stabiles both showed the same association of HR with Factor I, but the relationship with Factor III was found to have been produced by the labiles.

DISCUSSION

In the experiment in which changes in attitude were evoked by auditory presentation of different positions on the French Canadian issue (Burdick, 1972) there were no significant relationships between HR and difference in attitude. But here evaluated "badness" (Factor I) was associated with increased HR. And while evaluated "badness" was associated with increased HRV in the previous study, there were no significant attitudinal correlates of HRV in the present study.

We are unable to explain the conflicting results of the two experiments, and can only draw attention to the differences in the experimental procedures. Probably most important is that in the previous study the French Canadian issue was very meaningful to the subjects, while the slide stimuli in the present study were relatively bland. In keeping with this is that the mean heart rate was about 10 beats per minute less in the present investigation, suggesting a lower level of arousal.

Our chief reason for reporting the results of the present study is to caution other investigators who may be interested in the relationship between cardiac activity and evaluation. There are two main problems; the first pertains to cardiac responses to different experimental conditions. In keeping with the general psychophysiological literature we have found that HR changes significantly across different conditions. (Adamson et al., 1972; Burdick, Stewart and Adamson; Pierce, 1972). However, HRV (measured as coefficient of temporal variability) is much less regularly affected. Furthermore changes in HR, compared to HRV changes, are more predictable or understandable.

The second problem is that in those investigations in which we have conducted correlational analysis the relationships between cardiac activity and our measures of attitude have been weak and inconstant. In our most recent investigation along these lines (Burdick, Stewart and Adamson) significant changes in both HR and HRV were produced, but there was no significant association between the measures of cardiac activity and of attitude. A possible explanation of these results is that we have not been very successful in tapping the relevant attitudes.

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