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FUNCTIONAL ANALYSIS AND TREATMENT OF SELF-INJURY ASSOCIATED WITH TRANSITIONS

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We applied functional analysis methodology to the assessment and treatment of 2 individuals' self-injurious behavior (SIB), which was reported to be occasioned by transitions from one activity or location to another. A structural (task) analysis of activity transitions identified at least three separate components that might influence behavior either alone or in combination: (a) termination of a prechange activity, (b) initiation of a postchange activity, and (c) movement from one location to another. Results of preference and avoidance assessments were used to identify activities to which participants were exposed in varying arrangements during transitions in a functional analysis. Results of 1 participant's functional analysis indicated that his SIB was maintained by avoidance of having to change locations, regardless of the activity terminated prior to the change or the activity initiated following it. The 2nd participant's analysis revealed the same function but also an additional one: avoidance of certain task initiations. This information was used to identify transition contexts during intervention and to design treatment procedures appropriate for a given context and behavioral function. A procedure involving advance notice of an upcoming transition had no effect on SIB, and differential reinforcement of alternative behavior (DRA) had limited effects in the absence of extinction. Sustained decreases in SIB were observed when DRA was combined with extinction and response blocking. Further extensions of functional analysis methodology to the assessment of problem behavior in situations characterized by multiple or protracted stimulus changes are discussed.

DESCRIPTORS: activity transitions, advance notification, avoidance assessment, differential reinforcement, extinction, functional analysis, preference assessment, response blocking, self-injurious behavior

Transitions, typically defined as changes from one activity or setting to another (Archer & Hosley, 1969; Newman et al., 1995), have been reported to be difficult for persons with autism or other developmental disabilities because transitions often occasion problem behavior (Davis, 1987; Doss & Reichle, 1991; Lansing, 1989; Schreibman, 1988). Timely completion of activity changes throughout one's day is important to success in a variety of environments and situations (Sowers, Rusch, Connis, & Cummings, 1980). For example, students are expected to move from one classroom to the next when the school bell rings, workers are expected to return from lunch breaks at predetermined times, and individuals are expected to perform various activities at home (e.g., self-care, meals, etc.) when asked to do so. The importance of appropriate transition behavior is underscored by the fact that transitions occur frequently throughout the day and have been estimated to account for 20% to 35% of an individual's time in some settings (Sainato & Lyon, 1983).

Based on the results of naturalistic observations, Repp and Karsh (1994) hypothe-

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sized that the tantrums exhibited by a 7-year-old girl with mental retardation during school transitions (e.g., moving from the classroom to the bus) were maintained by access to attention. Tantrums were reduced when a treatment program was implemented that emphasized eliminating attention for tantrums and increasing attention for appropriate transition behavior. This study was important in three respects: (a) Although a functional analysis was not conducted, treatment was based on observational data suggesting a specific behavioral function. (b) Tantrums ostensibly maintained by attention during transitions decreased despite the fact that attention continued to be delivered on an intermittent schedule. (c) The study provided the only demonstration of treatment for problem behavior during transitions based solely on consequences (differential reinforcement and extinction).

Manipulation of antecedent events has been a more common method for decreasing problem behavior during transitions. For example, a teacher in one study (Sainato, Strain, Lefebvre, & Rapp, 1987) instructed 3 students with autism to ring a bell at the location of the next scheduled activity prior to transitions and observed that rates of movement between classroom activities improved. Although no specific reinforcers were delivered contingent upon completing transitions in a timely manner, the authors speculated that ringing the bell may have acquired reinforcing properties.

Kennedy and Itkonen (1993) presented data from 2 participants with mental retardation whose problem behavior did not appear to be related to transitions per se but, rather, to events that occurred either prior to or concurrent with the transitions. One participant's problem behavior, which occurred during transitions at school, was correlated with waking late in the morning (remaining in bed for more than 5 min after her alarm clock sounded). Problem behavior during school transitions was reduced when a contingency was implemented in which she could earn access to preferred stimuli for waking up within 5 min of her alarm clock sounding. The 2nd participant's problem behavior was more likely to occur when her bus traveled a particular route to school. A change in the bus route corresponded with a decrease in this participant's problem behavior during home-to-school transitions. Although manipulation of the antecedent event resulted in decreased problem behavior in both cases, the consequences that maintained problem behavior were unidentified.

Some researchers have hypothesized that the unpredictability of transitions may pose difficulty for persons with developmental disabilities (Flannery & Horner, 1994; Flannery, O'Neill, & Horner, 1995) and have suggested the use of auditory or visual cues to signal upcoming transitions. For instance, Flannery and Horner decreased the disruption and noncompliance of an adolescent boy with autism by modeling the content, sequence, and duration of unfamiliar tasks prior to delivering instructions. The authors suggested that these antecedent events made tasks more predictable and, as a result, less aversive, although the participant's ability to actually predict upcoming tasks was not demonstrated. In a second study, the authors observed that the property destruction and aggression of a young man with autism were more pronounced when academic tasks were presented randomly than when they were presented according to a constant schedule. The participant's problem behavior decreased when he was given a timer and a task schedule at the beginning of each day; in addition, his ability to predict upcoming tasks was demonstrated by having him provide verbal reports.

Three studies have extended the research of Flannery and Horner (1994) by examining different forms of problem behavior during transitions and variations in the manip-

ulation of antecedent events. Tustin (1995) observed higher levels of stereotypy (body rocking and hand flapping) in a condition in which a man with autism and mental retardation was asked to switch vocational tasks immediately relative to a condition in which "verbal notice" was provided prior to such requests. In another study, Schreibman, Whalen, and Stahmer (2000) decreased the problem behaviors of 3 young children with autism and mental retardation during transitions to various community sites (mall, department store) and leaving home by using a "video priming" technique. Each child was shown a video depicting images that would be seen in upcoming transitions as a means of priming appropriate behavior. Decreases in problem behavior for all 3 participants were observed when the video priming treatment was introduced. The authors speculated that transitions became more predictable or that features of the video became discriminative for the availability of reinforcement at the conclusion of transitions; however, they also pointed out that the exact mechanism by which video priming decreased problem behavior was unclear. Interestingly, the problematic transitions for each participant involved either the presentation of potentially aversive events (e.g., self-care tasks) or the denial or postponement of access to preferred events (going to a favorite store). Finally, Ardoin, Martens, and Wolfe (1999) examined the use of a high-probability instruction sequence in improving the compliance of second-grade (regular education) students during an activity transition. Results showed that the compliance of 2 of the 3 students increased when the low-probability request (completing a transition) was preceded by three high-probability requests (requests likely to be followed by compliance).

Findings from the above studies suggest that antecedent manipulations may reduce the likelihood of problem behavior during transitions. However, the authors were unable to identify the learning processes that accounted for the observed changes in behavior. Smith and Iwata (1997) noted difficulties involved in identifying the operant characteristics of antecedent interventions and emphasized the importance of tying procedural descriptions and outcomes to their underlying principles (as originally suggested by Baer, Wolf, & Risley, 1968). Toward this end, it may be advantageous to systematically examine the role of consequences in maintaining problem behavior during transitions.

As an example of such a strategy, Doss and Reichle (1991) suggested recording various aspects of the transition process to identify the motivational basis for problem behavior. Specifically, they recommended analyzing whether transitions involved going from (a) pleasant to pleasant situations, (b) unpleasant to pleasant situations, or (c) from unpleasant to unpleasant situations. However, problem behavior associated with any one of these three transition types would be difficult to interpret from the standpoint of maintaining contingencies. If a pleasant situation is defined as reinforcing (i.e., an individual would emit behavior to gain access to it) and an unpleasant situation is defined as aversive (i.e., an individual would emit behavior to avoid or escape it), then the motivation for avoiding pleasant situations (a and b) or remaining in unpleasant situations (b and c) should be very low and should not occasion problem behavior. Transitions of a fourth type (from pleasant to unpleasant situations) would also be difficult to interpret because both positive and negative reinforcement would always be implicated.

Another way to analyze transitions might stem from a functional analysis in which the pre- and postchange activities associated with transitions are viewed separately (e.g., as changes from pleasant to neutral situations or from neutral to unpleasant situations). For example, a transition in which a

student is instructed to perform difficult math drills (unpleasant activity) immediately following a brief period of sitting at her desk alone (neutral activity) would provide a test for negative reinforcement (i.e., problem behavior during the transition to math drills could be maintained by avoidance of that activity). On the other hand, a transition in which a student went from recess (pleasant activity) back to his classroom (neutral activity) would provide a test for positive reinforcement (i.e., problem behavior during the transition could be maintained by regaining access to recess). Of course, it is possible that the transition per se, irrespective of the pre- and postchange activities, may occasion problem behavior. In such cases, the likely function of problem behavior would be negative reinforcement (avoidance of the transition). Analyses of this type may facilitate the identification of specific transitional elements that occasion and maintain problem behavior, in a manner similar to that demonstrated by Smith, Iwata, Goh, and Shore (1995), who identified distinct elements of task demands that evoked self-injurious behavior (SIB). Thus, the primary purpose of this study was to illustrate the use of functional analysis to identify reinforcers that maintain problem behavior during transitions, which were conceptualized as a change in activity, location, or both. In addition, we evaluated a progressive series of interventions (from least to most intrusive) suggested by results of the functional analyses.

GENERAL METHOD

Participants and Setting

Two individuals who lived in a state residential center for persons with developmental disabilities participated, based on referral by professional staff who indicated that both participants engaged in SIB during transitions. Hayden was a 27-year-old man with profound mental retardation and severe visual impairment. He used a wheelchair for mobility but required assistance from staff for navigational purposes. His SIB consisted of head hitting, which often caused redness and swelling to his left eye. Michael was a 38-year-old man with profound mental retardation who was ambulatory. His SIB consisted of hand biting, which required periodic use of protective equipment (a modified glove) to prevent tissue breakdown. Both individuals had some receptive language skills but very limited expressive repertoires. Hayden communicated via gestures, unintelligible vocalizations, and 5 to 10 manual signs. Michael communicated using idiosyncratic vocalizations, gestures, and facial expressions.

Sessions were conducted in several locations at Hayden's and Michael's homes to incorporate locations, activities, and other stimuli (furniture, fixtures, etc.) associated with transitions that the participants made routinely. Hayden's transitions involving a change in location included going to or from the dayroom to the dining room, his bedroom, and an outside courtyard. Michael's transitions with change in location were conducted in the dayroom, training room, and kitchen. Sessions were conducted four times per day, 3 to 5 days per week, except on a few occasions when either the participants or therapists were unavailable.

Experimental Sequence

Because we were interested in assessing the effects of transitions in which the pre- and postchange elements consisted of both reinforcing and aversive activities, initial assessments were conducted to identify preferred (Phase 1) and nonpreferred (Phase 2) activities. Phase 3 consisted of a functional analysis in which participants were presented with changes in various combinations of activities, while the effects of these changes on their SIB were observed. Phase 4 consisted

of a treatment analysis in which the effects of several interventions on participants' SIB during transitions identified as problematic in Phase 3 were evaluated.

Phase 1: Preference Assessment

Procedure

Preference for edible and leisure stimuli was assessed during separate assessments. During a session, the therapist sat directly across from the participant at a table, presented stimuli (as described below), and recorded the participant's selections. Stimuli were presented to Hayden using a paired-stimulus procedure for persons with visual impairment described by Paclawskyj and Vollmer (1995). Two food and two leisure assessments were conducted in which four items were presented in pairs (12 trials per stimulus across the two assessments). The order in which stimulus pairs were presented was randomly determined, and the left-right positioning of stimuli was counterbalanced. Prior to the first trial of a session, Hayden was given a small piece of each food item or was allowed to sample each leisure activity for 30 s. The therapist began a trial by physically guiding Hayden to touch the left stimulus and then the right stimulus for 3 s each. The therapist then physically guided Hayden's arms to his lap and instructed him to "choose one." If Hayden reached for and touched either item, he was allowed to consume the chosen item (edible) or was given access to that item for 10 s (leisure), and the other item was removed from the table. If Hayden did not approach either item within 5 s, the therapist repeated the trial; if Hayden did not approach either item following this second prompting, the trial was terminated.

Stimuli were presented to Michael using procedures described by DeLeon and Iwata (1996). Separate arrays consisting of four edible and four leisure items were assessed during seven and five sessions, respectively. Prior to the beginning of a session, Michael was given a small piece of each food item or was allowed to sample each leisure activity for 30 s. The therapist began the first trial by arranging the items on the table in random order in a line in front of Michael and instructing him to "pick one." When Michael selected an item, he was allowed to consume the chosen item (edible) or was given access to that item for 10 s (leisure), and the remaining items were rearranged on the table. This sequence continued until all items were selected or until Michael made no selection within 30 s of an instruction.

Response Measurement and Reliability

During each trial of an assessment, the therapist recorded the item selected by each participant. A second observer independently recorded Michael's selections on 60% and 43% of the trials during his first and second food preference assessments, and on 60% and 80% of the trials during his first and second leisure preference assessments. Interobserver agreement was examined based on trial-by-trial comparison of observers' records. An agreement was scored if both observers recorded the same selection on the same trial, and agreement was calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100%. Mean interobserver agreement was 99% (range, 96% to 100%) for his food preference assessments and 99% (range, 92% to 100%) for his leisure preference assessments. Reliabilty data were not taken for Hayden's preference assessments.

Results

Table 1 summarizes results obtained for the preference assessments. Percentages are based on the number of times an item was chosen out of the number of times it was present in the pair or array. Cookies and the Connect 4® game were found to be Hay-

Table 1
Mean Percentage of Trials on Which Items Were Selected

Participant	Food items	%	Leisure item	%
Hayden	Cookie	83.2	Connect 4®	73.2
	Pecan pie	63.2	Massager	60.0
	Oatmeal	50.0	Cards, ziploc bag	33.4
	Soda	1	Dominoes, paper bag	30.2
Michael	Cheese puff	70	Poker chips	43
	Potato chip	42	Blocks	35
	Vanilla wafer	38	Clacker	12
	Fruit juice	4	Electronic ball	9

den's most preferred food and leisure items, respectively; cheese puffs and poker chips were found to be Michael's most preferred items. (Although Michael selected poker chips on only 43% of the trials, he manipulated these items longer than he did other items that were presented informally.) These stimuli were used during functional analysis conditions in Phase 3 involving transitions associated with the termination or presentation of preferred events.

Phase 2: Avoidance Assessment

An attempt was made to identify one nonpreferred ADL (activity of daily living) skill and one nonpreferred chore or work-related task for each participant. Based on staff reports and on informal observations, tasks were presented to the participants separately during 10-min sessions using procedures similar to those described by Fisher et al. (1994). Because results of this assessment were somewhat inconclusive, data collection and procedural details are not reported here. Briefly, Hayden's performance was inconsistent across tasks; therefore, we selected for inclusion in his functional analysis one ADL skill (brushing his teeth) and one work skill (cleaning off tables) taken from his individual support plan. Michael rarely complied with any of the tasks presented to him. We selected brushing his teeth as his ADL skill and picking up items from the floor as his chore.

Phase 3: Functional Analysis

Procedure

We exposed participants to different types of transitions involving different types of activities to identify which components of the transitions occasioned and maintained SIB. Transitions included activity initiations (changes from no activity to a target activity) and activity terminations (changes from a target activity to no activity). Target activities consisted of both preferrred and nonpreferred events and included a food activity and a leisure activity (preferred), two tasks (suspected to be nonpreferred), and social interaction, which was included because a common daily transition involves the introduction or removal of social interaction. These activity transitions were presented under two conditions, those requiring a change in location (moving approximately 7 to 10 m from one area to another) and those not requiring a change in location. These combinations yielded 20 types of transitions (2 transitions $\times$ 5 activities $\times$ 2 location requirements). Two final transition types consisted of no activity, with and without a change in location, to assess the effects of location change independent of activity change.

Each type of transition was presented as a single trial, five times on different days. A trial began 2 min prior to the scheduled transition (to allow data to be collected prior

to the transition), continued during the transition when the therapist initiated or terminated an activity (via instruction, prompt, etc.), and ended when 2 min had elapsed following the transition (except as noted below). Thus, each trial lasted approximately 5 min, such that each transition was observed for 25 min (five trials at 5 min each), and the entire functional analysis lasted for about 550 min.

One to three sessions were conducted daily, with each session consisting of two different transitions (trials). The order of presentation was determined randomly, with the exception that transitions involving a change in location were not presented consecutively. Also, a second trial was not conducted until the participant had ceased engaging in SIB for at least 2 min following the end of the first trial. The procedures used to conduct a trial varied somewhat based on the type of transition but generally conformed to the types of test conditions used to assess behavioral sensitivity to positive and negative reinforcement as maintaining contingencies (e.g., see Iwata, Dorsey, Slifer, Bauman, & Richman, 1982/1994). Brief descriptions of the different classes of transitions are as follows.

Activity initiation (+ activity), no location change. Following 2 min during which the participant was not engaged in any of the activities included in the assessment (the participant was usually sitting alone), the therapist initiated a target activity. For example, the therapist would begin giving the participant access to food or a leisure item, initiate a task, or engage the participant in social interaction (which consisted of pleasant comments or neutral statements). If SIB did not occur during the transition, the newly initiated activity continued for 2 min, with the therapist providing prompts and physical assistance as necessary during task trials. If the participant engaged in SIB at any time during the trial, the activity was terminated. Thus, occurrences of SIB during activity initiations were considered avoidance or escape responses maintained by negative reinforcement.

Activity initiation (+ activity), location change. Activities were initiated as in the previous condition, except that transitions also required the participant to move from one location to another to engage in the new activity. If SIB did not occur during the transition, the newly initiated activity continued for 2 min. If SIB occurred at any time during the trial, the participant was returned to the original location. For example, if a participant exhibited SIB while being moved to the new location at which a task was initiated, he was immediately returned. If the participant exhibited SIB only after the activity was begun, the activity was terminated and the participant was returned.

Activity termination (− activity), no location change. Following 2 min during which the participant engaged in a target food, leisure, or task activity, the therapist terminated the activity (no other activity took its place). If the participant engaged in any SIB during the 2 min immediately following termination of the activity, the activity was resumed for the remainder of the 2 min. Occurrences of SIB during activity terminations were considered to be responses maintained by access to the just-terminated activity (positive reinforcement).

Activity termination (− activity), location change. Activities were terminated as in the previous condition above, except that the participant was also directed to a new location (where no activity took place). If SIB occurred, the participant was returned to the original location, where the activity resumed.

Location change, no activity. The effects of location change per se could be identified given the above conditions if SIB consistently occurred during location changes regardless of the type of transition. However, variability in responding might result if cer-

tain types of activity changes, but not others, occasioned SIB. Thus, to assess the effects of location change independent of activity change, we arranged a condition in which the participant was simply asked to change locations. Following 2 min during which the participant was not engaged in any target activity, the therapist approached the participant and requested (with physical prompts as necessary) the participant to move to a new location, at which no new activity was initiated. If SIB occurred during the transition, the participant was returned to the original location. Although it is possible that SIB occurring during transitions of this type might reflect the influence of either positive (access to the previous activity) or negative (termination of the new activity) reinforcement, no identifiable activity was either terminated prior to the transition or initiated following it. Instead, the only programmed event was the presentation of a request to change locations, which was terminated contingent on the occurrence of SIB. Thus, it seemed more likely that SIB observed during this condition was indicative of maintenance by negative reinforcement.

Response Measurement and Reliability

Because transitions ceased when SIB occurred (i.e., an activity being initiated was terminated; an activity being terminated was resumed), events that occasioned SIB were sometimes present for brief periods of time and were not re-presented during a given trial. Thus, the occurrence of any SIB seemed like a more relevant response measure than the amount of SIB that occurred. An observer recorded whether the participant engaged in SIB during each trial (prior to or following initiation of the transition). Hayden's SIB was defined as any contact between his open left palm and the left side of his face. Michael's SIB was defined as placement of his hand inside his mouth while making a biting motion with his teeth. A second observer independently scored occurrences of SIB during 46% and 36% of Hayden's and Michael's functional analysis sessions, respectively. Agreement was examined by comparing observers' records on a trial-by-trial basis. An agreement was defined as both observers recording that SIB did (or did not) occur on a given trial. Agreement scores for each transition type were calculated by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100% and yielded 100% agreement for all transitions for both participants.

Results

Figure 1 shows results of the functional analyses, expressed as the percentage of transitions (five of each type) during which SIB was observed. The most notable finding was that both Hayden and Michael consistently engaged in SIB during the no-activity transition, which involved merely a change in location (represented by the shaded bar farthest to the left on both graphs). All of the other transitions involved either initiation or termination of an activity with and without a location change, and, regardless of transition type, changes in location were consistently associated with high levels of SIB (shaded bars). Thus, transitions involving change in location per se (combined with termination of such transitions contingent on SIB) occasioned considerable amounts of SIB and were therefore selected as target transitions during treatment.

Data from transitions that did not involve a change in location revealed other sources of influence over SIB, which differed for the 2 participants. Hayden engaged in a moderate amount of SIB when one type of task demand was initiated (wiping a table) but not when another was initiated (brushing his teeth). Thus, negative reinforcement did not seem to account for much of his SIB. Somewhat different results were observed when

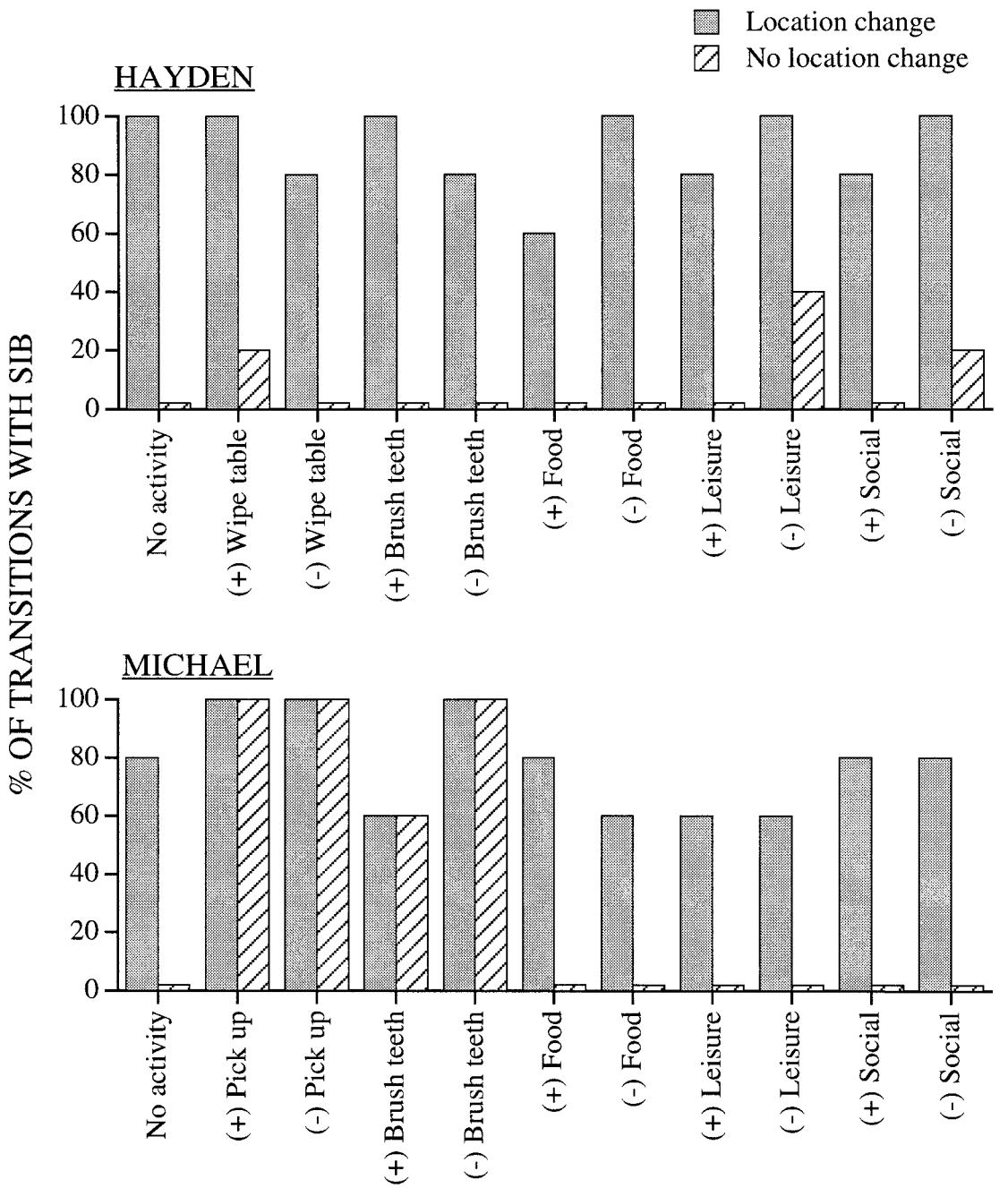

Figure 1. Percentage of transitions containing SIB across functional analysis conditions. Items preceded by + denote activity initiation; items preceded by − denote activity termination.

leisure and social activities were terminated, suggesting that Hayden's SIB may have been maintained in part by positive reinforcement (access to leisure activities and social interaction). However, because Hayden exhibited SIB during only 3 of 15 trials in which apparently preferred activities (food, leisure, social) were terminated, and because caregivers did not report that removal of access to these activities typically occasioned SIB in

the absence of movement transitions, maintenance by positive reinforcement was not addressed further.

Michael consistently engaged in high levels of SIB during both task contexts (picking up and brushing teeth), regardless of whether the transition consisted of activity initiation or termination. These apparently conflicting results were due to the fact that Michael's SIB occurred at different points in the transition process for these activities. When picking up and brushing teeth were terminated, Michael engaged in SIB only during the 2-min prechange interval (before the activities were terminated); however, when these activities were initiated, Michael rarely engaged in any SIB until after the therapist introduced the activity (1 out of 10 trials). In other words, Michael's SIB occurred almost exclusively *during* the picking up and brushing teeth tasks (before they were terminated and after they were initiated), and the immediate consequence for SIB was task termination. Thus, it appeared that Michael's SIB, in addition to being influenced by location-change transitions, also functioned as an escape response because it occurred in the presence of task demands but not in their absence. Due to the consistency of this latter finding, a task-related transition (initiation of picking up) was also selected for treatment of Michael's SIB.

Phase 4: Treatment Evaluation

Procedure

Based on the results of Phase 3, transitions involving location change (Hayden and Michael) and initiation of task demands (Michael only) were selected as contexts for treating escape behavior. A series of interventions was introduced sequentially, in the order of perceived intrusiveness, according to reversal (Hayden) and multiple baseline (Michael) designs.

Each daily session consisted of four trials (transitions). Hayden's transition involved manual operation of his wheelchair over a distance measuring approximately 3 to 5 m initially. Michael's transitions involved (a) walking a distance of 1 m initially and (b) picking up a piece of paper from the floor.

Baseline. Baseline procedures for both participants were identical to those used in the functional analysis conditions associated with the target transition. If no SIB occurred within 2 min following the transition, the trial was terminated. If SIB occurred any time during or within 2 min following the transition, the trial was terminated and the participant was returned to the pretransition location or activity.

Advance notice. Sessions were conducted as in baseline, except that the therapist informed the participant of an upcoming transition 2 min prior to its occurrence (Tustin, 1995). Although Tustin did not specify the behavioral functions for which advance notice would be an effective treatment, it seemed that the intervention might be an appropriate means of reducing the aversiveness of an upcoming activity change (i.e., altering the establishing operation for escape). Two minutes prior to a scheduled transition, the therapist spoke to the participant and made reference to the transition; 2 min later, the therapist provided an instruction and initiated the transition. For example, the therapist initiated Hayden's transition by saying something like "Hayden, would you like to move to the kitchen soon?" Two minutes later, the therapist said "It's time to move" and allowed Hayden 5 s to initiate the response. If Hayden did not initiate the response within 5 s, the therapist began to physically prompt completion of the transition. As in baseline, the occurrence of SIB produced an immediate termination of the trial.

Differential reinforcement of alternative behavior (DRA). During this condition, participants earned access to preferred food (iden-

tified in Phase 2) contingent on appropriate transition behavior in an attempt to strengthen competing behavior (Lalli et al., 1999). Hayden's location-change transition was conducted as follows. The therapist first approached Michael and asked, "Would you like a cookie?" After 5 s, the therapist informed Hayden that if he wanted a cookie he would have to keep his hands on the wheels of his wheelchair. The therapist provided guidance as needed to ensure that Hayden placed his left hand on the left wheel (Hayden never engaged in SIB with his right hand). When Hayden's left hand was on the wheel, the therapist immediately placed a cookie into Hayden's right hand, reminded Hayden that he could earn more cookies by keeping his hand on the wheel, and then told him that it was "time to move." The therapist then began pushing Hayden's wheelchair toward the desired location. Hayden initially earned cookies on a 5-s schedule during the transition. If Hayden engaged in SIB, the therapist terminated the trial. Michael's location-change sessions were similar to Hayden's, with the following exceptions: (a) Michael's transition involved walking (1 m initially), and (b) he was offered a choice from among three reinforcers for completing the transition without SIB. Michael's task (picking up) sessions were similar to his location-change sessions, except that the target behavior consisted of picking up a piece of paper from the floor and handing it to the therapist.

DRA plus escape extinction plus blocking. Procedures in this phase were identical to those in the previous (DRA) condition, except that SIB was now placed on extinction (Iwata, Pace, Kalsher, Cowdery, & Cataldo, 1990). In addition, attempts at SIB were blocked by the therapist as a means of preventing continued SIB during trials. Thus, if the participant engaged in the appropriate transition behavior (i.e., moved from one location to another or picked up the paper without engaging in SIB), reinforcement was delivered. If SIB occurred, the therapist withheld reinforcement and physically guided the participant to complete the transition.

Response Measurement and Reliability

Observers recorded SIB as previously described and also scored blocked attempts at SIB as responses. Reliability was assessed during 77% and 68% of Hayden's and Michael's trials, respectively. Mean agreement for the occurrence of SIB was 100% for Hayden and 99% for Michael.

Results

Figure 2 shows the results of Hayden's treatment evaluation, expressed as the percentage of transitions (three or four per day) during which SIB occurred. Hayden's SIB occurred 100% of the time during most baseline sessions and during every session of the first treatment condition (advance notice). A decrease in SIB was observed during the first session of the DRA condition, but an increase was observed during subsequent sessions. During Hayden's first DRA plus extinction plus blocking condition, his SIB decreased to levels lower than those observed during any previous condition. SIB increased again during a return to baseline and then decreased again when DRA plus extinction plus blocking was reintroduced. When Hayden's SIB remained at zero for 7 days (Session 71), we increased the interval between reinforcer deliveries from 5 s to 10 s, 15 s, and finally 20 s. The last data point represents a 3-week follow-up probe, during which Hayden exhibited no SIB.

Figure 3 shows results for Michael's treatment evaluation across his location-change (walking) and task-initiation (picking up) transitions. SIB occurred 100% of the time during most baseline sessions for both transitions. The advance notice condition was associated with a temporary decrease in SIB during walking and no decrease in SIB dur-

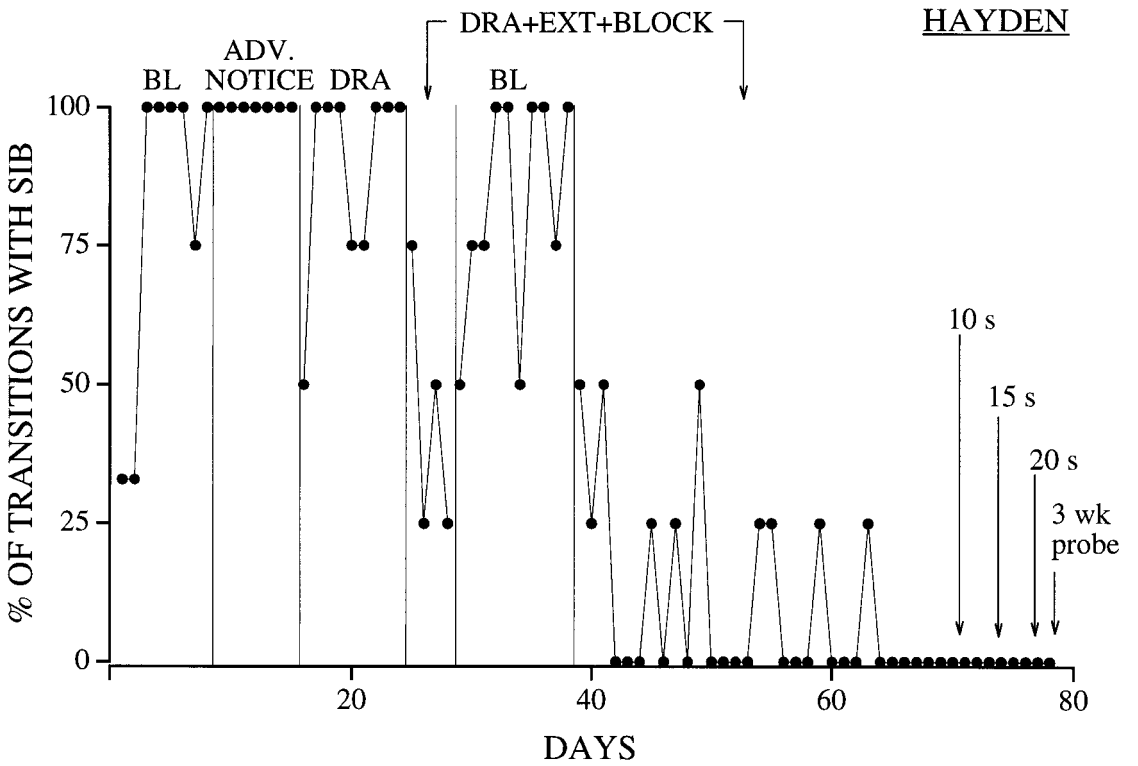

Figure 2. Results of Hayden's treatment evaluation (location-change transition only).

ing picking up. Michael's SIB decreased during the first 5 days of his DRA condition (implemented only with walking) but increased when the distance was lengthened from 1 to 2 m. SIB decreased again initially when the distance was reduced to 1 m but returned to near-baseline levels after a few days. When DRA plus extinction plus blocking was implemented for walking, Michael's SIB decreased again and remained low throughout the condition, except for periodic increases when the transition distance was lengthened (from 1 m to 5 m by the end of treatment). The effects of DRA plus extinction plus blocking were replicated with Michael's picking-up task.

DISCUSSION

We applied functional analysis methodology to the assessment of SIB during transitions, which were operationalized as the termination or initiation of an activity, with or without a change in location. Results of assessments were used to identify preferred and nonpreferred activities to which participants were exposed in a functional analysis. Results of Hayden's functional analysis indicated that his SIB was maintained by avoidance of having to change locations, regardless of the activity terminated prior to the change or the activity initiated following it. Michael's analysis revealed the same function but also an additional one: escape from ongoing tasks and avoidance of task initiations. This information was used to identify transition contexts during intervention and to design treatment procedures appropriate for a given context and behavioral function.

The present study extends previous research in several ways. First, although transitions have been identified as occasions for problem behavior in a number of previous reports, few attempts have been made (a) to

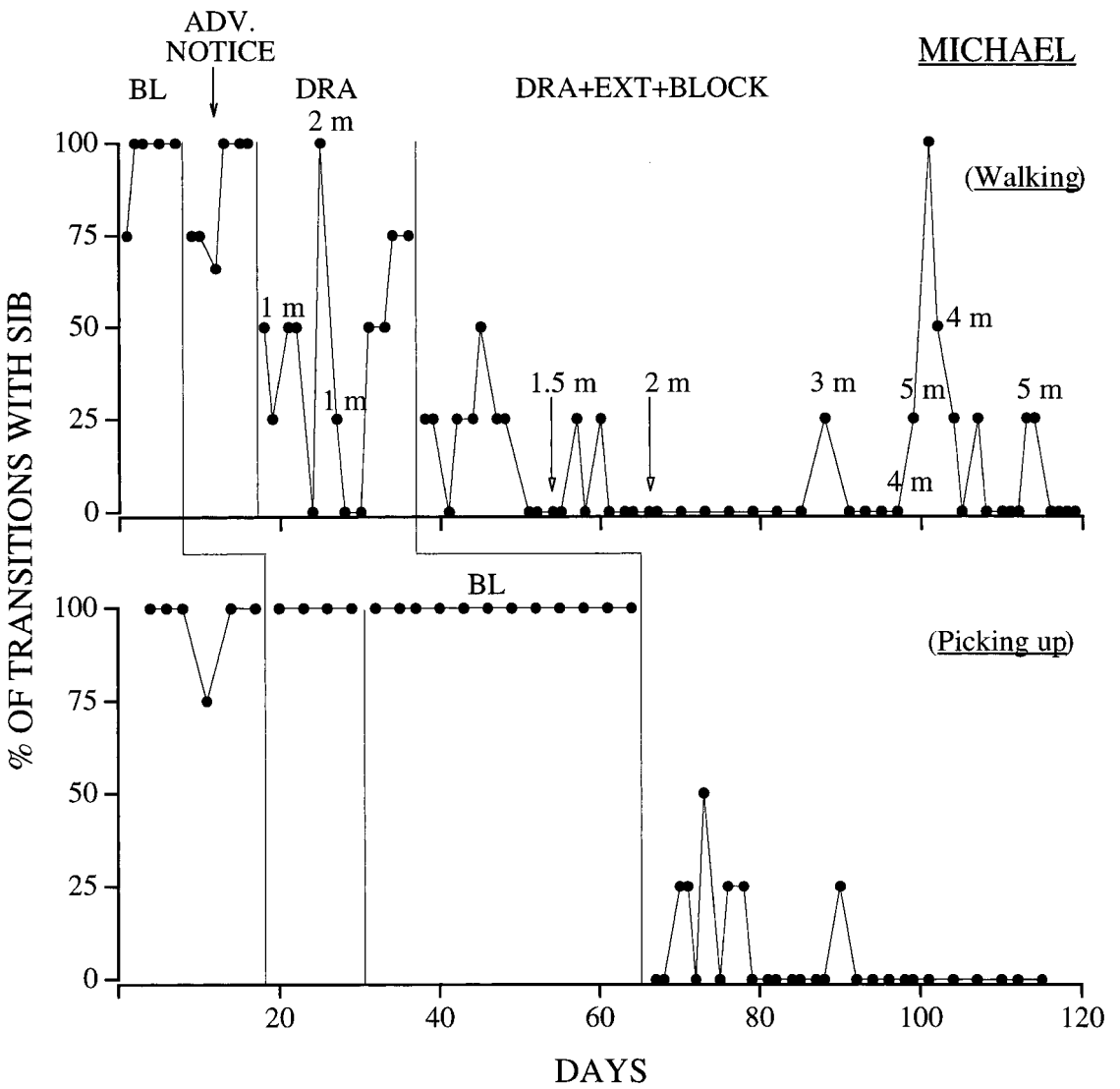

Figure 3. Results of Michael's treatment evaluation across transitions (location change and activity initiation).

isolate the specific components of a transition that are problematic or (b) to identify the functions of problem behavior that occurs during transitions. In the present study, we first applied a structural (task) analysis to activity transitions and identified at least three separate components that might influence behavior: (a) termination of a prechange activity, (b) initiation of a postchange activity, and (c) movement from one location to another. In most naturalistic situations, these elements are confounded because many transitions are comprised of more than one element (e.g., termination of a leisure activity in one location followed by initiation of a work activity in another location). By separating the transition process into its separate components, we were able to better identify the context for problem behavior.

Second, systematic preference and avoidance assessments were used to identify specific activities whose termination or initiation was more likely to occasion problem be-

havior. These assessments did not yield consistent results in all cases; nevertheless, their use seems to represent an improvement over casual observation.

Third, results of the functional analyses revealed specific functions for participants' SIB. Hayden and Michael both exhibited considerable SIB when the transition consisted only of a change in location. Thus, movement per se appeared to function as an aversive event that occasioned avoidance behavior because in some cases, no activity preceded or followed the movement. Michael also exhibited high levels of SIB when the transition consisted of initiating work or self-help tasks. It was interesting to note that both participants never engaged in SIB when the transition consisted of initiating a preferred activity (food, leisure, social). Thus, change of activity per se did not occasion SIB. Other noteworthy features of the functional analyses include the fact that they were conducted in naturalistic settings with activities experienced routinely by participants, and that they were presented in a discrete-trial format (each transition comprised a single trial), which seemed more appropriate for assessing the effects of transition (a temporary state) rather than those of continued exposure to the pre- or postchange conditions associated with the transition.

Finally, results of the treatment analysis indicated that two procedures had limited effects in the absence of extinction (continuing with the transition while blocking SIB). Providing advance notice of a transition had little effect on SIB and, as a result, did not replicate findings reported by Tustin (1995). Two factors might account for these differences. First, the function of problem behavior (stereotypy) in Tustin's study was unclear; second, the participant in that study may have had more highly developed communication skills than did our participants. Our results obtained with another intervention (DRA) were somewhat inconsistent with those reported by Lalli et al. (1999), who found that the use of positive reinforcers successfully competed with escape from task demands (negative reinforcement). It is possible that the advance notice combined with DRA might have been more effective in the absence of extinction, and future research might evaluate this strategy.

Several limitations in the present study should also be noted. First, although results of Michael's functional analysis indicated that two tasks (picking up, brushing teeth) occasioned SIB, we did not address the second task in the treatment phase of the study. Instead, we selected two classes of transition (location change, activity initiation) rather than two transitions from the same class (activity initiation). However, the procedures found to be effective during Michael's treatment (DRA plus extinction plus blocking) were incorporated into his treatment plan upon completion of the study.

Second, although the measure of SIB used during assessment and treatment (percentage of transitions with SIB) was extremely conservative, it may have obscured partial treatment effects, although those effects were somewhat evident during Michael's DRA condition. More sensitive measures of behavior during assessment (e.g., response rates) could have been obtained only by either persisting with the transition when SIB occurred (which would eliminate the relevant reinforcement contingency by imposing extinction) or repeatedly changing activities (which may have introduced another source of influence over behavior). Repeated activity changes in rapid succession may, in fact, characterize some transitions in the natural environment; if so, their effects as yet another component could be assessed. Finally, it is possible that more extensive preference assessments may have identified a larger pool of reinforcers whose delivery could have competed better with SIB.

Individuals who exhibit problem behavior

commonly encounter situations on a daily basis that involve multiple stimulus changes, which may affect behavior in isolation or in combination. Although the functional analysis methodology used in this study was limited to a rather simple example of such a situation (an activity transition), our results suggest that further extension to behavioral sequences of a more protracted nature (e.g., morning wake-up routine, community outing, etc.) may be helpful in isolating specific environmental determinants of problem behavior as well as potential interaction effects.

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STUDY QUESTIONS

1. Describe several types of treatment that have been used to decrease problem behavior during transitions.

2. What was the rationale for conducting the preference and avoidance assessments?

3. What components of transitions were manipulated during the functional analysis, and how were these components arranged to test various functions of self-injury?

4. Describe the results of Hayden's and Michael's functional analyses. What type of contingency maintained self-injury for both participants?

5. What was the discrepancy in Michael's data, and how was it explained by the authors?

6. What features of the functional analysis results indicated that activity changes per se did not occasion SIB?

7. Describe the key features of the three interventions designed to decrease SIB during transitions.

8. Describe the effects of the three interventions on SIB during transitions. In what way do these results illustrate the importance of conducting a functional analysis of transitions?

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