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# EXPLORING THE UTILITY OF FUNCTIONAL ANALYSIS METHODOLOGY TO ASSESS AND TREAT PROBLEMATIC VERBAL BEHAVIOR IN PERSONS WITH ACQUIRED BRAIN INJURY

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Functional analyses were conducted on four adults with acquired brain injuries who regularly displayed instances of inappropriate verbal behavior including depressive, aggressive, suicidal, profane, and sexually inappropriate utterances. After the functional analysis yielded a maintaining variable for each participant, a function-based intervention consisting of differential reinforcement of alternative verbal behavior was implemented. Results of the behavioral interventions show that instances of vocal behavior can be assessed and subsequently treated using the functional analysis methodology often reserved for nonverbal forms of behavior. The utility of functional analysis for assessing complex human behavior is discussed. Copyright © 2004 John Wiley & Sons, Ltd.

## **INTRODUCTION**

Every 21 seconds another person in our society sustains a brain injury. As a result, approximately 5.3 million people or 2% of the United States population currently live with this debilitating condition (Brain Injury Association of America, 2002). Many changes occur in the lives of persons incurring a brain injury including the loss of independence, disruption of a previously existing family structure, and confronting new psychological and physical disabilities (McGuire & Sylvester, 1990). One means of identifying a person's tragic confrontation with such life changes is via the alteration of their previously intact verbal repertoire. The verbal behavior of persons with brain injury often appears disjointed, reduced in frequency, lacking in relevant topography, and explosive in emotion (Callon & Jackson, 1995).

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Skinner (1957) defined verbal behavior as behavior reinforced via the mediation of another person. Using this definition as a foundation, he went on to say that specific consequences provided by a listener (e.g. interverbal responses) should shape the verbal behavior of the speaker (Skinner, 1957). Take, for example, a client with brain injury who emits an utterance such as 'I hate my life'. This utterance is then followed by attention from a listener (i.e. a caregiver) in the form of a vocal response such as 'Why? What is wrong?' This 'depressive' verbal behavior of the person with brain injury may actually increase in frequency if it is emitted to gain caregiver attention. Yet on the other hand, a caregiver who simply ignores the vocalization may be doing more harm than good. It is quite plausible that frequency may increase as well as intensity. In the case with vocalizations containing topographies suggesting personal harm, a change in intensity could result in a life-threatening situation (i.e. an actual suicide attempt). Therefore, simply ignoring inappropriate vocalizations is not possible. On the other hand, if caregivers could program consequences to promote a functional change, positive results could develop. Instead of simply ignoring comments such as 'I hate my life', caregivers might provide differential reinforcement for alternative responses that do not center around thoughts of depression. For example, a caregiver might provide attention following a more appropriate vocalization such as 'It is hot in here' with comments like 'I agree. Boy we could sure use some cool weather'.

Recent advances in the area of functional analysis and intervention of verbal behavior with other clinical populations may hold promise for caregivers providing treatment for persons with brain injury. For example, Wilder, Masuda, O'Connor, and Baham (2001) recently incorporated the functional analysis technology reported by Iwata, Dorsey, Slifer, Bauman, and Richman (1982/1994) whereby an adult male with schizophrenia was exposed to brief assessment conditions in which inappropriate vocalizations, termed bizarre, were met with different consequences. During attention conditions the participant was provided with verbal attention by a caregiver upon emission of the target behavior, during demand conditions bizarre vocalizations resulted in the removal of performance tasks, during alone conditions the participant remained alone in a quiet room, and during control conditions the participant received verbal responses with eye contact from the caregiver to appropriate vocalizations and withdrew attention contingent on bizarre vocalizations. Following assessment, bizarre vocalizations were reduced dramatically with a differential reinforcement procedure for more logical vocalizations. Dixon, Benedict, and Larson (2001) reported similar results from a case study involving an adult male with a dual diagnosis of mental retardation and a psychiatric disorder, as well as Rehfeldt and Chambers (2003) involving an adult male with autism. A number of other studies have shown inappropriate, bizarre, or illogical verbal behavior successfully reduced by providing reinforcement for more appropriate vocalizations

(e.g. Durand & Crimmins, 1987; Mace & Lalli, 1991; Mace, Webb, Sharkey, Mattson, & Rosen, 1988), noncontingent reinforcement (Buchanan & Fisher, 2002), or competing response training and attention extinction (Wilder, White, & Yu, 2003). Interestingly, in all of these studies, inappropriate verbal behavior was maintained by attention from a caregiver. The only exceptions of participants' verbal behavior not being solely under the control of attention that have been published in the literature were one elderly participant in the Buchanan and Fisher (2002) research, whose behavior appeared to be controlled by both attention and sensory stimulation, and one participant with brain injury investigated by Pace, Ivancic, and Jefferson (1994), whose behavior displayed by clinical populations often serves non-attention-based functions, and whether these functions can be detected via the functional analysis technology of Iwata et al. (1982/1994).

Regardless of the potential multiplicity of function, these procedures suggest that it is often the case that unusual or bizarre verbal utterances emitted by persons with disabilities are simply under environmental control instead of indicators of underlying psychosis. Using Skinner's (1957) conceptualization of verbal behavior, along with the technology of the functional analysis approach of Iwata et al. (1982/1994), perhaps it is possible to alter inappropriate verbalizations often found in the newly acquired repertoire of persons with brain injury. The reduction of this problematic behavior would not only shed additional empirical light on Skinner's theoretical conceptualization and potentially detect maintaining functions other than attention; it would also possibly aid in the rehabilitation attempts for this clinical population. Therefore, the purpose of the present study was to conduct a functional analysis and functional intervention consisting of differential reinforcement of alternative vocalizations (DRA) for four participants with acquired brain injury. All participants were exposed to standard functional analysis conditions in a multielement fashion followed by a reversal design consisting of DRA treatment conditions and baseline conditions.

## METHOD

#### Participants, Setting, and Target Behaviors

Tommy was a 21-year-old male who had suffered injury as the result of a six-story fall through a tube at a construction site. He suffered an acquired brain injury as well as extensive orthopedic injuries and also received bilateral pneumothoraces that required emergency cricothyroidotomy, an open pelvic fracture, right scapular fracture, and an open right tibia/fibula fracture. Tommy took Zyprexa 10 mg, Aricept

10 mg, Depakote 1000 mg, Effexor 150 mg, and Adderal 20 mg daily throughout the study. His target behavior was defined as negative self-statements consisting of utterances related to physical pain that he was experiencing or the negative aspects of his life after his injury. Many comments were about attempting suicide. Examples of these utterances included comments such as 'I just want to die', 'I hate my life', and 'The pain is too unbearable'.

*Matt* was a 20-year-old male who had suffered an acquired brain injury as the result of a motorcycle accident. He suffered diffuse axonal shears and a subarachnoid hemorrhage on the right side of his cerebrum. He also had several fractures, a tracheostomy and a subsequent g-tube placement. Matt took Elavil 10 mg, Inderal 80 mg, Tegretol 400 mg, and Zoloft 50 mg throughout the study. His target behavior was defined as vocally aggressive behaviors towards staff including the extensive use of profanity and demanding that he be left alone. Examples of these utterances included comments such as 'Leave me alone you \*\*\*\*\*\*' and 'Get the \*\*\*\* away from me you \*\*\*\*\*\*'.

*Chaz* was a 48-year-old male who had sustained multiple brain injuries when he was involved in two separate motor vehicle accidents. He suffered numerous lacerations, facial fractures and extensive damage to most of his brain. Chaz took Klonopin 2 mg, Depakote 750 mg, and Zyprexa 10 mg throughout the duration of the study. His target behavior was defined as vocalizations towards staff that were sexually inappropriate and at times sexually aggressive. Examples of these utterances included comments such as 'I really like your \*\*\*\*' and 'If I catch you alone I am going to \*\*\*\* you'.

*Eddie* was a 61-year-old male who had suffered a traumatic brain injury as the result of an automobile accident. He suffered extensive damage to most of his brain. Eddie was not on any medication throughout the duration of the study. His target behavior was defined as verbal outbursts consisting of negative self-statements, profanity, and threats towards staff. Informal staff reports noted that this behavior often occurred during Eddie's daily physical therapy sessions. Examples of these utterances included comments such as '\*\*\*\* you' and 'I hate this \*\*\*\*\*\* place'.

All sessions took place in one of a series of small rooms at the participants' residence, which was an inpatient center for persons with severe brain injury. All sessions were conducted in a room absent of any other clients or staff besides the experimenter and the occasional second observer for reliability purposes. Experimenters recorded an instance of an emitted target behavior following the vocal emission of a member of each participant's vocal response class with no more than a 2 s pause between words. For example if Eddie emitted an utterance such as 'I hate you. I hate this place' without a 2 s pause between sentences, this would be recorded as one instance of the target behavior. However, if Eddie paused between sentences for longer than 2 s, this would be recorded as two instances of emission of

his target behavior. An identical procedure for obtaining the frequency of a participant's verbal behavior was noted by Dixon et al. (2001).

Interobserver agreement was collected during at least 25% of all sessions for each participant. Interobserver agreement was calculated by dividing the smaller number of verbal utterances by the larger number of utterances and multiplying this ratio by 100%. Mean agreement was 92.5% (range 88–100).

## **Functional Analysis**

Four conditions (attention, demand, alone, and control) of 10 minutes in length were alternated within each participant in a multielement design. Attention conditions consisted of the experimenter responding to an inappropriate verbal utterance with 2-3s of attention in the form of verbal comments reprimanding the participant (e.g. 'That was an inappropriate thing to say. You know you should not say things like that'). The only exception to this occurred with Chaz. His problem behavior was so severe that agency policy dictated that all instances of his behavior be placed on extinction. As a result a modified attention-extinction condition occurred where the experimenter was visibly present in the room, yet provided no consequences upon an emission of the target behavior. Demand conditions consisted of the experimenter presenting the participant with basic academic tasks (Tommy and Chaz), prompts to talk about problems they had been encountering in their rehabilitation (Matt), or prompts to engage in a physical therapy task (Eddie). Each occurrence of a targeted verbal utterance resulted in the termination of the task, conversation, or prompt for 15 s. Alone conditions consisted of the participants being placed in the room alone and observed via a one-way mirror. In rooms where such a mirror was not present, the experimenter looked unobtrusively through a door opened 1 inch from the doorframe. Control conditions consisted of participants having free access to preferred activities (magazines, T.V., radio). The experimenter delivered noncontingent attention every 30 s and provided no consequences for inappropriate behavior. The only exception to this occurred with Tommy, who instead was exposed to a tangible condition where preferred items were given to him for 15 s contingent upon the emission of the target behavior.

#### Intervention

A differential reinforcement of alternative behavior (DRA) intervention was instated in a reversal design for each participant. During DRA conditions that attempted to alter a behavior maintained by attention, a 2–3 s verbal statement from the experimenter that was appropriate to the participant's comment or question followed each appropriate verbal utterance. For example, if a participant stated 'I would like to have pizza for lunch today', the experimenter would reply 'Yes, pizza

sounds like a good option' or 'Perhaps tomorrow, since today we already have mock chicken legs on the menu'. No attention from the experimenter was given upon the emission of an inappropriate verbal utterance.

During DRA conditions that attempted to alter a behavior maintained by escape from demands, as was the case with Eddie, the participant was instructed at the onset of the session 'If you need to take a break, please ask appropriately'. Afterwards, each appropriate verbal utterance was followed by a 30 s termination of prompts to engage in a physical therapy exercise. Inappropriate utterances were ineffective in terminating the exercise. In the case of Matt, the experimenter asked questions regarding difficulties that he was having in rehabilitation every 15 s and provided a 30 s termination of questioning following appropriate verbal utterances along with a 2–3 s verbal statement that was content relevant. For example, if the experimenter asked Matt 'Why did you punch John yesterday at lunch?' and Matt responded by saying 'I was upset and know I should not have done this', the experimenter would respond with a neutral comment such as 'Ok. I see' and then terminate any further questioning for the next 30 s. All inappropriate utterances were ignored.

The DRA intervention was alternated with a baseline condition identical to the condition conducted in the functional analysis that yielded the highest frequency of problematic verbal behavior. Here during baseline, inappropriate behavior produced attention or escape from demands and appropriate verbal behavior was ignored.

## RESULTS

The top panel of Figure 1 displays the results of the functional analysis with Tommy. These data suggest that his inappropriate depressive and suicidal vocalizations were maintained by attention from others. The bottom panel of Figure 1 displays the results of the DRA intervention, a return to baseline, and a second implementation of DRA. The last data point depicts a 1 month follow-up phone conversation with Tommy after his discharge from the treatment facility. During this phone conversation DRA contingencies were in place. The DRA treatment appeared to effectively reduce his inappropriate verbal utterances well below baseline levels of responding. In most instances of the intervention these utterances were not emitted at all.

The top panel of Figure 2 displays the results of the functional analysis with Matt. These data suggest that his inappropriate verbal behavior was maintained by escape from verbal demands of the experimenter to talk about the difficulties he was having in his therapy sessions. The bottom panel of Figure 2 displays the results of the DRA intervention, a return to baseline, and a second implementation of DRA. These results indicate that treatment was also effective in reducing Matt's inappropriate verbal behavior while maintaining constant levels of appropriate vocalizations.

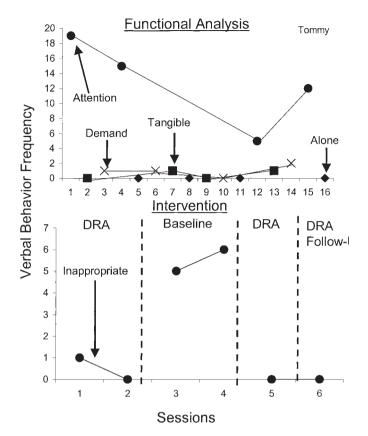


Figure 1. The number of verbal utterances during the functional analysis condition (top panel), and the number of utterances during DRA and baseline conditions (bottom panel), for Tommy.

The top panel of Figure 3 displays the results of the functional analysis with Chaz. These data suggest that his inappropriate verbal behavior was maintained by attention/ extinction from the experimenter. The bottom panel of Figure 3 displays the results of the DRA intervention, a return to baseline, and a second implementation of DRA. These results indicate that treatment was also effective in reducing Chaz's inappropriate verbal behavior while maintaining constant levels of appropriate vocalizations.

The top panel of Figure 4 displays the results of the functional analysis with Eddie. These data suggest that his inappropriate verbal behavior was maintained by escape from the prompts to engage in physical therapy made by the experimenter. The bottom panel of Figure 4 displays the results of the DRA intervention, a return to baseline, and a second implementation of DRA. This panel also contains a graphical representation of the number of physical therapy exercises that Eddie actually completed. As treatment continued, not only did Eddie's inappropriate vocalizations

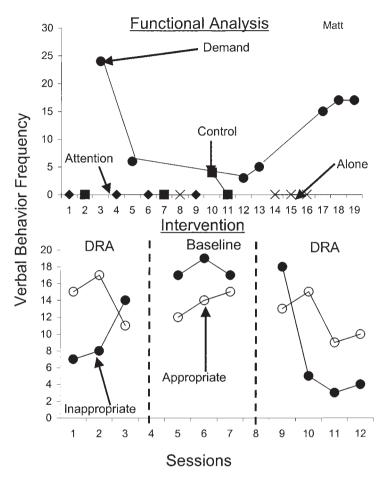


Figure 2. The number of verbal utterances during the functional analysis condition (top panel), and the number of utterances during DRA and baseline conditions (bottom panel), for Matt.

decline, but also his frequency of exercised increased. These results indicate that treatment was also effective in reducing Eddie's inappropriate verbal behavior while maintaining constant levels of appropriate vocalizations.

### DISCUSSION

Together the data obtained with from these four participants suggest the function of verbal behavior, like many forms of non-verbal behavior, can be accurately assessed and subsequently treated using a functional analysis/intervention methodology. These data support previous research on the functional analysis of verbal behavior (i.e. Dixon

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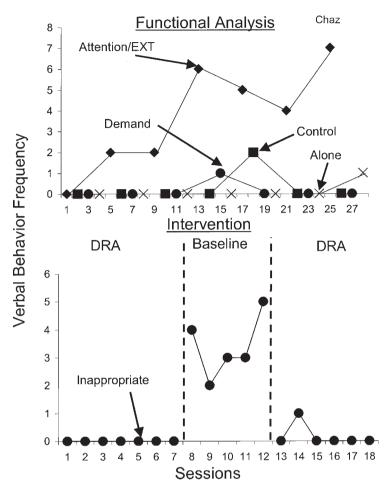


Figure 3. The number of verbal utterances during the functional analysis condition (top panel), and the number of utterances during DRA and baseline conditions (bottom panel), for Chaz.

et al., 2001; Wilder et al., 2001) and extend these findings beyond the single case study previously reported in the brain injury population (Pace et al., 1994). A clear function for inappropriate verbal behavior was found for each of our participants, and in two of our four cases it was not attention maintained. Although the majority of the previous published functional analyses of verbal behavior studies have yielded an attention function (e.g. Rehfeldt & Chambers, 2003; Wilder et al., 2001), our findings support the isolated instances of Pace et al. (1994) and Buchanan and Fisher (2002) that have shown attention may not be the sole maintainer of inappropriate vocalizations. Future research is still needed to discover whether other controlling variables such as access to tangible reinforcers and automatic reinforcement are present in participants

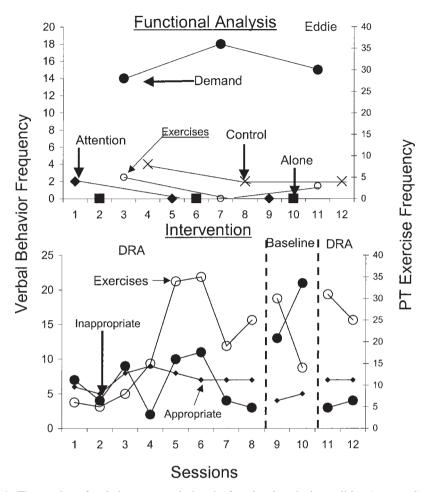


Figure 4. The number of verbal utterances during the functional analysis condition (top panel), and the number of utterances during DRA and baseline conditions along with frequency of physical therapy exercises completed (bottom panel), for Eddie.

emitting inappropriate vocalizations, as have been found when assessing non-verbal types of behaviors.

The current findings also extend the previous literature on the assessment and treatment of verbal behavior by the inclusion of verbal classes that were not exclusively 'bizarre' (Mace et al., 1988) or 'psychotic' (Durand & Crimmins, 1987). Here our participants emitted suicidal comments, sexually aggressive suggestions, or extensive profanity. Such verbal topographies, while common in persons suffering from acquired brain injury, are present in varying degrees in many clinical populations. As a result, the present treatment data are promising for therapists

treating persons with a multitude of psychological disorders that may be simply verbally constructed. The demonstration of treatment success with various verbal response typographies also further strengthens the utility of the functional assessment and intervention approach beyond persons with developmental disabilities.

Although appropriate vocal utterances were not recorded for all participants (Tommy and Chaz), it should not be deduced that they were simply silent during DRA sessions where few or no inappropriate vocalizations occurred. Reductions in problematic behavior were only demonstrated during these DRA treatment phases, suggesting that indeed reinforcement of appropriate behavior did occur. The obtained appropriate utterances observed with Matt and Eddie provide support for this point. Future studies may wish to obtain appropriate vocalizations for all participants to strengthen such claims, as well as collecting more than a few data points per intervention condition to ensure stability of treatment.

The present study demonstrated that our participants' verbal behavior could be modified via the mediation of another person (the experimenter), as Skinner (1957) suggested. Instances of Skinner's definition of verbal behavior were clearly present in our study. Yet we would like to suggest that according to his definition, 'behavior reinforced via the mediation of another person', all nonverbal functional analyses and interventions may meet his definition of verbal behavior as well. If caregivers provide reinforcement to participants who engage in a motor response such as a hair pull, eye poke, or head bang, those responses are also mediated by another person when they provide or withhold consequences contingent upon the response. While these traditionally conceptualized nonverbal responses are surely not vocal in nature, either are many of Skinner's verbal operants (cf. taking dictation, Skinner, 1957). Even the 'mand' may take the form of a non-vocal motor response such as a gesture (Skinner, 1957). Perhaps behavior analysts should begin to pursue this alternative conceptualization of verbal behavior further as suggested by Hayes (1990), Layng and Andronis (1984), and Mace and Lalli (1991).

In summary, we have expanded the growing literature on the functional approach to assessment and treatment as described by Iwata et al. (1982/1994) by utilizing persons with acquired brain injury who displayed a variety of inappropriate verbal behaviors. The incorporation of such technology will aid care-givers in the treatment of problem behavior often deduced as due to psychiatric illness when, in fact, it may simply be under direct environmental control.

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