STRESS REACTIVITY IN RELATION TO DELINQUENT AND PSYCHOPATHIC BEHAVIOUR

By

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INTRODUCTION

ANXIETY, either manifest or in the form of non-specific emotional disturbance, has been widely accepted as an operative factor in the personality structure of delinquent subjects (Aichhorn, 1; Burt, 5; Friedlander, 17; Stott, 53), and at present it appears that cognitive factors have little or no bearing upon the problem (Marcus, 43; Woodward, 61). By regarding anxiety or activated stress as a stimulus producing response (Hull, 24, 25; Miller, 45), delinquent behaviour has been postulated as learned responsiveness to anxiety or stress, which also functions as a learnable drive (Tong, 55). Previous investigations using Rorschach, persistence and galvanic skin response indices of anxiety or emotional disturbance have shown that there are significant variations according to both the nature of the conduct disorder (sex, violence, larceny, etc.), and ratings of stability (Tong, 54, 55). Different forms of conduct disorder are also known to carry different relapse potentialities, so that sex offenders, for example, are less likely to relapse than are larceny offenders (Mannheim and Wilkins, 42; Tong and Mackay, 60), although it is possible that different methods of treatment or disposal influence the likelihood of relapse for different sex offenders (Radzinowicz, 48). Prediction tables have been constructed for the purpose of more accurately assessing the most unstable offenders (42), and although such systems carry an encouraging degree of reliability it is apparent that greater reliability in prediction will only follow more accurate personality assessment than is possible by the use of impressionistic methods alone (58). Only knowledge of the relevant personality variables will lead to accurate assessment of change in subjects for whom the significant historical factors necessarily remain fixed. Furthermore, assessment techniques must be relatively unaffected by intelligence, education and rapport factors.

The present report is based upon the assumption that anxiety, or stress reactivity, is an important factor in delinquent instability. The *absence* of manifest anxiety has been observed to characterize the psychopathic offender, although little systematized research has been reported (McCord and McCord, 46). The purpose of this current report is to determine more closely the role of a stress reactivity factor in the structure of the delinquent and psychopathic subjects. Some of the following data are abstracted from a more detailed report (56). Relatively few studies have investigated the inter-relationship of reactions to different stressors, and most theoretical work on the psychology of the subject is based upon evidence derived from studies of normal, or at least intellectually average, people. For these reasons the data are treated firstly in terms of inter-relationships in order to determine certain theoretical issues concerning stress reactions, and secondly in relation to institution and social behaviour. The final analyses concern the problem of the relationship of early trauma to stress reactivity.

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Subjects

In all some 300 subjects were examined with one or more of the different techniques. The Normals (hospital staff), are not to be regarded as "controls", but were used simply to provide limited comparative data for the purpose of investigating certain issues. The patients are, or were at the time of examination, all certified male patients detained in a State Institution for mental defectives of "dangerous or violent propensities", and all had demonstrated some sort of serious misbehaviour. The age range of the patients is from 14 to 50 years with the majority being in their early twenties; the I.Q. range is from 60 to 120, with the majority being between 75 and 85 I.Q. Many, or most, of these patients could fit a legal definition of the psychopath. Care was taken to exclude from the analyses the data provided by any patient who might possibly suffer from a psychotic condition or show symptoms of intracranial organic pathology.

The various analyses given below show different values for N. This is due to the impracticability of examining every patient with every technique and to occasional failures in the recording devices.

Techniques and Indices

Four separate groups of indices were applied, as follows:

1. Overt response to a specific stressor. The apparatus was a standard Hardy-Wolff type dolorimeter designed to assess the subjective point at which heat intensity to an area of the skin changes from being rather pleasantly warm to being perceived as slightly noxious. This perceptual or attitudinal point is, in fact, well below the reaction or withdrawal point, and the whole testing procedure was designed to be as unrestrictive as possible with the extent of stimulation wholly dependent upon the patient's answers to questions at each point on the stimulus intensity scale. The index applied is termed VRP (verbal report of pain), following the suggestions of Hall, etc. (see below), and is measured in volts to the stimulus source—a 500-watt lamp. Corrections were made for mains supply fluctuations, and the range used was from 80 to 160 volts. The lower point is below normal *warmth* threshold and a good proportion of subjects are unreactive at the upper point. The stimulus was applied to the forehead commencing at 80 volts intensity and rising in 4-volt stages to the VRP point or to the arbitrary ceiling of 160 volts, whichever was reached first. Stimulation was for 7 seconds at each successive intensity with a 13-second break. Relevant research reports on this subject include Hemphill, Hall and Crookes (23), Hall (19, 20), Hall and Stride (21), Hardy, Wolff and Goodell (22), Clark and Bindra (6), Stengel, Oldham and Ehrenberg (52), Elithorn, Piercy and Crosskey (8).

2. Autonomic response to a specific stressor. For this the index was the extent to which the galvanic skin response (GSR), could be conditioned to an innocuous auditory stimulus. The subject was seated with eyes closed and the palmar electrodes of the GSR apparatus attached. After a good period of adjustment stimulation was applied every 15 seconds and consisted of *either* a brush on the closed eyelid with a piece of cotton wool simultaneous with an auditory click, *or* the auditory click alone, in a standard order. For each subject it was earlier determined that the auditory click was within his hearing range and did not produce a perceptible galvanic skin reflex. The series provides for 26 stimulations permitting a maximum of 15 unconditioned responses (to the eyelid brush plus the click), and 11 conditioned responses (to the click alone). Graphic records were obtained by means of a sparking galvanometer needle on teledeltos, sensitive paper. The technique has been reported in detail elsewhere

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(57), and particularly relevant research reports on conditioned stressor responses include Franks (15, 16), Sampson and Bindra (50), Piercy, Elithorn, Pratt and Crosskey (47), Lykken (40).

3. Overt response to a generalized stressor. For this a frustration task was devised in order to assess the extent of regression, position stereotypy, and position fixation during mild frustration, and the effect of this upon subsequent learning. The subject is faced with two Morse keys mounted in front of a display panel containing a red bulb and a green bulb. The red bulb flashes momentarily every five seconds and is a signal for the subject to press one of the two keys. Pressing the correct key lights the green bulb (reward), and pressing the wrong key sounds a buzzer, for two seconds. The first three learning tasks are soluble, the fourth insoluble, and the final one also soluble. For Task I to obtain the reward light each time a key is pressed the subject must follow the temporal series Left Key, Right Key, L, R . . . For Task II the solution is L, L, R, R . . . For Task III the solution is L, R, R, L, R, R . . . For Task V the solution is R, L, L, R, L, L . . . During the attempts to solve Task IV (the insoluble task), the reward light and the buzzer occurred in random order (a total of 50 per cent. of each), for five minutes, i.e. 60 responses. All were reassured afterwards and informed that their attempts were very good. During this insoluble task period any five or more successive responses which constituted one of the earlier learned sequences was treated as regression, the Regression Score being the sum of these responses. Similarly, during the insoluble task period four or more successive responses were regarded as evidence of position stereotypy, the Stereotypy Score being the sum of these. The Learning Score for each of the four soluble tasks consisted of the number of responses made up to, and including, the first rewarded response for the criterion "eight successive rewarded responses". All responses, signals, reward lights and buzzer, were recorded on a polygraph. Relevant reports dealing with frustration research include Maier (41), Marquart (44), Jones (28), Russell and Steinberg (49), Knopfelmacher (31, 32), Farber (14).

4. Autonomic response to a generalized stressor. For this the skin temperature was taken at intervals throughout the frustration task. The apparatus is a standard commercial electrical thermometer measuring to 0·1° C. by means of a surface probe placed on the back of the wrist of the resting hand under a loose rubber band. (For one of the studies reported below, the forehead temperature was measured.) Relevant research reports, most of which refer to the problem of variability in temperature reaction—decrease and increase—include Hall (20), Baker and Csapo (3), Baker and Taylor (4), Jacobsen, Kehlet, Larsen, Skinhoj and Munkvad (27).

Psychophysiological research into the inter-relationship of autonomic stressor reactions indicates that eventually indices should include measures of both inter- and intra-subject variability, and it is possible that a mathematical solution can be found. However, such a solution will be useful only when the topic has been explored with a wide variety of subjects. Relevant reports include Altschule (2), and those by Lacey and associated workers (33, 34, 35, 36, 37, 38, 39).

Reactions to Stressors

VRP and Resting Temperature

A preliminary investigation to determine the reliability of the response to the specific stressor (VRP) and the accuracy of the modified apparatus concerned the derivation of the correlation co-efficient for the VRP and the

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resting temperature of the skin near to the point of stimulation. It has been suggested (22), that the relationship between skin temperature and VRP is characterized by a straight line passing through zero stimulus at a skin temperature of 44·8° C., and that the skin being tested must be raised to this temperature before stimulation becomes noxious, regardless of the initial level of skin temperature. However, it has been found (20), that there is a high negative correlation between the resting temperature of the skin and VRP for male and female neurotics. For the current study the skin temperature of the forehead was taken immediately prior to determination of the VRP. The temperature recorded was that maintained steadily for three minutes. The range for 17 male Normals was 31·6–35·7° C., mean 34·04, s.d. 1·00, and the range for 35 male Patients was 29·5–34·8° C., mean 32·92, s.d. 1·00. The range for the VRP score was 100–150 volts for the male Normals, and 82 to unreactivity at 160 volts for the male Patients. The product moment correlation coefficients for VRP and resting forehead temperature are −0·87 for the Normals and −0·41 for the Patients. The calculated regression equation is:

$$\text{Resting temperature} = 42 \cdot 48 - (0 \cdot 068 \times \text{VRP})$$

All Normals gave VRP scores which lie within three standard errors of the regression line, but 13 of the 35 patients gave results which deviated beyond three standard errors. All but one of these 13 patients reported prick perception long before what would be expected on physiological (i.e. skin temperature) grounds.

These results are in conformity with the earlier evidence concerning the high relationship between resting temperature and VRP (20), but also indicate that there is a certain amount of unreliability in the verbal responses of the Patients. This unreliability, showing itself mainly as over-excitation to a noxious stimulus, is important in the interpretation of the results given below, although it is equally important to note that over-inhibition (i.e. unresponsiveness), occurs for Patients but not for Normals, an observation also made in respect of neurotics, depressives, etc. (19, 20, 21, 23). A subsequent analysis of age and Wechsler I.Q. in respect of the VRP score for 100 male patients shows that although the age and I.Q. effects are insignificant, there is a slight tendency for the perception point to be later for those subjects over 30 years of age and also for those over 70 I.Q. There is no indication whatsoever of unreactivity being a function of, or associated with, very low intelligence; if anything the low I.Q. subjects demonstrated over-excitation.

VRP and GSR Conditioning

It seems reasonable to regard the VRP score as the subject's learned attitudinal overt response to a specific stressor, and the next problem concerns the relationship of this overt response with learning or conditioning to a specific stressor at the covert autonomic level, which would be in theory, the establishment of the intervening stimulus producing response. For 100 male patients both the VRP scores and resting forehead temperatures were taken simultaneously, and the GSR conditioning score determined about 30 minutes later. The results are as follows:

p = VRP; mean 126·2, s.d. 23·4, range 80–160 volts.
c = conditioning score; mean 4·9, s.d. 2·9, range 0–11 CR's.
t = resting forehead temperature; mean 34·0, s.d. 1·28, range 30·0–36·0° C.

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The product moment correlation co-efficients are as follows:

r_{pc} = −0·41 (significant, p=0·001).
r_{tc} = −0·04 (not significant).

These co-efficients indicate a high negative relationship between the prick perception point and GSR conditioning, i.e. early verbal responsiveness corresponds with a high autonomic conditioning score, and *vice versa*. If the resting skin temperature is taken as the index of what the perception point *should* be (as would be the case for Normals), then there is no relationship between this index and the conditioning score.

In this particular study, two further points emerged. Firstly, there is a high positive correlation between the number of conditioned responses and the number of unconditioned responses (r=+0·62), and secondly the technique induces a degree of temporary drowsiness in some patients. This "sleep effect" was examined in relationship with conditioning score and VRP but was found to be unassociated with either index. It was thought possible that a relationship might have become apparent in view of the Pavlovian interpretation of sleep in terms of irradiation of inhibition.

Effect of Frustration on Skin Temperature

The Frustration Task records of 120 consecutive male Patients and 20 Normals were examined to determine the effects of the task upon an autonomic index of stress activation—the change in the surface temperature of the forearm. All of the Normals successfully learned the three preliminary soluble problems of the Frustration Task and so underwent the trial with the insoluble problem. Only 70 of the Patients solved the soluble problems and subsequently underwent the insoluble task, and these 70 form the Frustration Group. Following initial stabilization six temperature readings were taken for each subject, as follows:

Temperature reading 1	—	before Learning Task I
Temperature reading 2	—	before Learning Task II
Temperature reading 3	—	before Learning Task III
Temperature reading 4	—	before the Insoluble Task
Temperature reading 5	—	before Learning Task V
Temperature reading 6	—	*after* Learning Task V

The mean temperature readings for Patients and Normals are given in Table I, from which it will be seen that the effect of learning Tasks I, II, and III

TABLE I

Forearm Temperatures of Patients and Normals during the Frustration Task

Temperature Reading	Temperature °C. Normals (N=20)		Patients (N=70)	
	Mean	S.D.	Mean	S.D.
1	29·98	1·50	29·53	2·05
2	30·22	0·95	29·61	2·09
3	30·29	1·14	29·62	1·99
4	30·32	1·00	29·63	2·23
5	30·21	1·58	29·58	2·50
6	30·35	1·30	29·54	2·34

is to bring about a steady increase in skin temperature, but the effect of the frustration period is to bring about a fall in the mean but an increase in the

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size of the standard deviation. These observations hold good for both groups but whereas the mean temperature of the Normals rises rapidly during the final, soluble task, that of the Patients continues to fall. Care should be taken not to interpret this difference beyond the immediate data in view of the fact that the experiment was not designed to examine such differences, and consequently did not control age, I.Q. and other factors. The data are expressed graphically in Figure 1.

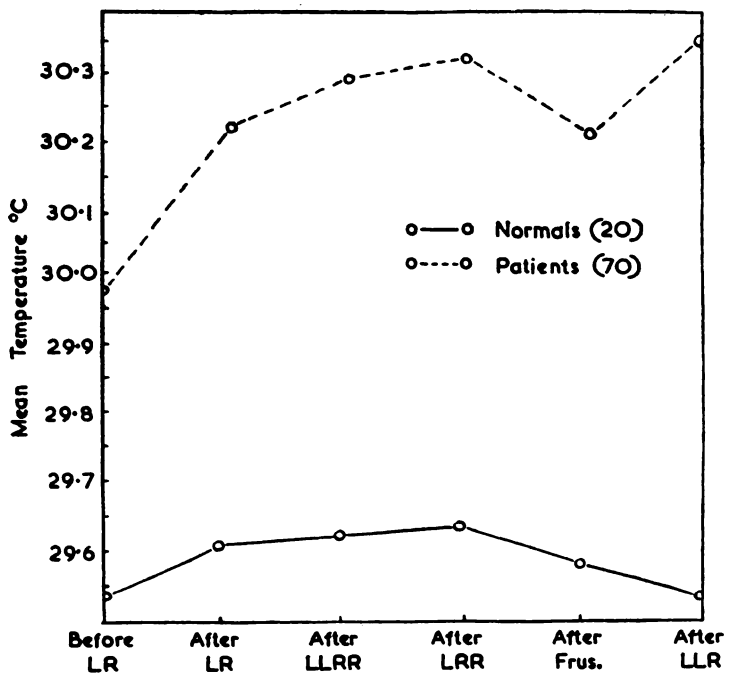


FIG. 1.—Variations in mean skin temperature during the Frustration Task.

The temperature readings indicate two things concerning the Patients. Firstly, the frustration period induces a physiological stress reaction in the form of a temperature decrease and secondly, this particular stress reaction (temperature fall), is not shown by all the subjects. This second point is central to the subsequent studies.

During the learning of Tasks II and III (Temperature reading 4 minus T.R. 2), 19 Patients demonstrated a rise in temperature, 27 no change, and 24 a fall in temperature. During Frustration (T.R. 5 minus T.R. 4), 22 demonstrated a rise, 8 no change, and 40 a fall. Ignoring the direction of change, it is clear that the surface temperature is greatly affected by the 5 minutes frustration, and justifies the usage of the Frustration Task as a stressor. This is indicated by the following table, for which the value of χ^2 is 13·85, P=0·001.

	Temperature Reactivity	
	During Learning	During Frustration
Change in temperature<0·1° C.	35	14
Change in temperature>0·1° C.	35	56

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Much psycho-physiological work is complicated by the fact that the experimentally produced index of change is found to be a function of the basal autonomic level. For skin temperature change under frustration not only might the magnitude of the change be associated with the pre-frustration level, but also the direction of change, i.e. rise or fall, might be similarly tied. The problem of magnitude is better approached by taking each group separately, i.e. those patients who show a rise in temperature ($>0\cdot1°$ C.), under the stressor and those who show a fall ($<0\cdot1°$ C.). For the increase group there is no apparent relationship between the magnitude of change and the temperature immediately prior to frustration (N=22, r=−0·01). For the decrease group there is a suggestion of a slight positive relationship although the co-efficient fails to reach significance (N=40, r=0·2).

The following table gives the data for the *direction* of temperature change during the frustration period relative to the basal temperature, i.e. T.R. 4, immediately prior to the Insoluble Task.

	Change in Temperature		
	Fall>0·1° C.	Zero	Rise>0·1° C.
Basal temperature <27·6° C. ..	10	3	1
Basal temperature 27·6–31·0 ..	25	7	9
Basal temperature >31·0° C. ..	1	4	10

These figures indicate that if the pre-frustration temperature is below 27·6° C. and a change of any magnitude occurs under frustration, the change will take the form of a decrease; if the basal temperature lies between 27·6 and 31·0° C. the ratio of decrease to increase is about 3:1; if the basal level is above 31·0° C. and a change occurs it will take the form of an increase. Restriction of the analysis to the 22 subjects of basal temperatures of below 27·6 and above 31·0° C. who demonstrated a change of any magnitude, the value of χ^2 is 14·43, significant at the 0·001 level of P. From these figures we can conclude that zero change in temperature is not associated with basal level, but rise or fall reflects a process already in operation before the experimental period of stress.

To this point we have considered only those Patients who were able to learn the pre-frustration learning tasks. For those Patients unable to learn Task III but who learned Tasks I and II (N=19), the temperature curve was similar to that of the Frustration Group in that there was an initial slight rise but failure to solve Task III brought about a fall in the size of the mean and an increase in the size of the standard deviation. The data for these 19 subjects are as follows:

Temperature reading 1 (before Task I) — mean 30·3° C., s.d. 2·1
Temperature reading 2 (after Task I) — mean 30·4° C., s.d. 2·03
Temperature reading 3 (after Task II) — mean 30·5° C., s.d. 1·99
Temperature reading 4 (after Task III) — mean 30·4° C., s.d. 2·05

It will be observed that the mean temperature of these Patients is nearly 1° C. higher than the temperature of the Frustration Group over the entire series, a factor possibly associated with the learning or motivational lack of this group. More anxious subjects would obviously be motivated to do better providing the anxiety level was below that necessary to produce disruption. For the other 24 subjects who failed the first or second of the learning tasks

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the initial resting temperature is comparable with that of the Frustration Group, i.e. 29·36, s.d. 2·17, and in this case probably indicates an anxiety level sufficient to produce disruption in performance.

Frustration and Learning

Maier (41), emphasizes that an important effect of frustration for an experimental group of rats is the distribution of the post-frustration learning scores. If frustration has been effective then these learning scores will be bi-modally distributed and indicative of position fixation in those animals who do not demonstrate normal patterns of learning. A bi-modal distribution of post-frustration learning scores has been found for human subjects following insoluble problem conditions of 75 per cent. non-reward, but a unimodal distribution with similar subjects under conditions of 25 per cent. non-reward or less (44). However, another study with human subjects did not result in a bi-modal distribution of post-frustration learning scores (28), but did determine a positive relationship between the length of frustration and subsequent learning. Post-frustration learning scores could, therefore, be useful indices of patients' reactivity to frustration stressors, or the disruption effect of frustration.

The present section concerns 114 Patients and 23 Normals who underwent the full Frustration Task. Ten Patients and two Normals failed to solve the post-frustration problem—roughly similar proportions, The learning scores for the four soluble tasks are given in Table II, and it will be seen that the means for

TABLE II

Learning Scores of Patients and Normals during the Complete Frustration Task

Learning Task	Learning Scores					
	Normals			Patients		
	N	Mean	Variance	N	Mean	Variance
I	23	3·96	3·35	114	5·80	42·72
II	23	6·22	24·76	114	11·05	93·30
III	23	7·87	35·89	114	16·60	160·29
IV (insoluble) ..	23	—	—	114	—	—
V (a)	21	11·33	51·40	104	12·59	70·57
V (b)	23	15·57	235·0	114	16·75	244·2

the post-frustration problem are calculated twice (Va and Vb, in the table); the first figure excludes the non-learners from the calculation and the second includes these subjects with arbitrary scores of 60. From Table II it will be seen that the Normals were consistently speedier at learning the soluble problems than were the Patients, as would be expected, but whereas the Normals demonstrated a marked retardation in learning following frustration, the Patients demonstrated an improvement. These differences between the two groups, similar to those noted above in respect of temperature changes, indicate the inadvisability of extending theory based upon data derived from Normal subjects to explain the behaviour of abnormal people, and *vice versa*. Nevertheless, for Patients the figures show some indication of bimodality in post-frustration learning scores, in that 10 subjects were unable to learn the final task, but on the other hand, these could reflect a simple biological survival curve.

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Frustration-Induced Regression, Post-frustration Learning and Temperature Reactions

During the attempts to solve the insoluble task, all subjects applied one or more of the previously learned response series on at least one occasion. Inspection of the polygraph records made it clear that two different phenomena were involved, depending upon the degree to which the subject regressed, i.e. the number of regressive responses. Occasional re-application of one of the earlier learned habits probably constitutes nothing more than chance behaviour or a measurement artifact, but continuous demonstration of an earlier learned habit in the face of intermittent non-reward (buzzer), is obviously a behavioural phenomenon analogous to certain social behaviour. It will be seen from Figure 2 that high regression scores are shown more frequently by Patients than Normals, and the question arises concerning the *nature* of this regressive behaviour. Does high degree regression constitute a simple stress reaction of no motivational significance except possibly continuation of activity, or is this behaviour stress reducing, or does it appear in lieu of stress and is therefore stress inhibiting?

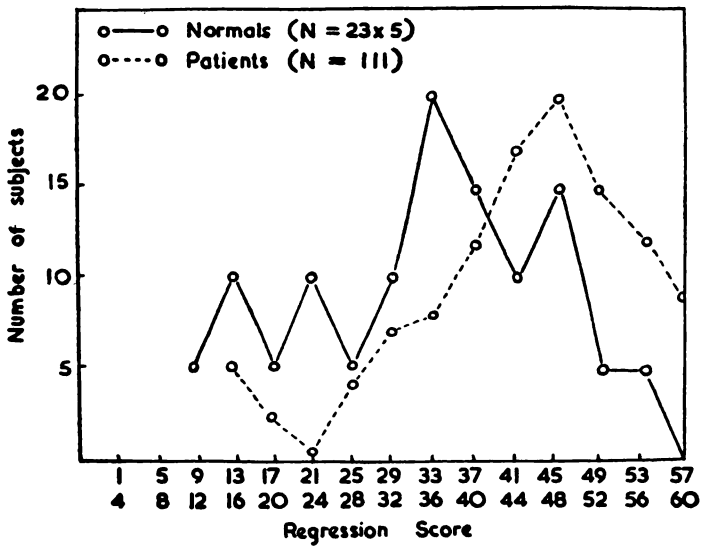


FIG. 2.—Distribution of Regression Scores for Patients and Normals.

We noted above that the temperature reaction to frustration can be regarded as evidence of stress activation or otherwise, depending upon whether it is a decrease or an increase, and similarly at the overt level, the post-frustration learning score should indicate the degree of disruption occasioned by the frustration stressor. In a study of 62 Patients it was found that those subjects showing a temperature decrease of more than 0·1° C. during frustration gave a mean regression score of 39·14, variance 157, N=34, whilst those showing zero temperature change or a temperature increase gave a mean regression score of 45·64, variance 91, N=28. (Variance ratio=1·714, P=0·05.) The mean post-frustration learning score of the temperature decrease subjects was higher than that of the zero change of increase subjects, although the variance ratio was not significant, and an analysis of the regression scores

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and the post-frustration learning scores also indicated no significant association between these two indices.

One can conclude that high degree regression tends to occur in the absence of activated stress (temperature fall), and on no occasion was the temperature found to fluctuate as would be the case if regression were stress *reducing* in nature. This latter hypothesis would require the temperature to fall at first as a stress response and then to return to the previous level as stress was reduced by regression. The indications are, therefore, that regression, at least in this specific situation, is stress inhibiting, or at least appears in lieu of the autonomic stress reaction.

Frustration Task Reactions, VRP and Conditioning

The previous data have established two sets of information, (*a*) there is a high association between the autonomic and overt responses of the "specific stressor" situations, and (*b*) there is an association between autonomic and overt reactions to the "generalized stressor" situation. The current problem concerns the relationship between these two sets of stress reactions.

It is noted above that not all subjects were able to learn the three soluble pre-frustration learning problems. Non-learners were found to have a slightly lower conditioning score than were those able to learn the soluble tasks, but the difference was not significant. However, marked differences were apparent in respect of the VRP score for Learners and Non-Learners, as is shown by the following table ($\chi^2=8\cdot82$, $P=0\cdot01$).

	VRP—Volts	
	100–149	<100 or >149
Non-learners group	27	24
Learners group	68	23

The difference is mainly centred upon the low end of the VRP scale, and in fact 22 per cent. of the Non-learners gave VRP scores below 95 volts, compared with 3 per cent. of the Learners group. The differences at the other end of the VRP scale are not quite so marked. It is obvious, therefore, that any application of the Frustration Task scores excludes those of subjects who are highly reactive to specific trauma. These subjects do not learn the necessary introductory habits. It is likely that a common attitudinal or motivational factor accounts for the fact that subjects who are highly reactive to specific trauma also demonstrate learning inability.

The remaining data of this section concern subjects able to learn the pre-frustration problems and who subsequently underwent the period of frustration. The following table indicates that those showing a fairly high conditioning score were very unlikely to show a temperature increase during frustration ($\chi^2=6\cdot43$, $P=0\cdot01$).

	Conditioning Score—CR's	
	<6	>5
Frustration temperature change—fall	23	16
Frustration temperature change—zero/rise ..	15	1

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Similar results were apparent in a comparison of VRP scores and temperature change although the coefficient of association was less.

Comparisons of specific trauma indices (conditioning and VRP), with the overt behavioural indices of the Frustration Task failed to yield significant correlation coefficients. The trends indicated that for Low Conditioners (CR's<6), the mean regression score is higher, but there is no apparent difference for the post-frustration learning score.

Position Stereotypy

Repetition of the same response in spite of its non-rewarding nature and in view of its futility, has come to be the hallmark of frustration research (14, 31, 32, 41, 44, 49, 28), and it has been suggested (41), that the phenomenon is analogous to certain behaviour disorders. For this reason the subject of stereotypy is treated separately. Virtually all earlier studies concern either rats or university students, and in the current study it immediately became apparent that the Patients differed considerably from Normals in the extent to which they displayed position stereotypy. However, contrary to expectation, the Patients demonstrated *less* stereotypy under frustration than did Normals, as is shown in Figure 3. The difference is even more pronounced if the four female Normals are excluded, as none of these girls demonstrated position stereotypy to any great extent. The possibility that stereotypy is a function of I.Q., which would account for the difference between Patients and Normals, is examined later.

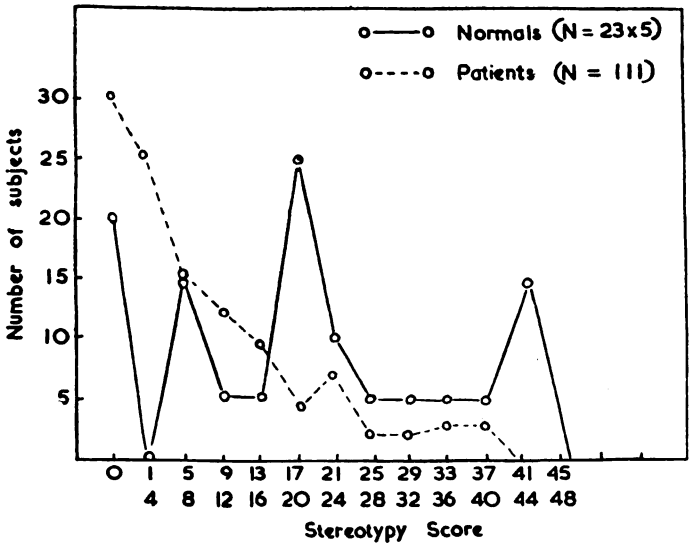


FIG. 3.—Distribution of Stereotypy Scores for Patients and Normals.

Analysis of the stereotypy scores of Patients indicated two important features concerning stereotypy. In the first place the phenomenon only occurred to any great extent in the presence of the autonomic stress reaction of temperature decrease during frustration. This is shown by the following table ($\chi^2=7\cdot01$, $P=0\cdot01$).

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	Frustration Temperature Change	
	Decrease	Zero or Increase
Stereotypy score <17	27	25
Stereotypy score <16	12	1

Position stereotypy is therefore an activated stress reaction, but we can make no substantiated comment as to whether it is stress reducing in nature, beyond noting that fluctuation in the temperature reading did not occur, i.e. immediate fall followed by a rise. Position stereotypy would therefore appear to be of a different logical, or psychological order from regression which occurs in lieu of the autonomic stress reaction (see above). The following table indicates the negative correlation which exists for position stereotypy and regression in accordance with the stress activation observations ($\chi^2=8{\cdot}45$, $P=0{\cdot}01$).

	Regression Score	
	<36	>35
Stereotypy score <17	16	74
Stereotypy score <16	10	11

There is no apparent relationship between the stereotypy score and the post-frustration learning score, contrary to Maier's theory (41). There is a slight trend relating high conditionability and low VRP score to higher position stereotypy scores.

Frustration Reactions and I.Q.

Various analyses concerning the relationship of regression, position stereotypy and learning with Wechsler I.Q. have given no indication that such a relationship exists.

Comments on Stress Reactivity

Certain of the observations are of particular interest. These are: (*a*) the high correlation between VRP score and surface temperature for Normals compared with the relatively low correlation for Patients, (*b*) the high correlation between VRP score and conditioning score which indicates an association between autonomic and overt responsiveness to specific stressors, (*c*) the indication that temperature fall occurs for only some subjects during frustration and that this reaction is slightly more pronounced but of shorter duration for Normals than for Patients, (*d*) evidence that temperature decrease during frustration is associated with lower regression but high position stereotypy scores, and *vice versa*, (*e*) the observation that subjects who are highly reactive to specific stressors almost invariably show temperature decrease under frustration, but other subjects who are not highly reactive to specific stressors may or may not show evidence of autonomic stress activation.

These features are relevant to the work emanating from three different theoretical sources. The range of reactivity which varies from high degree excitation to high degree inhibition is of direct relevance to, and in conformity with, Eysenck's dimensional theory. This is particularly so with regard to the interpretation of the introversion/extraversion dimension in terms of varying excitatory/inhibitory balance (11, 12, 13), and the validity of conditioning data in this respect (15, 16). The data are also related to the Pavlovian concepts of

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variation in inhibitory activity although these concepts have not been formalized by the Russian theorists (26). For frustration theory (41), several points are important. Firstly, the effect of experimental frustration on the autonomic state of the individual varies so that only a proportion of subjects demonstrate evidence of physiological fear or anxiety. Secondly, regression and position stereotypy would appear to be behaviour forms of different psychological order and should not be equated. Thirdly, and of practical importance, the behaviour of Normals is different from that of the nosological group in a different manner from that expected.

Considerable stress reactivity research is concerned with the problems of response specificity and variability between autonomic indices (33–39). The correlations of the current study do indicate considerable inter-response and inter-stressor agreement for subjects highly reactive to stressors but relatively little for others. Highly reactive subjects would probably never be encountered in the research studies concerning normals or highly selected military personnel.

Stress Reactivity and Conduct Disorder

Hospital Stability

The foregoing data indicate that the autonomic reactivity of Patients to stressors varies from extremely poor reactivity, for some of the men, to extremely high reactivity for others, with a moderate group falling in between the two extremes. According to theoretical interpretation of this variation we can put forward hypotheses for the overt social behaviour, firstly, within the hospital. There is some evidence to indicate that conduct disorder within hospital is associated with poor prognosis (60).

The following hypothesis contains the assumption that a stable person, or one who responds to therapy or social training, is moderately reactive to the stressors and frustrations of everyday life. The stable person accepts them and learns from them, but the unstable person avoids them *or* is highly reactive and hence disrupted.

Hypothesis. Patients showing stable behaviour in the hospital will be those showing laboratory evidence of overt behavioural or autonomic reactivity to mild stressors. Unstable patients will demonstrate high degree stress inhibition, or virtually no inhibition of the intervening stress response.

Stability Ratings. Three senior male nurses independently rated the ward behaviour of 200 patients as either Stable (S), Unstable (U), or Not Known (NK). Laboratory records of 19 of these patients were discarded owing to suspected psychotic or organic disorder. From the ratings patients were classified into a Stable group and an Unstable group. The Stable group consisted of those men rated Stable by at least two of the assessors, and whose ratings would therefore be SSS, SSU or SSNK. The Unstable group consisted of those men rated Unstable by at least two of the assessors, i.e. UUU, UUS, UUNK. Patients not falling into either of these categories were excluded from the subsequent analysis.

Results. There was found to be a slight tendency for the Stable group to contain relatively more patients able to learn the soluble problems of the frustration task, than the Unstable group, but the coefficient of contingency is insignificant. The subsequent frustration task data concern only those subjects able to learn the pre-frustration soluble learning tasks. We have noted above that patients who are highly reactive to specific trauma do not learn these

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preliminary series, so that highly stress reactive unstable subjects are necessarily excluded from the frustration figures. From the hypothesis, therefore, and bearing in mind the exclusion of highly stress reactive subjects, from the frustration data, it would be expected that Stable subjects would show a temperature fall during frustration. This expectation is upheld by the following table ($\chi^2=5\cdot32$, $P=0\cdot05$).

	Frustration Temperature Change	
	Decrease	Zero or Increase
Stable group	17	12
Unstable group	4	13

It would also be expected that Stable patients would show (*a*) lower regression scores, (*b*) higher post-frustration learning scores, and (*c*) higher stereotypy scores, than Unstable patients. The expectation is upheld for the regression scores by a variance ratio for the two groups of patients, which is significant at the 0·01 level of P. The expectation is also upheld to a slight, but insignificant extent, for the learning scores, but not by the stereotypy scores. (Regression scores: Stable group—mean 41·5, variance 164·1, N 50; Unstable group—mean 43·42, variance 61·7, N 25.) Of some theoretical interest it should be noted that four patients unable to learn the post-frustration task were rated as Stable, and another four also unable to learn after frustration, were rated as Unstable.

Data from the specific stressor techniques support the hypothesis more strongly. For the conditioning score the following distribution is significant at the 0·01 level of P ($\chi^2=8\cdot69$).

	Conditioning Score—CR's	
	4–6	<4 or >6
Stable group	18	25
Unstable group	2	22

For the 25 Stable group subjects who show extremity scores, 15 lie below score 4, and 10 above score 6. For the 22 Unstable group who show extremity scores, 13 lie below score 4, and 8 above score 6. Figure 4 shows the frequency distribution curves, and brings out clearly the marked differences between the two groups. The curve for the Stable group is unimodal but that of the Unstable group indicates bimodality.

The other specific stressor index is the VRP score, and again the distribution supports the hypothesis, as follows:

	VRP–Volts	
	90–159	<90 or >159
Stable group	56	7
Unstable group	23	10

For this table the value for chi squared is 6·04, which is significant at the 0·01 level of P. For the 7 Stable group extremity scores, 2 are below 90 volts, and 3 above 159 volts. For the 10 Unstable group extremity scores, 5 are below score 90 volts and 5 above 159 volts.

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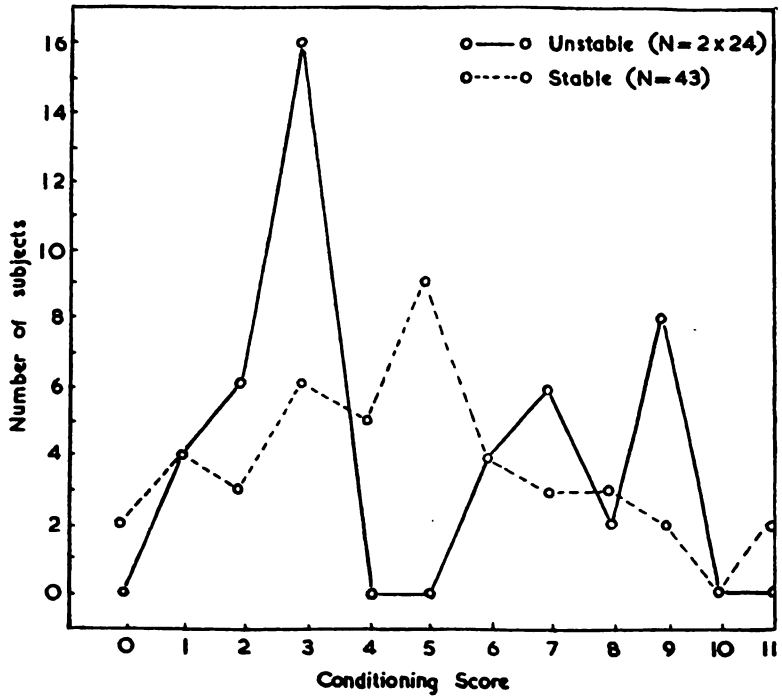


FIG. 4.—Distribution of Conditioning Scores for Stable and Unstable Patients.

In general these various data are fairly clear-cut and provide quite substantial evidence in support of the hypothesis that high degree inhibitory functioning is associated with instability, and that less intensive stress inhibition is associated with stability, with the proviso that hyper-excitation is also indicative of instability.

Types of Criminal Behaviour

There is some evidence to suggest that different types of criminal behaviour may indicate fundamental structural personality differences for the subjects concerned (54, 55, 60). In support of this there is also evidence which indicates different relapse rates for different forms of offender (42, 48, 60). Although in the current early stages of research a legal classification can be applied, it is obvious that this will eventually prove to be too crude and further clinical subdivisions must be determined. The formal hypothesis given below proposes that the personality differences reflected by different conduct disorder habits are differences of reactivity to stressors. In broad terms, one would expect behaviour such as indecent assault (when this is not attempted rape), which resembles the incomplete behaviour of experimentally neurotic animals (7), and which carries a relatively good prognosis, to be the behaviour of agitated, anxious, possibly neurotic subjects likely to be highly reactive to laboratory stressors. Rorschach data (54), persistence and GSR data (55), and the results of a 17-ketosteroids study (18), would support this view. Aggressive sex behaviour, which appears to be hyper-normal, could possibly be the outcome of fortuitously summated drives, one of which is a stress drive and the other a normal sex drive. (The notion of an abnormally high sex drive alone cannot

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explain this behaviour satisfactorily. Rape, for example, is not performed often by the same person, and a rapist rarely shows evidence of frequent sex behaviour, promiscuity, etc. In addition, patients speak of precipitating emotional upsets.) Indecent exposure and larceny, however, are conduct disorders which respond poorly to therapy and penological training—factors which suggest poor emotional responsiveness (primary sociopathy), and little reactivity to laboratory stressors.

Classification of Disordered Behaviour

A total of 181 non-psychotic subjects were classified into six exclusive groups according to the type of pre-admission behaviour disorders. A seventh group, Homosexuality, is also used but the data are examined separately, as this group contains subjects falling also into the other groups. The classifications are:

1. A history of some form of *Illegal Intercourse* with a female irrespective of any other form of behaviour disorder recorded (sex or non-sex); this includes rape, attempted rape, intercourse with a female defective or a female under 16 years of age (24 subjects).

2. A history of *Indecent Exposure* as the only sex offence recorded, irrespective of any form of non-sex disorder recorded (7 subjects).

3. A history of *Indecent Assault* on a girl or woman (not an attempt at intercourse), as the only sex offence recorded, irrespective of any non-sex disorder, recorded (29 subjects).

4. A history of *Violence Only* (to some person), not for the purpose of sex or larceny (39 subjects).

5. A history of *Larceny Only* with no other form of behaviour disorder recorded, but not including larceny by violence (37 subjects).

6. A history of *Violence and Larceny* either on the same occasion or on different occasions, with no other form of behaviour disorder recorded (34 subjects).

(7. A history of *Homosexuality* with or without any other form of misbehaviour recorded. This group of 24 subjects is separate from the others owing to its non-exclusive nature.)

Hypothesis. There are differences in the stress reactivity measurements for these various groups varying from high reactivity for Indecent Assault sex offenders, to low reactivity for the Larceny Only group, and the Indecent Exposure group.

Results. According to the hypothesis VRP scores should differentiate the disorder groups, e.g. low scores for Indecent Assault, and high scores for Larceny Only. Conditioning scores should differentiate by high scores for Indecent Assault and low scores for Larceny Only. The data in Table III support the hypothesis quite strongly. For VRP scores a variance analysis yields a value for F of 2·56 (P=0·05), and for the conditioning scores F=3·33 (P=0·01). A direct comparison of the conditioning scores for Indecent Assault and Larceny Only is particularly interesting, as is shown by the following table (χ^2=13·66, P=0·001).

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TABLE III

VRP and Conditioning Scores for the Five Main Disorder Groups

Disorder Groups	VRP Score			Conditioning Score		
	N	Mean	Variance	N	Mean	Variance
Indecent assault ..	28	118·1	475·5	21	6·14	7·7
Illegal intercourse ..	20	131·8	456·2	15	5·80	9·5
Violence only ..	32	120·9	574·4	19	4·58	5·7
Violence and larceny	33	128·2	434·9	26	4·54	8·0
Larceny only ..	26	135·5	572·5	22	3·45	8·3

	Conditioning Score	
	<7	>6
Indecent assault subjects	11	10
Larceny only subjects	22	0

The results for the Indecent Exposure subjects are too meagre for inclusion in the table, but the trend is in support of the hypothesis. Seven of the group were examined for VRP scores, 5 giving scores above 129 volts, i.e. high scores; six were examined for conditioning scores, 5 giving less than 5 CR's, i.e. low scores—poor stress reactivity.

The data provided by the generalized stressor technique, the Frustration Task indices, do not differentiate so well as those of the specific stressors given above, but in general, support the hypothesis. We noted earlier that more subjects who are highly stress reactive fail to learn the pre-frustration tasks than do others. We would therefore expect more Indecent Assault subjects to be screened off from the frustration period in this way, than other subjects. This was in fact found to occur with a subsequent loss in the differentiating power of the generalized stressor technique. All except one of the remaining Indecent Assault subjects demonstrated a fall in temperature during the period of frustration, whereas for all the other groups about 50 per cent. demonstrated a fall in temperature and the other 50 per cent. a rise or no change. This supports the hypothesis of relatively high stress reaction for Indecent Assault subjects. Further support for the general hypothesis is provided by the data in Table IV

TABLE IV

Regression and Post-Frustration Learning Scores for the Five Main Disorder Groups

Disorder Groups	Regression Score			Post-Frustration Learning Score		
	N	Mean	Variance	N	Mean	Variance
Indecent assault ..	15	42·3	162·6	15	20·4	314·0
Illegal intercourse ..	14	38·6	193·0	14	21·6	356·4
Violence only ..	26	41·0	80·0	26	16·5	197·5
Violence and larceny	22	44·0	69·2	22	11·8	79·1
Larceny only ..	25	38·8	118·7	25	12·7	76·4

which shows the regression scores and post-frustration learning scores of the groups. A comparison of the regression scores for Indecent Assault subjects and Larceny Only subjects yields a value for F of 2·4, significant at the 0·05 level of P, and a comparison of the learning scores for the same groups yields a value for F of 4·23, significant at the 0·01 level of P. Stereotypy scores yielded no significant differences.

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The small Homosexual group does not allow for useful statistical analysis. However, differentiation according to Indecent Assault and Other Homosexuality indicates greater stress reactivity for homosexual Indecent Assault subjects similar to that of heterosexual cases. Again the specific stressor indices differentiate better than the frustration task scores. The mean CR score for Indecent Assault subjects (N=6), is 6·8, variance 12·6, and for Other Homosexuality cases (N=8), the mean is 4·62, variance 7·5.

Prediction of Relapse

The ultimate purpose of this research is to determine the structural personality factors which contribute towards relapse and continued instability. It is clear that reliable data will only be obtained from a relatively long term study when the data of several hundred discharged patients are analysed. The present assessment is therefore a pilot analysis simply to determine whether or not stress reactivity appears to be fundamentally associated with social instability, as we have postulated, and also whether the particular indices carry any predictive validity.

A patient is discharged from the State Institution when the medical superintendent recommends discharge on the grounds that the patient no longer possesses "dangerous or violent propensities". From the earlier observations we would expect that social relapse would be associated with either very high stress reactivity or very low reactivity. However, very high stress reactivity is demonstrated by agitated, emotionally disturbed patients who are very unlikely to be regarded as stable and fit for discharge in the light of a clinical assessment. The formal hypothesis, given below, is based upon this point and assumes therefore, that social relapse patients will be mainly drawn from very low reactivity subjects.

The test data of 22 patients definitely known to have relapsed after discharge were compared with the data for 32 patients *believed* not to have relapsed within one year of discharge. Obviously, such a comparison is weighted in an adverse direction owing to the short period of risk and the absence of definite knowledge concerning "success".

Hypothesis. Patients discharged owing to apparent stability and who subsequently relapse will be mainly subjects showing little stress activation.

Results. All the various stress indices lie in the direction predicted by the hypothesis, but again the most satisfactory results are those provided by the specific stressors. The conditioning scores are particularly interesting as is shown by the following table in that only one subject in the Relapse Group is misclassified ($\chi^2=6\cdot50$, P=0·01; one cell is weak).

	Conditioning Score	
	<7	>6
Success Group	16	10
Relapse Group	18	1

Similar trends are apparent for the VRP scores but there is weaker differentiation:

	VRP—Volts	
	<130	>129
Success Group	16	16
Relapse Group	7	15

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For the frustration task scores we would first predict slight or zero temperature change for Relapse subjects (absence of stress activation), and temperature decrease for Success subjects, and this is in fact the case. (Relapse Group, N=15, mean temperature change, 0·006° C., variance 0·23; Success Group, N=22, mean temperature change, 0·24° C., variance 0·16.)

The hypothesis requires relatively high regression scores, and relatively low stereotypy scores, and low post-frustration learning scores for the Relapse Group. This trend was found to exist but only in the case of the learning scores did there appear a significant difference from those of the Success Group.

Familial Environment Factors

The previous studies have all demonstrated that the index most closely tied to the various social criteria, is the autonomic response to the specific stressor, i.e. the conditioned galvanic skin response. For this reason this final note concerns the autonomic conditioning index alone.

The previous studies give general support to the notion that stress reactivity is fundamentally associated with delinquent and psychopathic instability. In contemporary literature delinquency is frequently linked with the occurrences and traumata of early childhood. On the other hand, psychopathy is frequently postulated to be a mainly non-psychogenic disorder. On the assumption that there are two forms of instability, as was found in the earlier studies, corresponding to very high and very low stress reactivity, it remains to determine what relationship exists between these two categories and early environmental factors. The subjects were 80 consecutive male admission patients, none of whom were included in the previous studies. The test score analysed is the GSR conditioning score described above.

Results

For this group it was found that the conditioning score correlated slightly with Wechsler I.Q. ($r=0·23$, $P=0·05$; mean I.Q. 76·87, variance 162·7), and to a similar extent with Raven's Matrices score. A further correlation was found for the conditioning score and age at the time of testing ($r=0·4$, $P=0·001$; mean age 26·35 years, variance 104·9), and with age at the time of first Court appearance for those subjects who had appeared before a Court on any occasion ($r=0·4$, $P=0·01$; mean age 14·02 years, variance 15·3, N=69). The age at testing correlation is probably due to the fact that sex offenders who tend to be of higher conditionability also tend to be older on admission to the State Institution than do other subjects. The age of first conviction correlation is probably linked with another known fact that early first conviction is associated with social failure for most delinquents (42).

For only 28 of the 80 subjects was the parental background complete in the sense of both parents being alive and living together, for 21 subjects the parents were separated or divorced or never lived together, and in 31 cases one or both parents were dead. The differences in the conditioning scores of these groups are insignificant and indicate no relationship between conditionability and contemporary home conditions. There is also no correlation between CR score and age of admission to an institution of any sort ($r=0·08$, mean age 12·45 years, variance 44·4). For 30 subjects there was evidence of deprivation or trauma in the first two years of life and for 50 subjects there was no such evidence. There is no significant difference between the con-

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ditioning scores of these groups, but there is a slight trend indicating *higher* stress reactivity following early trauma.

The conditioning score in respect of family placement indicated a slight trend towards higher conditionability for the first or only child. Subjects in this category gave significantly higher scores than those falling in a "middle child" category ($P=0\cdot05$). This difference appeared to be centred upon the score of the first child of a family rather than the only child.

These various data indicate that whatever the weighting of environmental and constitutional factors which leads to admission to the State Institution, these factors do not markedly differentiate the form of stress reactivity, of the subjects. There is a slight suggestion that non-genetic factors such as family placement influence the conditioning score in that first children show higher conditionability—high stress reactivity. So far as they go, therefore, the data would indicate simple psychogenic factors as being important for the high stress reactivity group and other factors for the low stress reactivity type of instability.

General Discussion

From these various studies one can conclude that laboratory indices of stress reactivity are undoubtedly correlated with the problems of social instability and the form of instability of psychopathic and delinquent subjects. This is of some practical importance in that stress assessment techniques can be applied to subjects beyond the reach of most psychological tests owing to low I.Q., illiteracy and personal unreliability factors. For the general theory of stress reactivity it is important to note that there is a very high degree of inter-index agreement for highly reactive subjects but more variability for other subjects. This observation is directly relevant to the problems of autonomic response variability (33–39).

For the theory of delinquent and psychopathic behaviour the important result is the demonstration of two forms of instability, a finding in line with Eysenck's theory and the notions of Primary and Neurotic Sociopathy (40), and a finding which would explain the differences in relapse potentiality. For frustration research it is clear that regression and position stereotypy are reactions of different logical or psychological orders.

For the social behaviour disorders, one can suggest that two forms of learning, or two forms of habit are involved. One concerns escape learning, when stress is necessarily activated (high reactive instability), and the other involving traumatic avoidance learning when stress is inhibited or conserved (51). This would explain the relatively poor therapeutic response of low conditioners and indicate that therapies must take into account these reactivity variables. One can also conclude that these variables must be taken into consideration in, and may even be fundamental to, issues of prognosis or prediction. They are the sort of variables which could well respond to specific therapeutic devices. Finally, of technological importance, it should be noted that the index most highly correlated with the various social criteria is the autonomic response to a specific stressor, GSR conditioning, which reduces extraneous factors to a minimum.

Summary

To investigate the importance of anxiety or stress reactivity in the personality structure of delinquent and psychopathic male adults, subjects were examined by four techniques assessing the overt and autonomic responses to specific and generalized stressors, respectively. The inter-relationships of the various responses are assessed and indicate that stress reactivity

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ranges from extreme excitation to extreme inhibition, with a certain amount of inter-test and inter-response agreement. Subjects rated Unstable were found to fall at one or the other of the two extremes of stress reactivity, and Stable subjects to demonstrate moderate reactivity. Different forms of conduct disorder were found to be associated with different forms of stress reaction. Subjects who demonstrated subsequent social instability were found to be of low stress reactivity. The final study indicated a slight trend towards higher reactivity for subjects with histories of psychological trauma.

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