ANALYSIS OF SOCIAL VARIABLES WHEN AN INITIAL FUNCTIONAL ANALYSIS INDICATES AUTOMATIC REINFORCEMENT AS THE MAINTAINING VARIABLE FOR SELF-INJURIOUS BEHAVIOR

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Self-injurious behavior (SIB) that occurs at high rates across all conditions of a functional analysis can suggest automatic or multiple functions. In the current study, we conducted a functional analysis for 1 individual with SIB. Results indicated that SIB was, at least in part, maintained by automatic reinforcement. Further analyses using protective equipment (i.e., a helmet with face shield) revealed an attention function for the SIB.

DESCRIPTORS: automatic reinforcement, functional analysis, protective equipment, self-injury

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When self-injurious behavior (SIB) occurs across multiple conditions of an experimental functional analysis (Hanley, Iwata, & McCord, 2003), including the alone condition, it is often concluded that behavior is maintained, at least in part, by automatic (i.e., nonsocial) reinforcement. Yet, it is also possible that SIB could be maintained by both nonsocial and social sources. To ascertain whether or not SIB is maintained by multiple reinforcers, it is important to evaluate them independently (i.e., evaluate one source of reinforcement at a time by delivering only a single source of reinforcement following SIB). Unfortunately, it can be difficult or even impossible in some cases to withhold reinforcement for automatically maintained SIB so that social reinforcement (i.e., escape, attention, tangible) can be analyzed.

One option may be the use of protective equipment (Powers, Roane, & Kelley, 2007) that reduces or eliminates the stimulation that produces automatic reinforcement but does not prevent the occurrence of SIB. Although protective equipment has been used in interventions for individuals with SIB, researchers have cautioned against its use during assessment procedures (e.g., Borrero, Vollmer, Wright, Lerman, & Kelley, 2002; Le & Smith, 2002; Moore, Fisher, & Pennington, 2004) and have demonstrated that the use of protective equipment can obscure the identification of functional relations between SIB and environmental events. For example, Borrero et al. found that the use of protective equipment (i.e., baseball cap and gauze, helmet) during functional analyses for 2 participants reduced responding to the point that a function could not be identified. However, with 1 participant, responding in the absence of protective equipment was observed only during the alone condition, suggesting that the sole reinforcer in this case was automatic. In the second case, SIB was observed across all conditions at similar rates when the functional analysis was conducted without protective equipment, and SIB was suppressed across all conditions when protective equipment was applied. It is likely that in this case, SIB was again solely maintained by automatic reinforcement. In both cases, if functional analysis procedures were implemented only under conditions in which the participant wore protective equipment, SIB would not have been observed and the development of hypotheses regarding behavioral function would have to have been made in the absence of data.

It is possible that, for some individuals, protective equipment may suppress SIB maintained by automatic reinforcement but not SIB maintained by social reinforcement (i.e., attention, escape, tangible) when those reinforcers remain available following SIB. The purpose of the current investigation was to examine the use of protective equipment to block access to potential automatic reinforcement to determine whether SIB was also sensitive to social reinforcement such that an appropriate function-based intervention could be identified.

METHOD

Heather was a 7-year-old girl who had been admitted to an inpatient facility for the assessment and treatment of SIB. Her diagnoses included severe to profound mental retardation, stereotypic movement disorder with SIB, disruptive behavior disorder, cerebral palsy, dysphasia, kyphoscoliosis, and severe visual impairments. *SIB* was defined as attempts or successes at hitting head, face, chin (from greater than 15 cm) with open or closed fist; hitting head or face with object in hand; and banging head against surfaces. A second observer collected data simultaneously but independently during 34% of sessions. Interobserver agreement was calculated on an interval-by-interval basis by summing the frequency of responses within each 10-s interval for each observer, dividing the smaller number by the larger number, averaging the resulting coefficients, and converting this ratio to a percentage. Mean agreement was 87% for SIB. Sessions were conducted 6 to 16 times per day, 5 days per week. Sessions were conducted in a padded room (4 m by 4 m) equipped with a one-way window from behind which observers used laptop computers to collect frequency data on SIB. In addition, all sessions were supervised by trained behavioral staff and medical criteria for termination were followed to ensure Heather's safety. All sessions were 10 min in length, with the exception of five sessions (marked with an asterisk in

Figure 1) that were terminated early based on safety criteria (length of terminated sessions ranged from 5 min to 8 min).

First, a functional analysis (Iwata, Dorsey, Slifer, Bauman, & Richman, 1982/1994) consisting of four conditions (alone, demand, social attention, and toy play) was conducted. Sessions were conducted during 2-hr blocks in the morning and 1.5-hr blocks in the afternoon. During the alone condition, Heather was alone in the room and did not have access to toys. During the demand condition, she was presented with a variety of academic (e.g., sort shapes, match colors) and daily living (e.g., brush hair, wipe face) demands. The therapist presented demands using three-step guided compliance that consisted of sequential verbal, gestural, and physical prompts. The therapist presented a new prompt every 30 s with 5 s between prompts. Heather received 30 s of escape following each instance of SIB. The therapist ignored SIB during the escape period. After 30 s of escape, the therapist presented a new demand. During the social attention condition, the therapist occupied him- or herself with a magazine and provided brief verbal reprimands (e.g., ''Don't do that, you'll hurt yourself'') following SIB. Heather had access to less preferred toys. During the toy-play condition, Heather had continuous access to preferred toys. The therapist was present in the room and provided continuous verbal and physical attention. The therapist ignored all SIB and did not issue demands. Toy preference was determined via a preference assessment (data available from the first author). Heather did not wear any protective equipment during the functional analysis.

We conducted two functional analyses (for attention and escape) that assessed the functions of positive (attention) and negative (escape) reinforcement while Heather wore a protective helmet with a face shield. The conditions during these functional analyses were identical to the functional analysis described above, with
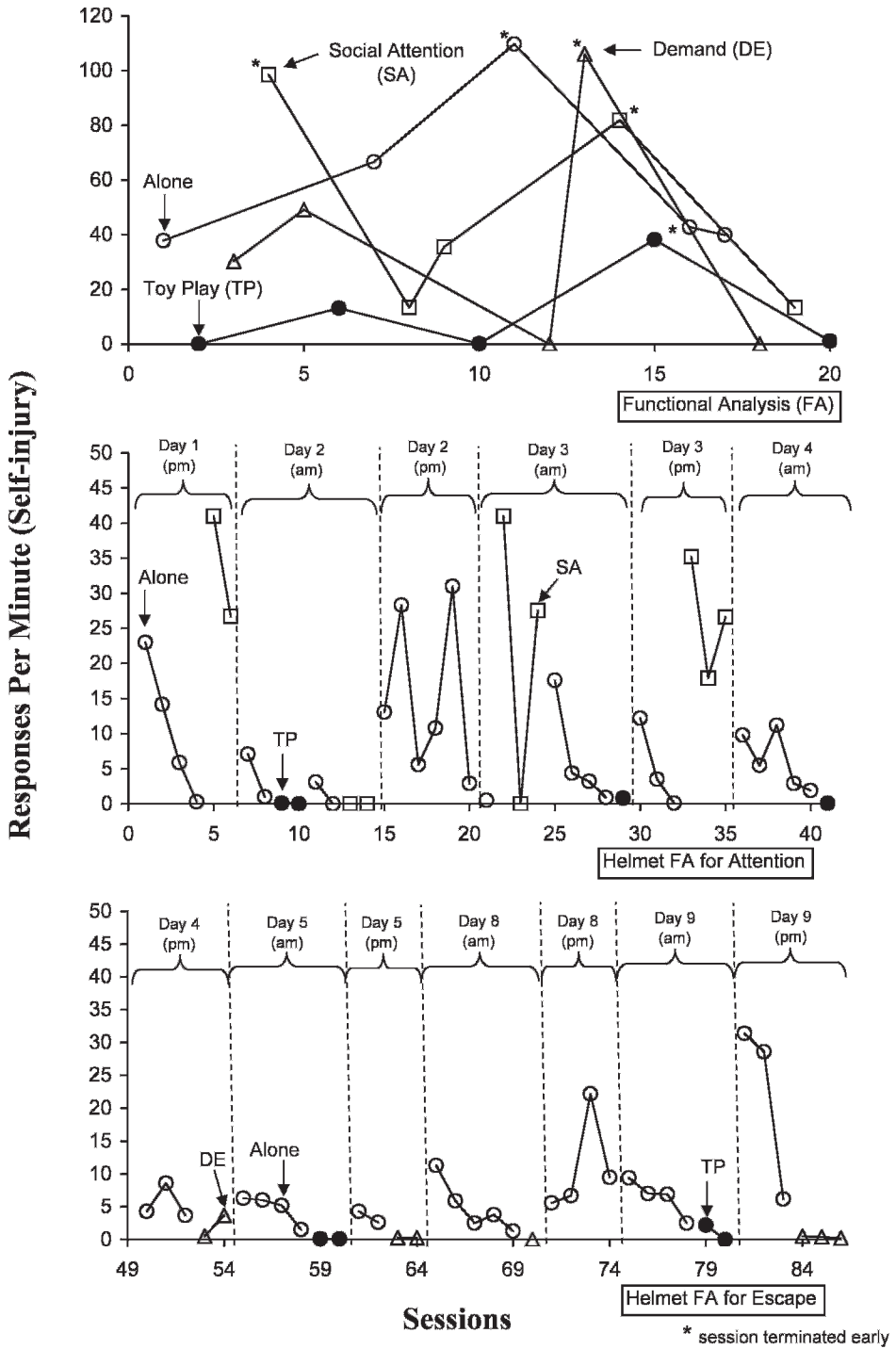
Figure 1. Responses per minute of SIB for Heather during the functional analysis (top), helmet functional analysis for attention (middle), and helmet functional analysis for escape (bottom).

the exception that Heather wore the helmet throughout. The helmet sessions were conducted over a 10-day period (sessions were not conducted on Days 6 and 7, which were weekend days). The procedures were similar in both analyses, in that each block of sessions began with consecutive alone sessions that were conducted until a decrease in SIB was observed (i.e., an extinction effect). Next, we conducted consecutive attention or toy-play sessions (for attention) or consecutive demand or toy-play sessions (for escape), and we selected the type of session (attention or toy play, demand or toy play) according to a random schedule. We conducted the selected session until the end of that session block. The purpose of this arrangement was to extinguish any automatically maintained SIB prior to making other potential reinforcers available while Heather wore the helmet. For example, during one block of the functional analysis for attention, multiple alone sessions were conducted until SIB decreased to near-zero rates. Once a decrease in SIB was observed, consecutive social attention sessions were conducted. During the next block, toy-play sessions were conducted following multiple alone sessions. Some exceptions to this pattern occurred due to variations in responding (e.g., when SIB did not decrease across multiple sessions, and session time expired prior to conducting attention or toy play sessions; see Figure 1, Sessions 13 and 14 and 71 through 74).

RESULTS AND DISCUSSION

During the initial functional analysis (Figure 1, top), Heather engaged in variable, undifferentiated rates of SIB during the social attention ($M = 48$ responses per minute; range, 13 to 98), alone ($M = 59$; range, 38 to 110), demand ($M = 37$; range, 0 to 106), and toy-play ($M = 10$, range, 0 to 38) conditions. Results suggested that SIB was maintained, in part, by automatic reinforcement.

During the functional analysis for attention with the helment (Figure 1, middle), Heather engaged in elevated rates of SIB during the initial alone sessions followed by a decrease across sessions. This pattern was generally consistent across blocks of alone sessions ($M = 8$ responses per minute; range, 0 to 28), which suggests that the helmet appeared to block the reinforcing effects of SIB, resulting in a gradual decrease in responding. She engaged in consistently higher rates of SIB (with one exception) when the therapist provided social attention following each occurrence of SIB ($M = 22$; range, 0 to 41) and low rates of SIB during toy-play sessions ($M = 0.5$; range, 0 to 3). Elevated rates of responding during the social attention condition compared to the toy-play condition suggested that SIB was, in part, maintained by social positive reinforcement in the form of adult attention.

During the functional analysis for escape with the helmet, Heather engaged in elevated rates of SIB at the beginning of each alone session block followed by a decrease in responding across sessions for five of the seven alone session blocks (Sessions 1 through 3 and 71 through 74 did not follow this pattern; see Figure 1, bottom). This pattern was generally consistent with each application of the helmet and implementation of the alone sessions ($M = 8$ responses per minute; range, 1 to 31). She engaged in consistently low rates of SIB during demand ($M = 0.7$; range, 0 to 4) and toy-play sessions ($M = 0.6$; range 0 to 2).

Results suggested that the use of a helmet to decrease automatically maintained SIB (i.e., possibly due to automatic extinction) allowed further analysis and identification of a social function for SIB. These results are noteworthy given that previous evaluations of protective equipment during functional analyses indicated that its use was contraindicated (e.g., Borrero et al., 2002; Le & Smith, 2002; Moore et al., 2004) and that in the current study, the helmet would not have been an effective intervention if social attention continued to be delivered following SIB.

There are some limitations of the present study that should be considered. First, during the second exposure to contingent attention during the helmet analysis, SIB was not observed. It is possible that SIB did not occur during either of these sessions because Heather was unaware of the contingencies in effect for SIB. Nevertheless, SIB did occur at differentially high levels during the majority of attention sessions. Second, during two of the blocks (from Sessions 5 to 6 and Sessions 13 to 14), only two attention sessions were conducted, and the rate of SIB in the second session was the same or lower than in the first session in each of these two session blocks. This downward trend may have continued if additional sessions had been conducted. Because sessions were limited to a 2-hr block in the morning and a 1.5-hr block in the afternoon, additional sessions beyond that time could not be conducted. A third and final concern is that the attention function could have been taught during the course of this study. However, the brief exposure to assessment conditions appears to be justified, given the outcome and the potential for Heather to live a more inclusive and socially acceptable life.

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