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Using Self-management to Reduce Automatically Maintained Behavior in Children with Autism

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Abstract

Children with autism often engage in repetitive, stereotypic behaviors. Many of these behaviors prove difficult to eliminate due to the non-socially mediated nature of reinforcement available to them. Self-management techniques, including self-monitoring and self-reinforcement, have proven effective in modifying a variety of behaviors in children with autism, including stereotypic behaviors (Koegel & Koegel, 1990; Shabani, Wilder, & Flood, 2001). This study examined the effects of a self-management package on the stereotypic behavior of children with autism, specifically, stereotypic behavior demonstrated to be a function of automatic reinforcement. The package included self-monitoring and self-reinforcement components, and led to behavior reduction in two of three participants.

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Using Self-management to Reduce Automatically Maintained Behavior in Children with Autism

Autism is characterized by a broad spectrum of behavioral excesses and deficits, especially in the realm of social behavior. Children with autism often engage in excessive stereotypic or repetitive behaviors that are socially isolating (Wolery, Kirk, & Gast, 1985) and that inhibit the acquisition of functional skills (Dunlap, Dyer, & Koegel, 1993). These behaviors typically serve a non-social function, making it difficult to design behavior reduction interventions. However, a variety of interventions have been successful in reducing automatically maintained stereotypy including differential reinforcement of other behavior (DRO; Harris & Wolchik, 1979), contingent shock (Baumster & Forehand, 1972), noncontingent reinforcement (Piazza et al., 1998), and re-direction to more appropriate behavior (Ahern, Clark, & MacDonald, 2007). While these procedures have been successful, they require many resources, including the presence of a person to manage the intervention. Self-management, arranging one's own contingencies in order to change a target behavior, may provide an alternative approach to reducing automatically maintained stereotypy.

Habit reversal, which includes some aspects of self-management (self-monitoring, self-instruction, social support) has been successful in treating tic disorders (see e.g., Carr, Sidener, Sidener, & Cummings, 2005 and Woods & Luiselli, 2007). Tics (repetitive vocal statements or motor movements) occur in a variety of populations and are often automatic in their function (Carr, Sidener, Sidener, & Cummings, 2005). If self-management procedures are useful in reducing automatically maintained tics, then

they may also be useful in reducing other automatically maintained, problematic behaviors.

Skinner (1953) describes self-management as involving controlled behavior and controlling behavior. A person engages in controlling behavior by altering the contingencies influencing controlled behavior. Self-management strategies can involve antecedent manipulations, behavioral contracting, manipulation of consequences, solicitation of social support, self-instruction and self-praise, goal-setting, and self-monitoring (Miltenberger, 2001).

Self-monitoring, self-reinforcement, and goal setting, have been shown to be an effective means of changing a variety of behaviors in children with autism. According to Miltenberger (2001), self-monitoring involves collecting and analyzing or reviewing data regarding a target behavior; self-reinforcement occurs when a person arranges for a reinforcer to be collected or delivered following a targeted behavior; and goal-setting involves identifying a criterion level of target behavior that must be reached. These strategies have been successful in increasing social communication and interactions, reducing disruptive behavior, increasing on-task school behavior, teaching daily living skills, and in increasing variability across a range of responses.

Using Self-management Procedures to Strengthen Appropriate Behavior

Koegel, Koegel, Hurley, and Frea (1992) taught 4 children diagnosed with autism to self-manage their social behavior. These children all demonstrated difficulties engaging in social interactions, specifically responding appropriately to questions. Furthermore, they engaged in a range of disruptive behaviors including self-injurious behavior, tantrumming, running away, delayed echolalia, and screaming. The children

were taught to self-monitor by recording a point each time they responded appropriately to a question. These points were then exchanged for preferred items. The reinforcement schedule was faded such that the children had to earn 30-40 points before exchanging them. They were also taught to initiate the exchange independently upon earning enough points. This self-management system was then applied in community, home, and school settings. Appropriate verbal responses increased from baseline across these settings for all four children. The system was withdrawn for two of the children, at which point the frequency of their appropriate vocalizations declined. Appropriate vocalizations increased once again with the re-implementation of the self-management procedure. Disruptive behavior was also reduced for all children in the self-management phase. This reduction in problem behavior was observed in community settings as well.

Koegel and Frea (1993) used a similar procedure to increase appropriate social behavior in two children with autism. The children were taught to discriminate appropriate and inappropriate targeted social behaviors by placing a mark on a piece of paper whenever they engaged in appropriate behavior during a specified interval. They then exchanged these marks for reinforcers. Two behaviors were targeted for one of the children (eye gaze, nonverbal mannerisms) and one behavior was targeted for the second child (preservation of topic). Increases in appropriate behavior were observed in all target behaviors relative to baseline. Untargeted social behaviors were also monitored (preservation of topic, voice volume, and facial expression), and increases in them were observed as well.

Morrison, Kamps, Garcia, and Parker (2001) compared the effects of peer-monitoring and self-monitoring strategies on increasing social initiations and other social

skills in children with autism. Typical peers were paired with children with autism and all students were taught to record when they engaged in a target behavior. Target behaviors included requesting, commenting, and sharing. Once one target behavior was taught, there was a return to baseline followed by training the next target. During self-monitoring, all participants monitored their own behaviors, while during peer-monitoring the typical peers monitored the behavior of the children with autism. Peers were responsible for delivering reinforcers in all conditions. Data were collected on the percentage of intervals in which the children with autism engaged in the target behaviors while playing a game with their peers. The percentage of intervals in which initiations were observed increased for all children in both the peer- and self-monitoring conditions.

Newman, Buffington, and Hemmes (1996) compared the effects of one aspect of self-management, self-reinforcement, to reinforcement delivered by treatment providers in increasing appropriate conversational responses in teenagers with autism. During baseline, the participants were read a story and then prompted to engage in a conversation about the story. Ten tokens were delivered (exchangeable for preferred items) following the conclusion of the conversation. The participants were then taught to collect their own token following every appropriate response during the conversation. A return to baseline followed in which participants earned the mean number of tokens they had earned during the first treatment phase at the conclusion of the conversation. The treatment phase was then implemented a second time. Conversational statements increased with the application of self-reinforcement, decreased with the return to baseline, and once again increased when self-reinforcement was reintroduced.

Newman, Reincke, and Meinberg (2000) taught three children with autism to use a self-reinforcement procedure to increase variability in play behavior. The experimenters first prompted the children to engage in different play behaviors with a preferred play item. Children were then taught to collect a token every time their play differed from the behaviors they had previously demonstrated. Tokens could then be exchanged for a reinforcer from a menu. Increases in variability were observed across all three children with the implementation of the self-reinforcement procedure.

Callahan and Rademacher (1999) taught a child with autism to use self-management within his second grade classroom to increase on task behavior. The child was taught (1) to identify on-task behavior, (2) to self-record occurrences of on task behavior at the end of an interval thereby earning a point, (3) to review whether or not he accurately recorded his behavior, (4) to review whether or not he met a daily goal, and (5) to exchange his points for reinforcers from a reinforcement menu. A multiple baseline across academic subjects (reading and math) was used. The child was generally accurate (within one or two intervals) when recording his own behavior, and increases in on-task behaviors were observed across both academic subjects. Furthermore, his teachers reported improvement in his general classroom behaviors as well as in his grades on his report card.

In 1994 Pierce and Schreibman developed a self-management procedure using pictures to teach daily living skills to children with autism. The children were initially taught to identify pictures associated with steps of a self-help task (e.g., dressing). The pictures were affixed to pages in a book and the children were taught to turn the page once they had completed a step. A “smiley face” was placed on the page following the

last step, at which point the children were taught to self-reinforce. The experimenter's presence was faded following training. A multiple baseline across three tasks for all participants was utilized. The tasks varied across participants. Increases in on-task behavior and reductions in inappropriate behavior were observed across all tasks for all participants.

Using Self-management Procedures to Weaken Inappropriate Behavior

The aforementioned studies show that there are a variety of self-management techniques that may be used with children with autism. Self-monitoring, review, and self-reinforcement have been effective in modifying a variety of behaviors in a variety of settings. Most of these studies have focused on increasing appropriate behaviors and have found reductions in non-targeted problematic behaviors. Reducing inappropriate behavior is often an important part of a treatment plan for children with autism, and yet it can be especially difficult when stereotypic behaviors maintained by non-social reinforcement are present. Two studies have demonstrated that self-management techniques can also be useful in the reduction of stereotypic responding.

Koegel and Koegel (1990) administered a self-management procedure with four students with autism as a means of reducing their stereotypic behaviors. Participants ranged in age from 9 to 14 years old. Stereotypic behaviors were defined as responses that did not serve any function beyond sensory stimulation. Examples included arm flapping, jumping, finger tapping, thumb sucking, manipulation of saliva with the fingers, humming, knee shaking, and finger flexing.

Koegel and Koegel (1990) began the intervention by identifying reinforcers for each child and determining an initial self-management interval based on the average

length of intervals during baseline that did not contain the target behavior. Discrimination training followed whereby each child was taught to identify both their stereotypic and appropriate behaviors. This training involved the experimenter modeling the target behaviors for each child. The child was then required to label these behaviors until reaching a mastery criterion of 80% correct identifications across 10 consecutive trials.

The self-management procedure for the children involved placing a mark in a printed box following an interval without stereotypic behavior. These marks could then be traded for reinforcers. The experimenter gave an instruction such as, "Show me 'no singing,'" which started the interval. When the interval was over, an alarm sounded and the child then conducted the self-management activities (prompted as needed). Once the child made a mark, verbal praise was delivered. If the child did not make a mark, but was nonetheless accurate (i.e., stereotypic behavior had occurred), praise was also delivered. Prompts were then faded and the interval was lengthened. The data indicated a reduction in stereotypic responding across all participants. The procedure was withdrawn for one child, resulting in an increase in the target behaviors. Following reinstatement of the self-management procedure, behavior reduction was observed once again.

In a second experiment, Koegel and Koegel (1990) extended their procedure to community settings for two children. Baseline data were collected in these settings, and the children had no access to the self-management materials. During the self-management phase, the children were given the materials (a watch and data sheet) and instructed to use them. Treatment withdrawals were implemented by withholding access

to the self-management materials. Also, the presence of the treatment provider was faded in order to assess the efficacy of the procedure in their absence. A reduction to near zero levels of the target response was observed for both children in the presence and absence of the treatment provider and after the intervention was formally withdrawn.

After Koegel and Koegel (1990), Shabani, Wilder, and Flood (2001) conducted a study evaluating a treatment package that included discrimination training, DRO, and self-monitoring. The participant was a 12 year old boy with autism, attention deficit hyperactivity disorder, mild mental retardation, and a seizure disorder. He engaged in stereotypic body rocking that was judged to be automatically reinforced. Baseline levels of the target behavior were evaluated while in "sitting" and "standing" conditions. Following baseline, a training phase was implemented to teach the child the self-monitoring procedures, to thin the DRO schedule to 5 minutes, and to train the child to discriminate between stereotypic body rocking and appropriate behaviors. The child was taught to self-monitor and to discriminate appropriate and inappropriate behaviors using the procedures outlined by Koegel and Koegel (1990). During these sessions, the DRO criterion following each interval that did not contain an instance of stereotypic behavior increased. These intervals were followed by access to preferred items. Brief discrimination training was also conducted prior to each of these sessions.

Once the terminal DRO interval length of 5 minutes was attained, the intervention sessions began. These were identical to previous training sessions except that the intervals remained at 5 minutes. A multiple baseline design was used to assess the intervention across sitting and standing conditions. Once low levels of rocking had been attained, the DRO was thinned according the criterion used in the training sessions.

Results indicated a reduction in stereotypic body rocking across both the sitting and standing conditions. Furthermore, the DRO was successfully thinned to 17 minutes for standing and 20 minutes for sitting. Shabani and his colleagues (2001) also reported that the child accurately labeled his behavior in 90% of the treatment sessions.

While the Koegel and Koegel (1990) and Shabani, Wilder, and Flood (2001) studies describe methods that were successful in reducing frequencies of stereotypic behaviors, they also share some limitations. First, neither study included a functional analysis of the targeted behaviors. While it is possible to determine function through interviews and observation, a data-based analysis adds credence to them. A second limitation is that the children in the studies were taught to discriminate appropriate and inappropriate behaviors modeled by a treatment provider (or experimenter) and then inaccurately labeled their own stereotypic behavior when it occurred. Discrimination training of the child's own behavior may be necessary for accurate labeling, and accurate labeling, in turn, appears to be necessary for self-monitoring. A third limitation is that these interventions occurred separately from regular treatment, taking time away from other learning. Fourth, the interventions took place in the absence of other learning activities, potentially limiting generalization of the effects of the interventions. Finally, both studies included pre-training procedures whereby the children were taught specific responses necessary to complete the self-management activities. It is possible that these activities could be embedded within the context of a comprehensive intervention program, thereby reducing the delay between baseline and intervention phases.

The purpose of the current study was to examine the effects of a self-management package (including self-monitoring and self-reinforcement) on the automatically

maintained behavior of three young children with autism. Functional analyses were conducted to demonstrate that target behaviors served an automatic reinforcement function. Identification of appropriate and inappropriate behavior and all instruction on the self-management procedures occurred within the same session and within the context of each child's ongoing intervention program. This feature allowed the child to be active in his or her own treatment and introduced aspects of the natural environment such as control over one's own reinforcers.

Method

Participants, Setting, and Apparatus

The participants in this study were three children with autism, ages 4 to 6 years old. The three children were enrolled in either a home- or center-based intervention program, and all of them participated in a token economy as part of their program. Table 1 contains a summary of information relevant to each participant.

All sessions were conducted in the child's home (or center if the program was center-based) as part of their ongoing treatment. All previously established protocols and procedures remained in place, including those regarding the selected target responses. Trained tutors implemented all phases of the study as part of their assigned duties during their regularly scheduled sessions. The participants were provided with the materials for the self-management procedure, including a pencil or pen, paper data sheets, and a timer at the beginning of each session.

Jake was a 6 year old male diagnosed with autism who received academic tutoring using precision teaching methods at the Center for Advanced Learning (CAL) for approximately 5 hours per week (one 50 minute session per week-day). At the

beginning of the study his Autism Index Score was 111 on the Gilliam Autism Rating Scale-Second Edition (GARS-2; Gilliam, 2006), indicating a “very likely” probability of autism. Jake was able to answer simple social questions, follow simple instructions (including some multi-step instructions), and request preferred items. He could also engage in the behaviors necessary for the current protocol such as setting a timer and marking on a sheet.

The targeted behavior for Jake was inappropriate vocalizations, defined as all vocalizations inappropriate to the social and instructional context. Each inappropriate vocalization was counted as one instance, with a pause of 5 seconds between inappropriate vocalizations denoted as a new instance. There was not a specified protocol for inappropriate vocalizations.

Ian, was a 4 year old male. At the time of the study his Autism Index score was 83 on the GARS-2 indicating “possibly” as his probability of autism. Ian had participated in the UNR Early Childhood Autism Program for 1.25 years prior to enrolling in the study. Ian received 30 hours of treatment per week, 24 of which were in-home sessions and six of which were school-based sessions. Ian could engage in basic conversation (ask and answer simple social questions), follow multi-step instructions related to daily and academic activities, and request preferred items. He could also engage in the behaviors required for the self-management protocol, such as setting a timer and marking on a sheet.

The self-management protocol for Ian was only in place during his home sessions. The targeted behavior for Ian was inappropriate vocalizations. The definition of inappropriate vocalizations was the same as it was for Jake, however, Ian sometimes

rapidly vocalized with a variety of sounds or words in quick succession. When this occurred for 5 seconds or longer, it was considered a burst. Single instances and bursts of inappropriate vocalizations were recorded separately. A break of 5 seconds between inappropriate vocalizations and bursts denoted a new instance. The protocol for inappropriate vocalizations was to interrupt and redirect them to a more appropriate response. For instance, the tutor would instruct him to imitate appropriate vocalizations or would ask him a question that required a vocally appropriate answer (e.g., "What is your name?").

Chris was a 5 year old male. At the time of the study his Autism Index score on the GARS-2 was 74 indicating "possibly" as his probability of autism. Chris had participated in the UNR Early Childhood Autism Program for 2.1 years at the start of the study. He had been receiving 30 hours per week of in-home treatment prior to the study and during the baseline phase. Chris entered kindergarten near the beginning of the first self-management phase, which coincided with a re-distribution of his 30 hours per week of treatment to 18 hours at home and 12 hours at school per week. Chris could engage in conversation (ask and answer social questions with some detail), follow multi-step instructions related to academic and daily activities, and request preferred items. He could also engage in the behaviors required for the self-management protocol, such as setting a timer and marking on a sheet.

The self-management protocol was only in place during Chris' home sessions. The targeted behavior for him was nose-picking. Nose-picking was defined as any time the tip of his finger entered the opening of his nostril. This included scratching his nose if a finger entered a nostril. Each time the finger entered a nostril, one instance was

counted. If he switched nostrils, two instances were counted. Two instances were also counted when Chris picked both nostrils at once. Nose-picking also included wiping (with one or more fingers) from the bottom of his nose to his mouth, with or without licking his fingers or palm. A new instance was recorded when he removed his finger from his nostril or his hand broke contact with his face and wiped again. The protocol for nose-picking was to interrupt and redirect the response to a more appropriate response (e.g., using a tissue).

Response Measurement

Upon a parent's request for their child to participate, the child's treatment team was consulted and the child was observed to determine behaviors that were available for self-management. Only automatically maintained behaviors were selected as determined by an analogue functional analysis or descriptive assessment.

Data collected included correct and incorrect self-recording responses, independent and prompted timer setting, turning the timer off, and token collection, as well as data regarding the targeted responses. Percent correct responding and average prompt strength required on self-management measures, as well as the frequency and/or rate of the target behavior, was recorded for each session.

Design and Procedure

Determining the target response. The treatment team was first asked to identify potential target responses. Following these initial interviews, observations were conducted during the child's sessions to isolate a target response and develop an operational definition for it.

Determining response function. A functional analysis (FA) was conducted to determine the function of the target behavior for all children. The functional analysis was based on the procedures outlined by Iwata, Dorsey, Silfer, Bauman, & Richman (1982, 1994). Sessions in all conditions for Jake were 5 minutes in length; 10 minute sessions were used with Ian and Chris. Conditions for all children were presented using an alternating treatments design. The conditions included attention, demand, ignore, and play. A tangible condition was not present for any of the participants. An ignore condition, during which the experimenter stayed in the room and did not interact with the child, was implemented instead of the alone condition due to space constraints. A room where the child could be left alone safely and still observed was not available. Also, Jake was presented with an additional condition in which the form of the attention was social disapproval delivered with a stern tone of voice and facial expression, rather than the neutral delivery of attention typical of the condition, in order to determine whether or not different forms of attention had an effect on inappropriate vocalizations. Sessions were conducted during each participant's regular sessions and continued until the function of a target behavior was identified. It was not possible to determine a function for one participant (Chris) with an FA, thus a descriptive assessment (DA) was conducted. Tutors recorded the antecedent and consequence for each instance of the target behavior, and these data were graphed and visually inspected in order to determine a reinforcement function.

Baseline. During baseline, data were collected on the target responses observed during the child's regular session activities. Baseline sessions continued until at least three consecutive data points with no new trends or no new highs or lows were achieved.

Phase one: Self-management. During Phase one, the child was taught to name the target response as well as identify whether or not it occurred within a specific interval. At the beginning of the session the child was given two data sheets and a timer. Initial interval lengths were 2, 4, and 5 minutes for Jake, Ian, and Chris, respectively. Prior to beginning a session, the tutor set out the child's data sheets, pencil, and timer. When the child was brought into the room he was instructed to set his timer if he did not do so independently.

When a target response occurred during an interval, the child marked a tally on the Target Behavior Data Sheet (TBDS). In the event the child did not make a tally independently, the tutor implemented a three-step prompting procedure. Prompts were assigned an arbitrary value in order to calculate an average prompt strength with 1 representing the least intrusive prompt necessary and each consecutive number representing a more intrusive prompt. Prompts included delivering an instruction to make a response (average prompt strength of 1), modeling the correct response (average prompt strength of 2), or physically guiding the response (average prompt strength of 3). The child was given the opportunity to complete the task following each prompt before the next prompt was delivered. Target responses that occurred between intervals were not recorded on the TBDS, however, the tutor did record these as part of the frequency measure for each session.

The end of an interval was signaled by a beep from a timer. The child turned off the timer, indicated on the Self-monitoring Data Sheet (SDS) whether or not the target response occurred, collected a penny per their session token economy, and then reset the timer. The tokens earned were in addition to any tokens the child earned for engaging in

regular session activities and could be exchanged for backup reinforcers (throughout sessions for Ian and Chris, at the end of sessions for Jake). Each child had a menu of back-up reinforcers which varied in cost for each participant with a range of 1 token (all participants) to 25 tokens (Chris).

A correct response was scored if the child independently and accurately recorded the target response as having occurred, or not, during the previous interval on the SDS. The child then collected a token and reset the timer. If the child did not collect the token or set the timer independently, the tutor implemented the three-step prompting procedure described above.

An incorrect response was scored if the child did not accurately or independently record the target response as occurring, or not, in the previous interval. The tutor implemented a least-to-most prompting procedure until the child made the correct response. This procedure involved delivering an instruction to complete the SDS (average prompt strength of 1), directing the child to look at the TBDS to see if the behavior occurred or not (when applicable; average prompt strength of 2), modeling the correct response for the child (average prompt strength of 3), or physically guiding the correct response (average prompt strength of 4). The child was given the opportunity to make the response following each prompt before the next prompt was delivered. In the event of an incorrect response, the child did not collect a token, but was instead instructed to set the timer for the next interval. If the child did not set the timer independently, the tutor implemented the three-step prompting procedure outlined above.

Implementation of Phase two began when the child met a mastery criterion of 80% correct recording across three consecutive sessions.

Phase two: Reinforcing appropriate behavior. Phase two was identical to Phase one, but with the exception that tokens were collected only for correctly recording appropriate behavior. Chris was the only participant to reach Phase two. In this phase he only collected tokens following intervals in which he did not nose-pick and he marked the SDS correctly and independently. Attempts to collect a token following inappropriate behavior were rare for Chris, but when it occurred, the tutor instructed him to return the token and stated, "You did not earn a token because you picked your nose." Chris continued to record his behavior following every interval regardless of whether or not it was appropriate. Phase three began once he met a mastery criterion of 80% correct recording across three consecutive sessions.

Phase three: Increasing the interval length. Phase three was identical to Phase two, but with the exception that the interval was systematically increased. An interval increase occurred following three consecutive sessions with 80% correct recording. Chris' intervals increased to 7, 10, and then 14 minutes.

Inter-Observer Agreement and Treatment Integrity

Trained graduate and undergraduate research assistants collected data on the behavior(s) while watching video recordings of sessions. All sessions were videotaped and a second observer independently collected data for 33% of sessions. Inter-observer agreement (IOA) data were calculated by adding the number of agreements and dividing by the number of agreements plus disagreements and multiplying by 100%. Mean agreement was 83% (range: 41%-100%). Treatment integrity data were also collected during 33% of sessions. Treatment integrity was calculated by adding the number of properly implemented steps each session and dividing by the total number of steps in a

session and multiplying by 100%. The mean for correct implementation was 90% (range: 57%-100%).

Design

An ABCD time-series design was utilized. The A phase was designated as baseline. The B, C, and D phases represented the self-management phase, the reinforcing appropriate behavior phase, and the increasing interval length phase, respectively. For one participant (Ian) there was a reversal to baseline and then a reimplementation of the B phase.

Results

Determining Function

Figure 1 depicts the results for the FA for each participant. There was no differentiation across conditions for either Jake or Ian, and the target behavior occurred in the ignore condition for both, suggesting the behavior served an automatic function. It appeared that the frequency of Jake's inappropriate vocalizations may have been different in the presence of different forms of attention, thus a second attention condition was added in which social disapproval rather than neutral attention was given. There was no differentiation between these two conditions.

The data for the attention and demand conditions for Ian show an increasing trend (a limitation of analogue functional analysis is the risk of establishing new behavioral functions for the target behavior during the analysis [Mace, Lalli, & Lalli, 1991; Lerman & Iwata, 1993]). In combination with direct observations by the experimenter during the FA, these data suggested that his behavior was coming under the control of the different variables in each condition. For example, during the demand condition Ian would make

an inappropriate vocalization and then laugh when the experimenter removed the demand. This behavior was not typical of other circumstances in which inappropriate vocalizations occurred. The ignore condition was presented more frequently than the other conditions in order to demonstrate the automatic function while minimizing reinforcement of this problematic behavior under other conditions.

The data for Chris did not indicate a clear automatic function. As with Ian, for Chris, the frequency of nose-picking increased during the later sessions. This suggested that his behavior was affected by the contingencies in place during each condition, and thus these data were judged as unrepresentative of the actual function of his behavior under more natural circumstances.

Informal observations by the experimenter and Chris' tutors, plus the presence of nose-picking during the ignore condition of the FA, suggested that the behavior served an automatic function. In light of these observations and given the relatively low rate of behavior, which made it difficult to capture in the 10 minute sessions of the FA, a DA was conducted rather than conducting extended sessions of the alone condition (research has shown that DAs can be as useful as FAs in determining social and nonsocial functions of behavior [Lerman & Iwata, 1993]).

The DA took place during Chris' regular session activities wherein his tutors recorded the antecedent and consequence for each instance of nose-picking. The data from the DA, shown in Figure 2 (upper panel), indicate that nose-picking occurred under three antecedent conditions (i.e., in the absence of attention, in a demand context, and while engaged with preferred activities). The lower panel of Figure 2 shows the frequency with which tutors ignored or redirected nose-picking. These data indicate that

attention in the form of redirection, the programmed consequence for nose-picking, occurred most frequently. Still, nose-picking occurred under a variety of antecedent conditions suggesting it did not serve an attention function. The undifferentiated data for the DA combined with the presence of nose-picking during the alone condition of the FA strongly suggest that it served an automatic function.

Self-management

Jake. Jake's inappropriate vocalizations are depicted in Figure 3, and his self-management activities are shown in Figure 4. Throughout baseline (Figure 3) Jake engaged in roughly two inappropriate vocalizations per minute. Following Phase one there was an increase to about 3 inappropriate vocalizations per minute. It is possible that the increase was due in part to increased proficiency by the tutors in collecting these data; indeed, an increase in the rate of inappropriate behavior in Phase one was observed for all participants. The supervisor for Jake's case elected to withdraw the self-management procedure from his treatment program following eight sessions in Phase one. The procedure was very difficult for the tutors to implement in the context of Jake's treatment protocols and was taking more time away from his protocols than was anticipated. Concerns were also expressed regarding the increase in rate of inappropriate vocalizations.

Jake did not make any independent, correct self-monitoring responses during Phase one (Figure 4, upper panel). He usually required prompting to check his TBDS to see if inappropriate vocalizations occurred (average prompt strength of 2), and sometimes a tutor had to model the correct behavior for him (average prompt strength of 3). Jake also needed prompts to set the timer (Figure 4, middle panel), which often included a

vocal prompt (average prompt strength of 1) or a model of the correct behavior (average prompt strength of 2).

Jake had more success in independently turning off the timer (Figure 4, lower panel). He turned it off 5, 6, and 7% of intervals in session two, five, and seven, respectively. Jake never collected a token because he did not independently mark his SDS. Note that average prompt strength data are missing for setting the timer (session one; Figure 4, middle panel) and turning the timer off (sessions one and five; Figure 4, lower panel).

Ian. The data for the rate of Ian's target behavior are seen in Figure 5 and his self-management data are shown in Figure 6. The rate of inappropriate vocalizations during baseline 1A (Figure 5) was 10 to 15 per hour. The rate of bursts during baseline 1A was about three to five per hour. The hourly rate of both initially increased following the implementation of Phase 1A. Both vocalizations and bursts remained relatively steady, though a slight decrease in the rate of inappropriate vocalizations may be observed beginning with session 50.

During Phase 1A Ian did not learn to mark the SDS independently (Figure 6, upper panel). He usually required physical guidance to mark the data sheet correctly (an average prompt strength of 4). He would often scribble on the data sheet rather than circle the appropriate answer.

Ian was more successful with turning the timer on (Figure 6, second panel) and off (Figure 6, third panel). He usually needed a reminder (an average prompt strength of 1) or a model of the correct behavior (an average prompt strength of 2) when he did not engage in these behaviors independently. He had very few opportunities to collect a

token during this phase and did not do so independently (Figure 6, lower panel). Phase 1A was suspended following session 70 due to concerns regarding the increase in inappropriate vocalizations and increases in other problematic behaviors (crying, hitting) that were occurring during sessions. Percent correct and average prompt strength data are missing for setting the timer (session 40; Figure 6, second panel), turning the timer off (session 40; Figure 6, third panel), and token collection (sessions seven and 60; Figure 6, lower panel). Data are also missing for the rate of inappropriate vocalizations and bursts (session 41; Figure 5).

Session 71 signaled Ian's return to baseline 1B (Figure 5). During this second baseline (Figure 5) the rate of inappropriate vocalizations and bursts remained at roughly the same level, but with less variability relative to the end of Phase 1A. Other problematic behaviors also remained at their previously observed levels. A decision was made to reinstate Phase 1B at session 109. Inappropriate vocalizations and bursts were similar to baseline 1B.

It is important to note that at session 175 Ian moved into a new home where he had a room that was reserved for his sessions. This minimized the distractions that were present in his former home where sessions were conducted in a guest bedroom that also served as an office. Coincidental with this move was a reduction of inappropriate vocalizations and bursts.

During Phase 1B, Ian often marked the SDS independently, but needed prompts to do so accurately (Figure 6, upper panel). As sessions progressed, his accuracy improved slightly and the level of prompting decreased from physical guidance (prompt strength of 4) and models (prompt strength of 3) to gestural prompts to look at his TBDS

to determine whether or not he had engaged in the target behavior or not (average prompt strength of 2). He also was more successful setting the timer and turning the timer off (Figure 6, second and third panels). The strength of the prompts for both of these responses decreased as well.

Ian collected many tokens during Phase 1B, though he often required prompting to do so (Figure 6, lower panel). He typically required a vocal prompt to collect a token (average prompt strength of 1). Near the end of Phase 1B, Ian was frequently collecting his tokens independently 100% of the time. The variability seen in this data set was likely due to the intermittent availability of tokens, which were available only for those intervals in which Ian (and all participants) accurately and independently marked the SDS. For instance, if in any given session Ian had one opportunity to collect a token and he did so independently, it would be scored as 100% correct for that session. If in the next session he had two opportunities to collect a token and did so independently one time, it would count as 50% correct. In each case he had responded correctly the same number of times, but due to the change in denominator, the percent correct was different.

Phase 1B was withdrawn as part of a broader change in Ian's treatment. He was progressing slowly during sessions and it became necessary to alter how he earned his reinforcers. This included changing his token economy, making it impossible to continue with the self-management procedure.

Chris. The data for Chris' nose-picking are shown in Figure 7. Note that the scale of the y axis is extended to 200 per hour in order to accommodate one session (session 24) that had a comparatively high rate of nose-picking. During baseline, the rate of nose-picking was roughly 5 per hour. Following the implementation of Phase one,

there was an increase in nose-picking; the hourly rate was notably high in sessions 22, 24, and 29. With the exception of these outliers, the rate of nose-picking at the beginning of Phase one was roughly 10 to 15 per hour. A reduction in the rate of nose-picking to less than 5 per hour occurred in session 40, and thereafter remained low throughout the remainder of the study.

Chris' self-management data are shown in Figure 8. Of the four self-management activities, Chris was most successful at marking his SDS (upper panel) and turning off the timer (third panel). He acquired these responses quickly and remained successful with them throughout all phases of the study. When prompting was necessary, it typically involved a reminder to complete the response (an average prompt strength of 1). He was less successful setting the timer (second panel) and collecting a token after he had marked his data sheet correctly (lower panel), and yet needed very little prompting to complete these activities. Chris' token collection data were more variable than the data for his other self-management responses. Token collection was not available at the end of every interval, but was instead available at the end of an interval wherein the response criterion for a phase was met. As a result, the denominator for calculating percent correct varied from session to session, and while Chris may have been making the same number of correct responses, the percentage correct changed according to the number of times token collection was available during that session.

A decreasing trend in the percent correct of self-monitoring, setting the timer, and token collection is shown following the increase in interval length in Phase three from 7 minutes to 10 minutes. This is likely due to the reduced number of opportunities to engage in these behaviors as the length of the interval increased. Note that average

prompt strength data are missing for token collection for session 2 (Figure 8; lower panel).

Appendix A depicts nose-picking during Chris' school sessions. The self-management protocol was not in place while Chris was in school. The protocol for nose-picking at school was the same as home (i.e., to redirect to something more appropriate such as using a tissue). The rate of nose-picking at school was not as high as it was at home, however, it did decrease to near zero levels following the implementation of Phase one. It continued to decrease and remained at near zero levels as Chris progressed through the phases of the study at home.

Three in-home probes were also conducted outside of sessions (see Figure 8). In each probe Chris was told to take his self-management materials with him at the end of a session. No further instructions were given. Chris did not engage in any self-management activities under these conditions.

Discussion

The results of the present this study show that a self-management protocol can be implemented successfully in the context of ongoing treatment for some children with autism. The study aimed to reduce automatically maintained behaviors in this context, and was successful in doing so for two of the three participants. The results also show that it is possible to teach a child to discriminate their own behavior and that it is also possible to teach a child aspects of a self-management procedure in the context of regular treatment sessions. The results further show that a child can take an active role in their own treatment and that they can contact aspects of the natural environment such as

control over one's reinforcers. This outcome was achieved for only one participant (Chris), however.

There are several aspects of the results that are common to all participants. First, the rate of the targeted behavior increased with the implementation of Phase one. It is possible that this was due to treatment reactivity, a common feature of self-monitoring. This effect often occurs in the absence of alternative sources of reinforcing or punishing consequences. A number of studies suggest that valence (the positive, neutral, or negative social value of a behavior) has an effect on the direction of behavior change when reactivity is present (Kazdin, 1974; Litrownik & Freitas, 1980; Willis & Nelson, 1982). Behaviors with a neutral or positive valence (socially or personally desirable) tend to increase temporarily, while those with a negative valence (socially or personally undesirable) tend to decrease temporarily. The targeted behaviors for the participants in this study could initially be described as having a positive valence vis-á-vis their automatic function. If this is the case, it would be expected that the behavior would temporarily increase once the child began self-monitoring.

Reactivity cannot account for the changes in behavior entirely, however, given that the rate of the behavior eventually decreased for two participants (Chris, and to a lesser extent, Ian) before the consequences for engaging in the target behavior changed in Phase two. In fact, for Chris, the only child to participate in Phase two, the change in reinforcement contingencies was not necessary to suppress nose-picking to zero levels. The reduction in the behavior may have been due to increased self-awareness of his inappropriate behavior and the appropriate alternatives to engaging in it (e.g., using a

tissue, saying something appropriate), and/or to differential praise when he did not engage in the behavior.

Ian's inappropriate vocalizations were suppressed beginning with session170, but bursts continued to occur at this time at a steady rate. He began to engage in rapid bursts between intervals, though this occurred less often within intervals. The consequence for engaging in bursts between intervals (redirection to appropriate vocalizations) was less effortful than the consequences for engaging in this behavior within intervals (redirection and marking the TBDS). It is likely that the observed increase in bursts, even as the rate of inappropriate vocalizations decreased, was due to this contingency.

Another commonality among the participants is that they were more successful in learning to turn the timer off than they were setting the timer or collecting a token (Jake never had an opportunity to collect a token). It is likely that the beep of the timer was a more salient cue than was the cue available for other behaviors (completing marking the data sheet). Also, Chris successfully self-monitored in all phases of the study, but responded less accurately and more variably with regard to setting the timer, turning the timer off, and collecting tokens. This suggests that tokens were not the functional reinforcer for his self-monitoring behavior or for using a tissue in lieu of picking his nose. It also suggests that these self-management activities may not be necessary to achieve a change in behavior.

While he did not engage in the self-management behaviors outside the treatment setting, Chris' behavior changed at school (see Appendix A) and, according to parental report, remained low at home during non-treatment periods. Chris did not self-manage when given the materials in home probes (see Figure 8), yet his nose-picking remained

low at home. It is likely that Chris did not self-manage during the home probes due to a history of self-management occurring only during sessions. Chris did not have access to the self-management materials outside of sessions (except during probes) adding further evidence that the self-monitoring was the important aspect of the protocol and that the timer, data sheets, and tokens might not have been necessary. Chris learned to identify his behavior through the self-monitoring component, and it is likely that discriminating his own behavior was more important to controlling it than the presence of the self-management materials. Chris' parents and tutors also reported that he enjoyed carrying his clipboard and was excited and seemingly proud of himself when he took his data, suggesting that the self-monitoring component acquired reinforcing properties. If so, it allowed Chris to play a pivotal role in his own treatment by making contact with the natural reinforcers attendant to self-management behavior.

It is important to consider what factors played a role in Chris' success that may not have been present for the other two participants. One possible factor, as indicated by his score on the GARS-2 (see Table 1), is that he was more advanced in his behavioral development than the other two participants. It is important to note that the GARS-2 assesses the probability of autism based on parental report of a child's behavior, not direct observation, and as such, is vulnerable to errors in reporting. That said, Chris and Ian scored similarly on the GARS-2 and their cognitive skills were such that they could both engage in basic conversation, ask and answer questions, and follow multi-step instructions. Jake could also answer simple questions and could follow multi-step instructions. Furthermore, all three participants were able to make discriminations regarding their own behavior (e.g., answer, "What are you doing?" questions), though

none of them could label their targeted behavior (Ian and Chris both learned to do this in the context of the study). The three participants were also able to engage in the other component behaviors necessary for the self-management procedure, including setting the timer and turning it off, responding appropriately to the beep of a timer, writing tally marks, reading and responding appropriately to the words, "yes," and, "no," writing circles, and collecting tokens from a container. Taken together, these factors indicate that the differences in performance observed during this study were not related to the differences in the participants' scores on the GARS-2.

Another possibility is that Chris engaged in relatively few problematic behaviors during sessions. Consequently, the majority of his session time was spent learning new skills rather than interacting with behavior reduction procedures. This was not the case for the other two participants. The high rate of inappropriate behavior during Jake's treatment sessions prohibited acquisition activities from occurring during his sessions prior to, and during, the study. Instead, his tutors focused on reinforcing appropriate, independent mands (Skinner, 1957) in an effort to shape appropriate vocal behavior. Ian also engaged in frequent inappropriate behavior, including crying, rubbing his eyebrows, playing with his fingers, staring at shadows, and tongue chewing. Much of his session time was spent interrupting and redirecting these behaviors. Furthermore, it was determined that Ian's tokens were either not functioning as reinforcers or were not competing effectively with the reinforcers for engaging in problematic behavior. Indeed, when attempting to suppress automatically maintained behaviors, the rate, quality, and magnitude of competing reinforcers must be greater than the reinforcers attendant to engaging in the behavior (see Vollmer, 1994, for further discussion). It is possible that

the presence of these behaviors, and the lack of functional alternative reinforcers, inhibited acquisition of the self-management responses (and other behaviors) for both Jake and Ian.

The difficulties experienced in implementing this protocol indicate some limitations of this study. First, the presence of the experimenter during the ignore condition may have served as a discriminative stimulus for the target behaviors, suggesting that those behaviors may have had a social function. If so, the target behaviors had multiple functions, and it is possible that they were inadvertently evoked or reinforced by some aspect of the protocol. Even if the target behaviors were multiply maintained, the protocol was effective in reducing Ian and Chris' targeted responses. Future research could better isolate the reinforcing variables for target responses in order to demonstrate the effects of a self-management procedure on behaviors only maintained by automatic reinforcement.

A second limitation is indicated by the difficulties encountered when the procedure was implemented for Jake in an academic tutoring setting with tutors who were not trained in implementing behavior reduction procedures. That it was successfully implemented in a home-based treatment setting suggests three possibilities. One possibility is that the number of treatment hours that the children contact in an intensive home-based treatment program may be necessary for success. Another is that the protocol may be more successful when applied in a setting specialized in teaching children with autism, which is likely to include behavioral acquisition and reduction programs. It is possible that with increased training, the tutors implementing the protocol in an academic setting may have been better prepared for the rigor that is often necessary

in applying behavior reduction protocols, thereby increasing the likelihood of success in that setting. Future research might investigate the aspects of the instructional setting that must be present in order for a child to self-manage his or her own behavior successfully, such as tutor training, number of treatment hours, and treatment setting.

Another limitation is the sheer number of components present in the protocol. While the child was responsible for collecting data on one behavior, the tutors were responsible for collecting data on a number of aspects of the child's behavior. These responses often occurred in quick succession and in the presence of a number of other factors that tutors were attempting to track (other programming, timing of session breaks, other problematic behaviors, etc.). It is likely that the difficulty in monitoring all of the child's behavior played a role in the tutor sometimes forgetting to record data, recording data inaccurately, and sometimes implementing the procedure incorrectly. One purpose of the study was to demonstrate that behavior reduction procedures are available that do not require the presence of a treatment provider. For purposes of the current study, it was necessary to record the participants' performance on all aspects of the protocol. Future research might investigate whether it is necessary to track the child's responding on all components of the self-management procedure or whether tracking accuracy in self-monitoring alone is sufficient (thereby reducing the role of the treatment provider). A related limitation is that none of the children independently engaged in all aspects of the self-management procedure, thereby requiring the presence of a treatment provider to apply prompts. Future research could examine which self-management activities are necessary for behavior change and also whether or not delivering reinforcers contingent upon completion of each activity, rather than completion of all activities as was done in

this study, may lead to more independence and complete self-management on the part of the child.

Automatically maintained behaviors in children with autism can be especially difficult to eliminate, and given the constant availability of these behaviors and the reinforcement attendant to them, it is important that behavior reduction procedures are effective even in the absence of a treatment provider. Self-management appears to be a promising approach to eliminating these problematic behaviors. Future research will help determine the exact conditions under which it can be best taught and will be most effective.

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Table 1

Summary of Participant Information

Participant	Age	Type of Treatment program	Number of Treatment Hours	GARS-2 Score		Target Behavior
				Autism Index	Probability of Autism	
Jake	6 years	Center-based (academic)	Approx. 5 per week	111	Very Likely	Inappropriate Vocalizations
Ian	4 years	Home-based	24 in-home per week	83	Possibly	Inappropriate Vocalizations
Chris	5 years	Home-based	18 in-home per week	74	Possibly	Nose-picking

Figure Captions

Figure 1. Functional analysis data. Panel one (Jake) shows the frequency of inappropriate vocalizations per session. Panel two (Ian) shows the percentage of one minute intervals per session containing inappropriate vocalizations. Panel three (Chris) shows the frequency of nose-picking per session.

Figure 2. Descriptive assessment data for Chris. Panel one shows the frequency of nose-picking per session as related to antecedents. Panel two shows the frequency of nose-picking per session as related to consequences.

Figure 3. Depicts the rate (per minute) of inappropriate vocalizations for Jake.

Figure 4. Self-management data for Jake. Panel one shows the percent correct and average prompt strength necessary on the SDS. Panel two depicts percent correct and average prompt strength necessary for setting the timer. Pane three shows the percent correct and average prompt strength necessary for turning the timer off.

Figure 5. Depicts the rate (per hour) of inappropriate vocalizations and bursts for Ian.

Figure 6. Self-management data for Ian. Panel one shows the percent correct and average prompt strength necessary on the SDS. Panel two depicts percent correct and average prompt strength necessary for setting the timer. Pane three shows the percent correct and average prompt strength necessary for turning the timer off. Panel four shows the percent correct and average prompt strength necessary for collecting a token.

Figure 7. Depicts the rate (per hour) of nose-picking for Chris. Panel one depicts the entire data set. The scale of the y axis of panel two is smaller showing a more detailed representation of the data.

Figure 8. Self-management data for Chris. Panel one shows the percent correct and average prompt strength necessary on the SDS. Panel two depicts percent correct and average prompt strength necessary for setting the timer. Pane three shows the percent correct and average prompt strength necessary for turning the timer off. Panel four shows the percent correct and average prompt strength necessary for collecting a token.

Figure 1

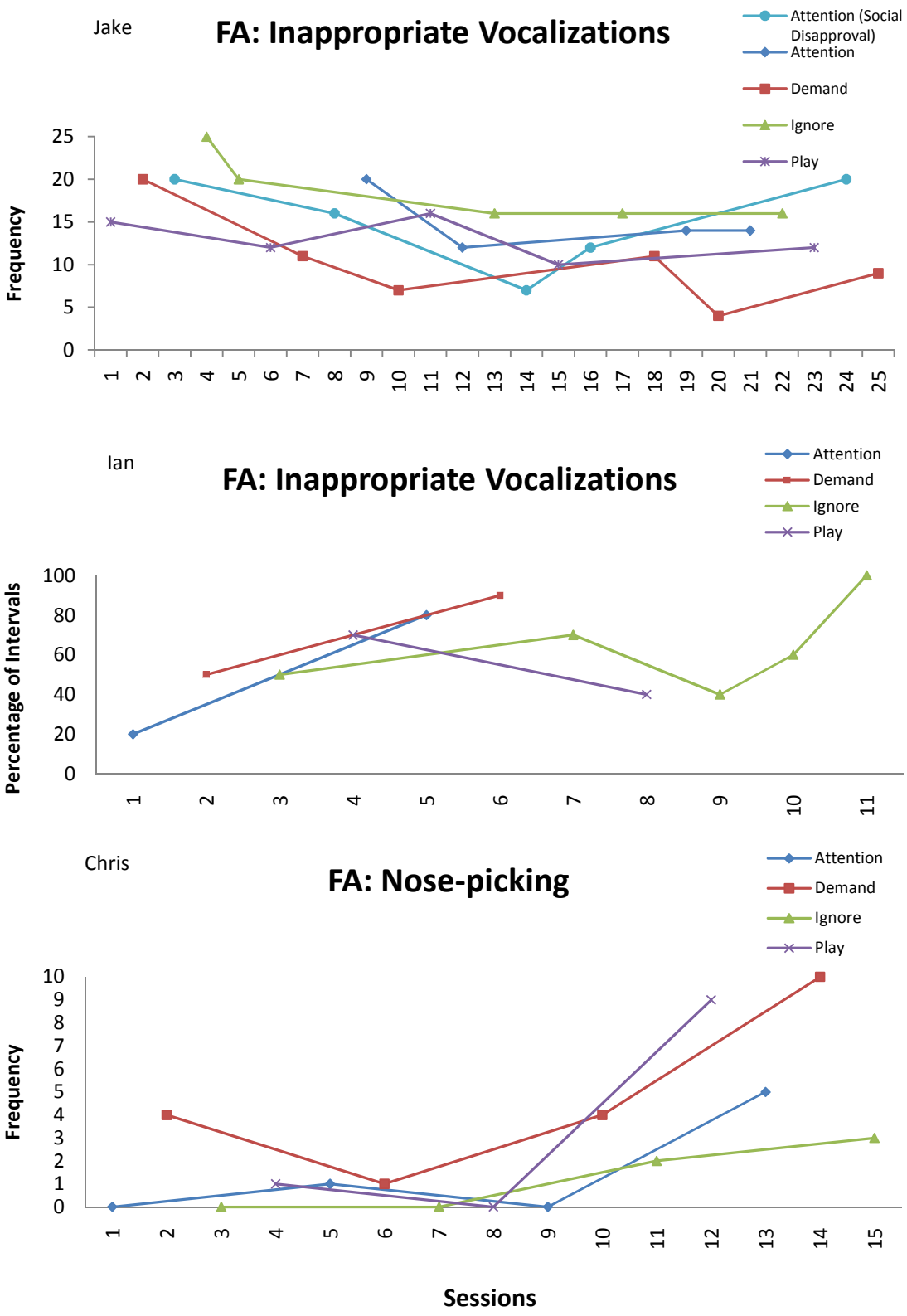

Jake
FA: Inappropriate Vocalizations
Attention (Social Disapproval)
Attention
Demand
Ignore
Play
Frequency
Ian
FA: Inappropriate Vocalizations
Attention
Demand
Ignore
Play
Percentage of Intervals
Chris
FA: Nose-picking
Attention
Demand
Ignore
Play
Frequency
Sessions

Figure 2

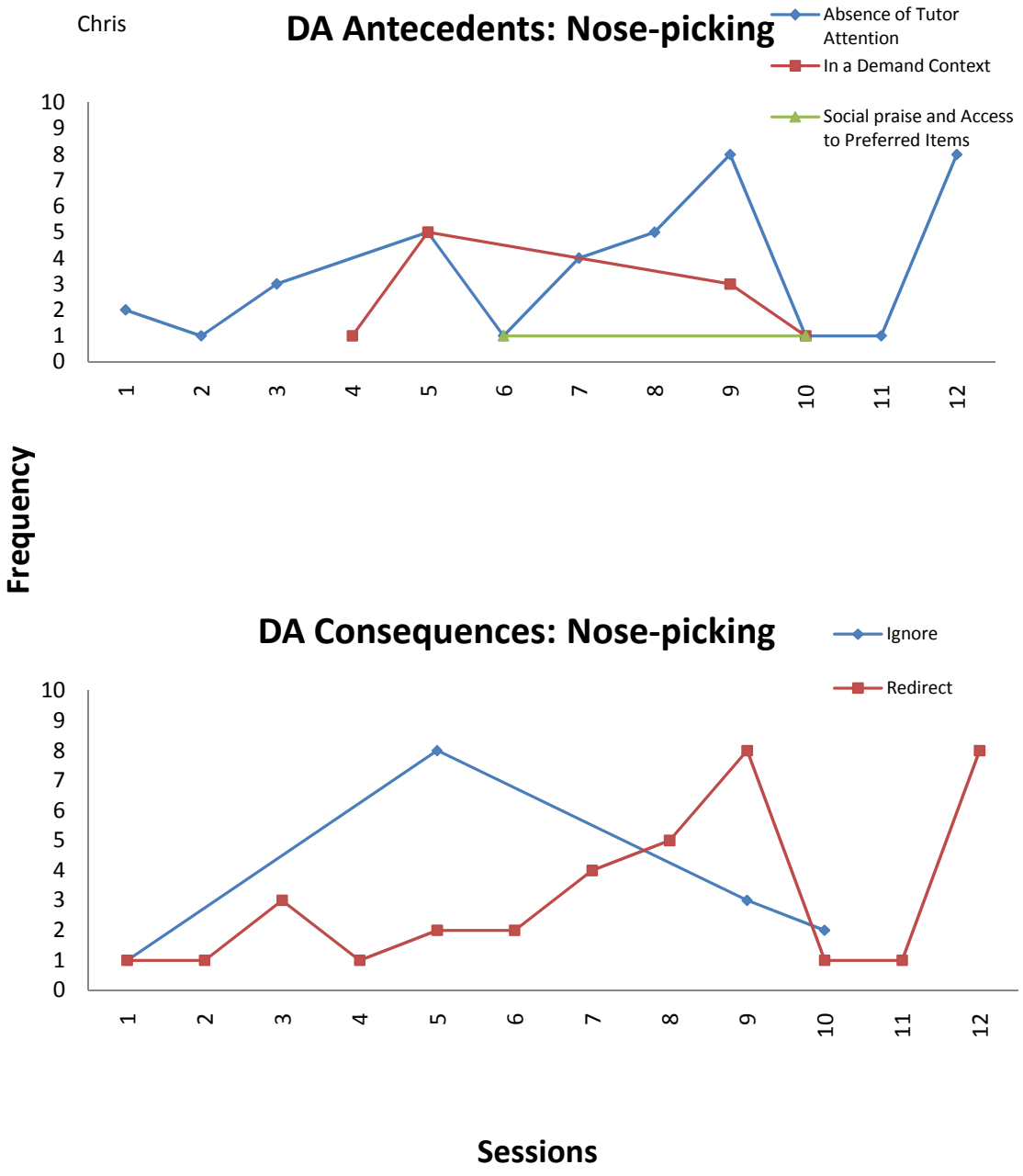

Chris
DA Antecedents: Nose-picking
Absence of Tutor Attention
In a Demand Context
Social praise and Access to Preferred Items
10
9
8
7
6
5
4
3
2
1
0
1
2
3
4
5
6
7
8
9
10
11
12
Frequency
DA Consequences: Nose-picking
Ignore
Redirect
Sessions

Figure 3

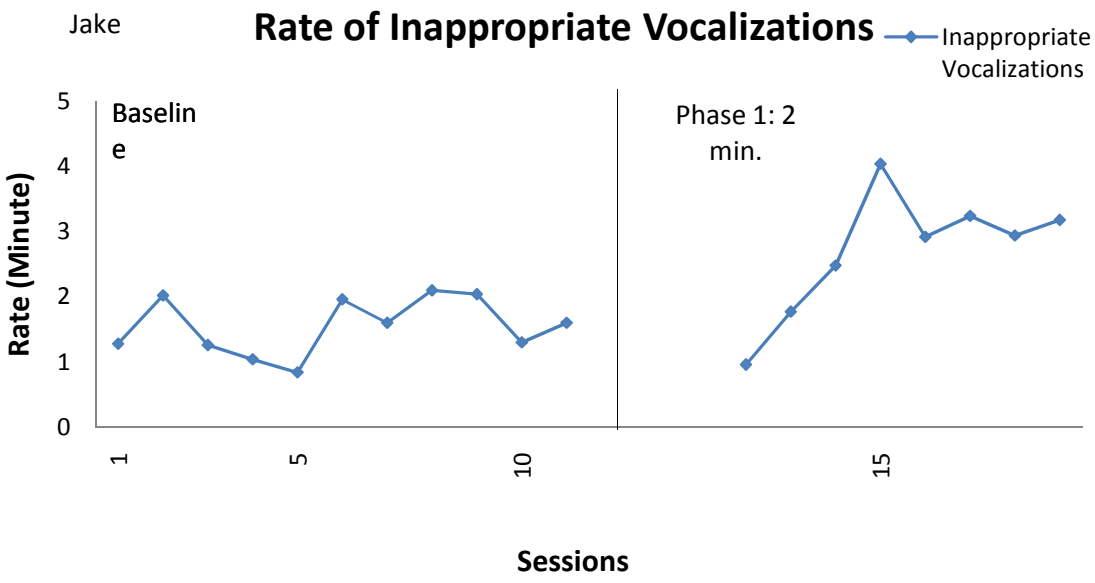

Jake
Rate of Inappropriate Vocalizations
Inappropriate Vocalizations
Baselin e
Phase 1: 2 min.
Rate (Minute)
0
1
2
3
4
5
1
5
10
15
Sessions

Figure 4

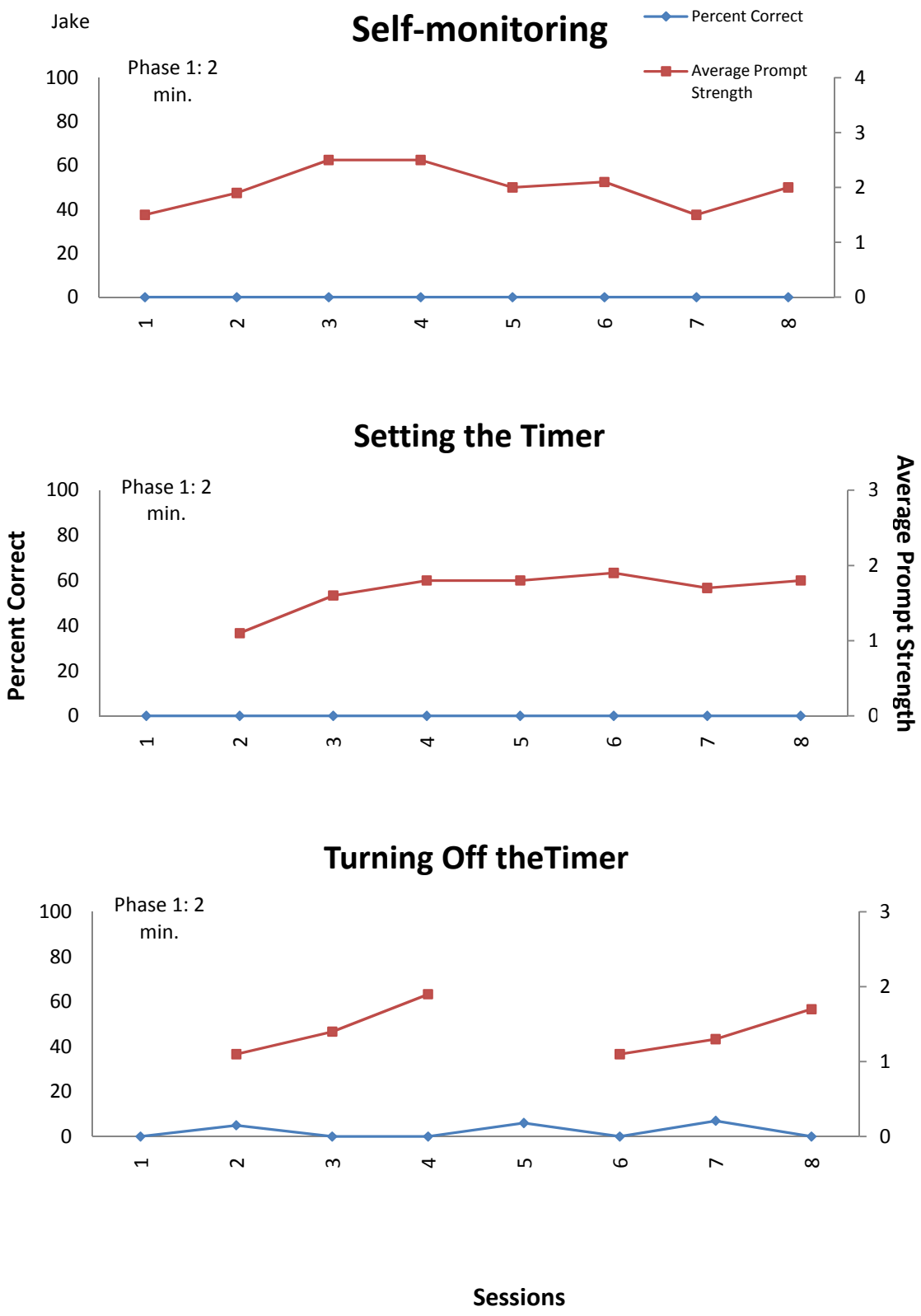

Jake
Self-monitoring
Percent Correct
Average Prompt Strength
Phase 1: 2 min.
100
80
60
40
20
0
4
3
2
1
0
1
2
3
4
5
6
7
8
Setting the Timer
Phase 1: 2 min.
Percent Correct
Average Prompt Strength
Turning Off theTimer
Phase 1: 2 min.
Sessions

Figure 5

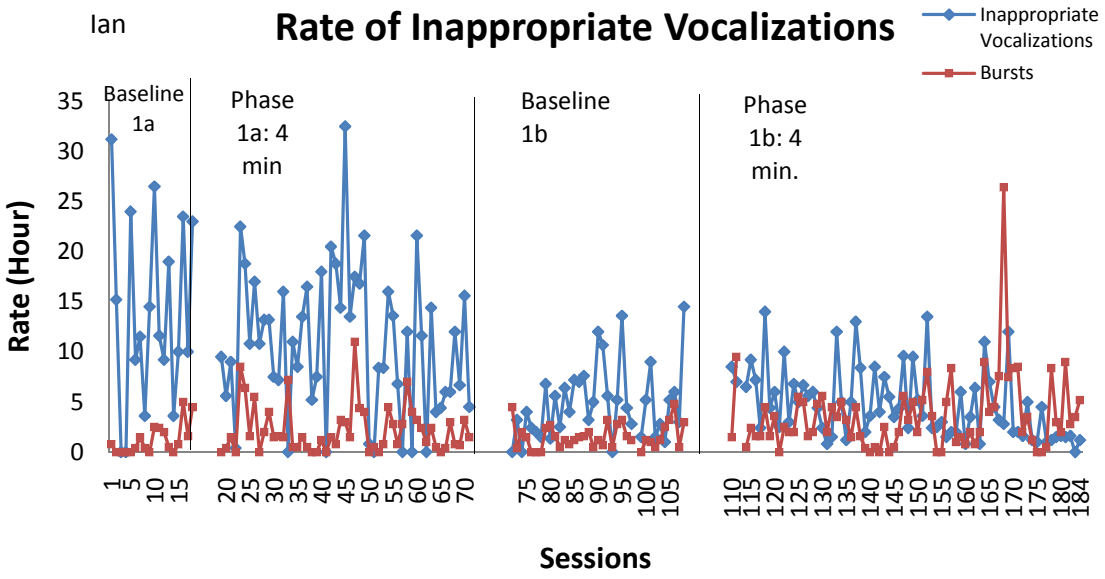

Ian
Rate of Inappropriate Vocalizations
Inappropriate Vocalizations
Bursts
Baseline 1a
Phase 1a: 4 min
Baseline 1b
Phase 1b: 4 min.
Rate (Hour)
Sessions

Figure 6

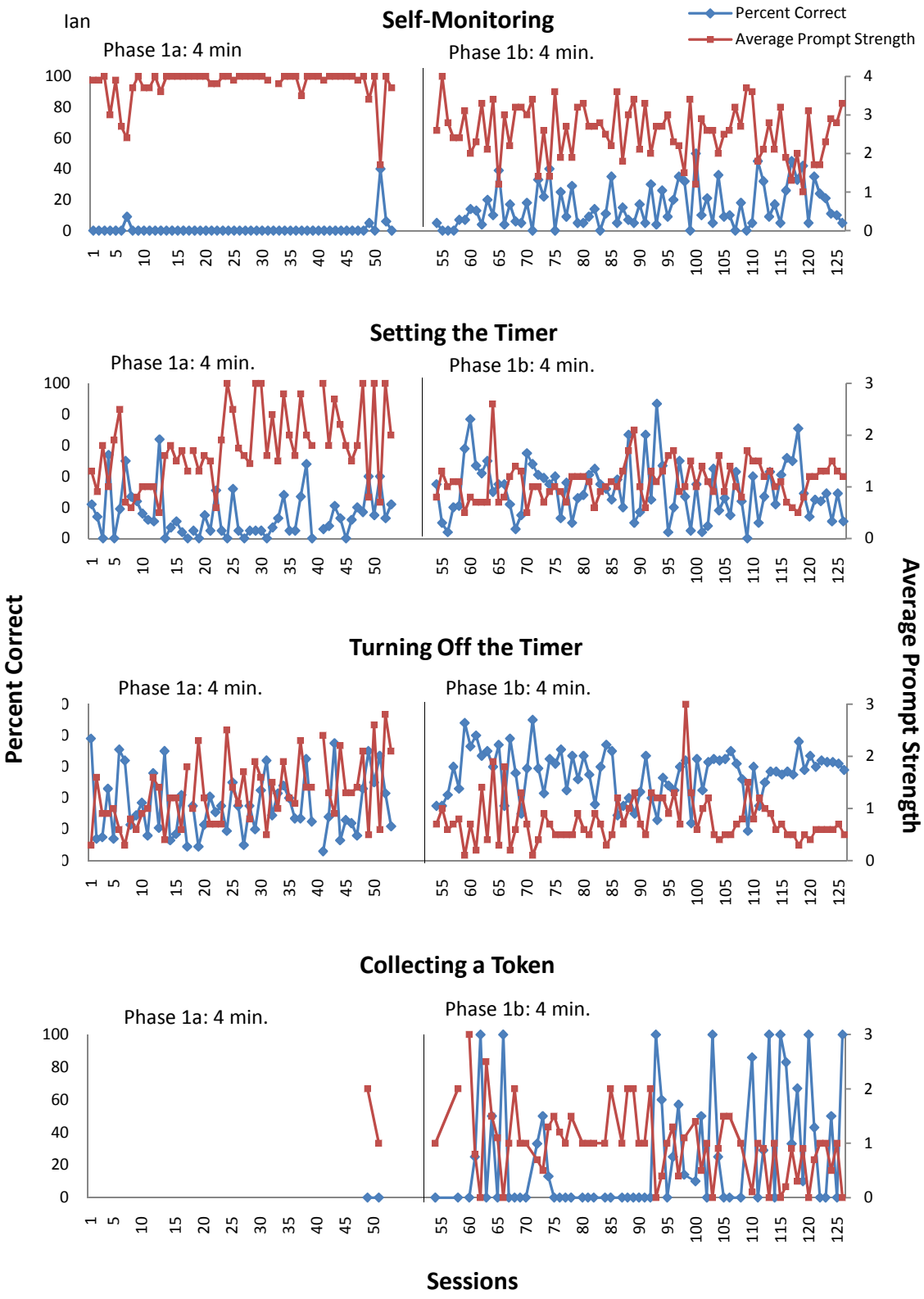

Ian
Self-Monitoring
Percent Correct
Average Prompt Strength
Phase 1a: 4 min
Phase 1b: 4 min.
Setting the Timer
Phase 1a: 4 min.
Phase 1b: 4 min.
Turning Off the Timer
Phase 1a: 4 min.
Phase 1b: 4 min.
Collecting a Token
Phase 1a: 4 min.
Phase 1b: 4 min.
Percent Correct
Average Prompt Strength
Sessions

Figure 7

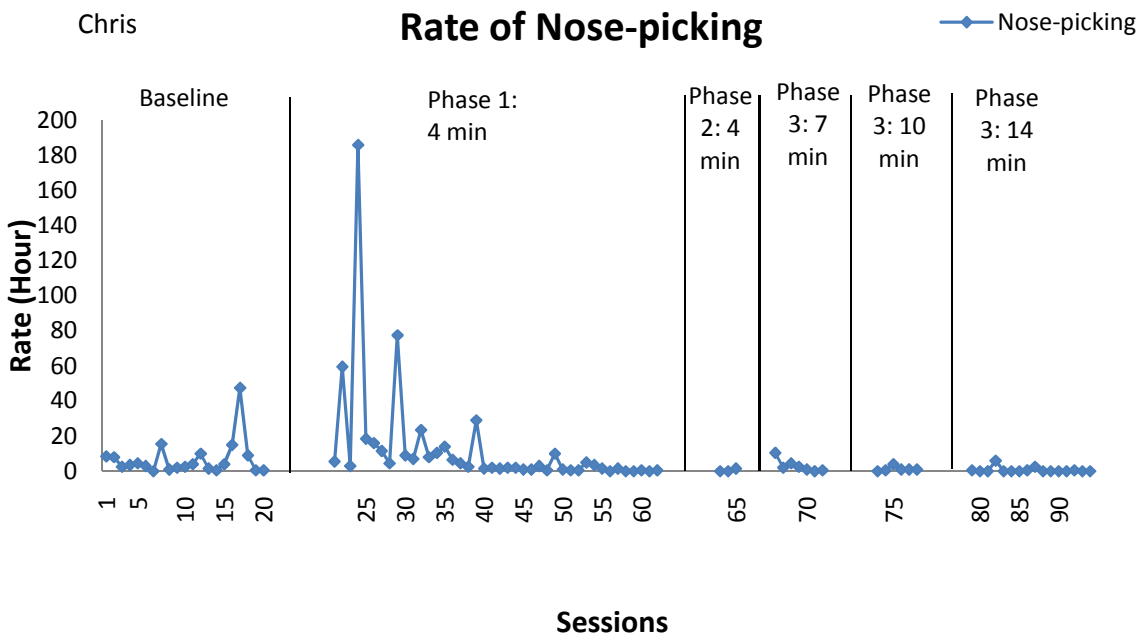
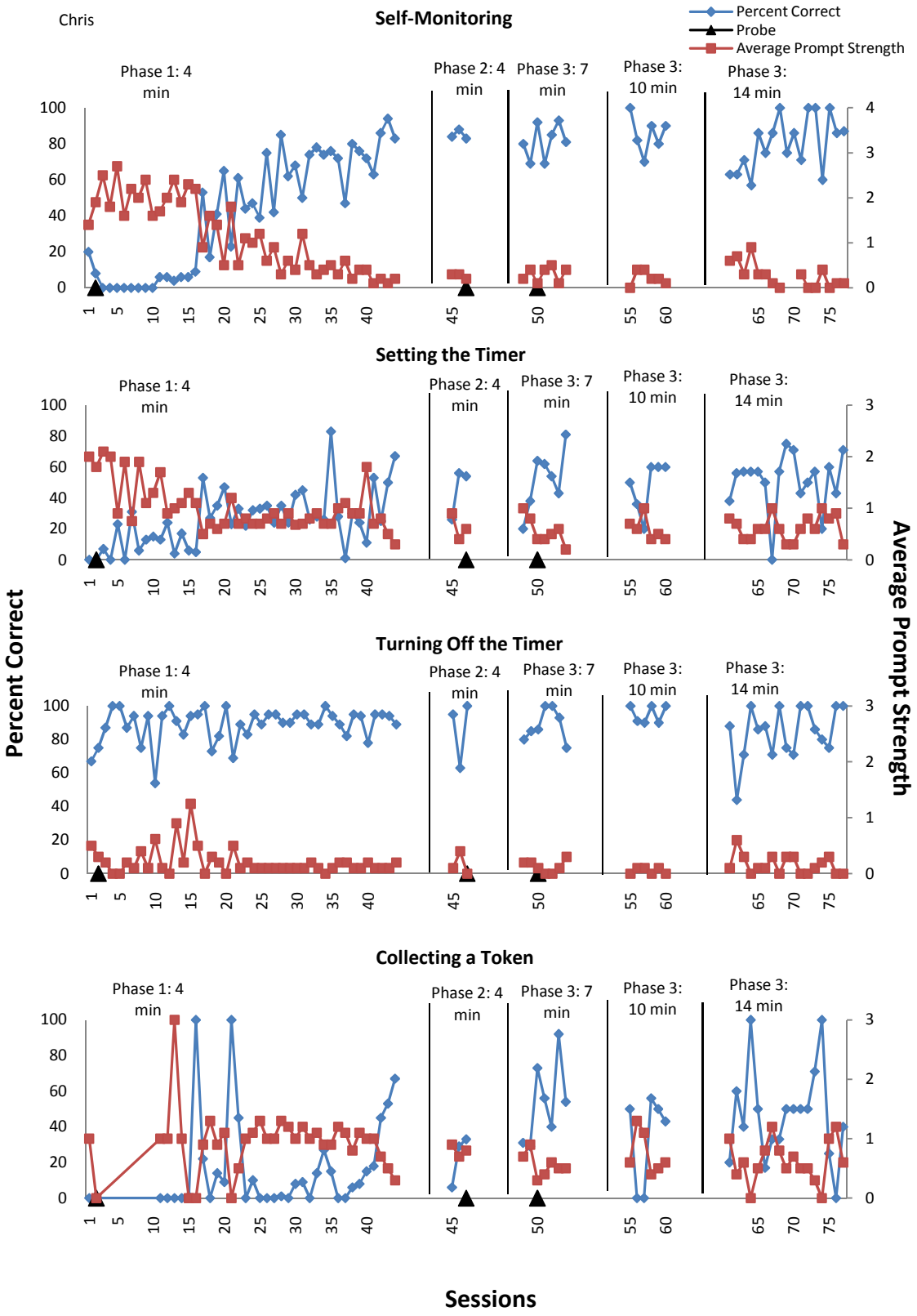

Chris
Rate of Nose-picking
Nose-picking
Baseline
Phase 1: 4 min
Phase 2: 4 min
Phase 3: 7 min
Phase 3: 10 min
Phase 3: 14 min
Rate (Hour)
200
180
160
140
120
100
80
60
40
20
0
1
5
10
15
20
25
30
35
40
45
50
55
60
65
70
75
80
85
90
Sessions

Figure 8


Chris
Self-Monitoring
Percent Correct
Probe
Average Prompt Strength
Phase 1: 4 min
Phase 2: 4 min
Phase 3: 7 min
Phase 3: 10 min
Phase 3: 14 min
Setting the Timer
Turning Off the Timer
Collecting a Token
Percent Correct
Average Prompt Strength
Sessions

Appendix

Chris' hourly rate of nose-picking at school.