The Role of Automatic Negative Reinforcement In Clinical Problems

Raymond G. Miltenberger
North Dakota State University

Abstract

This paper discusses the role of automatic negative reinforcement in the maintenance of clinical problems. Following a brief introduction to the functional conceptualization of clinical problems and discussion of four classes of reinforcement maintaining clinical problems, the paper suggests that automatic negative reinforcement is an understudied function of problem behaviors. The role of automatic negative reinforcement is then discussed in the context of three clinical problems, binge eating, hair pulling, and compulsive buying. Finally, treatment for problem behaviors maintained by automatic negative reinforcement is briefly reviewed.

Key Words: Automatic negative reinforcement, negative reinforcement, clinical problems, binge eating, hair pulling, trichotillomania, compulsive buying, functional assessment, functional analysis, functional interventions.

Perhaps one of the greatest contributions of applied behavior analysis in recent years has been the development and refinement of a functional approach to the assessment and treatment of clinical problems (e.g., Carr, 1994; Durand, 1987; Mace, 1994). Beginning in the 1970s, behavior analysts turned their attention to understanding the contingencies maintaining clinical problems (e.g., Carr, 1977) and suggested that identification of the antecedents and consequences maintaining problem behaviors would lead to more effective and efficient treatments. Instead of identifying treatments based on the topography of the problem behavior (e.g., overcorrection for self-injurious behavior), behavior analysts began to identify treatments for problem behaviors based on the antecedents and consequences of the problem behaviors (e.g., noncontingent attention and extinction involving withholding attention for problem behavior maintained by attention; Iwata, Vollmer, Zarcone, & Rodgers, 1993).

This functional approach to treatment was predicated on at least two developments in the field. One was the developing view that problem behaviors were maintained by a unique set of contingencies operating in the individual's life (Carr, 1977). The other was the development of an operant methodology for identifying the contingencies maintaining an individual's problem behaviors (Iwata, Dorsey, Slifer, Bauman, & Richman, 1982). In an influential paper promoting a functional conceptualization of self-injurious behavior, Carr (1977) suggested that self-injurious behavior was maintained by different forms of reinforcement and that understanding the nature of reinforcement for the behavior would lead to effective interventions. Iwata et al. (1982) then published a ground-breaking paper detailing a method for analyzing the function of self-injurious behavior. The functional analysis methodology developed by Iwata et al. (1982), or variations of this methodology (termed functional assessment more broadly; Lennox & Miltenberger, 1989; O'Neill et al., 1997), are now widely used by behavior analysts for understanding problem behaviors and for developing treatments to address the function of the problem behavior (e.g., Chandler & Dahlquist, 2002; Repp & Horner, 1999; Witt, Daley, & Noell, 2000).

Four Classes of Reinforcement Maintaining Problem Behaviors

As the functional approach to assessment and treatment has been evaluated and refined over the years, researchers have identified four general classes of reinforcement maintaining problem behaviors. These four classes involve combinations of positive and negative reinforcement and social and automatic reinforcement (Iwata et al., 1993; Miltenberger, 2004).

Social positive reinforcement. Social positive reinforcement occurs when a stimulus is presented by another individual following the occurrence of a behavior and the behavior is strengthened. In social positive reinforcement the reinforcers maintaining problem behaviors may include attention (child disruptive behavior produces parent attention), tangibles (aggressive behavior produces a reinforcing object from the victim), or access to preferred activities (tantrum behavior results in additional television time).

Social negative reinforcement. Social negative reinforcement occurs when an aversive stimulus or situation is terminated by another individual contingent on a behavior and the behavior is strengthened. In social negative reinforcement the reinforcing consequences for the behavior may involve escape from aversive tasks (outbursts result in termination of school work), social interaction (anger displays get a partner to stop arguing), or physical stimulation (a parent's nagging gets a teenager to turn down the stereo).

Automatic positive reinforcement. Automatic positive reinforcement occurs when a behavior produces some form of stimulation through direct contact with the physical environment and the behavior is strengthened. The reinforcing stimulus is not delivered by another individual. In automatic positive reinforcement the reinforcing consequences maintaining the behavior may include self-stimulation (finger sucking is reinforced by tactile stimulation) or external stimulation (plate spinning is reinforced by the sound of a plate spinning on the table).

Automatic negative reinforcement. Automatic negative reinforcement occurs when a behavior terminates an aversive stimulus directly and the behavior is strengthened. The aversive stimulus is not terminated by another individual. In automatic negative reinforcement the reinforcing consequence maintaining the behavior may include termination of internal stimulation (a problem behavior is maintained by termination of pain, discomfort, autonomic arousal, or negative affect/emotion) or removal of external stimulation (closing a window terminates the flow of cold air).

There is substantial research demonstrating the role of social positive reinforcement, social negative reinforcement, and automatic positive reinforcement in the maintenance of clinical problems and substantial research detailing treatment strategies for problem behaviors maintained by these classes of reinforcement (e.g., Iwata et al., 1993). However, there is little research demonstrating the role of automatic negative reinforcement in the maintenance of clinical problems and little research detailing treatment strategies for problem behaviors maintained by automatic negative reinforcement involving the termination of aversive internal stimulation (e.g., Iwata et al., 1993; Smith & Iwata, 1997).

Automatic Negative Reinforcement: An Understudied Function of Problem Behaviors

There are two possible reasons why behavior analysts have not studied problem behaviors maintained by automatic negative reinforcement to the extent they have studied problems maintained by other classes of reinforcement. One explanation is that current functional analysis methodologies are not adequate to identify automatic negative reinforcement. Researchers cannot manipulate the internal stimulation involved in automatic negative reinforcement to show its functional relationship to the behavior, nor can they measure the

change in the internal stimulation following the occurrence of the behavior to establish its relationship to the behavior (e.g., Anderson, Hawkins, & Scotti, 1997). Instead researchers must rely on the client's own self-report of his or her internal stimulation and whether the problem behavior produces changes in this stimulation.

Another explanation is that treatment for automatically negatively reinforced behavior is more difficult. Antecedent control is difficult because the relevant antecedent is covert (aversive internal stimulation). Differential reinforcement of functionally equivalent alternative behavior is difficult because the reinforcer for the problem behavior (relief from aversive internal stimulation) cannot be delivered contingent on the desirable behavior. Finally, extinction cannot be used because the internal stimulation that functions as an establishing operation (EO) for the behavior, and is terminated by the behavior, is impossible to manipulate directly. With problem behaviors maintained by automatic positive reinforcement, a therapist can alter or mask the stimulation produced by the behavior, thus leading to sensory extinction (e.g., Rincover, Cook, Peoples, & Packard, 1979). With behavior problems maintained by social positive and social negative reinforcement, the therapist can teach individuals to respond to the problem behavior in ways that are not reinforcing (by withholding positive reinforcers or no longer terminating aversive activities contingent on the behavior; e.g., Iwata, Pace, Cowdery, & Miltenberger, 1994). In each case, the therapist removes the reinforcer for a problem behavior by manipulating some aspect of the physical or social environment. In contrast, the reinforcer for problem behavior maintained by automatic negative reinforcement cannot be removed by the therapist in an extinction procedure because it is not accessible to the therapist.

The Role of Automatic Negative Reinforcement in Clinical Problems: Binge Eating, Hair Pulling, and Compulsive Buying

There are a number of clinical problems for which an automatic negative reinforcement analysis is appropriate, even though behavior analysts typically have not discussed the problems in such terms (e.g., Stickney & Miltenberger, 1999). This section discusses three clinical problems as exemplars of the role of automatic negative reinforcement. In each case, private events, typically strong negative emotions, function as establishing operations for the problem behavior (e.g., Dougher & Hackbert, 2000) and the problem behavior is negatively reinforced when it results in relief from the negative emotions.

***Binge eating*.** Binge eating is defined as eating an unusually large amount of food in a discrete period of time usually accompanied with a feeling of being out of control. Binge eating is a component of Bulimia Nervosa and Binge Eating Disorder (APA, 1994). Researchers have documented that binge eating often occurs in response to strong negative emotions and that the individual gets momentary relief from the negative emotional experience during the binge eating episode (e.g., Abraham & Beaumont, 1982; Lingswiler, Crowther, & Stephens, 1989; McManus & Waller, 1995; Telch & Agras, 1996). Therefore, the individual continues to engage in binge eating when experiencing aversive emotional responses even though the long term outcome of the behavior is negative (e.g., obesity or other negative health outcomes). From an automatic negative reinforcement analysis, the strong negative emotions experienced by the individual function as an EO and the relief produced by binge eating negatively reinforces binge eating (Redlin, Miltenberger, Crosby, Wolff, & Stickney, 2002; Stickney & Miltenberger, 1999; Stickney, Miltenberger, & Wolff, 1999). In this case, the S^D for binge eating would be when high caloric foods are available and the person is alone. When the S^D and EO occur together, binge eating becomes more probable. Unfortunately, the relief produced by binge eating is short-lived and the person soon begins to experiences the negative emotions again, which increases the likelihood of the next binge eating episode occurring once the S^D is present again.

Hair pulling. Trichotillomania is a disorder characterized by chronic hair pulling that produces noticeable hair loss. Two of the DSM criteria for a diagnosis of trichotillomania are that the person experiences a building sense of tension prior to hair pulling and that pulling produces relief or pleasure (APA, 1994). An automatic negative reinforcement analysis of hair pulling is explicit in the diagnostic criteria. The tension (or other aversive internal sensations such as anxiety, anger, or depression; Christenson & Mansueto, 1999) experienced prior to hair pulling functions as an EO and hair pulling is negatively reinforced by relieving the tension or other unpleasant sensations (Christenson, Mackenzie, & Mitchell, 1991; Miltenberger, Rapp, & Long, 2001; Stanley, Borden, Mouton, & Breckenridge, 1995). Even though hair pulling results in negative long term outcomes (bald areas from pulling, lifestyle disruptions that result from trying to hide the hair loss), it continues to occur because it provides immediate relief (i.e., automatic negative reinforcement). Being alone is often an S^D for hair pulling due to a history of punishment for hair pulling in the presence of others. When the S^D and EO occur together, hair pulling becomes more probable. As in the case of binge eating, hair pulling provides only momentary relief from the tension or other aversive emotional experience and, shortly after pulling hair, the tension or negative emotion typically returns.

It also is possible that automatic positive reinforcement is involved in the maintenance of hair pulling if the behavior produces pleasurable sensations (Rapp, Milteberger, Galensky, Ellingson, & Long, 1999). Although most accounts identify relief rather than pleasure as the reinforcer for hair pulling (Miltenberger et al., 2001), it is important to conduct a functional assessment to establish the nature of reinforcement maintaining hair pulling in order to chose the most appropriate intervention.

Compulsive buying. Compulsive buying is a problem behavior characterized by repetitive episodes of buying, typically in response to negative events or emotions (Faber & O'Guinn, 1992; O'Guinn & Faber, 1989). Often the individual buys unneeded items and the buying behavior results eventually in negative consequences (e.g., financial difficulties or relationship problems). Researchers have shown that compulsive buying is more likely to occur when the person experiences negative emotions such as tension, depressed feelings, anger, and loneliness (e.g., Faber & O'Guinn, 1992; McElroy, Keck, Pope, Smith, & Strakowski, 1994) and that the buying behavior brings relief from the negative emotions, at least momentarily (Miltenberger et al., 2003). In an automatic negative reinforcement framework, the negative emotions function as an EO and the buying behavior is negatively reinforced by terminating or lessening the negative emotions. As with binge eating and hair pulling, the S^D for compulsive buying is present when the individual is alone (with the opportunity to buy items from a store), and compulsive buying becomes more probable when the EO and S^D are both present (i.e., the individual is alone with buying opportunities while experiencing strong negative emotions).

Management of Problem Behaviors Maintained by Automatic Negative Reinforcement

Treatment for problem behaviors maintained by automatic negative reinforcement should proceed in the same manner as does treatment for problem behaviors maintained by other types of reinforcement. The first step in the process is to conduct a functional assessment to identify the antecedents and consequences that are functionally related to the behavior. Behavior analysts have identified three approaches to conducting a functional assessment; indirect assessment involving behavioral interviewing, direct observation of the antecedents and consequences, and a functional analysis in which antecedents and/or consequences are manipulated to demonstrate their influence on the behavior (e.g., Iwata, Vollmer, & Zarcone, 1990; Lennox & Miltenberger, 1989; O'Neill et al., 1997). In the case of problem behaviors maintained by automatic negative

reinforcement, the first two methods are most applicable because the reinforcing consequence cannot be manipulated in a functional analysis (Lee & Miltenberger, 1997). However, a functional analysis might be useful to rule out social reinforcement for the behavior (e.g., Miltenberger, Long, Rapp, Lumley, & Elliott, 1999). Furthermore, it may be possible to arrange environmental events that elicit negative emotions in a functional analysis (e.g., Woods & Miltenberger, 1996) and look for corresponding changes in behavior. However, the limitation of this approach is that the negative emotions or changes in the negative emotions contingent on the problem behavior reported by the client cannot be objectively verified. Therefore, a behavioral assessment interview or self-monitoring of antecedents and consequences by the client are the primary ways in which to conduct a functional assessment of problem behaviors maintained by automatic negative reinforcement.

In conducting a behavioral interview, the researcher asks the client to describe her experiences before, during, and after the occurrence of the behavior, with an emphasis on physical sensations, emotions, feeling, mood, or cognitions (thoughts and images) and how they change as the behavior occurs. The interviewer also asks the client to identify the situations in which the behavior occurs to identify the likely S^Ds associated with the behavior. During self-monitoring, the client is instructed to record antecedents and consequences each time the problem behavior occurs (e.g., Deaver, Miltenberger, Smyth, Meidinger, & Crosby, 2003; Miltenberger et al., 2003; Redlin et al., 2002; Stickney & Miltenberger, 1999; Stickney et al., 1999). For example, in conducting a functional assessment of compulsive buying, Miltenberger et al. (2003) asked individuals to provide a rating of the intensity of six emotional/affective factors immediately before, during, and after a buying episode. In this way they could identify how the ratings changed from before to during and from during to after the buying episode to develop hypotheses about which emotional or affective experiences were functionally related to the behavior.

Once a functional assessment is complete and the therapist has developed hypotheses about the antecedents and consequences of the problem behavior, functional treatments are then developed to address the antecedents and consequences. A functional approach to treatment typically involves three types of interventions; extinction to remove the reinforcing consequences maintaining the problem behavior, differential reinforcement to strengthen functionally equivalent behavior to replace the problem behavior, and antecedent manipulations to make the problem behavior less probable by removing the opportunity or motivation for the behavior (e.g., Miltenberger, 2004). However, because extinction is not possible with behaviors maintained by automatic negative reinforcement, treatment should focus on antecedents control and differential reinforcement procedures.

Antecedent control. Antecedent control procedures involve altering the S^Ds, EOs, or response effort for the problem behavior or competing behaviors (Miltenberger, 2004). In simplest terms, removing the S^D for the problem behavior involves removing the opportunity for reinforcement for the behavior. In the case of binge eating, it may involve limiting access to food or ensuring that others are present at high risk times (e.g., for a high school student who binge eats after school before family members get home, intervention could involve altering her routine so she is not home after school). For hair pulling, removing the S^D would involve limiting access to situations where hair pulling takes place (e.g., not being alone in one's own home or apartment in the evening when hair pulling typically takes place). Likewise for compulsive buying, if shopping alone is the S^D, intervention might involve asking others to accompany the client when shopping.

It should be noted that removing the S^D for the problem behavior is an interim solution designed to get control over the problem behavior quickly and should be used initially while other

procedures are also being initiated. Removing the S^D for the problem behavior does not alter the conditions that motivate the client to engage in the behavior and does not promote alternative behavior. Therefore, this strategy should not be considered a long term solution, although it may be used as an adjunct procedure with other functional interventions.

Increasing response effort for the problem behavior makes it more difficult to engage in the behavior, thus making the behavior less likely to occur (e.g., Friman & Poling, 1995). Increasing response effort for the problem behavior would require the client to make changes in his or her physical environment, daily routine, or lifestyle. For example, a binge eating client could remove all binge foods from her apartment to increase the effort involved in binge eating. A hair pulling client could wear a hat or put tape on her finger tips to make it more difficult to pull her hair. An individual who drives to the store to engage in compulsive buying could have a family member take the car for the day to make it more difficult to get to the store. In many cases, removing the S^D for the problem behavior also increases the response effort for the behavior (Miltenberger, 2004).

Although increasing response effort for the behavior will decrease the probability of the behavior, this strategy should be seen as an interim solution or an adjunct procedure, much like removing the S^D for the behavior is an interim solution. Lasting change in the problem behavior will occur when the motivation for the behavior is eliminated and the client develops a repertoire of functionally equivalent alternative behavior.

For problem behaviors maintained by automatic negative reinforcement, eliminating the EO is a more viable long term solution than is eliminating the S^D or increasing response effort. Eliminating the EO involves decreasing or eliminating the aversive internal stimulation that motivates the client to engage in the problem behavior. If a binge eating client no longer experienced strong negative emotions, escape from negative emotions would no longer be a reinforcing outcome for binge eating and the client would no longer be motivated to engage in binge eating. If a hair-pulling client did not experience tension as an EO, the client would not be motivated to engage in hair pulling that produces tension reduction. If a person engages in compulsive buying because it produces relief from angry or depressed feelings, she would no longer be motivated to engage in the behavior if the aversive feelings were eliminated.

In principle, eliminating the EO for problem behaviors maintained by automatic negative reinforcement is relatively straightforward. In practice, eliminating the strong negative emotions that motivate the problem behavior (the EO) can be a complicated and lengthy process that is not always successful. Because the EO cannot be controlled directly, the EO is eliminated or lessened indirectly through such interventions as relaxation training, cognitive therapy, acceptance and commitment therapy, problem solving therapy, stress inoculation training, assertiveness training, or other approaches that alter the events in the client's life (including the client's own behavior) that give rise to strong negative emotions (e.g., Spiegler & Guevremont, 2003). Often, a number of these interventions are combined in multifaceted treatments termed cognitive behavior therapy (CBT; e.g., Lewandowski, Gebing, Anthony, & O'Brien, 1997; Peterson et al., 1998). CBT, frequently outlined in treatment manuals, has been shown to be an effective intervention for binge eating and hair pulling (e.g., Lerner et al., 1998; Lewandowski et al., 1997; Peterson et al, 1998; Stanley & Mouton, 1996), although not all participants benefit or benefit fully from such interventions. No research has been published to date on CBT as a treatment for compulsive buying.

Differential reinforcement. The goal of differential reinforcement is to strengthen appropriate behaviors that are functionally equivalent to the problem behavior so they ultimately

replace the problem behavior (e.g., Miltenberger, 2004). In most instances, when differential reinforcement is used to decrease a problem behavior, a reinforcer is delivered by a change agent such as a parent or teacher each time a desirable alternative behavior occurs. For problem behaviors maintained by automatic negative reinforcement the therapist must teach the client a desirable behavior that competes with the problem behavior and provide instructions for the client to engage in the desirable behavior in relevant circumstances outside of the therapy sessions. Thus, differential reinforcement is more difficult to implement for problem behaviors maintained by automatic negative reinforcement. Although extinction for the problem behavior is also a component of differential reinforcement, for problem behaviors maintained by automatic negative reinforcement, extinction is not possible. Therefore, the focus of differential reinforcement would be on teaching the client coping responses that provide relief from the negative emotions in the same way the problem behavior provides relief. Getting the client to engage in the coping responses can be challenging, however, because the coping responses may take time to learn, may require more effort than the problem behavior, may not be as immediately reinforcing as the problem behavior, and may not provide the same magnitude of reinforcement (degree of relief) as the problem behavior.

Consider relaxation as a coping skill for a person who gets relief from tension when she pulls her hair. Hair pulling provides relief immediately, in large degree, and with relatively little effort. The relaxation behavior on the other hand is a skill that takes time to learn, does not lead to immediate tension reduction, and may not fully relieve the tension. In this case, hair pulling as a concurrent operant is more likely to occur than is the relaxation behavior. Relaxation training would be most likely to be successful if it were a component of an intervention that also addressed the EO and S^D associated with hair pulling.

Consider engagement in a pleasant activity as an alternative behavior to compulsive buying. If compulsive buying provides relief from depressed feelings, then the pleasant activity would also have to provide relief from depressed feelings in order to compete with the compulsive buying behavior. The client would be most successful if she scheduled a pleasant activity known to be highly reinforcing (associated with pleasant feelings) while at the same time addressing the antecedents to the compulsive buying behavior to decrease the motivation for the behavior.

Finally, consider the case of binge eating that provides relief from sadness associated with negative thinking (e.g., cognitive distortions, inappropriate attributions, etc.). An alternative behavior would have to be one that competes with negative thinking in order to provide relief from the sadness caused by the negative thinking. The alternative behavior might involve activities that direct the client's attention away from her negative thinking, or a pattern of positive thinking (e. g., accurate labeling of events, appropriate attributions, etc.) that competes with the negative thinking. In the former case, to be successful, the client would have to have the activity available to her every time she engaged in the negative thinking, would have to detect the negative thinking immediately, and would have to engage in the activity immediately to displace the negative thinking. In the latter case, to be successful, the client would have to work with the therapist to rehearse the positive thinking until it occurred with the automaticity of the negative thinking it is meant to replace.

Conclusions

Problem behaviors maintained by automatic negative reinforcement are some of the most difficult problems to treat successfully. The difficulty in dealing with problem behaviors maintained by automatic negative reinforcement stems from the fact that the reinforcing consequence for the behavior involves changes in internal stimulation. Because the EO and

reinforcing consequence for the behavior are internal, they are inaccessible to direct control by the therapist and thus not amenable to typical functional analysis procedures and typical functional interventions. However, the antecedents and consequences can be assessed through interview and self-monitoring methods and functional interventions can be developed based on hypotheses derived from these functional assessment methods.

Interventions that address the EO for the problem behavior, although often difficult and time consuming to implement, are most likely to be successful because they address the strong negative emotions that motivate the behavior. If the negative emotions can be abated (or the functional relationship between the negative emotions and the problem behavior altered; e.g., Hayes, Strosahl & Wilson, 1999), then the motivation to engage in the problem behavior is eliminated or lessened. Although the assessment and intervention approaches most often used with problem behaviors maintained by automatic negative reinforcement are not those typically used by most behavior analysts, analysis and intervention with such problem behaviors by behavior analysts is sorely needed. Problem behaviors maintained by automatic negative reinforcement are largely understudied but often serious clinical problems. It is time for behavior analysts to use their expertise to contribute to a greater understanding and more successful treatment of these problems.

References

Abraham, S. F., & Beaumont, P. J. V. (1982). How patients describe bulimia and binge eating. *Psychological Medicine, 12*, 625-635.

American Psychiatric Association (1994). *Diagnostic and statistical manual of mental disorders, 4th ed*. Washington, DC:

Anderson, C. M., Hawkins, R. P., & Scotti, J. R. (1997). Private events in behavior analysis: Conceptual basis and clinical relevance. *Behavior Therapy, 28*, 157-179.

Carr, E. G. (1977). The motivation of self-injurious behavior: A review of some hypotheses. *Psychological Bulletin, 84*, 800-816.

Carr, E. G. (1993). Behavior analysis is not ultimately about behavior. *Behavior Analyst, 16*, 47-49.

Chandler, L. K., & Dahlquist, C. M. (2002). *Functional assessment: Strategies to prevent and remediate challenging behavior in school settings*. Upper saddle River, NJ: Merrill Prentice Hall.

Christenson, G. A., Mackenzie, T. B., & Mitchell, J. E. (1991). Characteristics of 60 adult chronic hair pullers. *Journal of Psychiatry, 148*, 365-370.

Christenson, G. A., & Mansueto, C. S. (1999). Trichotimmomania: Descriptive characteristics and phenomenology. In M. B. Stein, G. A. Christenson, & E. Hollander (Eds.), *Trichotillomania* (PP 1-41) Washington, DC: American Psychiatric Press.

Deaver, C., Miltenberger, R., Smyth, J., Meidinger, A., & Crosby, R. (2003). An evaluation of affect and binge eating. *Behavior Modification, 27*, 578-599.

Dougher, M. J., & Hackbert, L. (2000). Establishing operations, cognition, and emotion. *The Behavior Analyst, 23*, 11-24.

Durand, V. M. (1987). "Look Homeward Angel": A call to return to our functional roots. *Behavior Analyst, 10*, 299-302.

Faber, R. J., & O'Guinn, T. C. (1992). A clinical screener for compulsive buying. *Journal of Consumer Research, 19*, 459-469.

Friman, P. C., & Poling, A. (1995). Making life easier with effort: Basic findings and applied research on response effort. *Journal of Applied Behavior Analysis, 28*, 583-590.

Hayes, S. C., Strosahl, K. D., & Wilson, K. G. (1999). *Acceptance and commitment therapy: An experiential approach to behavior change*. New York: Guilford.

Iwata, B., Pace, G., Cowdery, G., & Miltenberger, R. (1994). What makes extinction work: An analysis of procedural form and function. *Journal of Applied Behavior Analysis, 27*, 131-144.

Iwata, B. A., Dorsey, M. F., Slifer, M. F., Bauman, K. E., & Richman, G. S. (1982). Toward a functional analysis of self-injury. *Analysis and Intervention in Developmental Disabilities, 2*, 3-20.

Iwata, B. A., Vollmer, T. R., & Zarcone, J. R. (1990). The experimental (functional) analysis of behavior disorders: Methodology, applications, and limitations. In A. C. Repp & N. N. Singh (Eds), *Perspectives on the use of non-aversive and aversive interventions for persons with developmental disabilities* (pp 301-331). Syracuse, IL: Sycamore Publishing Co.

Iwata, B. A., Vollmer, T. R., Zarcone, J. R & Rodgers, T. A. (1993). Treatment classification and selection based on behavioral function. In R. Van Houten & S. Axelrod (Eds.), *Behavior analysis and treatment* (pp 101-125). New York: Plenum.

Lee, M. I., & Miltenberger, R. G. (1997). Functional assessment and binge eating: A review of the literature and suggestions for future research. *Behavior Modification*, *21*, 159-171.

Lennox, D., & Miltenberger, R. (1989). Conducting a functional assessment of problem behavior in applied settings. *Journal of the Association for Persons with Severe Handicaps, 14*, 304-311.

Lerner, J., Franklin, M. E., Meadows, E. A., Hembree, E., & Foa, E. B. (1998). Effectiveness of a cognitive behavioral treatment program for trichotillomania: An uncontrolled investigation. *Behavior Therapy*, *29*, 157-171.

Lewandowski, L. M., Gebing, T. A., Anthony, J. L., & O'Brien, W. H. (1997). Meta-analysis of cognitive behavioral treatment studies for bulimia. *Clinical Psychology Review, 17*, 703-718.

Lingswiler, V. M., Crowther, J. H., & Stephens, M. A. P. (1989). Affective and cognitive antecedents to eating episodes in bulimia and binge eating. *International Journal of Eating Disorders, 8,* 533-539.

Mace, F. C. (1994). The significance and future of functional analysis methodologies. *Journal of Applied Behavior Analysis, 27*, 385-392.

McElroy, S. L., Keck, P. E., Pope, H. G., Smith, J. M. R., & Strakowski, S. M. (1994). Compulsive buying: A report of 20 cases. *Journal of Clinical Psychiatry, 55*, 242-248.

McManus, F., & Waller, G. (1995). A functional analysis of binge eating. *Clinical Psychology Review, 15*, 845-863.

Miltenberger, R.G., (2004). *Behavior modification: Principles and procedures* (3rd Ed.). Pacific Grove, CA: Wadsworth.

Miltenberger, R., Long, E., Rapp, J., Lumley, V., & Elliott, A. (1998). Evaluating the function of hair pulling: A preliminary investigation. *Behavior Therapy, 29*, 211-219.

Miltenberger, R.G., Rapp, J.R., & Long, E.S. (2001). Characteristics of trichotillomania. In D. Woods & R. Miltenberger (Eds.), *Tic disorders, trichotillomania, and repetitive behavior disorders: Behavioral approaches to analysis and treatment* (pp. 133-150). Norwell, MA: Kluwer.

Miltenberger, R., Redlin, J., Crosby, R., Stickney, M., Mitchell, J., Wonderlich, S., Faber, R., & Smyth, J. (2003). Functional assessment of factors contributing to compulsive buying. *Journal of Behavior Therapy and Experimental Psychiatry, 34,* 1-9.

O'Guinn, T. C., & Faber, R. J. (1989). Compulsive buying: A phenomenological exploration. *Journal of Consumer Research, 16*, 147-157.

O'Neill, R. E., Horner, R. H., Albin, R. W., Sprague, J. R., Storey, K., & Newton, S. (1997). *Functional assessment and program development for problem behavior: A practical guide*. Pacific Grove, CA: Brooks/Cole.

Peterson, C. B., Mitchell, J. E., Engbloom, S., Nugent, S., Mussell, M. P., & Miller, J. P. (1998). Group cognitive behavioral treatment of binge eating disorder: A comparison of therapist-led versus self-help formats. *International Journal of Eating Disorders, 24*, 125-136.

Rapp, J., Miltenberger, R., Galensky, T., Ellingson, S., & Long, E. (1999). A functional analysis of hair pulling. *Journal of Applied Behavior Analysis*, *32*, 329-337.

Redlin, J., Miltenberger, R., Crosby, R., Wolff, G., & Stickney, M. (2002). Functional assessment of binge eating in a clinical sample of obese binge eaters. *Eating and Weight Disorders, 7,* 106-115.

Repp, A. C., & Horner, R. H. (1999). *Functional analysis of problem behavior: From effective assessment to effective support*. Belmont, CA: Wadsworth.

Rincover, A., Cook, R., Peoples, A., & Packard, D. (1979). Sensory extinction and sensory reinforcement principles for programming multiple adaptive behaviors. *Journal of Applied Behavior Analysis, 12*, 221-233.

Smith, R. G., & Iwata, B. A. (1997). Antecedent influences on behavior disorders. *Journal of Applied Behavior Analysis, 30*, 343-375.

Speigler, M. D., & Guevremont, D. C. (2003). *Contemporary behavior therapy* (4th ed). Belmont, CA: Wadsworth.

Stanley, M. A., Borden, J. W., Mouton, S. G., & Breckenridge, J. K. (1995). Non-clinical hair pulling: Phenomenology and related psychopathology. *Journal of Anxiety Disorders, 8*, 119-130.

Stanley, M. A., & Mouton, S. G. (1996). Trichotillomania treatment manual. In V. B. Van Hasselt and M. Hersen (Eds), *Sourcebook of psychological treatment manuals for adult disorders* (pp 657-687). New York: Plenum.

Stickney, M., & Miltenberger, R. (1999). Evaluation of direct and indirect measures for the functional assessment of binge eating. *International Journal of Eating Disorders*, *26*, 196-204.

Stickney, M., Miltenberger, R., & Wolff, G. (1999). A descriptive analysis of factors contributing to binge eating. *Journal of Behavior Therapy and Experimental Psychiatry*, *30*, 177-189.

Telch, C. F., & Agras, W. S. (1996). Do emotional states influence binge eating in the obese? *International Journal of Eating Disorders, 20*, 271-279.

Witt, J. C., Daley, E. J., & Noell, G. H. (2000). *Functional assessments: A step-by-step guide to solving academic and behavior problems*. Longmont, CO: Sopris West.

Woods, D., & Miltenberger, R. (1996). Are people with nervous habits nervous? A preliminary examination of habit function in a nonreferred population. *Journal of Applied Behavior Analysis, 29*, 259-261.

Author Contact Information:

Raymond G. Miltenberger, Ph.D.
Department of Psychology
North Dakota State University
Fargo, ND 58105
Phone: 701 231 8623
E-mail: ray.miltenberger@ndsu.edu