

# SYMPOSIUM ON BEHAVIOUR MODIFICATION TREATMENTS

## I. THE REDUCTION OF SELF-STIMULATING BEHAVIOURS USING A DIFFERENTIAL REINFORCEMENT OF OTHER BEHAVIOUR (D.R.O.) SCHEDULE

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### INTRODUCTION

The literature relating to childhood autism and subnormality commonly reports a variety of unusual behaviours (Lovaas and Simmons, 1969). Such behaviours are found in association with sensory deprivation (Robbins, 1979). Hoshmand (1975) reports on the incidence of unusual behaviours in blind children while Schroeder *et al.* (1978) noted the relationship between unusual behaviours and linguistic and communication skills.

Unusual behaviours have been variously described as autisms and stereotyped behaviour (Azrin *et al.*, 1978), self stimulation (Harris & Wolchik, 1979), persistent high-rate behaviours (Pendergrass, 1972), self-injurious behaviour (Matson *et al.*, 1978) and blindisms (Blasch, 1978).

Carr (1977) has reviewed the hypotheses offered to explain the behaviour in terms of the possible underlying motivation of the Ss. Other causes have been attributed to:-

Organic	aberrant physiological processes (Misuno and Yugari, 1975; Primrose, 1979).
Frustration	responses to the blocking of goal directed behaviour (Baumeister and Forehand, 1971).
Psychodynamic	states of the personality (Greenacre, 1954).
Positive reinforcement	attention seeking behaviour.
Negative reinforcement	avoidance of unwanted stimulation.
Self-stimulation	compensation for lack of availability of external stimulation due to sensory or perceptual deficits.

It would seem that often more than one cause exists in any given individual. Although precise causes may not be amenable to discovery, very often there is an overriding need to intervene due to aspects of unusual behaviours which are regarded as undesirable by those professionally involved with these children. Commonly these unusual behaviours are stigmatising and render the children objects of ridicule to be shunned and regarded as abnormal. As a result opportunities for social interaction are lost and many whose help

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would be beneficial are repelled. When the individual spends long periods of time indulging in the unusual behaviour interaction with environmental stimulation is limited. Often the behaviours are indulged to the exclusion of more adaptive behaviours so that learning is impeded or precluded. Boer (1968) found some individuals who spent 90% of their time in stereotyped highly repetitive activity. The behaviours may be directly harmful due to primary or secondary physical damage causing incapacity or endangering life (Schneider *et al.*, 1979).

Justification abounds for intervention to which a threefold classificatory system has been applied by Forehand and Baumeister (1976).

- 1) Withdrawal of positive reinforcement on occurrence;
- 2) Positive reinforcement for non-occurrence;
- 3) Aversive stimulation contingent on occurrence of the undesired behaviour.

Guidelines for the use of aversive stimulation have been put forward by Bellack and Hersen (1977) who favour the use of positive procedures first and punishment only when these have failed. These writers list the problems in evaluating reports of studies which lack experimental sophistication. These reservations notwithstanding, effective use of positive reinforcement procedures applied to the reduction of a variety of unwanted behaviours are widely reported. Tierney, *et al.*, (1979) used a Variable Time reinforcement schedule to reduce body rocking in profoundly retarded individuals. Body rocking is commonly found in the visually handicapped (Blasch, 1978). Eichel (1979) includes it in a description of the mannerisms found in blind children and indicates the need for accurate description of effective remedial techniques applicable to the unusual behaviours in children with severe sensory deprivation.

The present study centres on the application of a Schedule of Differential Reinforcement of Other Behaviour (D.R.O.) in which reinforcement is contingent upon the non-occurrence of unwanted behaviours. Three children were studied; one blind, one deaf and a deaf child with visual difficulties. The study attempts to avoid the experimental weaknesses in similar studies found by Forehand and Baumeister (1976) and to investigate the Self Stimulation hypothesis (Carr, 1977) as it might apply to these children. Assuming that interaction with another person is a state of sufficient stimulation then there should be a negative correlation between measures of involvement of Ss and other people and the occurrences of the unwanted behaviours.

## METHOD

### The Children

The study concerned 3 children suffering from auditory and visual handicaps who were 5 day boarders at a special school for children with these handicaps. They were selected for the study because of their high rate of stereotyped behaviour, as reported by school staff. The children are referred to by the fictitious names; Mary, Jeff and Paul.

Mary, aged 7, was blind in one eye and deaf. At baseline she engaged in a high frequency of rocking, hand flapping and hyperventilation.

Jeff, aged 10, was blind with limited speech and slightly spastic. As baseline he engaged in head banging, high frequency finger tapping and body spinning.

Paul, aged 9, was deaf. At baseline he engaged in chin punching, hand jerking and unusual posturing.

## Design

A multiple baseline across behaviours is used, each child being treated as a single case. Three target behaviours were specified for each child. Following a baseline period of 2 weeks, the intervention is applied to target behaviour 'A', and maintained for the remaining 3 weeks of the investigation. During the first intervention week baseline recordings continue to be taken for behaviours 'B' and 'C' and at the end of the week intervention commences with behaviour 'B'. Finally, intervention commences with behaviour 'C' 2 weeks after the initial intervention with behaviour 'A'. The design is illustrated in Figure 1.

## Recording

Observations were taken during four 10 minute periods at random times on each day of the five week study. Each period was divided into 10 one-minute intervals, during the first  $\frac{1}{2}$  minute of which the observer counted the specified behaviour and then recorded it in the second  $\frac{1}{2}$  minute on a score sheet. Thus 10 readings were obtained from each observation period, for each of the target behaviours. The number of times the child engaged in interaction with others was recorded as an engagement score (E).

Reliability checks were taken by having a second observer independently make recordings of the same child on 15% of the recording sessions.

## Target Behaviours

Details of the target behaviours for each child are as follows:

MARY. Target Behaviour 'A' "Rocking". The movement of the head or body back and forth or up and down. When the head or body is returned to the starting position this counts as one rock.

Target Behaviour 'B' "Hand Jerk". This is a sharp movement of the hand and may occur at the side or in front of the face. Each such jerk counts as one.

Target Behaviour 'C' "Other". For Mary, this category referred to hyperventilation. This was observed as gasping and grunting. No count was made of the frequency, if this behaviour occurred during the 30 second observation, the observer recorded a tick "✓" in the appropriate space in the 'other' section.

JEFF. Target Behaviour 'A' "Head Banging". Head banging was a pounding of the head against a wall, the floor, furniture or any other object. Each bang obtained a score of one.

Target Behaviour 'B' "Finger Tapping". Repetitive beating of the finger on the other hand or other parts of the body. Jeff also used toys or other small objects for his tapping. Each tap received a score of one.

Target Behaviour 'C' "Other". For Jeff, this category referred to repetitive rocking or spinning his body whilst standing. If these behaviours occurred during the 30 second observation, the observer recorded a tick "✓" in the appropriate space in the 'other' section.

PAUL. Target Behaviour 'A' "Chin Banging". A chin bang is each single punch to the subject's chin. Paul used either hand to punch his chin. Each bang received a score of one.

Target Behaviour 'B' "Hand Jerks". Frequently the subject engaged in a ritualistic type set of behaviours. This involved placing a toy or other object on a table or chair, then jerking or slapping his hand on the surface while he pushed the object to the floor. The number of jerks was recorded. Each jerk obtained a score of one.

Target Behaviour 'C' "Other". Other repetitive behaviour such as rocking and moving his hand above his head, were recorded as a tick "✓" in the 'other' section of the observation tables.

## Intervention

Differential Reinforcement of Other Behaviour (D.R.O.) is employed, specifying that reinforcement is given if and only if the target response does not occur for a specified time interval. Reinforcers used were a spoonful of ice-cream or a smartie, as other observations showed these to be suitable as reinforcers for the subjects concerned.

On the first treatment day, Mary and Paul were introduced to D.R.O. 1 min. with ice-cream reinforcement, by one of the investigators (C.M.). Successful progress enabled the schedule to be increased to D.R.O. 5 mins. and then D.R.O. 10 mins. within the first session. Subsequent intervention was conducted by child care and teaching staff, who had been previously instructed. They were given smarties, a timer and activity chart specifying the target behaviours and directed to give a smartie, contingent on the non occurrence of the target behaviour in the preceding 10 mins. The 10 mins. was subsequently increased to 20 mins.

For Jeff, target behaviour 'A', head banging, was not treated as staff had independently and successfully started treating head banging by withholding attention when the behaviour occurred.

Following an accident at school, Paul was sent home and discontinued from study after week 3.

## RESULTS AND ANALYSIS

Frequency counts for the target behaviours are in Table 1.

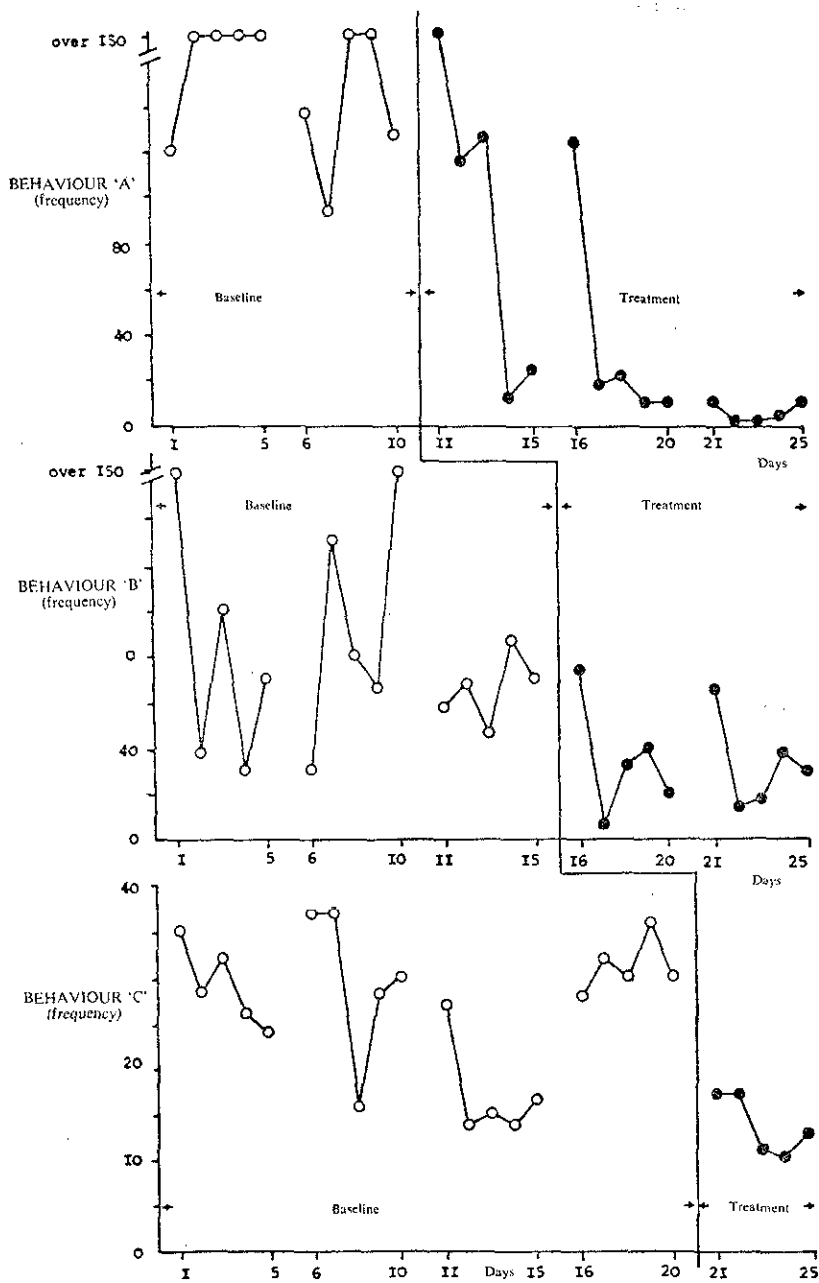
Child	Behaviour	Week 1	Week 2	Week 3	Week 4	Week 5	Autocorrelation	F	P
Mary	A	302	167	96	37	6	.68	7.8	<0.01
	B	97	110	66	35	34	.03	1.9	0.17
	C	29	30	17	31	14	.58	14.0	<0.01
Jeff	A	3	2	0	0	0	—	—	—
	B	306	191	171	76	116	.49	7.3	<0.01
	C	25	16	22	17	17	.15	2.1	0.12
Paul	A	109	124	83	—	—	.23	t=2.3	<0.05
	B	42	67	77	—	—	.08	t=1.7	<0.10
	C	18	18	19	—	—	-.02	t=0.4	<0.40

Table 1

Weekly Totals Frequency Counts for Target Behaviours for the 3 children over the Five Weeks of the Study. Treatment Weeks are Marked. Autocorrelations of Lag 1 are given for the Sequential Readings of that Behaviour. F ratios for Repeated Measures ANOVA and their Associated Probabilities are given (t ratios in the case of the third child, Paul).

Weekly total frequency counts for Mary, the only child for whom complete data could be obtained, are presented graphically in Figure 1.

Figure 1



Daily frequencies of three target behaviours for Mary.

The multiple baseline technique is illustrated: baseline days are shown by open circles and treatment days by filled circles. The reading is interrupted after every 5th day by the child's going home for weekends.

The purpose of the multiple baseline procedure is to enable inferences to be drawn about the significance of treatment effects without taking the ethically undesirable step of returning behaviour to baseline levels. For this type of data the correct inferential technique is repeated measures ANOVA (cf. McCain & McCleary, 1979). Errors in the use of conventional statistics can derive from the serial correlation of the data. The autocorrelation was calculated for each target behaviour in each subject according to the method of Kendall & Stuart (1978) and results are presented in table 1. One-way ANOVA was computed across the 5 treatment weeks for each target behaviour in each subject. Results are presented in table 1. Successful intervention predicts a significant main effect in each case. More importantly, having obtained significant ANOVA, successful intervention predicts that the significant differences lie between baseline and treatment weeks, and not within baseline weeks viz weeks 1 and 2 versus weeks 3, 4, and 5 for behaviour 'A'; weeks 1, 2 and 3 versus weeks 4 and 5 for behaviour 'B' and weeks 1, 2, 3 and 4 versus week 5 for behaviour 'C'. Scheffé tests (cf. Hays, 1973) were conducted to detect these differences. The results are presented in table 2.

**Table 2**

Pairwise Treatment Week Mean Differences for Target Behaviours Yielding Significant F ratios in Table 1. Predicted Significant Differences are Underlined. Obtained Significant Differences on the Scheffé Test are Marked by Asterisk (\* $p < 0.05$ , \*\* $p < 0.01$ ). Mean Differences Pre - Post Intervention are also shown.

		Week				Pre - Post Intervention	
		2	3	4	5		
<i>Mary</i> Behaviour 'A'	Week	1	135.1	<u>206**</u>	<u>265**</u>	<u>290**</u>	96.1*
		2		<u>71</u>	<u>130</u>	<u>161</u>	
		3			59	80	
		4				31	
		Week				Pre - Post Intervention	
		2	3	4	5		
<i>Mary</i> Behaviour 'C'	Week	1	-0.6	11.8*	-2.2	<u>15.4**</u>	13.2**
		2		12.4*	-1.6	<u>16.0**</u>	
		3			-14.0	<u>4.6</u>	
		4				<u>17.6**</u>	
		Week				Pre - Post Intervention	
		2	3	4	5		
<i>Jeff</i> Behaviour 'B'	Week	1	114.8	135.2	<u>230.0*</u>	<u>190.7*</u>	127.0**
		2		20.6	<u>115.2</u>	<u>75.9</u>	
		3			<u>94.6</u>	<u>55.3</u>	
		4				-39.3	

The Self Stimulation Hypothesis (Carr, 1977) is tested by examining the correlation between the engagement score (E), the number of recorded interactions with other persons, with SS, the total recorded self stimulating behaviours, the sum of target behaviours A, B and C. The self stimulation hypothesis predicts that this correlation should be negative.

Product moment correlation coefficients were calculated between E and SS for each subject and were: S1 = -.23 S2 = .16 S3 = -.44.

Inter observer reliability was calculated as the ratio of inter observer agreements to agreements plus errors (Harris & Wolchick, 1979). The agreement was 87.5% for S1, 79.0% for S2 and 77.5% for S3.

## DISCUSSION

The intervention appears to have been reasonably successful in effecting significant reductions in self stimulating behaviour. Of the total of six treated target behaviours, all show a reduction in overall frequency (table 1). Four show significant reductions following intervention as demonstrated by the Scheffé tests (table 2 pre - post intervention) and the t-test on subject 3, behaviour A (table 1). Figure 1 illustrates a clear reduction in target behaviours in subject 1.

The question of whether improvement can be reliably attributed to the intervention technique rather than to non-specific features of the treatment situation is resolved by the multiple baseline technique. Table 2 gives pairwise comparisons of all treatment and baseline weeks for those target behaviours yielding significantly different weekly response counts. Significant differences between baseline and treatment weeks, shown by underlined differences in Table 2, would be predicted by successful intervention; 8 of 16 differences thus predicted were significant beyond the 5% level. Significant differences within successive baseline weeks would be predicted by the operation of non-specific factors; table 2 shows that 2 of these 10 differences were significant (though another 4 differences were in the opposite direction indicating increase in target behaviour frequency prior to treatment).

These points are illustrated in Figure 1 which gives daily response totals for Mary. Response totals in each case are seen to fall chiefly following the start of treatment. The increases in frequency during treatment (behaviour A, day 16 and behaviour B, day 21) occurred during the first day back at school following weekends at home.

The use of D.R.O. schedules for reducing self stimulating behaviours has been pointedly criticised by Carr (1977), as literal interpretation of the schedule could involve the reinforcement of other equally undesirable behaviours, e.g. temper tantrums, simply because they do not feature in the specification of the target behaviour. However, this literal interpretation of the schedule seems unlikely in situations where the reinforcing agent is one with a broader view of the child's interest such as a member of the care staff, as was the case with present study. Indeed the lack of experimental control inherent in studies in this area is not always disadvantageous. Despite the steps taken in this study to extricate treatment effects from non-specific effects on target behaviour, it seems clear that generalization between target behaviours occurred, as well, perhaps, as some beneficial effects of increased attention. Further, the most serious target behaviour, Jeff's head banging, had been spontaneously and successfully treated by care staff following a discussion of reinforcement principles with them, prior to the commencement of this study. Serendipity is not to be despised.

Clear evidence for the self stimulation hypothesis (Carr, 1977) was not forthcoming as the predicted negative correlation between self stimulation and engagement score was high in only one child, Paul.

Possibly the presence of other more salient features in the environment — the intervention programme — rendered the study of engagement inappropriate in this case.

## REVIEW OF THE CHILDREN SUBSEQUENT TO THE PERIOD OF THE STUDY

JEFF. When last seen, eighteen months after completion of the study, this boy was still indulging in the minor repetitive self stimulatory behaviours. Everyone involved with Jeff were very relieved that the head banging had not reappeared and was not replaced by any self injurious behaviour.

PAUL. 12 months later this little boy was still banging his chin. However the frequency of this behaviour had reduced very markedly and it was possible to control the chin banging by adult intervention indicating that he should stop. There was an increase in stimulus control over some of his other obsessional behaviours so that he would refrain from them if he thought that he was being observed. Adults who come into contact with him suggest that he is much more aware of others since the experimental time and one major benefit was the increase in his rate of learning in the classroom situation.

MARY, when seen 24 months after the completion of the study was still hyperventilating and producing the noises described earlier by restricting the air flow at the back of the mouth. Hand regard and hand flapping were still a feature. In her case the intervention had not significantly affected the rate at which she produced the behaviours which were indulged in even when she was engaged with an adult. However she demonstrated an increased awareness of others which all the staff judged to be a consequence of the experimental period. She started to hug and kiss people she knew and seemed to enjoy their company. Her mother remarked that Mary seemed to know her better and to make more covert signs of recognising her when she visited the classroom.

One unexpected side effect of the study was on the child care staff who had participated in the procedures. They confessed to being more aware of the need for observational skills, of being precise in their descriptions of behaviours and the need for early intervention when undesirable skills emerge or are recognised. They were sure that the experimental treatment had been of benefit to an extent unwarranted by the achieved results but they expressed the view that the results would have been better had the period been extended and expressed their willingness to carry on with the treatments. The authors are of the opinion that the experimental approach used gave these caring adults something that they could do for children who anyone could see were severely handicapped and hereto had presented problems that seem to defy intervention. Non-professional care staff may well need something purposive to do with these children and as a result may be less inclined to give up all hope. This change in attitude may well have resulted in the after affects which they were prepared to attribute to the experimental treatment.

## SUMMARY

A D.R.O. schedule was used in an attempt to reduce self stimulating behaviours in 3 children, who suffered various handicaps.

The design employed was multiple baseline across behaviours. ANOVA and planned comparison of means revealed significant reductions in target behaviours attributable to the intervention. The judicious employment of D.R.O. is argued to be appropriate for reducing self stimulating behaviours.

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