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Assessing and treating problem behavior reported to be evoked by noise

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Assessing and Treating Problem Behavior Reported to be Evoked by Noise

A Thesis Presented

by

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Submitted in partial fulfillment of the requirements for the degree of Master of Science in
Applied Behavior Analysis in the Bouve College of Health Science Graduate School of
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Abstract

There is limited empirical research on the assessment and treatment of problem behavior reported to be evoked by loud noise. In the current study we examined a method for assessing and treating problem behavior reported to be occurring in loud environments. results of an indirect assessment in the form of a survey to a direct assessment of problem behavior and noise in vivo, a formal noise analysis, and a functional analysis. A treatment evaluation based on the outcome of the assessments was then created. Three participants were referred to the study because aggressive or self-injurious behavior was hypothesized to occur in the presence of specific noises. Despite caregiver reports of problem behavior occurring in the context of specific noises, results of the formal analyses did not not show a correlation between loud noise and problem behavior.

Keywords: Noise sensitivity, Functional Analysis, Autism

Assessing and Treating Problem Behavior Reported to be Evoked by Noise

There is limited empirical research on the correlation between problem behavior and auditory stimulation. According to a study conducted by Rimland and Edelson (1995), 40% percent of individuals diagnosed with an autism spectrum disorder show some evidence of auditory hypersensitivity. In general, individuals are identified as having auditory hypersensitivity because of informal caregiver reports (Rimland & Edelson). To date, there have been few studies that suggest methods for assessing and treating problem behavior reported to be evoked by noise.

Iwata, Dorsey, Slifer, Bauman, & Richman (1994), experimenters assessed the maintaining variables of 152 cases of individuals who exhibited self-injury, and negative reinforcement was the most commonly observed maintaining variable. Although relatively standard functional analysis demand conditions were effective in detecting these cases of negatively reinforced problem behavior, there is growing evidence that not all putative negative reinforcers are equal (Roscoe, Rooker, Pence, & Longworth, 2009) and there may be negative reinforcers operating in participant's natural environment that aren't included in typical functional analysis demand conditions (for example: McCoord, Iwata, Galensky, Ellingson, Thomson, 2001). What is aversive varies at the level of the individual, something may be aversive to one person and not to the next. Because of this, it is important to identify environmental events that do function as establishing operations to evoke the target behavior for assessment and treatment to be most effective.

Identifying these environmental events before conducting functional analyses to identify the maintaining variable of problem behavior is important for many reasons. It can reduce the need for additional assessments if the first one yielded undifferentiated results, also, if

no responding occurred in an initial analysis this could have been due to the manipulation of irrelevant motivating operations in the demand condition.

Zarcone et al. (1994), Zarcone, Crosland, Fisher, Worsdell, and Herman (1999), and Roscoe, Rooker, Pence, & Longworth (2009) used similar methods to identify aversive stimuli prior to conducting subsequent assessments. These preliminary assessments have been given the name demand assessment. First, potential aversive stimuli are identified through an indirect assessment.. These stimuli (generally task related) are presented continuously to the participant, one at a time, in a multielement design. Prompting procedures are implemented if the participant doesn't comply, and compliance with the demand is verbally praised. Contingent on the occurrence of problem behavior the aversive stimulus is terminated for 30 s. The frequency of problem behavior across stimuli is compared to identify which stimuli to include in subsequent assessments and treatment of the individuals problem behavior. Zarcone et al. identified tasks, which were identified as high-probability, in that compliance was likely to occur. Zarcone and colleagues then presented these tasks before presenting a lower probability task to increase the likelihood of compliance occurring. This method in conjunction with extinction was an effective treatment for two individual's self-injurious behavior. In another study (Zarcone et al, 1999), a brief negative reinforcer assessment was conducted prior to designing a treatment for behavior that was reported to be escape maintained. Roscoe and colleagues in 2009 then built upon this previous research in creating a methodology to assess stimuli that will evoke a response in the demand condition of a functional analysis. Initially, in the demand assessment, the experimenters used tasks similar to those in each participant's individualized education plan (for example: sight-

word reading, silverware sorting, or folding clothes) were presented continuously in a 5-minute session. Using a prompt hierarchy the participant was required to complete the task, and contingent on an occurrence of the target behavior the task was terminated for 30-seconds. Results of the demand assessment informed the use of a low-p and high-p task conditions in a functional analysis. Roscoe et al. found that the pre-assessment identified stimuli that were correlated with high levels of compliance and low levels of problem behavior, and stimuli correlated with low levels of compliance and high levels of problem behavior. The use of these stimuli in the functional analysis led to clear outcomes for all participants.

Auditory Hypersensitivity Research

Only three articles published in the Journal of Applied Behavior Analysis assessed problem behavior related to auditory stimulation. McCord et al. (2001) developed a systematic method for evaluating the potentially aversive properties of noise and for evaluating treatment procedures that could reduce problem behavior evoked by noise in 7 adults with developmental disabilities. McCord et al. initially conducted an assessment of different noise to identify those that acted as establishing operations for problem behavior. All noises were identified through an indirect assessment completed by direct care staff. Sounds were assessed at 65dB, a decibel level slightly above normal conversation level (normal conversation occurs at approximately 40-60dB). Sounds were assessed somewhat louder than normal because the participants lived in a residential setting with multiple other consumers and the noise level of the residence was relatively high. If no responding occurred at the current volume, it was increased by 5dB until responding did occur. Upon instances of the target behavior the sound was terminated for

30s. Then, the results of the noise assessment were used to inform the noise condition of a functional analysis. Attention, no interaction, and play conditions were tested, and in the noise in which the highest levels of responding occurred in the noise assessment was presented and contingent on responding the noise was terminated for 30s. Finally, a treatment evaluation was conducted based on the results of the participant's functional analyses. Treatment involved stimulus fading by increasing decibel levels of noise, combined with a differential reinforcement of other behavior contingency for one of the participants. Results of this study showed that this methodology was an effective way to identify and treat problem behavior that is evoked by noise.

Buckley and Newchok (2006) identified specific stimuli associated with music that served as establishing operations for problem behavior and used negative reinforcement to reduce problem behavior evoked by music in a 7-year-old diagnosed with pervasive developmental disorder. The participant covered his ears and screamed whenever music played. Experimenters conducted an auditory stimulus assessment where four different genres of were played at 67 decibels (dB) on either a compact disc or a tape. The music was played continuously in a treatment room where the participant had free access to preferred play materials. The music was terminated contingent on the occurrence of problem behavior. The taped music showed the highest percentage of intervals with disruption, and was then used exclusively during the differential negative reinforcement of other behavior (DNRO) treatment condition. Experimenters increased tolerance to noise by reinforcing appropriate behavior during sessions, and increased the time, which the tape was left on for reinforcement to occur. This study identified that

establishing operations for problem behavior can be highly idiosyncratic, and that potential establishing operations need to be identified prior to designing treatment.

More research is needed to identify the establishing operations influencing behavior reported to be evoked by noise. To date there is extensive research on how to assess and identify problem behavior maintained by negative reinforcement, and to effectively manipulate establishing operations to find differential outcomes in analyses to better identify the reinforcer maintaining problem behavior. With the high percentage of individuals with autism reported to have evidence auditory hypersensitivity, a need for a systematic method to assess this problem is relevant, and a better understanding of the influences of noise on problem behavior is necessary. The purpose of the current investigation is to evaluate an assessment method to aid in identifying an effective treatment for problem behavior reported to be evoked by noise. A five-step analysis was developed to assess noise and the effects on problem behavior with individuals who have caregiver report of this being a common problem. The first phase involved conducting an indirect assessment with direct care staff, to identify possible auditory stimuli that may evoke problem behavior. Next, we compared the results of this assessment with direct assessment taken in vivo, and an experimental functional analysis with a noise condition. Once these assessments were complete a treatment analysis of the behavior was conducted based on the individual participants needs.

Method

Participants and Setting

Participants were 3 individuals diagnosed with an autism spectrum disorder who were attended a residential school specializing in applied behavior analysis. Participants

were referred to the study based on anecdotal evidence reported by the clinical staff of a correlation between problem behavior and specific noises.

Josie was an 18-year-old female; she currently had no treatment or assessment in place for her suspected noise sensitivity, other than wearing a pair of noise canceling headphones which seemed ineffective as to her problem behavior continued to occur at high frequency. Josie's target behavior was aggression, defined as any attempted punch, hit, grab, or kick to any part of the therapist's body. Evan was a 21-year-old male who exhibited aggression, and head-directed self-injurious behavior. Evan left the treatment center while the assessment was being conducted, resulting in a limited data set. Max was a 17-year-old male whose target behavior was self-injury, defined as any instance of his hand or elbow making contact with any other body part or wall from more than 10 cm away. Neither Evan nor Max had a treatment in place to address problem behavior evoked by noise. For all participants session, termination criteria were established for the safety of both the participant and the therapist. For Josie, sessions were terminated upon any instance of an actual bite, or non-redirectable head-directed aggression, or any time the therapist felt it was unsafe to continue. For both Max and Evan, sessions were terminated if a participant emitted 10 head hits, had visible tissue damage, or if the therapist felt it was unsafe to continue.

For both Max and Evan sessions were conducted in a treatment room (1.5m by 3m), containing a small table, two chairs, and session-specific materials. For Josie sessions were conducted initially in the same treatment room as Evan and Max, but at Session 15, they were moved to a classroom within the school due to the fact that responding began to occur prior to going into the treatment room. .

Indirect Assessment

An indirect assessment in the form of an open-ended e-mail was sent to all staff (10-15 people per participant) that worked with each participant for an average of 40 hours a week. All respondents were bachelor-level teachers, and some staff were also working towards a masters degree in either severe special needs or behavior analysis. All staff had worked with the participant for at least one month. The e-mail stated: *Please identify up to five antecedents to X's problem behavior. Keep in mind antecedents are environmental events, and please be as specific as possible.* Once responses were received they were then categorized into possible conditions that could be formally assessed in a functional analysis (e.g., demands, denied access, noise). Specific noises mentioned in the indirect assessment were used as the stimuli in the noise analysis.

Direct Assessment

Following inclusion determined by the indirect assessment a direct assessment was conducted to identify probabilities of problem behavior given a loud noise for both Max and Josie. A descriptive assessment in which data were collected on noise and problem behavior at residence and school in-vivo from 8am to 8pm. Data were collected for 10 weeks for Josie, and for 8 weeks for Max. The direct care staff that worked with the participant throughout the day collected data. Staff were trained on the data collection system (lead experimenter explained the rationale, definitions, and partial interval recording), and asked to collect it each hour and also to ask another teacher in the same room to collect interobserver agreement. Partial interval recording was used, and the hour was broken down into 10-min intervals. During each interval, staff indicated whether the environment was loud or quiet, and if problem behavior occurred. Data were collected on

multiple target responses to see if any other behavior should be assessed in a formal analysis. A loud environment was defined as any environment where more than just the participant and their current teacher was working in and the other people present were talking, or environmental noises were occurring (timers beeping, doors slamming, etc.) and a quiet environment was defined as any environment where just the participant and their teacher were making noise (talking, running academic programs). Results were analyzed to generate an unconditional probability of problem behavior or the probability of behavior occurring in a randomly selected 10-min interval and the conditional probability, the probability of behavior occurring in any 10-min interval following a loud noise. Interobserver agreement (IOA) data were collected in vivo by another teacher in the same environment as the teacher taking primary data and was collected for 42% of 10-min intervals; IOA was 88.6%.

Noise Analysis

The most common noises identified in the indirect assessment were formally assessed in the noise analysis. All sessions were 10-min in duration and a multi-element design was used. A latency was used due to the severity of the participants' problem behavior (Call, Pabico, & Lomas, 2009). During each session a noise was presented continuously, and contingent on responding, the noise and the session were terminated. For Josie, responding was undifferentiated across conditions in the multielement phase of this analysis, so a reversal design was then implemented.

Noises that were used were all recorded instances of the noise, unless a live, not recorded version of the noise could be used. For Josie the trash can (trash can barrel open and shut every 5 s), whistling (continuous song), counting (1-20 repeated), and coughing

(cough every 5 s) were all presented in session. Radio static, timer (beeping for 10 s 5 s of silence), loud vocals of another peer, and tantrum (recording of a peer having a tantrum) were all recorded noises used. For Evan, music (same song every time), and loud vocals were both recorded; for Max, a fire alarm, door slamming, music, loud vocals, gym (background noise which occurs during the gym class) were all recorded. All noises that were recorded were done so by using a recorder that could be uploaded into music editing software so that all other noises could be edited out, and the target noise could be made into a ten-minute loop. Volume was controlled for in a session by playing the noise with the same speaker and playing device, both marked at the volume that it should be played at. For all participants the control condition was a no interaction condition where no noises were presented, but the therapist remained in the room.

For both Josie's and Evan's noise analysis, an independent observer was trained on how to score taped sessions and scored the sessions independently. IOA was collected for 46% of sessions of Josie's noise analysis, at 99.7% agreement, and 100% of sessions for Evan's noise analysis, at 100% agreement. Due to a staff member at the center leaving, and taking the tapes of the sessions of Max's noise analysis and functional analysis, no IOA data were collected.

Functional Analysis

A functional analysis based on procedures described by Iwata et al. (1984/1992) was conducted for Max and Josie. Sessions were 5 min in duration, and conditions were demand, attention, play (control), no interaction, and noise (Max only). For Max, the noises that reliably produced the shortest latency to responding in the noise analysis were assessed. In the noise condition, the antecedent was the noise presented, and contingent

on responding the noise was terminated for 30s. In the demand condition, demands in the form of motor directives (touch your nose, touch table, clap hands) were presented for Josie, and simple work tasks (time telling) were used for Max. Contingent on responding, demands were terminated for 30 s, and then represented. If the participant did not respond to a demand within 3 s, a least-to-most prompting procedure was used (tap at upper arm, forearm, hand-over-hand), for compliance verbal praise was provided. In the attention condition, the therapist told the participant he or she had some work to do and withheld attention. Attention was provided contingent upon the target behavior, occurring in the form of statements of concern (don't do that, ouch, you'll hurt yourself). The play condition served as the control and moderately preferred toys and activities were provided for the participant to engage in (beads, coloring materials). Any occurrence of the target behavior was ignored or redirected and praise was provided for appropriate engagement. The no interaction condition was identical to the no interaction condition of the noise analysis. A latency measure was used in the noise analysis at the request of participant's clinical staff to keep the rate of problem behavior low, however, clinical staff then assented to 10-min sessions and response frequency data for the functional analysis.

Treatment Evaluation

A treatment evaluation was only conducted for Josie, due to the other participants being terminated from the study due to unrelated reasons. Since the functional analysis indicated that Josie's problem behavior was maintained by escape from demands a treatment was implemented using escape extinction and training an alternate escape response, touching a card that said "break" and/or saying "I want to take a break." During

the differential reinforcement of alternate behavior condition (DRA), the same demands used in the demand condition of the functional analysis were delivered, and served as the control for this evaluation. Initially, after every demand, the therapist prompted the break response and, after each session, the amount of prompted breaks was decreased allowing for more opportunities for independent responding to occur. The break response was only prompted in the first session of the analysis, after this session the break response reliably occurred independently. Every time the break response was emitted a 30-s break from demands was granted and all independent break responses were honored, breaks were granted by the therapist saying “nice job asking for a break” while taking a step back and removing presentation of demands for 30 s. In the DRA condition, if aggression occurred the therapist redirected the participant to a chair and prompted the break response. In the demand condition, identical demands as those presented in the functional analysis were used, this condition served as the control. If aggression occurred in this condition then a 30-s break from demands followed. All sessions were 10 min in duration, and a frequency measure of responding was used. . An independent observer was trained on how to score the data, and scored interobserver agreement for both DRA and demand sessions. Interobserver agreement was collected for 80% of DRA sessions and 83% of demand sessions. Mean agreement was 89% (range for demand, 66.6%-100% agreement; range for DRA, 83.3% to 93.7%) for both demand and DRA conditions.

Results

Figure 1 depicts the results for the indirect assessment for all three participants. For Josie’s survey 60% identified noise to be the most common antecedent to problem behavior, 40% identified denied access to preferred items, and these were the only two

antecedents identified by staff. In response to the indirect assessment sent out inquiring about Max's problem behavior, staff identified 90% noise, 10% denied access to preferred items, and 4% presentation of demands as possible antecedents to instances of Max's problem behavior. For Evan's problem behavior 74% of staff identified noise, 24% identified denied access to preferred activities, and 2% identified presentation of demands.

The results for Josie's auditory stimulus assessment are depicted in the top panel Figure 2. Across the x-axis are sessions, and latency to responding in seconds is on the y-axis. Data points that are lower indicate a shorter latency, so if a particular noise had a differential effect on problem behavior, we may see that data point to be lower than that of the control. In this case, the closed square indicates the no interaction condition that served as the control in this analysis. All other data paths are test conditions. Initially in a multi-element phase, several conditions were associated with lower latencies to respond than in others. Responding became undifferentiated across conditions, so a series of reversals were conducted, and although there was some responding initially in several conditions, eventually she stopped responding in all conditions. Results from Max's noise analysis are shown in middle panel of Figure 2, no responding was observed in the no interaction phase, and responding was observed in the fire alarm condition indicated by the closed square, loud vocals indicated by the open circles, and door slamming condition indicated by the closed triangle. These results show that Max's problem behavior could be evoked by some loud noises. The bottom panel of Figure 2 shows the results for Evan's noise analysis, no responding occurred in any session of this analysis.

The results of the data collected in the direct assessment are depicted in Figure 3. For Josie (top panel) the unconditional probability of aggression was .05, and the probability of aggression given a loud environment was .04 thus very similar to the unconditional probability. Similar results were found for the direct assessment conducted for Max, the unconditional probability of self-injury was .05, and the probability of self-injury given a loud environment was .04. These results suggest that noise did not increase the probability of behavior occurring in the natural environment, despite caregiver report.

The results of Josie's functional analysis are depicted in the top panel of Figure 4 attention, demand, and play conditions were tested and responding was differentially higher in the demand condition, suggesting that her problem behavior was maintained by escape from demands. The bottom panel of Figure 4 shows the results of Max's functional analysis; elevated responding was observed in both of the contingent noise conditions, attention condition, and the no interaction. Due to the undifferentiated results of the functional analysis the clinical team decided it was in the participants best interest to terminate the evaluation.

Figure 5 shows the results for the treatment evaluation, the closed diamonds indicate the independent break responses throughout DRA sessions, and the closed triangle indicates instances of problem behavior during the DRA condition. Independent responding increases throughout sessions, and aggression never occurs in the DRA condition. During the demand condition, the break response was never emitted and aggression was observed in 3 of the sessions. Results from the treatment evaluation suggest that escape extinction, and training an alternate break response was an effective treatment for Josie's aggressive behavior

Discussion

In conclusion for all three participants results of the indirect assessment suggest noise as a possible establishing operation for problem behavior. However for the one participant for whom direct observation was completed noise was not identified as an establishing operation and for two of the three participants for whom the noise analysis was completed noise was also not shown to be an establishing operation for their problem behavior. Even though we were unable to find a relation between loud noise and Josie's problem behavior in the descriptive assessment and noise analysis, we were able to conduct an analog functional analysis and found a maintaining variable for Josie's aggressive behavior, which provided information to create an effective treatment. This suggests the utility of the analog functional analysis with standard conditions, even if caregivers do not identify antecedents in these conditions as possible controlling variables.

Although we were able to identify a maintaining variable and create an effective treatment for one participant, we were unable to identify a consistent relation between loud noise and their problem behavior for the other two. More research should be done on the effects of environmental noise and problem behavior, and if it's the noise or something else in the environment effecting the behavior. It would also be helpful for future research to expand upon why clinical staff reports noise to be an antecedent to problem behavior when it may not actually act as an establishing operation in formal analysis.

Methods have been assessed to treat problem behavior occurring in the context of loud noise. But a clinician may not know when it is necessary to assess noise as a

potential establishing operation. Our data suggest that caregiver report is not necessarily a reliable indicator of cases in which noise may be evoking problem behavior and further analysis may be necessary. It would be useful for future research to evaluate the prevalence of reports and the number of cases that actually have problem behavior maintained by escape from loud noise.

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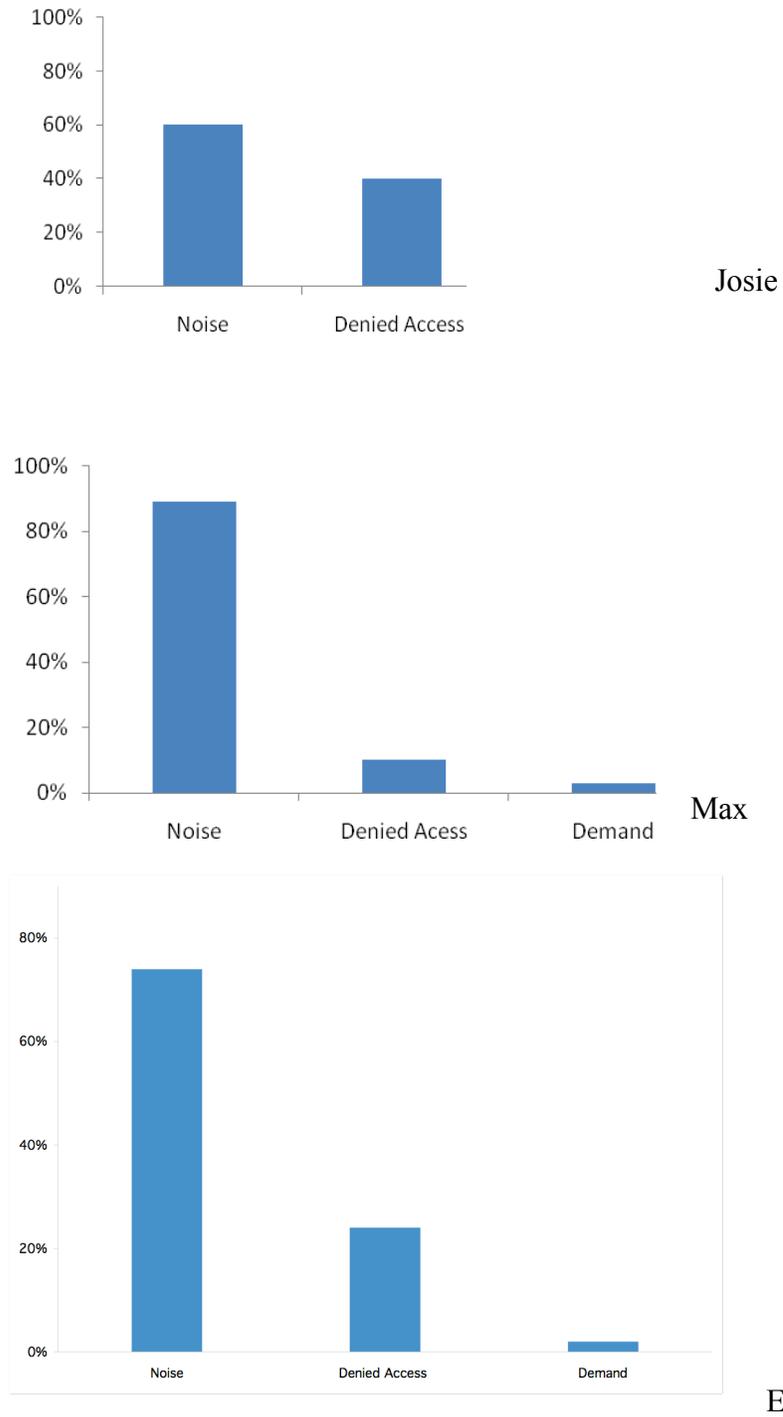


Figure 1. Antecedent identified is on the x-axis, and percentage of respondents is on the y-axis, for Josie (top panel), Max (middle panel), and Evan (bottom panel)

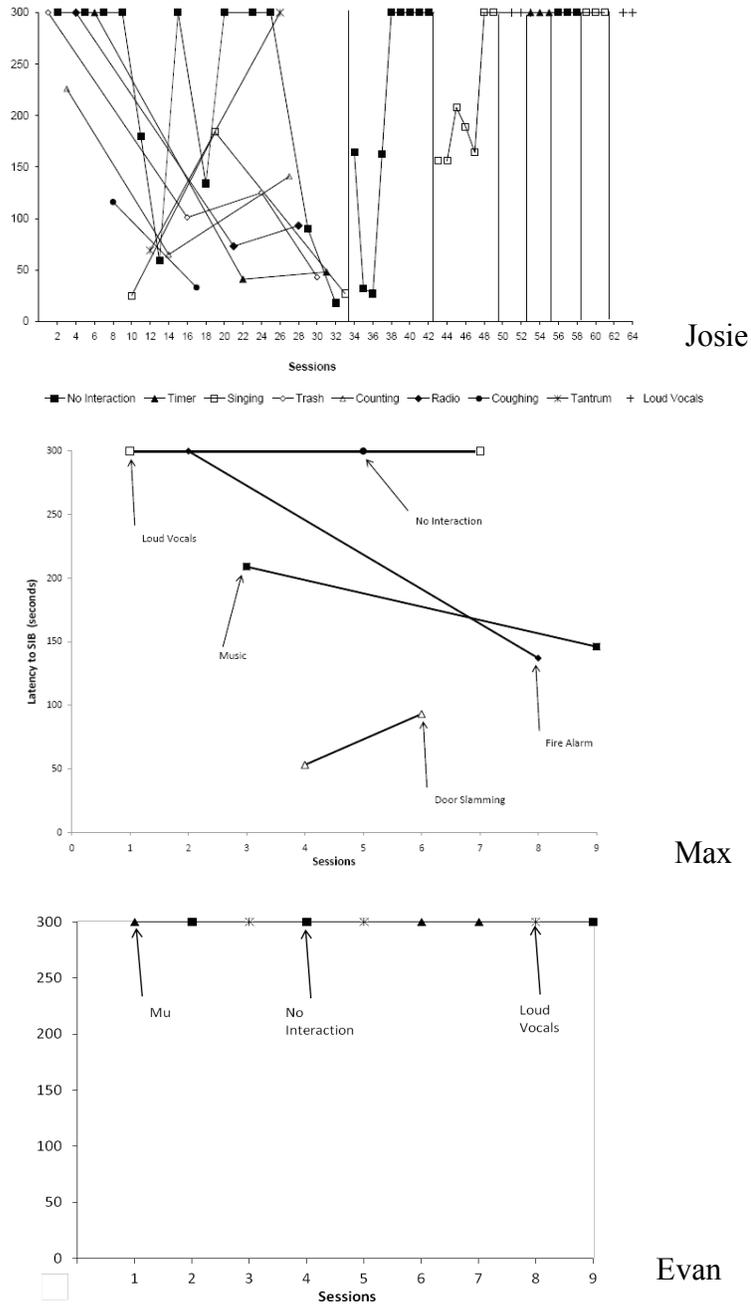


Figure 2. Results for the noise analysis conducted for Josie’s aggressive behavior (top panel), Max’s self-injury (middle panel), and Evans self-injury (bottom panel). Session number is on the x-axis, and latency to responding in seconds is along the y-axis.

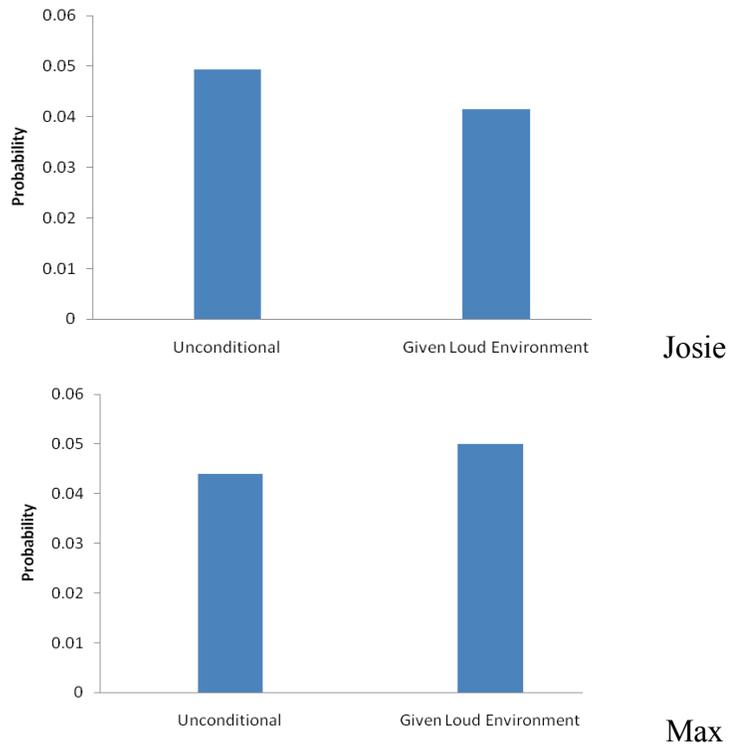
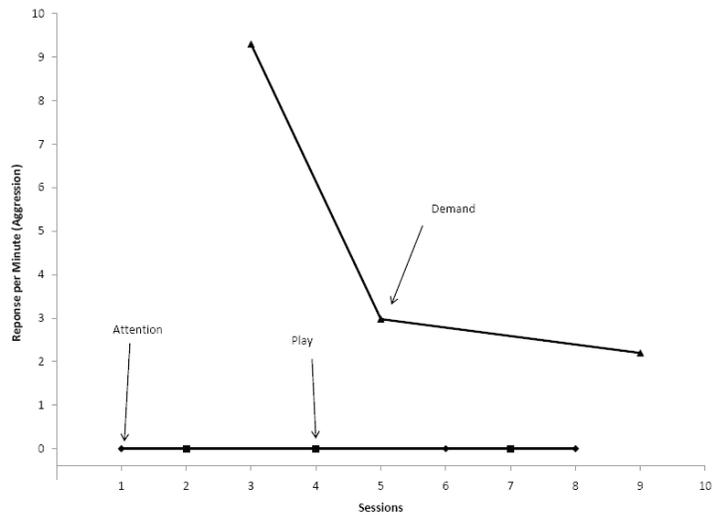
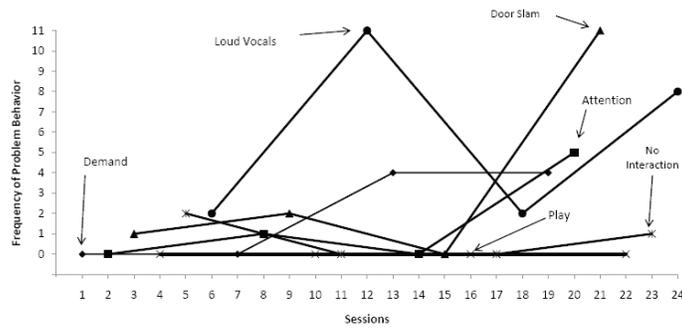


Figure 3. Direct assessment results collected for Josie’s aggressive behavior (top panel), and Max’s self-injury (bottom panel).

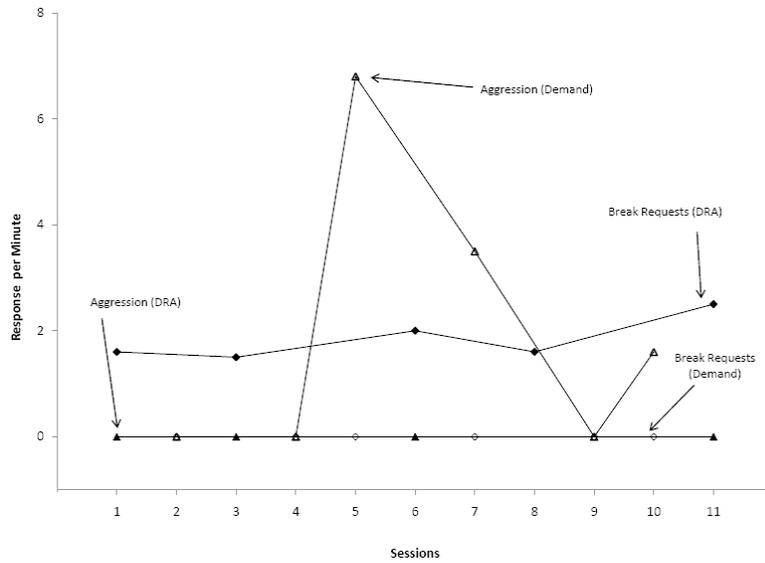


Josie



Max

Figure 4. The functional analysis conducted for Josie’s aggressive behavior (top panel), and Max (bottom panel). Sessions are along the x-axis and response per minute (Josie), and frequency of responding (Max) is along the y-axis.



Josie

Figure 5. Treatment evaluation results for Josie’s aggressive behavior. The demand condition (open and closed triangles) served as the control, and the DRA condition is indicated by the diamonds.