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Identifying the Variables Maintaining Self-Injurious Behavior[1]

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Reliability and validity data are reported for an instrument designed to identify variables maintaining self-injurious behavior. The Motivation Assessment Scale (MAS) is a 16-item questionnaire that addresses the situational determinants of self-injurious behavior in persons with autism and other developmental disorders. The reliability study indicated that teachers of 50 developmentally disabled persons could agree on the variables presumably maintaining their student's self-injury (interrater reliability), and that they would be in agreement again 30 days later (test-retest reliability). The validity study indicated that teacher's ratings on the MAS of 8 subjects' self-injury predicted how their students would behave in analogue situations. Specifically, the MAS predicted the subjects' self-injurious behavior in situations with decreased adult attention, with increased academic demands, with restricted access to tangibles, and in unstructured settings. The MAS is presented as an alternative or adjunct to more formal functional analyses in efforts to identify the variables controlling self-injurious behavior.

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Self-injurious behaviors such as face slapping, head banging, and hand biting continue to concern those who work with autistic and other developmentally disabled persons. In part, because of frequent failures to control self-injury among persons with severe handicaps, recent work has focused on investigating those variables involved in the maintenance of this behavior. It is expected that a better understanding of maintaining variables should lead to more effective treatment of self-injury. Four classes of variables have been identified as involved in the maintenance of self-injurious behavior: social attention (e.g., Carr & Durand, 1985a; Lovaas, Freitag, Gold, & Kassorla, 1965), tangible consequences (e.g., Durand, 1986; Edelson, Taubman, & Lovaas, 1983), escape from unpleasant situations (e.g., Carr, Newsom, & Binkoff, 1976; Durand, 1982), and sensory consequences (e.g., Durand, 1982; Rincover & Devany, 1982) (for reviews see Carr, 1977; Durand & Carr, 1985).

Because of the importance of determining the variables maintaining an individual's self-injurious behavior, recent work has focused on assessment procedures. Iwata, Dorsey, Slifer, Bauman, and Richman (1982) devised as series of analogue conditions to determine the role of social attention, sensory consequences, and task demands on the self-injury of nine subjects. They found considerable variability both within and between their subjects in these conditions, suggesting that self-injurious behavior may be a function of different consequences. Similarly, Carr and Durand (1985a) observed that low levels of adult attention and high task demands were discriminative for self-injury in three developmentally disabled children. Providing the children with alternative verbal responses based on the assessment findings resulted in significant reductions in self-injury. Thus, knowledge of the role of these variables was predictive of treatment outcome.

Although constructing analogue situations in order to observe changes in self-injury may be a valid way of assessing maintaining variables, this approach has several drawbacks. First, conducting such analogue assessments requires extensive staff training. Second, these assessments can take from several days to several weeks, which may be unacceptable in certain crisis situations. A less time-intensive procedure that could be carried out by existing staff would be a valuable aid to clinicians who must deal with this troubling behavior.

In an effort to provide an alternative assessment method, we have developed the Motivation Assessment Scale (MAS), a rating scale designed to assess the relative influence of social attention, tangibles, escape, and sensory consequences on self-injury. The MAS asks questions about the likelihood of the target behavior's occurring in a variety of situations (e.g., as a function of task difficulty or social isolation). The present investigation reports on the interrater and test-retest reliability of this instrument, as well

as its ability to predict how self-injurious individuals will behave in analogue conditions similar to those described above (i.e., Carr & Durand, 1985a; Iwata et al., 1982).

RELIABILITY STUDY

Methods

Subjects and Setting

Students. Fifty developmentally disabled children with frequent self-injurious behavior served as subjects. Selection of subjects was accomplished by the administration of a problem-behavior checklist given to the students' teachers. This checklist was used to generate a list of students who exhibited frequent self-injurious behavior. The teachers reported that these students' self-injurious behavior interferred with classroom activities.

Children ranged in age from 3 years 1 month to 18 years 10 months, with a mean age of 14 years 6 months. Primary diagnoses provided by psychologists independent of the present project included infantile autism ($N = 22$), severe mental retardation ($N = 25$), and developmental language disorder ($N = 3$) (DSM-III); American Psychiatric Association, 1980). Mental age, assessed by the Vineland Social Maturity Scale, ranged from 11 to 84 months, with a mean of 32 months. Estimates of intellectual functioning placed all children in the moderate to profound range of retardation (moderate = 9, severe = 24; profound = 17).

Teachers. Children's self-injurious behaviors were rated on the MAS by two persons. The primary raters ($N = 35$) were the classroom teachers to whose class the children were assigned. These raters were certified special education teachers who had worked with the children for the academic year. Secondary raters ($N = 35$) were assistant teachers in the same classrooms. Secondary raters had generally obtained 2- or 4-year degrees in social-science-related fields.

Setting. Students and teachers were selected from six schools in New York, New Jersey, Massachusetts, and Rhode Island. These sites allowed for an evaluation of the MAS with a variety of raters and students.

Procedure

Response Definitions. Students were selected if they displayed frequent self-injurious behavior. The mean frequency of self-injury exhibited by this group exceeded 15 self-injurious episodes per hour. Self-injurious

behaviors included hand biting, face hitting, and/or head hitting. Hand biting was defined as any time the participant's top and bottom teeth came in contact with any part of his/her hand. Face hitting was scored any time the participant's hand made forceful contact with his/her face. Forceful contact was defined as contact audible to the observer and that usually left a red mark on the face. Head hitting was scored whenever the participant made forceful contact to the head with an object or his/her hand.

The Motivation Assessment Scale. The Motivation Assessment Scale (MAS) was derived after extensive informal interviews with teachers, clinicians, and parents of developmentally disabled children. The scale consists of 16 questions that assess the likelihood of a problem behavior's occurring in different situations. For example, one question that is designed to assess for the role of escape from demands as a maintaining variable asks, "Does this behavior occur following a command to perform a difficult task?" A question that assesses the role of sensory influences asks, "Does this behavior occur repeatedly, over and over, in the same way?" A question assessing the role of social attention asks, "Does this behavior occur when you are talking to other persons in the room?" Finally, a question about tangible influences asks, "Does this behavior ever occur to get a toy, food, or game that he or she has been told that he or she can't have?"

Raters are instructed to answer these questions on a 7-point Likert-type scale—never (0), almost never (1), seldom (2), half the time (3), usually (4), almost always (5), always (6). The 16 questions represent four examples from each of four maintaining variables—sensory consequences, escape, attention, and tangible consequences. A score is obtained for each of the four categories of maintaining variables by adding the scores for each of the category's four questions and computing a mean. High scores on one or more of these categories indicate that these variables may be responsible for the maintenance of the student's self-injury.

Administration. Interrater reliability was assessed by administering the MAS to a primary (teacher) and a secondary (assistant teacher) rater for each target child. Test-retest reliability was assessed by administering the MAS to the primary rater again 30 days following the initial administration. In each case, raters were separated in order to reduce the possibility of their influencing each other's scores.

Results and Discussion

Responses from each of the 16 questions on the MAS were recorded from both the primary and secondary raters for each of the 50 children. Pearson correlation coefficients on the raw Likert scores for the individual questions were all significant at the .001 level (correlations ranged from .66

Table I. Mean MAS Scores for Subjects in Reliability Study

Subject no.	MAS categories			
	Sensory	Escape	Attention	Tangible
1	1.00[a]	2.00	4.75	3.25
2	.75	3.75	1.25	2.00
3	1.75	2.50	1.50	3.50
4	2.50	2.75	3.25	2.50
5	2.00	4.50	5.25	3.75
6	4.50	2.75	2.75	2.00
7	2.25	2.50	2.25	2.50
8	3.50	2.00	2.75	5.00
9	1.75	3.00	.50	1.50
10	1.50	3.25	2.25	3.75
11	2.75	4.50	2.50	1.25
12	1.50	3.25	0	5.25
13	3.00	2.75	2.50	4.75
14	1.00	2.75	1.75	4.00
15	4.50	2.75	2.50	1.25
16	1.75	2.50	1.50	.50
17	2.75	2.75	2.75	3.75
18	2.75	4.25	2.50	5.00
19	3.25	4.25	3.75	3.50
20	5.25	3.75	4.50	4.25
21	2.75	4.25	2.50	5.00
22	4.00	1.75	6.00	2.00
23	2.25	1.25	4.25	2.25
24	3.00	2.75	2.50	4.75
25	1.50	2.75	1.50	4.50
26	1.00	3.50	3.25	1.25
27	2.75	4.25	2.50	5.00
28	3.75	3.25	.50	5.75
29	3.50	3.00	.50	6.00
30	3.75	3.25	.50	5.75
31	2.75	2.75	2.00	4.75
32	2.75	2.75	2.75	3.75
33	2.75	4.25	2.50	5.00
34	4.50	2.75	2.50	1.25
35	2.75	4.25	2.50	5.00
36	3.25	2.50	2.75	2.50
37	4.50	2.75	2.50	1.25
38	1.50	2.75	1.25	4.50
39	3.00	2.75	2.50	4.75
40	2.50	4.00	2.25	4.50
41	3.75	2.75	1.75	2.25
42	4.75	1.25	1.50	.75
43	3.50	2.25	2.00	4.25
44	3.25	4.75	3.75	3.50
45	1.50	3.75	1.00	4.75
46	1.00	3.50	3.25	1.25
47	3.75	3.25	.50	5.75
48	4.50	2.75	2.50	1.25
49	1.00	3.50	3.25	1.25
50	1.50	2.75	4.00	1.75

[a]Mean score from primary (teacher) rater.

to .92). An analysis of the mean scores for the categories was conducted by correlating the raw mean scores and by ranking the scores. Pearson correlation coefficients for the raw mean scores were all significant at the .001 level (correlations ranged from .80 to .95). The means were also ranked since this most closely resembled how the scores are used clinically. Thus, the highest mean score for a child (e.g., in the escape category) was given a rank of one. The other three mean scores (e.g., sensory, attention, tangible) were given ranks of two, three, and four, respectively. This corresponds to our use of the scores as an indication of possible maintaining variables. Tie ranks were averaged. Spearman rank-order correlation coefficients for the category scores were significant at the .001 level of significance (range = .66 to .81).

Responses from each of the 16 questions on the MAS were recorded from both administrations with the primary rater. Pearson correlation coefficients for the individual questions were all significant at the .001 level (correlations ranged from .89 to .98). Mean scores for each of the categories were correlated as above. An analysis of the means for the raw scores were all significant at the .001 level (range = .92 to 98). Spearman rank-order correlation coefficients were significant at the .001 level of significance (range = .82 to .99).

MAS data for the 50 subjects are displayed in Table I. These data indicate that tangible consequences were the most frequently cited motivation (48%), followed by escape (18%), attention (17%), and sensory (17%). There were four subjects whose highest scores were either the same or were within .25 points (these were counted as ties since they were considered to be equivalent influences).

Data from the interrater and test-retest reliability assessments indicate that the Motivation Assessment Scale is a reliable instrument. Raters can agree on the category of maintaining variable presumably influencing a particular child's self-injurious behavior. Scores on the MAS also appear stable over time. The same rater is likely to place a behavior in the same category 1 month following an initial rating.

VALIDATION STUDY

The next study was designed to assess how well the MAS predicts the occurrence of self-injury in situations with reduced adult attention, with increased task demands, with unavailable tangibles, and in unstructured situations. This type of information was seen as valuable because it has proven helpful in designing treatment interventions for self-injury (Durand & Carr, 1985) and other problem behaviors exhibited by developmentally disabled persons (Carr & Durand, 1985a; Durand & Carr, 1987; Durand & Crimmins, 1987).

Subjects and Setting

Eight developmentally disabled children who participated in the first study served as subjects in the Validation study. Table II describes the participants in the Validation study.

The participants were randomly selected from all of the 50 subjects assessed in the Reliability study, with the following qualification: Two subjects were randomly selected from each subgroup of subjects identified on the teachers' MAS. Thus, 2 subjects who were identified on the MAS as exhibiting sensory-maintained self-injurious behavior were randomly selected from all of the subjects who were rated in the Reliability study as having sensory-maintained behaviors. Similarly, 2 subjects with MAS-rated escape-maintained self-injurious behavior, 2 with attention-maintained behavior, and 2 with tangibly maintained behavior were selected from their respective groups. The experimenters were blind to the MAS scores of the subjects prior to and during the validation sessions.

The validation sessions were conducted either in a 2.0-m by 3.0-m room that was adjacent to the subjects' classrooms or in an area set aside in the classroom. Each participant was seated behind the table with an experimenter seated next to him or her.

Procedure

The procedures used in the validation sessions were adapted from Carr and Durand (1985a). Prior to the validation study, each participant was administered the Leiter International Performance Scale (Leiter, 1969), and two tasks were developed from pictures on the Leiter. These pictures include a series of discriminations that are on a continuum of difficulty. An easy task was constructed from a pool of items on which a subject could answer approximately 100% correct. A difficult task was developed from a pool of items on which a subject received approximately 33% correct responses. Thus, task difficulty was assessed independently and prior to the study.

The task presented in the experimental conditions was conducted as follows. From one to three 3″ × 5″ cards with the Leiter pictures pasted on them were placed in a row in front of the subject. Approximately 20 copies of each picture were mixed together and placed in the subject's hands. The experimenter pointed to the card at the top of the pile and said, "Match this." The subject was expected to place the card on top of the correct sample. Correct responding resulted in verbal praise (e.g., "That's right!") and the presentation of a tangible reinforcer on approximately a VR3 schedule. When an error was made, the experimenter said, "No," or "That's not right!" and went on to the next trial.

Table II. Subjects in Validation Study

	Descriptive information						
Name	MAS category	Chronological age (months)	Mental age (months)	Language age (months)	DSM-III diagnosis	Topography of SIB	Medication
Bob	Sensory	147	33	30	Autism severe MR	Hand biting	Thorazine
Ted	Sensory	200	23	1	Autism prof. MR	Face hit	Haldol Cogentin
Jim	Escape	37	31	13	Autism	Hand biting	None
Nat	Escape	174	51	36	Autism moderate MR	Head hit	Mellaril
Tim	Attention	48	30	12	Autism	Hand biting	None
Ann	Attention	54	48	21	Autism	Head hit	None
Wes	Tangible	170	43	30	Autism severe MR	Hand biting	None
Dan	Tangible	220	34	6	Autism prof.MR	Hand biting	Tegretol

Adult attention was delivered to the subjects in the form of commands, praise, and comments. The experimenter was cued to present commands, praise, and comments by means of an earphone connected to a tape recorder. A command ("Match this") was presented to the subject once during every third 10-sec recording interval (i.e., every 30 sec). Praise was also delivered once during every third 10-sec recording interval contingent on correct responding or appropriate task-related behavior (e.g., "You're working very nicely!"). Comments were also made approximately every third interval and these consisted of a variety of descriptive statements ("It's sunny today"). This schedule of presentation of attention allowed us to keep the amount of attention consistent across conditions.

Five experimental conditions were constructed in order to determine those stimulus conditions that were presumably involved in the maintenance of the participants' self-injurious behaviors. Each subject participated in every condition for three 10-minute sessions each. The order in which the participants were presented with the conditions was determined by random assignment.

Baseline. Baseline consisted of sessions in which the subjects were required to work on the easy match-to-sample task (100% correct responding) and were provided with one-to-one attention in the form of praise (e.g., "That's right!"), commands (e.g., "Match this"), and comments (e.g., "It's sunny today"). One-to-one attention was defined as some form of experimenter attention (praise, commands, comments) presented in each 10-sec recording interval. Subjects were given access to favorite tangible reinforcers for approximately every third correct task response (VR3). The experimenter ignored all self-injurious behavior (i.e., made no comment). If these behaviors posed a physical risk, the experimenter would block all serious attempts by the subject to harm him/herself. It was expected that socially maintained behavior problems would be low in this condition because the participants had access to a variety of reinforcers (i.e., adult attention, tangibles) and no aversive situations were present (i.e., difficult task).

Attention. This condition involved all aspects of Baseline except that adult attention was reduced from 100% of the 10-sec recording intervals to about 33% of the intervals. Specifically, commands, praise, and comments were presented during one-third of the recording intervals as in Baseline; however, they were now programmed in the same interval rather than in different intervals. Thus, two out of every three intervals on the average involved no adult attention while one out of every three contained a command, a praise statement, and a comment. It was anticipated that behaviors being maintained by adult attention would tend to increase during this condition.

Escape. All aspects of this condition were identical to Baseline, except that instead of an easy task (100% correct responding), a more difficult task was presented to the subjects (33% correct responding). Behaviors maintained by negative reinforcement (e.g., escape from difficult tasks) were expected to increase during this condition.

Tangible. In this condition, favorite tangibles (assessed independently for each subject) were constantly visible but were available only for approximately every ninth correct answer. Behaviors being maintained by tangible consequences were expected to increase during this condition.

Unstructured. During this condition, favorite foods and toys were placed within reach, an adult was present and would interact with the subject if solicited verbally or nonverbally, and the task materials were placed on the desk if the subject chose to work. It was expected that behaviors maintained by their sensory consequences would be highest during this condition.

Response Definitions and Observer Agreement

Table II describes the form of self-injury exhibited by each subject. Hand biting, face hitting, and head hitting were defined as described in the Reliability study.

Commands were defined as any task-related request made by the experimenter (e.g., "Match this"). Praise was defined as any form of verbal approval delivered contingent on correct task responses (e.g., "That's right!") or general cooperative behavior (e.g., "I like the way you are working!"). Comments were defined as any descriptive statements made by the experimenter (e.g., "It's sunny today").

Finally, correct and incorrect responses to the match-to-sample task were recorded. Correct responses were recorded if the participant placed one of the copies of the pictures on the appropriate sample. An incorrect response was scored if the participant placed a copy on top of the wrong sample or failed to respond within 10 sec.

Self-injurious behavior, experimenter attention, and task performance data were recorded using a continuous 10-sec interval procedure. The presence or absence of the responses previously defined were scored at the end of each 10-sec interval (partial interval). Observers were cued to record responses each 10-sec through an earphone connected to a tape recorder.

Observer agreement was assessed by three standard observers. These observers were advanced undergraduate students who had extensive experience in behavioral recording. During the validation study, observer agreement was assessed in 100% of the sessions. Observer agreement was

assessed for each response by comparing the observer's and the standard's records on an interval-by-interval basis. Observer agreement data for self-injury and experimenter attention was computed by taking the number of agreements divided by the number of agreements plus disagreements multiplied by 100. Task performance was scored on a trial-by-trial basis to yield percent correct figures. The mean observer agreement scores for self-injury and experimenter attention exceeded 80% for all subjects and response categories (range = 80.1 to 98.3). Agreement scores for task performance exceeded 95% for all subjects (range = 95.1 to 99.6).

Results and Discussion

Results of Independent Variable Manipulation

Experimenter attention (i.e., commands, praise, and comments) was programmed in sessions during each condition (except Unstructured) so that they were each present in approximately 33% of the scoring intervals. Data from Baseline, Attention, Escape, and Tangible conditions confirm the success of these attempts. The mean percent of commands in these four conditions was 33.7%, 33.3%, 33.3%, and 33.5%, respectively. The mean percentages were 33.6%, 33.4%, 33.5%, and 33.4% for praise, and 33.3%, 33.3%, 33.5%, and 33.4% for comments.

Because experimenter attention was not programmed in the Unstructured condition, these data differ from the other conditions. No commands were recorded during this condition for any of the subjects. Mean percent of praise during the Unstructured condition was 23.6%, and the mean percent of comments during this condition was 16.8%.

Task performance averaged 96.1% (range = 90.1 to 98.0) for Baseline, 97.0% (range = 92.0 to 100) for Attention, 33.9% (range = 30.7 to 37.9) for Escape, and 96.9% (range = 93.3 to 100) for Tangible. Thus, the subjects' task performance data were consistent with the effort to keep performance at approximately 100% correct responding for Baseline, Attention, and Tangible, and at 33% correct responding for Escape. No task responses were prompted and none were emitted during Unstructured.

Correspondence Between MAS Scores and Observational Data

For the Validation study, we used the primary teacher's scores for comparison purposes since he/she had the most experience with the subjects. Table III shows the mean scores for each subject on each group of questions.

Table III. Teachers' Ratings on the MAS for Subjects in Validation Study

Subject	MAS category			
	Sensory	Escape	Attention	Tangible
Bob	4.50	2.75	2.50	1.25
Ted	5.25	3.75	4.50	4.25
Jim	2.75	4.50	2.50	1.25
Nat	3.25	4.75	3.75	3.50
Tim	2.50	2.75	3.25	2.50
Ann	1.50	2.75	4.00	1.75
Wes	1.00	2.75	1.75	4.00
Dan	3.00	2.75	2.50	4.75

[a]Mean scores out of a possible 6.00.

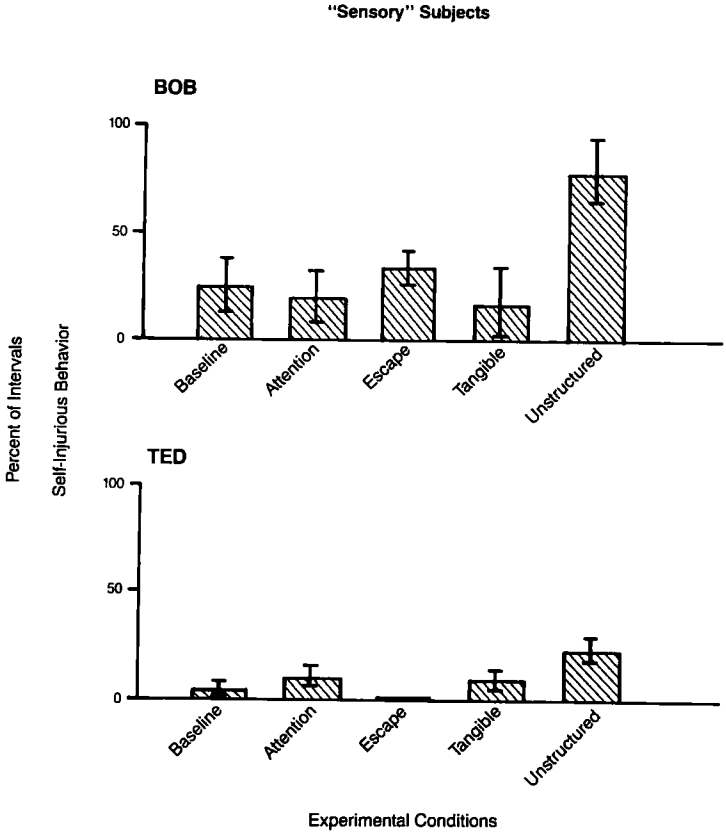

Fig. 1. The percent of self-injurious behavior in each experimental condition exhibited by the two subjects (Bob and Ted) rated as having "sensory-maintained" self-injury on the MAS.

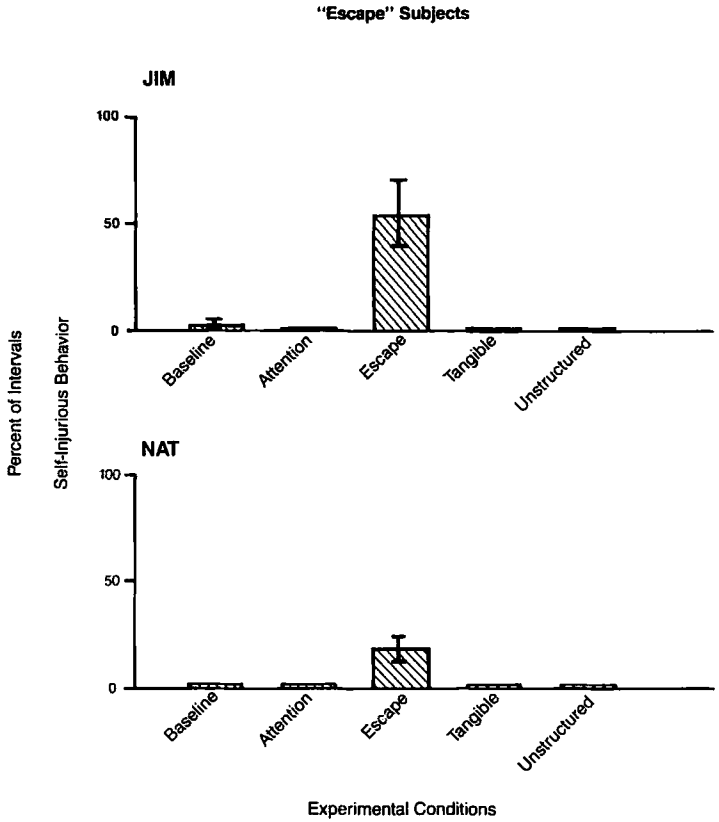

Fig. 2. The percent of self-injurious behavior in each experimental condition exhibited by the two subjects (Jim and Nat) rated as having "escape-maintained" self-injury on the MAS.

Figures 1,2,3, and 4 depict each subject's mean rate of self-injury as a function of the experimental conditions. Table IV shows the individual data for each subject. Note that Bob and Ted (Figure 1) were rated by their teachers as having sensory-maintained self-injurious behaviors and that they were most likely to exhibit self-injury in the Unstructured condition. Jim and Nat were rated as having escape-maintained self-injury and were also more likely to engage in these behaviors during the Escape condition. Tim and Ann were rated as having attention-maintained behaviors and they exhibited most of their self-injury during the Attention condition. Finally, Wes and Dan were rated by their teachers as having tangibly maintained self-injury and they exhibited this behavior most frequently in the Tangible condition.

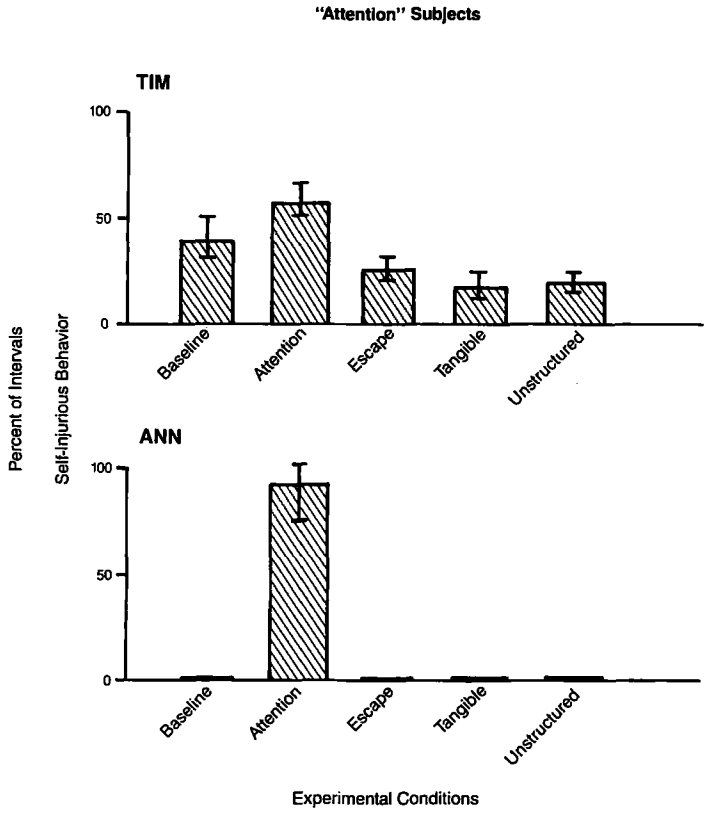

Fig. 3. The percent of self-injurious behavior in each experimental condition exhibited by the two subjects (Tim and Ann) rated as having "attention-getting" self-injury on the MAS.

We correlated the ranks of the MAS ratings with the ranks of the analogue data. Overall, the correlation between the teachers' MAS ratings and the analogue data was highly significant ($r = .99$, $p < .001$). Thus, the teacher's rating on the MAS predicted their student's behavior in the experimental conditions.

GENERAL DISCUSSION

The hallmark of applied behavior analysis is the functional analysis of behavior. Although the functional analysis of self-injurious behavior is frequently recommended, its absence is often lamented (e.g., Carr, 1977;

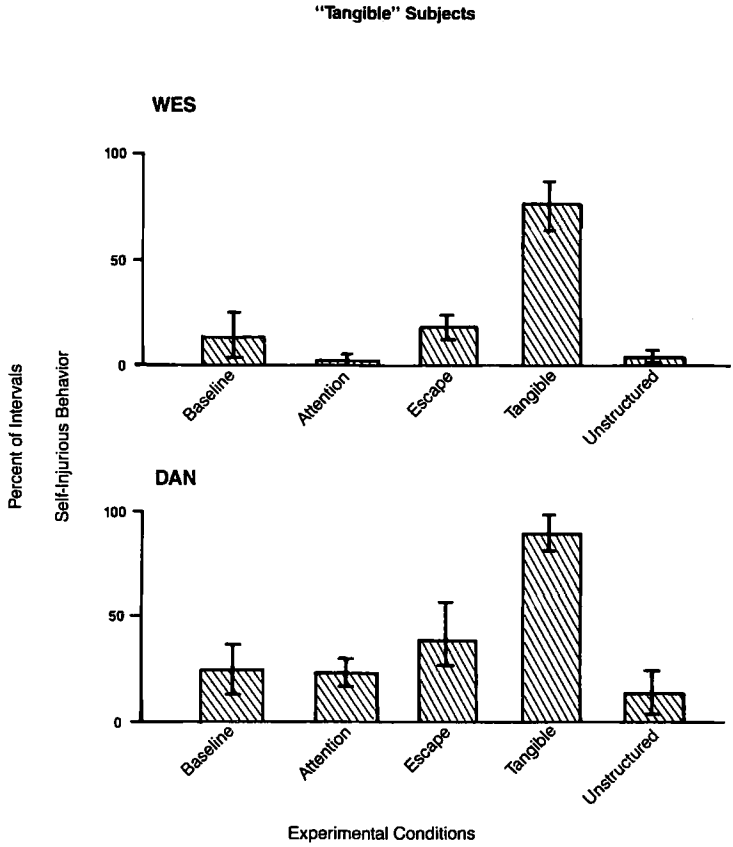

Fig. 4. The percent of self-injurious behavior in each experimental condition exhibited by the two subjects (Wes and Dan) rated as having "tangibly maintained" self-injury on the MAS.

Evans & Meyer, 1985; Sulzer-Azaroff & Mayer, 1977). The absence of formal functional analyses prior to treatment may be due to inadequate resources, the lack of trained staff, or insufficient time to perform such analyses. We present in this paper an assessment device that serves as an adjunct or alternative to the functional analysis of self-injurious behavior. The Motivation Assessment Scale was found to be reliable scale that can predict how individuals will behave in analogue assessment settings.

A feature of the present study is the identification of tangible consequences as an important variable in the maintenance of self-injurious behavior (Durand, 1986). This influence may be the result of both positive (access to tangibles contingent on self-injury) and negative (escape from the

Table IV. Self-Injurious Behavior Data for Subjects in Validation Study

	Experimental condition				
Subject	Baseline	Attention	Escape	Tangible	Unstructured
Bob	22.1	17.8	31.0	13.6	75.8
(range)	(8–37)	(7–30)	(23–38)	(0–33)	(63–92)
Ted	3.2	10.6	0	7.9	22.6
(range)	(0–12)	(5–20)	–	(0–13)	(7–37)
Jim	3.0	0	54.6	0	0
(range)	(0–12)	–	(33–62)	–	–
Nat	0	0	16.5	0	0
(range)	–	–	(10–25)	–	–
Tim	37.6	55.9	26.8	17.1	18.9
(range)	(23–48)	(42–65)	18–37)	(5–25)	(8–30)
Ann	0	93.6	0	0	0
(range)	–	(65–100)	–	–	–
Wes	13.5	4.6	18.0	76.8	4.0
(range)	(0–23)	(0–13)	(7–28)	(67–90)	(0–7)
Dan	26.1	24.1	37.8	88.1	12.5
(range)	(15–37)	(12–35)	(23–45)	(78–100)	(3–23)

denial of tangibles) reinforcement processes. Tangible consequences were shown to be independent of such well-documented influences as social attention, escape from difficult task demands, and sensory consequences. Thus, we have provided an extension of previous analyses of self-injury (e.g., Carr, 1977). Important treatment implications result from this additional analysis. For example, we have found that teaching an alternative attention-getting or assistance-seeking phrase will result in reductions in attention-maintained and escape-maintained problem behavior (Carr & Durand, 1985a). However, if an individual is engaged in behavior maintained by tangible consequences, an appropriate treatment might be to teach requesting strategies. More individually designed treatments should be developed as a result of the information obtained through the MAS.

Previous research has documented the use of analogue settings similar to Attention and Escape in determining the influence of social attention and task demands on self-injurious behavior (e.g., Carr & Durand, 1985b; Iwata et al., 1982). However, we have introduced two new methodologies not used previously (i.e., Tangible and Unstructured). The Tangible condition manipulated the tangible reinforcers preferred by these students while keeping social attention constant. Thus, by reducing access to preferred foods or toys, we assessed their separate influence on self-injury. One reason why this type of analysis has not been conducted may come from the results of using time-out as an intervention. Time-out typically involves the removal of both social attention and tangibles. Yet, when this procedure reduces self-injury, its success is usually attributed to the removal of attention.

Rarely is the separate effect of removing tangibles assessed. Our data and others' (Durand, 1986; Edelson et al., 1983) suggest that social attention and tangible consequences may be two separate influences on self-injury.

Other investigations have assessed the influence of sensory consequences on self-injury. Some have employed a "masking" procedure to determine sensory influences (e.g., Durand, 1982; Rincover & Devany, 1982). Thus, if a child's head banging is maintained by its tactile consequences, putting a helmet on the child should prevent or "mask" tactile feedback, thereby reducing the self-injury. However, a number of competing explanations could account for these results. The masking procedure could serve to *distract* the subject from engaging in self-injury (stimulus control). In fact, distraction has been used as a behavioral reduction technique (e.g., Favell, McGimsey, & Jones, 1978). This procedure could also serve as a discriminitive stimulus for the unavailability of social attention or favorite tangibles (i.e., extinction) or signal the absence of aversive stimuli (i.e., negative reinforcement), each of which might result in reduced levels of self-injury. In a second sensory paradigm, Iwata et al. (1982) placed their subjects in a room alone, devoid of any toys, to assess sensory influences on self-injury. High rates of self-injury in such a setting may indicate that sensory influences are involved, but it may also suggest the role of tangible or attention influences (Lovaas, 1982).

Owing to limitations of the previous methodologies, a "subtraction" paradigm was designed. It was assumed that by providing unlimited access to social attention, behaviors maintained by social attention would be exhibited at low rates. Similarly, if favorite tangibles were available, behaviors maintained by this influence should also be less frequent. And, if no task responses were required, then behaviors that served to escape task demands should be less frequent. Finally, since no incompatible behaviors were prompted, this should not interfere with sensory-maintained behavior. What should be left, then, were behaviors being maintained by their sensory consequences. Some preliminary support for this paradigm comes from the correlation between the behaviors exhibited in this condition and the teacher's reports on "sensory" questions from the MAS.

An additional consideration is the necessity of the MAS. Would simply asking teachers if a student's self-injury was maintained by attention, escape, tangibles, or sensory consequences be sufficient? Following the final administration of the MAS, the teachers were given descriptions of the four classes of maintaining variables and were asked to rank them in order of influence on their student's self-injury. A Spearman rank-order correlation for these ratings and the teacher's MAS scores was nonsignificant (r = .21; p = n.s.). Thus, while teachers could predict their student's self-injurious behavior through their answers on the MAS, their global ratings

of controlling variables were not as accurate. The MAS appears to bridge the gap between clinical intuition and the functional analysis of behavior.

One implication of the present study and others (Carr & Durand, 1985b; Durand, 1986; Durand & Carr, 1987; Durand & Crimmins, 1987; Iwata et al., 1982) is that a classification of problematic behaviors according to function may be useful in designing treatments. In other words, a *functional classification system* would involve the study and treatment of attention-getting, escape-maintained, tangibly maintained, and sensory-maintained behaviors. This is in contrast to the current practice of separately investigating behaviors that look self-injurious, aggressive, self-stimulatory, or tantrumous. A shift in focus from *form* to function could prove useful in efforts to mitigate the effects of problem behaviors.

A final implication involves the application of this information to the selection of reinforcers. For example, it is assumed that if an individual frequently engages in problematic behavior to solicit attention, then social attention should serve as a potent reinforcer for this person. Similarly, another individual frequently engages in problematic behavior to escape from academic tasks, then the opportunity to briefly escape from tasks should serve as a reinforcer for this person. We are currently conducting a series of investigations to determine whether information from the MAS on problem behaviors can be used to select effective reinforcers (e.g., attention, escape, tangibles, sensory feedback).

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