

*DOES FUNCTIONAL COMMUNICATION TRAINING
COMPETE WITH ONGOING CONTINGENCIES OF
REINFORCEMENT? AN ANALYSIS DURING
RESPONSE ACQUISITION AND MAINTENANCE*

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We examined the effectiveness of functional communication training (FCT) in reducing self-injurious behavior (SIB) and in shaping an alternative (communicative) response while SIB continued to be reinforced. Following a functional analysis of 3 individuals' SIB, we attempted to teach an alternative response consisting of a manual sign to each individual, using the reinforcer that maintained SIB. When FCT was implemented without extinction, SIB remained at baseline rates for all participants, and none of the participants acquired the alternative response. When extinction was added to the training procedure, SIB decreased and manual signing increased for all participants. To determine if signing, when established, would compete with SIB when both were reinforced, extinction was then withdrawn. Signing was maintained and SIB occurred at low rates for 2 individuals, but SIB returned to baseline rates for the 3rd individual, necessitating the reimplementation of extinction. These results suggest that it may be difficult to establish alternative behaviors if inappropriate behavior continues to be reinforced, but that, when established, alternative behavior might compete successfully with ongoing contingencies of reinforcement for inappropriate behavior.

DESCRIPTORS: extinction, functional analysis, functional communication training, self-injurious behavior

Functional communication training (FCT) has been found to be an effective treatment for a variety of behavior disorders, including self-injurious behavior (SIB), aggression, and disruption (Carr & Durand, 1985; Durand, Berotti, & Weiner, 1993). FCT typically consists of a two-step sequence in which (a) an assessment is conducted to identify the reinforcers that maintain problem behavior, and then (b) intervention is implemented using those reinforcers to strengthen a more

socially acceptable response in the context in which the problem behavior typically occurs. The rationale behind this approach is that individuals will be less likely to engage in problem behavior if they can gain access to reinforcement by exhibiting the alternative response.

One potentially important variable that is often not emphasized in studies on FCT is the contingency in effect for inappropriate behavior during treatment. Most applications of FCT include a component in which reinforcement for inappropriate behavior is eliminated through procedures such as extinction (Bird, Dores, Moniz, & Robinson, 1989; Carr & Durand, 1985; Durand & Carr, 1992) or response blocking (Durand & Carr, 1991). Results of studies in which the effects of these procedures were separated from those of FCT via component analysis indicate that FCT may be ineffective unless

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reinforcement for inappropriate behavior is withheld during treatment or, alternatively, punishment is delivered (Fisher et al., 1993; Wacker et al., 1990). Thus, the processes by which behavior reduction is achieved during FCT often remain unclear.

A related issue is whether the alternative response can be acquired initially or can be maintained if inappropriate behavior continues to be reinforced. In most previous research, the alternative response was taught in a separate condition in which a variety of consequences were delivered following both inappropriate behavior and the alternative response, and acquisition data for the alternative response were not presented (e.g., Bird et al., 1989; Carr & Durand, 1985; Durand & Carr, 1991, 1992; Fisher et al., 1993; Horner & Day, 1991). Descriptions of the shaping procedures contained in these studies suggest that removing the reinforcing consequences for problem behaviors may facilitate acquisition of the alternative response. For example, Wacker et al. (1990) shaped the alternative response directly in the treatment context and combined FCT with extinction or time-out. They found that inappropriate behavior increased in 2 participants and that the alternative response decreased in 1 participant when these procedures were later removed. However, Durand et al. (1993) interpreted these findings as a "contrast effect" rather than as a lack of maintenance and suggested that better results might have been obtained had FCT been implemented alone initially: "It is possible that if the negative consequences were never introduced concurrent with functional communication training, these consequences may not have been required to reduce their challenging behavior" (p. 336).

In the present study, we examined the effectiveness of FCT in reducing self-injurious behavior (SIB) and in shaping an alternative (communicative) response while SIB continued to be reinforced. A second purpose of

the study was to determine if the alternative response, once established, would compete with SIB if SIB were reexposed to reinforcement. Although continued reinforcement for inappropriate behavior during treatment may seem unusual, it could occur in clinical practice either inadvertently or if therapists assume that consequences for such behavior are unimportant when implementing procedures such as FCT. Similarly, reexposure of SIB to reinforcement could occur for a variety of reasons following the completion of treatment, including procedural drift, changes in staff, and so forth. Thus, in addition to providing some information about the active components of FCT, the findings of this study may have immediate implications for clinical practice.

GENERAL METHOD

Subjects and Setting

Three adults living in a state residential facility for persons with developmental disabilities participated. All were diagnosed with profound mental retardation. They were ambulatory and were capable of performing most self-care skills independently (e.g., feeding, dressing, toileting); however, they rarely followed instructions, did not exhibit any intelligible vocal behavior, and communicated through idiosyncratic gestures (e.g., reaching, pointing). Rick was a 29-year-old man whose SIB consisted of head hitting or banging and body or face slapping. Sue was a 24-year-old woman whose SIB consisted of face slapping, body hitting, and hand biting. John was a 39-year-old man whose SIB consisted of head banging and hand or arm biting. The study was conducted at a day-treatment center located on the grounds of the facility. Sessions lasted for 10 to 15 min and were conducted two to five times per day, usually 5 days per week.

Response Measurement and Reliability

The primary dependent variables were occurrences of SIB and the alternative response, which consisted of an arbitrary manual sign. SIB was defined as follows: (a) *hand biting*: insertion of any part of the hand or arm past the plane of the lips, accompanied by a biting motion of the teeth; (b) *head banging*: forceful contact of the head against an object; (c) *head or body slapping*: forceful contact of the hand against another body part. The alternative responses were selected following a number of informal sessions in which the responses were observed to occur independently at a low rate (i.e., usually once or more during a 15-min session). Rick's manual sign was a hand clasp (placing the hands together with fingers interlocked and palms facing inward), Sue's sign was a hand clap (audibly striking the palms of the hands against each other), and John's sign was a hand raise (lifting the hand above shoulder level for 3 s without touching the head). Prompted signs were those produced by a participant with assistance from an experimenter; independent signs were those produced by a participant without any assistance. Compliance was defined as completion of a requested task without physical guidance or the emission of SIB. All data were collected on a hand-held computer (Assistant Model A 102), and rates of SIB and signing were calculated by dividing the number of responses by session time. Data were also collected on experimenters' implementation of assessment and treatment procedures (delivery of instructions, prompts, and consequences); all of these measures were consistently above 95% accuracy.

Interobserver agreement was assessed by having a second observer simultaneously but independently collect data during 30%, 30%, and 39% of the sessions for Rick, Sue, and John, respectively. Agreement percentages were calculated by dividing session time

into consecutive 10-s intervals. For each interval, the observers' records were compared, and the smaller number of responses was divided by the larger number; these fractions were then summed and divided by the total number of intervals in the session. Mean agreement percentages across participants (Rick, Sue, and John) were 96.8%, 97.5%, and 98.4% for SIB; 99.8%, 97.8%, and 98.9% for independent signing; and 99.3%, 98.2%, and 98.9% for prompted signing, respectively.

Experimental Sequence

The study was divided into two parts. First, assessments were conducted using functional analysis methodology to identify the variables that maintained participants' SIB. Subsequently, the effects of FCT with and without extinction were evaluated in combined multiple baseline across subjects and reversal designs.

FUNCTIONAL ANALYSIS

All participants were exposed to four assessment conditions (attention, demand, alone, and play); Rick and Sue were exposed to an additional condition involving contingent access to specific materials. The assessments for Rick and Sue were conducted within a multielement design (Iwata, Dorsey, Slifer, Bauman, & Richman, 1982/1994); John's assessment was conducted within a modified design that combined features of the multielement and reversal designs (Iwata, Duncan, Lerman, & Shore, 1994).

Assessment Conditions

Attention. This was a test condition for SIB maintained by positive reinforcement in the form of attention. The participant and an experimenter were in a room containing a variety of leisure materials, to which the participant had free access. The experimenter delivered attention (e.g., "Don't do that,

you'll hurt yourself") contingent upon the occurrence of SIB but ignored all other behaviors.

Materials. This was a variation of the attention condition and served as a test for SIB maintained by positive reinforcement in the form of access to specific materials. Informal observations and reports from residential staff indicated that Rick often engaged in SIB during dressing routines when he was required to remove his favorite shirt and that Sue appeared to get "upset" when she was denied access to leisure materials. Just prior to each session, Rick was allowed to put on his favorite shirt, and Sue was allowed to play a solitary table game. When the session began, the experimenter removed the item but returned it for 30 s contingent upon the occurrence of SIB. At the end of the 30 s, the item was again removed. The experimenter did not otherwise interact with the participant throughout the session.

Demand. This condition was a test for SIB maintained by negative reinforcement in the form of escape from task demands. The experimenter presented instructional trials to the participant every 30 s using a three-prompt sequence (an initial instruction, a touch prompt, and, if necessary, physical guidance). Praise was delivered for compliance. If the participant engaged in SIB at any time during the trial, the experimenter removed the task materials and ignored the participant until the next scheduled trial.

Alone. This condition was a test for SIB maintained by automatic reinforcement (i.e., SIB that persisted in the absence of social consequences). The participant was alone in a room with no leisure materials available, and no social consequences were provided for SIB.

Play. This condition served as a control. Leisure materials were available continuously, and the experimenter provided noncontingent attention to the participant every 30 s. No instructions were presented during the

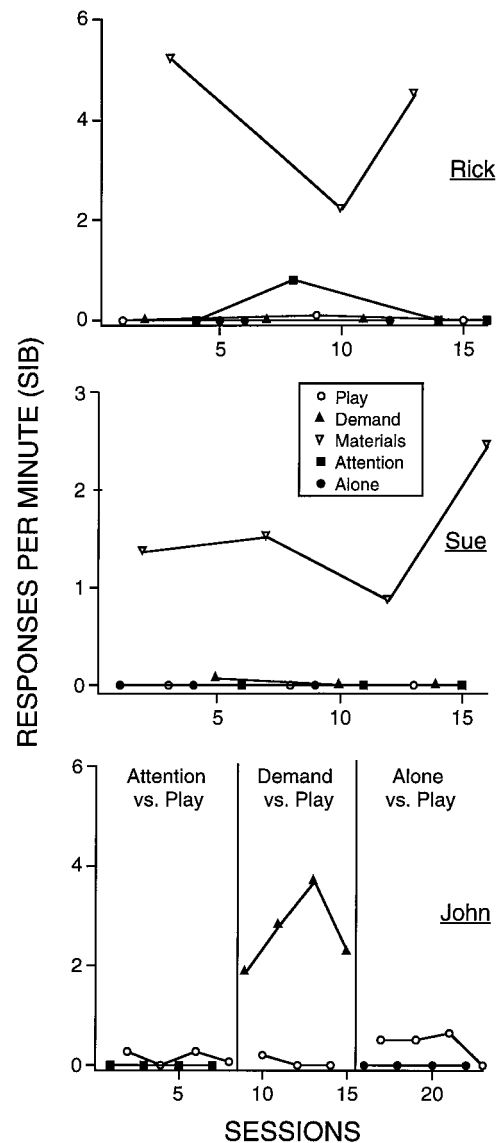


Figure 1. Rate of SIB for each participant across assessment conditions.

session, and no social consequences were provided for SIB.

Results

Figure 1 shows rates of SIB across assessment conditions for all participants. For Rick and Sue, the highest rates of SIB were observed during the materials condition, indicating that access to materials served as positive reinforcement for their SIB. The de-

Table 1
Consequences for Participants' Behaviors During Baseline and Treatment Conditions

	Condition		
	Baseline	FCT without extinction	FCT with extinction
Rick (materials context)			
SIB	Preferred shirt	Preferred shirt	Nonpreferred shirt
Sign	Continue trial	Preferred shirt	Preferred shirt
No response	Continue trial	Prompt sign → preferred shirt	Prompt sign → preferred shirt
Sue (materials context)			
SIB	Toy	Toy	No consequence
Sign	No consequence	Toy	Toy
No response	No consequence	Prompt sign → toy	Prompt sign → toy
John (demand context)			
SIB	Escape	Escape	Physical guidance
Sign	Continue trial	Escape	Escape
Compliance	Praise	Praise	Praise
No response	Continue trial	Prompt sign → escape	Prompt sign → escape

mand condition resulted in the highest rates of SIB for John, indicating that his SIB was maintained by escape. Based on these results and informal observations of the participants' behavior, alternative responses were selected and taught as replacements for SIB in the second phase of the study.

FUNCTIONAL COMMUNICATION TRAINING

Each individual was exposed to a series of conditions consisting of baseline, FCT without extinction, and FCT with extinction. Because SIB served different functions across participants, and because some conditions were either added or deleted based on an individual's pattern of responding, their procedures varied somewhat. The contingencies in effect during each condition are listed in Table 1 and are described in more detail below.

Treatment Conditions

Baseline. For Sue and John, baseline was identical to the assessment condition that produced the highest rate of SIB (materials and demand, respectively). Rick's baseline

was similar to the materials condition of his assessment but was conducted within the context of self-care training, which was typical of the conditions under which his SIB occurred at his home. The experimenter removed Rick's favorite shirt and then attempted to have Rick put on a different shirt. SIB resulted in removal of the non-preferred shirt and re-presentation of the preferred shirt for 30 s, followed by repetition of the sequence. Signing was ignored.

FCT without extinction. This condition was conducted in a manner similar to baseline, with the addition of training procedures to establish manual signing. Occurrences of both SIB and the alternative manual sign were followed by reinforcement.

Rick was taught to clasp his hands together in order to receive his favorite shirt. At the beginning of a trial, Rick's preferred shirt was removed from his body and he was prompted to put on another shirt. If Rick emitted SIB or a hand clasp, the preferred shirt was returned to him for 30 s. If Rick did not emit either response within 5 s, the experimenter physically prompted Rick to

clasp his hands together, then returned the preferred shirt for 30 s. A delay procedure was used to encourage Rick to emit the hand clasp independently. Following five consecutive trials during which no SIB occurred, the 5-s delay between trial initiation (removal of Rick's preferred shirt) and prompting of the hand clasp was increased by 1 s. No consequences were provided if Rick emitted SIB or a hand clasp while wearing the preferred shirt.

Sue was taught to clap her hands together to receive her preferred game (Connect Four). The experimenter removed the game at the beginning of a trial. If Sue emitted SIB or clapped her hands, she was given access to the game for 30 s. If neither response occurred within 5 s, the experimenter physically prompted Sue to clap her hands and then delivered the game for 30 s. The prompt was delayed an additional 1 s contingent upon five consecutive trials without SIB. Additional hand clapping or SIB was ignored while Sue had access to the game.

John was taught to raise his hand as a means of terminating instructional trials. After presenting an instruction (e.g., "John, stand up"), the experimenter delivered praise contingent upon compliance and permitted John to escape the trial contingent upon occurrences of either SIB or hand raising. If no response occurred within 5 s following initiation of a trial, the experimenter raised John's hand and then terminated the trial. Completion of five consecutive trials without SIB resulted in the prompt being delayed an additional 1 s. No consequences were provided for SIB or hand raising that occurred outside of the demand trial.

FCT with extinction. The prompts and consequences for signing, including criteria for incrementing the delay, were identical to those in the previous condition. However, SIB no longer produced reinforcement; the only way to obtain reinforcement was by emitting the alternative response. SIB exhib-

ited by Rick and Sue was ignored (it did not produce access to the preferred item); in Rick's case, SIB resulted in continuation of the trial. John's SIB during instructional trials resulted in the experimenter physically guiding John to complete the task, which, in addition to functioning as extinction (prevention of escape), may also have functioned as punishment.

Results

Figure 2 shows rates of SIB across conditions for all participants. Rick exhibited a mean of 2.67 responses per minute during baseline, which remained virtually unchanged when FCT was implemented without extinction ($M = 2.54$ responses per minute). When extinction was added to FCT, Rick's SIB increased initially and then decreased. During the last five sessions of the FCT plus extinction condition, his mean rate of SIB was 0.08 responses per minute. Extinction was then withdrawn to determine if signing would compete with SIB (when both were reinforced) when SIB had decreased and signing had increased. Rick showed no increase in SIB when extinction was removed ($M = 0.02$ responses per minute). The final set of data represents every fifth session out of a total of 50 maintenance probes conducted daily over a 2-month period. During this period, Rick's SIB remained low ($M = 0.19$ responses per minute).

Sue's SIB occurred at similar rates during baseline and FCT without extinction ($M = 2.45$ and 2.25 responses per minute, respectively). When extinction was implemented in conjunction with FCT, Sue's SIB initially increased and then decreased to a mean of 0.19 responses per minute during the last five sessions of the condition. When extinction was withdrawn, her SIB increased ($M = 1.2$ responses per minute). Because FCT without extinction was unsuccessful as a maintenance intervention for Sue, extinction was reimplemented. During this final con-

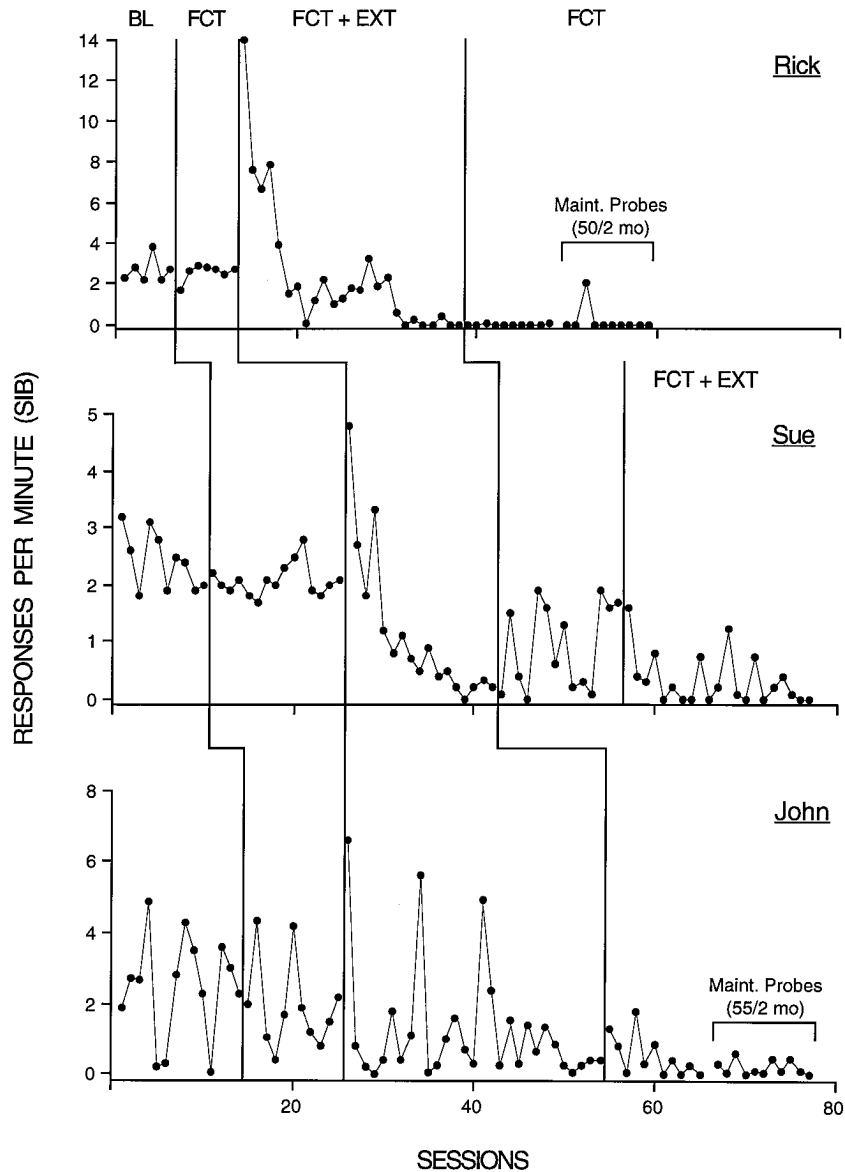


Figure 2. Rate of SIB for each participant during baseline and across treatment conditions (FCT alone and FCT plus extinction).

dition, Sue's SIB decreased once again ($M = 0.36$ responses per minute).

John exhibited a variable of rate of SIB during baseline ($M = 2.4$ responses per minute), which decreased only slightly during FCT without extinction ($M = 1.95$ responses per minute). When extinction was added to FCT, John's rate of SIB spiked periodically but decreased throughout the con-

dition ($M = 0.26$ responses per minute for the last five sessions). A slight increase in SIB was observed when extinction was removed ($M = 0.56$ responses per minute); however, SIB remained below its baseline level. Following Session 65, John's treatment was interrupted for reasons unrelated to the study; therefore, treatment was resumed under the FCT plus extinction condition when he re-

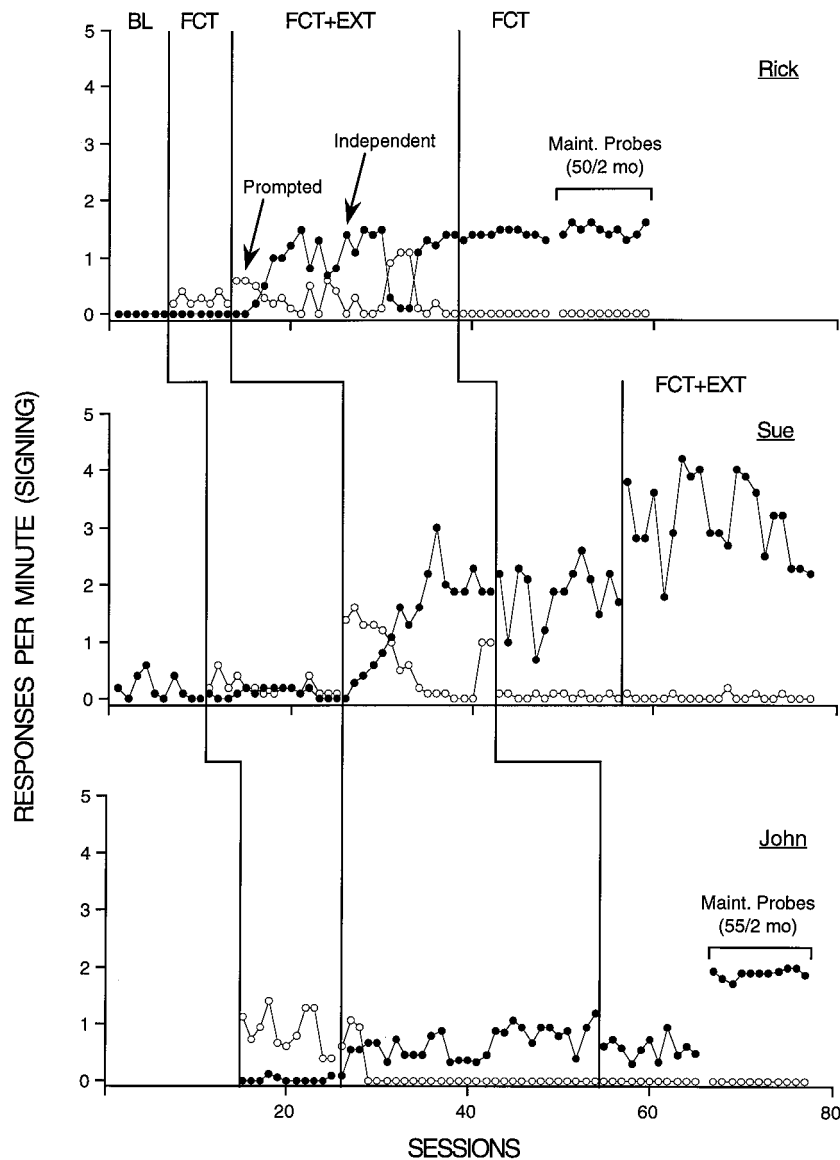


Figure 3. Rate of signing (prompted and independent) for each participant during baseline and across treatment conditions (FCT alone and FCT plus extinction).

turned (these data are not shown). Extinction was then removed again, and John's final set of data represents every fifth session out of a total of 55 maintenance probes conducted over a 2-month period. During that time, his SIB remained low ($M = 0.3$ responses per minute).

Figure 3 shows rates of prompted and independent signing across conditions for all

participants. Rick exhibited no independent hand clasps during baseline (signs were not prompted during this condition). During the FCT condition, prompted hand clasps occurred occasionally ($M = 0.3$ per minute) but no independent clasps were observed. When extinction was added to FCT, prompted signing increased and then subsequently decreased ($M = 0.3$ responses per

minute) as independent signing increased. However, during Sessions 18 to 30, Rick exhibited SIB and signing in what appeared to be a chained sequence. To the extent that SIB and signing occurred in close temporal proximity, both were essentially extinguished, and this seemed to have happened by Session 31. In an attempt to reestablish independent signing, the experimenter then began prompting Rick to sign on every trial if he did not do so independently. This modification resulted in an increase in signing. During the last five sessions of the FCT plus extinction condition, his mean rate of independent signing was 1.28 responses per minute. When extinction was withdrawn, Rick's independent signing remained stable ($M = 1.41$ responses per minute), and it was maintained at this rate across the 50 maintenance probes ($M = 1.49$ responses per minute).

Unlike Rick, who never signed during baseline, Sue showed a low rate of independent clapping during baseline ($M = 0.18$ responses per minute). Nevertheless, her clapping did not increase when FCT was implemented without extinction ($M = 0.12$ responses per minute). When extinction was implemented in conjunction with FCT, Sue's prompted clapping increased markedly and then decreased as independent responding increased ($M = 1.98$ responses per minute for the last five sessions). When extinction was withdrawn, Sue's clapping was maintained ($M = 1.5$ responses per minute). However, because her SIB also increased during this condition (see Figure 2), extinction was reimplemented. During the final FCT plus extinction condition, Sue's signing increased to a rate higher than that observed during any previous condition ($M = 3.25$ responses per minute).

Data were not collected on John's hand raising during baseline. During FCT without extinction, prompted hand raising occurred at a mean rate of 0.84 per minute;

however, independent responses occurred during only three sessions. John's rate of independent hand raising increased when extinction was added to FCT ($M = 0.96$ for the last five sessions of this condition) and was maintained when extinction was later removed. During the maintenance probes conducted following the interruption in John's treatment, independent signing was maintained at a very stable rate ($M = 1.9$ responses per minute).

At the completion of the study, all participants engaged in low rates of SIB and high rates of independent signing, although Rick's and John's SIB continued to be reinforced. As a precautionary measure, however, staff members at the institution were instructed to use FCT combined with extinction prior to discharge.

DISCUSSION

The primary purpose of this study was to evaluate the effectiveness of FCT in reducing the rate of SIB and increasing the rate of an alternative response (a manual sign) while SIB was concurrently reinforced. Results showed no decrease in SIB for any of the participants when FCT was initially implemented without extinction. Likewise, no participant acquired the response that was intended to serve as a replacement for SIB. When SIB was placed on extinction, however, all participants showed decreases in SIB and began to exhibit the replacement sign independently. Thus, for all 3 participants in this study, extinction was a prerequisite for both the reduction of SIB and the acquisition of an alternative response.

A second purpose of this study was to determine if, when rates of SIB were reduced to acceptable levels and the alternative response was learned, the alternative response would compete with SIB if SIB were reexposed to reinforcement. Results for all 3 participants showed that signing was main-

tained following the removal of extinction for SIB (i.e., when either SIB or signing produced reinforcement). Data on SIB revealed less consistent results. Rick engaged in very little SIB; instead, he showed almost exclusive preference for signing. John showed an initial increase in SIB, which subsequently decreased. Sue continued signing but also began to exhibit higher rates of SIB. When both responses were reinforced, she switched from one response to the other throughout many sessions. As a result, extinction was reimplemented, after which her rate of SIB again decreased. Thus, reexposure to reinforcement for SIB did not seriously disrupt signing or lead to an increase in SIB for 2 of the 3 participants; for the 3rd participant, intervention effects were compromised. In spite of the inconsistency in these results, they are somewhat more promising than those presented by Fisher *et al.* (1993) and Wacker *et al.* (1990), who found generally poor maintenance when extinction and punishment were removed following their combined use with FCT as initial interventions.

Several other features of the present data on acquisition and maintenance of the alternative response provide an interesting comparison with results from previous studies. In most research on FCT, data during initial acquisition of the alternative response were not presented, but it has been suggested that the behavior can be taught in a single training session (Carr & Durand, 1985) or in as few as 6 to 18 min (Durand & Carr, 1992), although Horner and Day (1991) reported that it took 6, 9, and 21 sessions to teach alternative responses to their 3 participants. Data presented by Wacker *et al.* (1990) during the acquisition phase showed that, although 1 participant learned the alternative response immediately, the other 2 participants required three and nine training sessions before unprompted responses exceeded prompted ones. In the present study, Sue's rate of independent signing increased quick-

ly during FCT plus extinction and was inversely related to her rate of SIB (signing occurred more often than SIB following six training sessions). Acquisition for Rick and John was more protracted. These individuals began to exhibit SIB and signing in combination, which resulted in apparent extinction of both responses for Rick. Although treatment was eventually effective, Rick and John required 21 and 28 training sessions, respectively, before their rates of signing exceeded their rates of SIB. Thus, reports by several investigators (Horner & Day; Wacker *et al.*) indicate that response acquisition during FCT may require extensive training for individuals who do not have highly developed verbal repertoires, and our experience with 2 participants (Rick and John) revealed that other problems such as response chaining may develop. These findings suggest that one alternative approach to treatment might consist of first decreasing the frequency of inappropriate behavior through extinction (or punishment) before attempting to teach the alternative response.

With respect to response maintenance, Horner and Day (1991) reported that, under conditions of concurrent reinforcement for both inappropriate and alternative behavior, the alternative behavior occurred more often if it was more efficient (i.e., less effortful or reinforced more often) than the inappropriate behavior. In the present study, both Rick's and John's rates of signing exceeded their rates of SIB when SIB was reexposed to reinforcement, even though both responses seemed to be of equal effort (head hit or body slap vs. hand clasp for Rick, head bang or hand bite vs. hand raise for John) and both were reinforced continuously. Thus, even when SIB and signing appeared to be of equal efficiency, both participants preferred the latter. Perhaps this was due to the fact that, although SIB produced reinforcement as readily as did signing, SIB also produced some undesirable conse-

quences in the form of painful stimulation. Sue, however, frequently switched between responses when both were reinforced during maintenance. Her SIB might have occurred at lower rates if it had been reinforced less often or if reinforcement for SIB had been reintroduced gradually. Both of these possibilities might occur in the natural environment if therapists inadvertently reinforced SIB only occasionally or if their implementation of treatment procedures gradually deteriorated.

An unanswered question for all 3 participants is whether they would have initially acquired the alternative signs if SIB had been reinforced intermittently (instead of continuously) at the outset of treatment. Results obtained by Horner and Day (1991) and Peck et al. (1996) suggest that richer schedules or longer durations of reinforcement for the alternative response might compete with lean schedules or brief durations of reinforcement for aberrant behavior (which might be inevitable when caregivers must interrupt the occurrence of extremely dangerous behaviors). A related question is whether participants' failure to acquire the alternative signs during FCT without extinction was merely a function of limited exposure to the shaping (prompting) procedure due to the continued occurrence of SIB. Data on prompted responses indicated that all participants were exposed to prompting during FCT without extinction, yet none acquired the alternative response. It is unclear what amount of prompting, if any, would have competed with reinforcement for SIB. These issues, as well as questions about the relative efficiency of extinction versus FCT as initial interventions, methods for rapidly teaching the alternative response, and ways to prevent response chaining, should be considered in future research on FCT so as to maximize the effectiveness of treatment.

In summary, the present results suggest that FCT is not effective in reducing SIB or

in establishing a replacement response if both behaviors receive similar types or amounts of reinforcement during training. However, after the alternative response has been acquired, continued reinforcement of the behavior might produce enduring treatment effects in spite of inadvertent reinforcement for inappropriate behavior.

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STUDY QUESTIONS

1. What were the two experimental questions posed in the study, and what is their practical significance?
2. Briefly describe the results of the individual functional analyses and how these data determined the manner in which FCT was implemented.
3. What were the similarities and differences among the baseline, FCT, and FCT plus extinction conditions with respect to contingencies?
4. What effects did FCT (with and without extinction) have on self-injurious behavior?
5. What effects did FCT (with and without extinction) have on the alternative responses (signs)?
6. Describe some schedule and reinforcer manipulations that might have been used during the FCT (without extinction) condition to make the occurrence of signing more likely than self-injury.
7. Speculate on a possible account involving response topography that may explain the failure of the second FCT alone condition to suppress Sue's self-injurious behavior.
8. What is the main implication of the results with respect to the treatment of behavior disorders with FCT?

Questions prepared by Iser DeLeon and Michele Wallace, University of Florida