TECHNICAL ARTICLE

*EVALUATION OF FAMILY INTERVENTION THROUGH
UNOBTRUSIVE AUDIO RECORDINGS:
EXPERIENCES IN "BUGGING" CHILDREN¹*

STEPHEN M. JOHNSON, ANDREW CHRISTENSEN, AND G. TOM BELLAMY

UNIVERSITY OF OREGON

Five children referred to a child-family intervention program wore a radio transmitter in the home during pre-intervention and termination assessments. The transmitter broadcast to a receiver-recording apparatus in the home (either activated by an interval timer at predetermined "random" times or by parents at predetermined "picked" times). "Picked" times were parent-selected situations during which problems typically occurred (e.g., bedtime). Parents activated the recorder regularly whether or not problems occurred. Child-deviant, parent-negative, and parent-commanding behaviors were significantly higher at the picked times during pretest than at random times. At posttest, behaviors in all three classes were substantially reduced at picked times, but not at random times. For individual subject data, reductions occurred in at least two of the three dependent variables for three of the five cases during random time assessments. In general, the behavioral outcome data corresponded to parent-attitude reports and parent-collected observation data.

DESCRIPTORS: behavioral recording, behavior modification, parent training, automatic audio tape recording, portable recording apparatus, observation code, children

Behaviorists working in applied settings usually rely on direct observation in the natural environment for the design, modification, and evaluation of treatment programs. In general, they have avoided the more controlled and convenient vehicle of laboratory analogs for clinical outcome research, primarily on the grounds that behavior in such artificial settings may not be representative of behavior in the subjects' natural habitat (e.g., Fawl, 1963; Kortlandt, 1962; Martin, Johnson, Johansson, and Wahl, 1976; Milgram, 1963; Lobitz, G. and Johnson, 1976). Yet, naturalistic observation data may also be affected by a variety of confounding influences such as subject reactivity, observer bias, lack of generalizability in observer agreement estimates, and lack of representativeness in time-sampling procedures (e.g., Johnson and Bolstad, 1973; Jones, Reid, and Patterson, 1975; Lipinski and Nelson, 1974; Kent, Fisher, and O'Leary, Note 1). Several investigators have developed new procedures for direct observation, including the use of audio recording (Bernal, Gibson, Williams, and

Pesses, 1971; Johnson and Bolstad, 1975) and radio transmitters (e.g., Purcell and Brady, 1965; Soskin and John, 1963).

The present work further developed and adapted audio-recording methods for assessment in the home setting. Radio transmitters as first described by Soskin and John (1963) were used in combination with interval timers to sample behavior at random intervals without subject awareness (as in Bernal *et al.*, 1971). This procedure was employed as one of several methods to evaluate the outcome of a behavior-modification training program.

METHOD

Subjects

Five families with children believed to exhibit active behavior problems in the home participated in the treatment program. One family contained two children treated in the program. "Active behavior problems" referred to aggressiveness, destructiveness, disobedience, hyperactivity, temper tantrums, or high-rate activity with annoyance value. Four families had both parents in the home; in one the father was absent. The treated children ranged in age from 4 to 10 yr, with a mean age of 6.6 yr.

Treatment Procedures

Six advanced graduate-student therapists worked in permanent two-person teams under the direction of

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a supervising therapist.² The treatment approach was educational in nature and based on the principles of social learning and techniques of behavior modification. Through a series of no more than 12 weekly sessions, parents were trained to keep data on their child's behavior and to institute behavioral programs. The treatment procedures are described in detail by Eyberg and Johnson (1974) and are based on those described by Patterson and his associates (Patterson, Cobb, and Ray, 1973; Patterson, Ray, and Shaw, 1968; Patterson and Reid, 1973).

Measures of Treatment Outcome

Four measures of treatment outcome—parent observation data, two parent verbal-report measures, and audio-tape observation data—were taken in the home.

Parental observation data. The therapists required both parents to record the to-be-treated child behaviors for a one-week baseline period before beginning an intervention for them. Parents recorded the frequency and/or duration of the behavior of interest for a specified time each day. During intervention, behavioral recording continued as long as the behavior remained a focus of treatment.

Verbal report measures. A form of the Becker (1960) Bi-Polar Adjective Checklist was employed to obtain parental descriptions of the treated child.³ The Therapy Attitude Inventory was constructed specifically for earlier research on the assessment of parents' satisfaction with the process and outcome of this treatment program and with the therapists involved (Eyberg and Johnson, 1974).

Home observations. The audio equipment used for home observations consisted of a transmitter, a receiver, a 24-hr timer, two 15-min time switches, and two reel-to-reel tape recorders.⁴ The transmitter was activated by the parents and placed on the belt of the target child for time blocks when he was inside the home. Time blocks included morning, afternoon, and evening periods for a total of approximately 5 hr a day. If bedtime behavior was to be recorded, the transmitter was placed in the child's bedroom, rather than on his person. In one case, the parent had diffi-

culty getting the child to wear the transmitter during the daytime blocks and placed the transmitter in the room with the child.

All other equipment was stored inside a trunk placed conveniently in the home (e.g., a closet). The receiver was wired to two tape recorders, one of which was activated at three predetermined 15-min "random times" each weekday. These random times were usually scheduled around breakfast, early evening, and late evening. If the target child was normally inside the home in the afternoon, a random time was recorded then in place of the early evening time. The target child and parents were aware that some segments of their interaction would be recorded, but they did not know the duration or exact time of the recordings. The timer did not activate the random tape on weekends.

The second tape recorder could be activated by the parents operating another 15-min timer located on the outside of the trunk. Thus, there was a potential for three 15-min segments of randomly selected audio material and one 15-min segment of picked material per day. The parents were instructed to operate the "picked tape" once a day during a regularly problematic time or situation. Four families selected bedtime and one family selected nap time as the most problematic situation and were instructed to turn the tape recorder on at the point in the situation when behavior problems usually occurred. It was emphasized that the same setting event should be used on each occasion.

The therapists in each case brought the taping apparatus to the home for both assessments and explained its operation to the family. The parents were given written and oral instructions in the use of this equipment. In every case but one, the recording apparatus was left in the home for five to seven consecutive weekdays. One family failed to follow the picked time instructions properly during part of the first week of baseline and had to repeat the assessment for a second week. Due to fluctuations in family schedules or failures in following instructions, less than the maximum amount of data was collected. The mean number of 15-min random time segments at each testing period was 9.10 (2 hr 16.5 min) with a range of 6 to 11 for all regular assessments and a high of 16 segments for the one special case at baseline. The mean number of picked time segments was 5.20 (1 hr 18 min) per assessment with a range of four to seven.

Three means of censorship were provided to protect the families' privacy. (a) The family could activate a censor switch located on the outside of the trunk to disconnect the receiver for 15 min. (b) The family could listen to and erase any part of the tapes before their coding by observers. (c) The family could listen to and erase any part of the tapes after their coding by observers. Confidentiality of all assessment materials was assured, and censorship was not discouraged. None of the families reported using the

²Therapists were G. Tom Bellamy, Andrew Christensen, Ricardo Munoz, Katy O'Banion, Elizabeth Steinbock, and Marie Rering Witt. The first author served as supervisor.

³All assessment instruments used in this research are available from the authors on request.

⁴Details of the equipment are as follows: Ecdor PM-1 transmitter: dimensions = 3.2 by 7 by 10 cm, weight = 11 ounces, cost = \$219.50; Ecdor St-3 Sensatuner: cost = \$225.00; Intramatic timer, Model T 1975: cost = \$25.93; Mark timer (15-min): Cost = \$5.99; Sony TC 106 AV tape recorder: cost = \$155.96; footlocker: cost = \$25.00. The transmitter's range is approximately 200 feet on a little-used, low-range band. Accidental pickup by other users is extremely unlikely, but families were informed of this risk. Breakdown of the above equipment was virtually nil.

sensor switch and none requested that they listen to or erase any tapes.

Observational system. A new observational code was developed for use with the audio tapes. A slightly shortened form of the present system was used in a recent study by Johnson and Bolstad (1975). The coding system was designed to provide observation data on all verbal behavior of the individual wearing the transmitter and the verbal behavior of those interacting with him.

The tapes were coded by two observers trained before coding these tapes. The first observer coded all tapes and was frequently aware of the baseline-termination status of the tapes. Thirty-six of the 142, 15-min tape segments (or 25%) were randomly selected and coded by a second observer. The second, calibrating observer was unaware of the baseline-termination status of the tapes being coded. Thus, calibrations done on these tapes are representative of the remaining noncalibrated data. To the extent that observers agree on the calibration tapes, an absence of observer bias is indicated.

Observers coded the tapes in 10-sec blocks demarcated by clicks recorded on the second channel of each interaction tape. The coding system contains 16 discrete codes, which were reduced to four summary statistics for the purposes of this research. These summary

codes were child-deviant, parent-negative, parent-commanding, and sibling-negative behavior. Because this system is relatively new, the computation of observer agreement was rather comprehensive. Observer agreement per cent was computed on each code and each summary statistic. To count as an agreement, both observers were required to record the same event (occurrence) in the same 10-sec block. In addition, correlations of the rate-per-minute scores obtained by each observer in the 36, 15-min blocks were computed. Those codes, which were used fewer than five times, were not analyzed. A listing of the codes and summary statistics, together with their associated calibrated occurrences and agreement figures is presented in Table 1. The code composition of each summary statistic is also indicated in this table.⁵

The mean agreement for individual code categories was 82%, with a range from 70% to 97%. The mean agreement for summary statistics was 82%, with a range from 77% to 86%. The mean correlation for individual code categories was 0.94 with each code but one showing correlations of 0.92 or better. Summary statistics yielded very high agreement correlations of 0.97 or higher. For the data analysis, the agreement figures on summary statistics are most directly relevant.

Table 1

Observer agreement computed by per cent and correlation for each code and summary statistic.

Code	Total Calibrated Occurrence	Per Cent Agreement	Correlation
Talk	2143	93	0.99
*Positive Command	193	81	0.98
*Negative Command	39	79	0.59
*Suggestive Command	17	76	0.95
*Repeated Command	131	87	0.99
*Vague Command	0	—	—
*Disapproval	3	—	—
†**Threat	30	73	0.92
†**Whine	179	84	0.96
†**Yell	219	80	0.97
†**Verbal Negativism	82	70	0.96
†**Tease	1	—	—
†**Physical Negativeness	1	—	—
†**Disapproving Tone	164	73	0.93
†Cry	101	97	0.99
†Demand Attention	82	78	0.99
Commands	379	81	0.99
Parental Negativeness	239	77	0.97
Sibling Negativeness	6	83	1.00
Child Deviant	622	83	0.99

*Codes included in the command category.

**Codes included in the parent or sibling negative category.

†Codes included in the child deviant category.

RESULTS

Verbal Report Measures

Both verbal report measures, the Becker Bi-Polar Adjective Checklist and the Therapy Attitude Inventory, indicated favorable outcome for all cases in agreement with previous research involving this treatment program and these verbal report measures (Eyberg and Johnson, 1974; Johnson and Christensen, 1975). The Checklist was scored on the basis of the five factors derived by Patterson (*cf.* Patterson, Cobb, and Ray, 1973). The three most relevant factors (tense disposition, aggression, and conduct problems) were subjected to a paired observation *t*-test comparing all nine parents' baseline scores with their termination scores and showed significant improvement ($t(8) = 4.83, p < 0.005$). On the Therapy Attitude Inventory, parents gave an average rating of moderately favorable to items relating to therapy and their therapists.

Parent Observation Data

Parents collected behavioral data on each child behavior problem treated. The average number of problems per family was 6.8, with a range from four to 10. The outcome results based on parent data were based on per cent reduction from baseline observed in the last three weeks of active treatment for the individual behavioral problem. An average per cent

⁵A coding manual containing detailed definitions of each code category is available from the authors on request.

Table 2

Rate per minute of child deviant, parent negative, and parent commanding behavior at pretest and posttest at random and picked times.

	<i>Picked Times</i>			<i>Random Times</i>		
	<i>Pretest</i>	<i>Posttest</i>	<i>% Change</i>	<i>Pretest</i>	<i>Posttest</i>	<i>% Change</i>
CHILD DEVIANT						
<i>Case</i>						
1	0.683	0.197	-71%	0.454	0.515	+ 13%
2	1.823	0.883	-52%	0.835	0.711	- 15%
3	1.480	0.333	-78%	0.291	0.073	- 75%
4	2.680	0.686	-74%	0.606	0.345	- 43%
5	1.824	0.413	-77%	0.314	0.773	+146%
Mean	1.670	0.502	-70%	0.500	0.483	—
PARENT NEGATIVE						
<i>Case</i>						
1	0.300	0.016	-95%	0.218	0.187	- 14%
2	0.101	0.050	-50%	0.181	0.070	- 61%
3	1.120	0.222	-80%	0.028	0.027	- 4%
4	2.206	0.372	-83%	0.598	0.142	- 76%
5	0.392	0.227	-42%	0.036	0.288	+700%
Mean	0.824	0.177	-70%	0.212	0.143	—
PARENT COMMANDS						
<i>Case</i>						
1	0.450	0.082	-82%	0.370	0.269	- 27%
2	0.253	0.250	- 1%	0.441	0.187	- 58%
3	1.356	0.500	-63%	0.080	0.036	- 55%
4	1.340	0.220	-84%	0.697	0.233	- 67%
5	0.757	0.440	-42%	0.153	0.439	+187%
Mean	0.831	0.298	-54%	0.348	0.233	—

reduction in child deviant behavior was then computed for each family. The average reduction per family was 77%, with a range of 58% to 91%.

Audio-Tape Data

The audio-tape data for each case on each of the three dependent variables—child deviance, parent negativity, and parent commands—are presented in Table 2.⁶ Four repeated measures, planned comparisons, were performed on each dependent variable reflecting: (a) a comparison of behavior rates at the pretest between picked and random times, (b) a comparison of the pretest and posttest behavior rates at the picked time, (c) a comparison of the pretest and posttest behavior rates at random times, and (d) a test of the interaction between taped time and assessment time. For each variable, significant effects were predicted for comparisons "a", "b," and "d", but not

for comparison "c". These results analyses appear in Table 3.

As predicted, deviant child behavior was much higher at baseline in the picked times than in the

Table 3

Planned comparison *t*-tests on child deviant, parent negative, and parent commanding behavior.^a

<i>Comparison</i>	<i>Variable</i>		
	<i>Child Deviance</i>	<i>Parent Negative</i>	<i>Parent Command</i>
Picked <i>versus</i> Random Times at Pretest	5.01‡	2.63**	2.48**
Pretest <i>versus</i> Posttest at Picked Times	5.98‡	2.61**	3.20†
Pretest <i>versus</i> Posttest at Random Times	.08	.30	.69
Interaction: Taped Time × Assessment Time ^b	4.49†	2.28*	2.21*

* $p < 0.05$

** $p < 0.025$

† $p < 0.01$

‡ $p < 0.005$

^aAll tests are one-tailed ($df = 8$ for first three comparisons; $df = 4$ for Interaction).

^bThe interaction for child deviance is illustrated in Figure 1.

⁶Case number three involved a family in which a 9- and a 10-yr-old boy were both involved in the treatment program, and each boy wore the transmitter on alternate days. This was the only family in which siblings could not be reliably discriminated in coding. As a result, all child and parent behaviors were coded only in those segments when both children were together and all data were averaged. These procedures resulted in the loss of only 1.33 min of data in pretest picked time and 12 min in the posttest picked time.

random times. Child deviant behaviors occurred at 1.70 per minute in the baseline picked times, but only at 0.50 per minute at the baseline random times, $t(8) = 5.01, p < 0.005$. The direction of this difference was the same in every case. Furthermore, the deviant behavior rate per minute was reduced at termination in every case to an average of 0.50 per minute, $t(8) = 5.98, p < 0.005$. On the average, the child deviant-behavior rates did not change during the random times and the interaction between taped time and assessment time illustrated in Figure 1 was significant, $t(4) = 4.49, p < 0.01$.

Fig. 1. Mean child deviant behavior at pretest and posttest during random — and picked ---- times.

The same pattern of results was repeated for parent negativity and parent commands. Both parent behaviors were significantly more frequent at the picked than random times at baseline. Both decreased reliably and significantly during the picked times but not during the random times, and the interactions were significant. The sibling negative variable was not analyzed because siblings were coded in only two cases and were quite inactive when present (see Table 1).

Although the random-tape data did not consistently decline in child-deviant, parent-negative, and parent-commanding behaviors as did the picked times, fairly substantial reductions in at least two of these variables were observed for three of the five families (families two, three, and four) (Table 2).

DISCUSSION

The radio-assisted audio-recording procedures used have considerable utility for assessment in the home. The procedures may solve many of the data representativeness problems, noted earlier, that have plagued naturalistic observations. The observer agreement checks can be made randomly, thereby yielding completely generalizable reliability assessments. Finally, and perhaps most important, behavior can be sampled at any time. The data indicated that this provision is particularly useful for treatment evaluation. Although the procedures for defining the "picked" times in the present study did not eliminate

subject awareness, high-density "random" taping at specific intervals would presumably have this effect.

The problems encountered with the system were primarily those of obtaining compliance from the parents and children. Parents must activate and place the transmitter on the child at several points in the day, recharge the transmitter over night, and finally, make certain that the child wears the transmitter. The child must wear the transmitter for most of his waking hours inside the home. In one case, it was so difficult getting the child to wear the transmitter that the parent placed it in the room where the child was and moved it when he moved.

The tape-data results at picked times were highly veridical with parent data and parent attitude reports. The picked-tape data showed a mean reduction in deviant behavior of 70%, which is comparable to the average 77% reduction in targeted behavior problems as recorded by parents. Although not statistically significant, the random-tape results showed reductions in two or more of the dependent variables for three of the five families. The veridicality of this outcome data is particularly encouraging in view of previous research in which behavioral data have failed to substantiate the same degree of treatment effectiveness as demonstrated by other data sources (Eyberg and Johnson, 1974; Johnson and Christensen, 1975). The present results were completely consistent with the trends observed in this earlier research, however, in that behavioral data showed greater improvement, as it was more specifically related to the behavior problems treated. Thus, in this earlier research, parent data on targeted problems showed the greatest improvement, followed by a significant but modest index of improvement based on observer records of those codes related to treated problems, followed by nonsignificant change on a general index of observed deviance.

The specificity made possible by a taping system is probably responsible for the enhanced agreement among data sources obtained in this study. Because these behavior-modification treatment procedures are frequently aimed at extremely situation- and time-specific behavior problems, the assessment procedures must possess sufficiently narrow "bandwidth" to yield high "fidelity".

The picked and random tapes may have differed on the dimension of parent awareness of recording. The behavior change could be a function of this awareness and the associated response of parents to demand characteristics. The available data would suggest that parents of generally "deviant" children can behave so as to cause their children to act significantly more deviant than usual but not significantly less deviant (Lobitz, W. and Johnson, 1976). On the average, children behaved more deviantly at pretest picked times than they did at the "usual" random times. At the posttest, the mean picked deviant-behavior rate was virtually identical to the mean rate at random times. Thus, the data could merely reflect a "fake bad" set at baseline. Several important considerations

mitigate against this interpretation. The first comes from consideration of the Walter and Gilmore (1973) study, in which a placebo intervention program was employed for families with child problems similar to those dealt with here. Although parental expectancies were successfully manipulated by this placebo procedure, observers who employed the presumably more obtrusive method of going into the homes recorded slight increases in child deviant behavior at the post-test. Furthermore, parental ratings of child symptom occurrence showed no change with placebo treatment. The second consideration derives from a study (Lobitz, G. and Johnson, 1976) in which the pretest deviant-behavior rates of referred and normal children were compared with similar behavior rates of comparable groups in which parents had been asked to "fake good", behave normally, or "fake bad". Deviant-behavior means of both referred and normal children corresponded most closely to the "fake-good" condition means of the appropriate comparison groups. Thus, most families in a home observation situation may respond more to a generalized social-desirability response set, rather than to any possible demand characteristics associated with treatment.

The present study is purely descriptive, in that no control group was employed. Three control-group studies have been completed, however, on very similar populations with comparable treatment and assessment procedures, including parent report and observational data. The Walter and Gilmore (1973) study involved comparison with an attention placebo group, while the other two studies involved comparisons with no-treatment groups (Johnson, Bolstad, and Lobitz, 1976; Wiltz, Note 2). The results of all studies have been consistent in showing either no change (Johnson *et al.*, 1976) or slight increases in observed deviant behavior in the control or placebo groups (Walter and Gilmore, 1973; Wiltz, Note 2). An absence of significant change in parent ratings of the target child was obtained by Johnson *et al.* (1976), and Walter and Gilmore (1973) found no change in parent ratings of the child's symptom occurrence with placebo treatment. Thus, although not completely comparable, the available research suggests that the kinds of changes observed here would not be observed in similar groups exposed to placebo or no treatment.

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