The Motivating Operation and Negatively Reinforced Problem Behavior. A Systematic Review.

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Biographical statement

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Abstract

The concept of motivational operations exerts an increasing influence on the understanding and assessment of problem behavior in people with intellectual and developmental disability. In this systematic review of 59 methodologically robust studies of the influence of motivational operations in negative reinforcement paradigms in this population, we identify themes related to both situational and biological variables that have implications for assessment, intervention and further research. There is now good evidence that motivational operations of differing origins influence negatively reinforced problem behaviour and that these might be subject to manipulation to facilitate favorable outcomes. There is also good evidence that some biological variables warrant consideration in assessment procedures as they predispose the person's behaviour to be influenced by specific motivational operations. The implications for assessment and intervention are made explicit with reference to variables that are open to manipulation or that require further research and conceptualisation within causal models.

Introduction.

Problem behaviors, such as aggression or self-injury, can exert a deleterious impact on quality of life. Such behaviors, which occur in 5-19% of people with intellectual and developmental disabilities (Borthwick-Duffy, 1994; Emerson et al., 2001; Joyce, Ditchfield, & Harris, 2001), are associated with a range of negative consequences including: social isolation (Robertson, Emerson, Gregory et al., 2001; Robertson et al., 2005), limited opportunities for choice (Robertson, Emerson, Hatton et al., 2001) or engagement in meaningful activity (Mansell, 1995), and high levels of environmental restriction, sometimes resulting in physical or emotional abuse (Rusch, Hall, & Griffin, 1986).

Whilst a range of perspectives have been adopted to understand such behaviors, the operant model is the dominant paradigm for assessment, formulation and treatment (see Oliver, 1995 for example). Within this model, problem behaviors are understood as behavioral adaptations to the antecedent and consequent conditions that arise within an individual's internal or external environment. Problem behaviors have been shown to be maintained by both positive and negative reinforcement processes (Hanley, Iwata, & McCord, 2003), and interventions based on this understanding have been demonstrated repeatedly to be effective in reducing such behaviors (Scotti, Evans, Meyer, & Walker, 1991).

Negative Reinforcement.

Problem behaviors' maintained by negative reinforcement have been the subject of considerable study over the past 30 years (e.g., Carr, Newsom, & Binkoff, 1976, 1980; Iwata, 1987). To quote Iwata (1987):

The process of negative reinforcement typically involves the removal, reduction, postponement, or prevention of stimulation; these operations strengthen the response on which they are contingent (p. 362).

With the advent of functional analytic methodologies has come increased conceptual refinement and technological precision and a corresponding increased ability to isolate various aspects of the three-term contingency that serve to influence problem behavior (Carr, 1994; Mace, 1994). Such advances have led not only to an improved understanding of the processes that influence negatively reinforced problem behaviors but also have demonstrated how such processes can be utilised to facilitate the treatment of such behaviors (Hanley, Iwata, & McCord, 2003).

Motivating Operations.

One part of the three-term contingency to have received attention in recent years has been that of the motivating operation (MO; Laraway, Snycerski, Michael, & Poling, 2003; Michael, 1982, 1993, 2000). The MO refers to any event, or stimulus change that momentarily alters: a) the *value* of a particular stimulus as a source of reinforcement or punishment and b) the probability of *behaviors* that have been associated historically with such consequences[1]. For problem behaviors maintained by negative reinforcement, the onset of an MO establishes (or abolishes) the reinforcing value of escape from or avoidance of a given stimulus (such as attention, pain or a demand) and evokes (or abates) behaviors associated with such consequences in the past. According to Iwata (1987), the defining

[1] MOs can be either *unconditioned* (i.e., result from the individual's phylogenic history), as in the deprivation of primary types of reinforcement (such as food, water or sexual activity) or *conditioned* (i.e., result from the individual's ontogenic history. It is beyond the scope of the current paper to provide a lengthy review of the concept of the MO and readers are referred to papers by Michael (1982; , 1993), and Langthorne and McGill (2009) for further description of the different classes of unconditioned and conditioned MOs and their influence on operant behavior.

feature of a negative reinforcement contingency is whether the change from an antecedent to consequent condition results in a reduction in aversive stimulation (p. 365). From this perspective, the extent to which a behavior-consequence contingency constitutes negative reinforcement is dependent on the antecedent condition that precedes it.

A series of review papers (e.g., Hanley, Iwata, & McCord, 2003; Iwata, Smith, & Michael, 2000; McGill, 1999; Smith & Iwata, 1997; Wilder & Carr, 1998) have examined the influence of MOs on problem behavior maintained by various sources of reinforcement. However, to date, there has not been a systematic review of the literature on MOs focusing exclusively on negatively reinforced problem behavior. Two previous reviews of the influence of antecedent events on problem behaviors maintained by escape were conducted (Carbone, Morgenstern, Zecchin-Tirri, & Kolberg, 2007; Miltenberger, 2006). However, both were limited to the analysis of negatively reinforced behaviors occurring in the context of instructional activities and neither employed a systematic methodology to either the identification or review of the studies. Given the growing number of studies conducted within this field, a systematic approach towards the identification and review of papers would be beneficial to provide a more comprehensive account of the literature and to facilitate a more rigorous assessment of its strength.

The current review will: a) identify trends over time in the study of MOs and negatively reinforced problem behavior, b) provide a summary of existing research for the assessment and treatment of negatively reinforced problem behavior, c) identify the strengths and limitations of existing methodologies used to assess MOs in negatively reinforced behavior and d) provide recommendations for further research.

Methodology.

Search Strategy.

A systematic methodology using two separate search strategies was adopted to identify papers. In the initial strategy, all empirical papers related to negatively reinforced problem behavior were identified using all possible combinations of the following search terms: ('Avoidance' OR 'Escape' OR 'Negative Reinforcement') AND ('Behavior Problems' OR 'Aggressive Behavior' OR 'Self Destructive Behavior' OR 'Behavior Disorder') using the search engines *PsychInfo* and *Web of Science*.

As a number of key studies on MOs did not make explicit reference to negatively reinforced problem behavior in the abstract or search terms, a second search strategy was also employed. In this search, all studies that cited key MO conceptual papers (Laraway, Snycerski, Michael, & Poling, 2003; Michael, 1982, 1993, 2000) were identified. Studies that included an individual with problem behavior maintained, at least in part, by negative reinforcement were then selected for further review.

The reference sections of all papers identified via each search strategy, as well as from previous reviews of the MO literature, were also searched to identify any related papers that may have fit the above criteria.

Inclusion and Exclusion Criteria.

All papers identified in this initial search were reviewed by hand to determine whether the following inclusion criteria were met. The papers were required to have: 1) allowed for an inference that the problem behavior was, at least in part, negatively reinforced. This was based on either topography (i.e., food refusal) or indirect, descriptive or experimental functional analysis, and 2) included an assessment of the influence of an antecedent variable on the negatively reinforced problem behavior AND reported on the direct observation of the target behavior. Studies of a correlational nature were only included if a within-subject experimental manipulation was not deemed possible due to the nature of

the variable under study (i.e., presence of a specific biological condition). In cases where an experimental manipulation could reasonably have been expected to have been conducted and was not, then studies were excluded. Papers were also excluded if they did not include the assessment of an antecedent variable or were not focused on problem behavior (e.g., focused on compliance only). Multi-component interventions that involved the manipulation of multiple variables at the same time were excluded in cases where the independent effects of an antecedent variable could not be inferred.

A body of studies that have examined the effects of providing positive forms of reinforcement for compliance whilst maintaining an escape contingency for problem behavior, best exemplified by Lalli et al (1999), were excluded from the current review. Whilst an MO account of such findings is possible (see Fisher et al., 2005 for example), the primary interpretation of these findings has been made in terms of choice responding between two concurrent operants (Lalli et al., 1999). Studies that examined this experimental manipulation, without providing further analysis to support an MO interpretation, were therefore excluded.

Historically, the function of negatively reinforced problem behavior has been assessed by the use of a 'demand' condition, whereby either the individual is presented with an academic demand, and the demand is removed contingent upon the occurrence of a target behavior as in an ABC analysis (Iwata, Dorsey, Slifer, Bauman, & Richman, 1982/1994), or the individual is presented with a non-preferred demand in the context of reduced attention and no programmed consequences are provided for the behavior, as in an AB analysis (Carr & Durand, 1985). Papers that solely included a demonstration of either of the above methodologies, without the use of additional variants, were excluded. The review included papers published between 1999 and 2011. Studies pre-dating 1999 have previously been

comprehensively reviewed (McGill, 1999; Smith & Iwata, 1997). The current review therefore included all studies that met inclusion criteria published between 1999 and 2011.

Methodology for Reviewing the Quality of the Evidence Base.

In accordance with the wider move towards evidence-based practice (Kaiser & McIntyre, 2010), the current review evaluated studies against recognized criteria for the methodological evaluation of single-case experimental designs (Kratochwill et al., 2010). The criteria used to assess each study are described in Table 1.

++++++++++++++ Insert Table 1 about here ++++++++++++

Results.

A total of 59 studies were deemed to meet selection criteria for the current review. Fourteen studies were identified which examined antecedent conditions, (other than the onset of academic demands) that appeared to occasion negatively reinforced problem behavior (see Table 2). Three studies were identified that examined the influence of manipulating parameters of conditions associated with alternative sources of negative reinforcement (see Table 3). Eight studies were identified that examined the role of biological variables (e.g., genetic syndromes, health conditions, medication) in negatively reinforced problem behavior (see Table 4). Thirteen studies were identified that examined the influence of adding potential sources of positive reinforcement to an aversive context (see Table 5); eight studies were identified that investigated the influence of manipulating the difficulty of instructional demands (see Table 6); five studies were identified that investigated the influence of altering the schedule of instructional demands (see Table 7); four studies were identified that examined the influence of manipulating choice or predictability of instructional demands (see

Table 8) and four studies were examined that influenced the effect of making pre-session manipulations prior to the onset of instructional demands (see Table 9). Finally, 11 studies were identified that examined the effect of altering the mode of demand presentation (see Table 10).

++++++++++++ Insert Tables 2 to 10 here ++++++++++++++

Biological Influences.

The concept of the MO has proved important in helping to bridge the historical divide between the biological and operant sciences (Langthorne, McGill, & O'Reilly, 2007; Oliver, 1993). Biological variables appear to play a critically important role in influencing the development and subsequent maintenance of escape-maintained problem behavior. In his review, McGill (1999) identified a handful of studies to have examined the role of sleep, allergies and physical illness as MOs for escape-maintained problem behaviors (Horner, Day, & Day, 1997; Kennedy & Meyer, 1996; O'Reilly, 1995). Whilst conceptual arguments had been made for the influence of more enduring genetic influences on the reinforcing value of specific sources of reinforcement (McGill, 1999; Oliver, 1993), there was an absence of empirical evidence to support these hypotheses.

Over the past decade there have been some considerable developments in this field. First in relation to the influence of genetic influences there has been considerable conceptual (Langthorne & McGill, 2008) and empirical (Tunnicliffe & Oliver, 2011) appreciation of their contribution to the phylogeny and ontogeny of problem behavior. In relation to negatively reinforced problem behavior, two studies were identified that utilized aggregate single-case design methodology to provide preliminary evidence to support possible elevated

rates of negatively reinforced problem behavior in both fragile X syndrome (Langthorne et al., 2011) and Angelman syndrome (Strachan et al., 2009). Whilst some evidence, using indirect methods of functional assessment, exists to support within- and between-subject differences in the distribution of specific behavioral functions (Langthorne & McGill, 2012), there is a need for large-scale, group comparison studies that employ experimental functional analytic methodologies.

Another important avenue in this line of research lies in the analysis of specific biological, cognitive or behavioral characteristics associated with particular syndromes and their interaction with the environmental conditions that give rise to problem behavior. In the current review one study was identified that demonstrated a relationship between hyperacusis and problem behavior occurring under demand conditions for a child with Williams syndrome (O'Reilly, Lacey, & Lancioni, 2000). Specifically, whilst pain-related behaviors occurred when a loud noise was present, problem behavior was only evoked when demands were combined with loud noise. The use of ear plugs in this specific context reduced escape-maintained problem behaviors and pain-related behavior. Single-case design methodology is particularly well suited towards meeting the needs of this type of research and further research is important if interventions are to be identified that help to meet the needs of children with genetic conditions associated with intellectual disabilities and problem behavior.

There has been continued investigation of the role of specific physiological variables on negatively reinforced problem behavior, including sleep deprivation (O'Reilly & Lancioni, 2000) and menses (Carr, Smith, Giacin, Whelan, & Pancari, 2003). The study by O'Reilly and Lancioni is particularly noteworthy for demonstrating an interaction between sleep deprivation and an increase in a specific member of a response class hierarchy (self-injurious behavior). The interaction between MOs and the 'price' individuals will pay to achieve a

specific behavioral outcome (such as escape) has received scant attention and may be an important parameter that influences the *matching law* (Herrnstein, 1961) and the distribution of responses when concurrent operants are available. This should be a priority for future basic and applied research on negatively reinforced problem behavior.

Interestingly, there appears to be a preponderance of studies that have demonstrated a relationship between fluctuations in health conditions and negatively reinforced problem behavior, as opposed to behaviors that serve other behavioral functions (Kennedy & Becker, 2006). It is unclear whether such a specific relationship exists and the nature of the mechanisms that could underpin such a relationship has also not been explicated. Basic research may help in elucidating the nature of such relationships. For example, a study by Harvey et al (2004) suggested that activation of serotonin receptors (5-HT1A) may be the mechanism by which REM sleep deprivation selectively increases avoidance behaviors in rodents. Further examination of these questions could offer important advances in our understanding of negatively reinforced problem behavior and the pathways that potentially underpin it.

Finally, examination of the influence of medications has been shown to influence problem behavior maintained by negative reinforcement. Two studies were identified that investigated the influence of risperidone on behavioral function during a cross over medication trial (Crosland et al., 2003; Zarcone et al., 2004). These studies suggested relatively idiosyncratic effects on escape-maintained problem behavior across different individuals. Both were, however, hampered by difficulties with experimental control. A well controlled study, reported by Kelley, Fisher, Lomas and Sanders (2006) noted a shift in response allocation from problem behavior to compliance following the introduction of amphetamine for a child with ADHD. This appears to provide an interesting paradigm through which the influence of specific medications can be investigated.

These findings have important implications for our understanding of the development of problem behavior and the ontogeny of specific behavioral functions. Equally, they have clear implications for the assessment of escape-maintained problem behavior. In cases, where there is variability in problem behavior then the influence of fluctuations in medications and health conditions should be considered as a potential contributory factor. In cases where their role is implicated then the treatment and amelioration of any discomfort should be prioritized (Carr & Blakeley-Smith, 2006). The findings of O'Reilly, Lacey and Lancioni (2000) highlight the importance of developing an understanding of phenotype-environment interactions in order to develop environments that are matched to the needs of individuals with specific genetic syndromes.

Alternative Sources of Negative Reinforcement.

From the advent of functional analytic methodology (Carr, Newsom, & Binkoff, 1976, 1980; Iwata, Dorsey, Slifer, Bauman, & Richman, 1982/1994), the presentation of instructional academic demands has been used as the standard MO to test for the presence of a negative reinforcement contingency. In his review of motivating operations, McGill (1999) identified only a handful of studies that tested for alternative sources of motivation for negatively reinforced problem behavior, specifically for the onset of social attention (Taylor & Carr, 1992) and ambient noise (O'Reilly, 1997).

The current review identified strong evidence for the role of social contact as a potnential source of aversive stimulation. Both Hagopian, Wilson and Wilder (2001) and Tiger et al. (2009) reported on the use of an 'escape from attention' condition as a variant of standard functional analysis. In both studies, the MO in this condition comprised the continuous presentation of social attention followed by 30s of escape contingent on the problem behavior and was indicated after elevated rates of problem behavior had been found

in the ‘Play’ condition of a prior functional analysis. As demonstrated by Oliver, Oxener, Hearn and Hall (2001), however, for some individuals it may not be social attention per se but rather social proximity that proves to be the critical source of aversive stimulation associated with social contact.

Such factors may conceivably influence problem behavior occurring in the context of instructional demands. Moore and Edwards (2003) identified two participants who showed higher levels of escape-maintained problem behavior in conditions associated with high levels of attention during school work. A subsequent analysis for these two participants revealed that providing praise for engagement was associated with higher rates of problem behavior and lower rates of engagement in comparison to attending to disengagement. This suggests that for individuals who find attention aversive, it may be the attention-component of demand presentation rather than the demand itself that evokes escape-maintained problem behavior.

Other studies have provided further evidence to show that problem behaviors occurring in the context of instructional demands may not necessarily indicate that the instructional sequence is the aversive component of the demand. McCord, Thomsen and Iwata (2001) completed a functional analysis to identify the aversive aspects of transitions between activities. The authors found that requests to change location, irrespective of the nature of the ongoing or subsequent task, motivated problem behavior for both participants. Likewise Hagopian et al. (2007) demonstrated that requests to complete an instructional demand may be aversive because of the interruption made to ongoing activities. It may be that in such cases, the ongoing activity functions as a form of transitive CMO, in that its onset establishes another stimulus (i.e., the demand) as aversive and evokes behaviors associated with the termination of the demand. In the absence of the ongoing activity one would expect that the demand would not retain its aversive properties.

Further evidence was also found for the presentation of food as an MO for negative reinforced problem behavior (Bachmeyer et al., 2009; LaRue et al., 2011; Piazza et al., 2003). A handful of studies have provided a more fine-grained analysis of such sources of negative reinforcement. Rivas, Piazza, Patel, and Bachmeyer (2010) for example demonstrated the distance between a spoonful of food and the mouth acted as a form of MO. This assessment was then used to direct an intervention directed at gradually fading the distance between the spoon and lips of a participant, under escape extinction conditions. Similarly, other manipulations, such as preference for specific types of food (Levin & Carr, 2001) have been shown to alter the value of escape in problem behaviors associated with food refusal.

Whilst the onset of noise has previously been demonstrated to form a general class of MO, more recent studies have provided a more fine-grained analysis of the specific type of sounds that can establish specific noises as aversive (Buckley & Newchok, 2006; McCord, Iwata, Galensky, Ellingson, & Thomson, 2001).

These findings have a number of implications for the assessment and treatment of problem behavior. First, it is important to assess a broader range of stimuli other than instructional demands when testing for a negative reinforcement contingency. Failure to do so may result in a Type II error (i.e., the presence of a negative reinforcement contingency may be missed when it is present). Pre-assessment, in the form of indirect or direct observation, has been shown to be critical in helping to identify a range of potentially aversive stimuli to include in an assessment (e.g., Roscoe, Rooker, Pence, & Longworth, 2009). Indeed, the current review identified a number of studies that incorporated a broader assessment of demands to assess for possible sources of aversive stimulation (Baker, Hanley, & Mathews, 2006; Long, Hagopian, DeLeon, Marhefka, & Resau, 2005; Roscoe, Rooker, Pence, & Longworth, 2009).

Equally, it is important to be responsive to the specific results of a functional analysis. Problem behaviors occurring in the control condition of a functional analysis should prompt the use of a condition to test the role of social contact as an aversive stimulus. Also, it should not be assumed that simply because problem behavior occurs in the general context of demands that it is the instructional demand that necessarily functions as the relevant MO. Within-session analyses may at times be required to help identify the aversive aspect of the demand context (Roane, Lerman, Kelley, & Van Camp, 1999). This would be especially indicated in situations where an individual continues to display problem behavior irrespective of within-session fluctuations in the presence of demands. For example, within-session analyses of MOs could be used to determine whether the conditional probability of problem behavior increases following the delivery of praise for compliance, which may indicate that it is the social contact aspect of demands that is aversive. In cases where such a relationship was found then modifications to the prompting procedures could be made that encouraged engagement with the instructional sequence, whilst minimizing aversive social contact. Finally, there are comparatively few studies to have provided fine-grained MO analyses of these forms of aversive stimulation; this would seem to be a priority for future research due to the implications such analyses have for the treatment of problem behaviors maintained by alternative sources of negative reinforcement.

Manipulation of Pre-session Variables.

There has been a relatively well established line of research, since the publication of McGill (1999), that has examined the influence of manipulating pre-session variables in order to examine the subsequent motivative effects on different sources of positive reinforcement (Edrisinha & O'Reilly, 2006; O'Reilly, 1999; O'Reilly et al., 2006; Roantree & Kennedy, 2006). However, the influence of such manipulations on behaviors maintained by escape from aversive stimuli has received comparatively less attention. Only four studies were

identified to have explicitly examined such variables for escape maintained problem behaviors. Whilst pre-session contexts characterized by high levels of demands have been shown to act as an EO for subsequent escape-maintained problem behaviors occurring within a functional analysis (O'Reilly, Lancioni, & Emerson, 1999), the majority of studies have focused on examining the potential influence of alternative pre-session variables some of which can be experimentally controlled, by, for example, manipulating pre-session access to attention (McComas, Thompson, & Johnson, 2003) or preferred tangible items (Rispoli et al., 2011). Other studies have attempted to identify correlations between more temporally distal events (Ray & Watson, 2001) and negative reinforced problem behavior. Due to their correlational nature, however, it is not possible to determine the extent to which such events serve to act as MOs. Given their likely influence such variables should be increasingly identified through indirect and direct methods of assessment and into experimental analyses.

Altering the Mode of Demand Presentation.

Studies have begun to discriminate between a demand (i.e., task that needs completing) and the prompting procedure that is used to support it (i.e., mode with which demands are presented). A number of studies were identified in the current review that manipulated the specific prompting procedures used to support an individual in completing instructional demands. This appears to have been a relatively recent development and did not feature in the studies reviewed by McGill (1999).

Three studies have investigated the influence of providing different numbers of steps to a prompting procedure, with relatively idiosyncratic effects reported across each study (Boelter et al., 2007; Crockett & Hagopian, 2006; Stichter, Sasso, & Jolivette, 2004; Tiger, Fisher, Toussaint, & Kodak, 2009). For example, Tiger et al. reported that problem behavior reduced following the introduction of a graduated, 3-step prompting procedure, in

comparison to a 1-step, verbal only prompting procedure, whereas both Boelter et al (2007) and Crockett and Hagopian (2006) report a contrasting pattern of results following similar manipulations in their studies. It would be of interest to see whether other factors, such as level of task difficulty, are related to such variability.

Other studies have demonstrated that manipulating the style with which prompts are delivered (Borrero, Vollmer, & Borrero, 2004; Peyton, Lindauer, & Richman, 2005) and the way in which corrective feedback is provided (Ebanks & Fisher, 2003) can abolish the aversiveness of demands. For example, Peyton et al. demonstrated that altering the how directive prompts were (e.g., from "show me the *X*" to "I wonder where the *X* is") successfully reduced escape maintained problem behavior in a 10 year old girl with autism. Similarly the verbal description used to describe an escape contingency has been shown to alter the probability of escape-maintained problem behavior (Northup, Kodak, Lee, & Coyne, 2004).

These studies are important in that they demonstrate that at times the task demand per se may not be the aversive feature of an instructional sequence but rather the prompting procedure used to support it may be. In applied settings, when an individual shows variation between different people presenting similar demands then it may be that differences in prompting procedures underpin such variability, as opposed to any feature of the task itself. Such variations may be important in accounting for the effects of factors such as 'rapport' on problem behavior (Magito-McLaughlin & Carr, 2005). It seems important that this be explored further in applied contexts as successful compliance with instructional demands could be elicited by a change in prompting procedure rather than necessitating a change to the task itself. Research is required that helps to elucidate when these relations are operative in order to ensure that this important distinction is not overlooked.

Task Difficulty/Preference

Task difficulty has been long-recognized as an important variable influencing the aversiveness of demands (Carr & Durand, 1985; Weeks & Gaylord-Ross, 1981). The current review identified several studies to support this position. A range of methods were used to help identify 'difficult' demands; including staff report (Butler & Luiselli, 2007), classroom approach behaviors (Reichle, Johnson, Monn, & Harris, 2010), the use of a demand hierarchy assessment (Call, Wacker, Ringdahl, Cooper-Brown, & Boelter, 2004), and task accuracy (Lee, Sugai, & Horner, 1999; Moore & Edwards, 2003; Reichle & McComas, 2004). All these studies demonstrated that demands rated as 'difficult' were more likely to evoke escape-maintained problem behavior than demands rated as 'easy'.

A number of studies demonstrated the utility of interventions designed at reducing the difficulty of a task *either* by altering supports available to the individual *or* by teaching adaptive behaviors to help the individual complete the task. McComas, Hoch, Paone and El-Roy (2000) showed that the introduction of instructional strategies to reduce task difficulty (use of calculator, number lines) successfully reduced the occurrence of escape-maintained problem behavior for a boy with autism. Both Lee, Sugai and Horner (1999) and Lalli, Kates and Casey (1999) identified the absence of component skills served to make specific tasks difficult and thereby become associated with escape-maintained problem behaviors. Both studies reported on instructional interventions designed at teaching students the component skills required to complete a task successfully and thereby reduce its difficulty and the probability of escape-maintained problem behavior.

Such findings have important implications for both the assessment and treatment of problem behavior. In relation to the assessment of problem behavior, it seems important that task difficulty should be assessed prior to the selection of tasks for the demand condition of a

functional analysis. There is a wealth of data to suggest that failure to include tasks of sufficient difficulty will fail to evoke the same level of problem behavior than would otherwise be expected. If task difficulty is found to be an important variable then clinicians should find opportunities to either: a) alter the task to reduce its difficulty, b) increase the level of support and c) ensure that the student has the full repertoire of skills required to complete the task.

Choice/Predictability of Tasks.

As reported in McGill's (1999) review, manipulations of both choice (Dunlap, Kern-Dunlap, Clarke, & Robbins, 1991; Foster-Johnson, Ferro, & Dunlap, 1994) and the predictability of tasks (Flannery & Horner, 1994) have been shown to reduce the occurrence of escape-maintained problem behavior. This literature has continued to grow in recent years. With regard to task predictability, Reichle, Johnson, Monn, and Harris (2010) demonstrated that the use of explicit cues signaling the end of a task (such as "only X more to go") resulted in reductions in the escape-maintained problem behavior of two four year old boys with an autistic spectrum disorder, in comparison to the use of more general delay cues (e.g., "only a few left"). Studies that have examined choice have shown that offering choice over the sequence of tasks, the type of reinforcers available and having the option to select a different task once instruction has begun can reduce escape-maintained problem behavior (McComas, Hoch, Paone, & El-Roy, 2000; Newman, Needelman, Reinecke, & Robek, 2002; Romaniuk et al., 2002). Romaniuk et al. (2002) demonstrated that a choice-making intervention reduced the escape-maintained problem behavior of four participants but had no influence on attention-maintained problem behavior, demonstrating the importance of matching an intervention to behavioral function. Part of the choice-making strategy employed by Romaniuk et al. involved offering the opportunity to choose a change of tasks during instruction. Findings by McComas, Hoch, Paone, and El-Roy (2000) suggest that, for one

participant at least, task repetition may have aversive properties and one effect of choice-making may be to interrupt the aversiveness of task repetition.

Non-contingent Escape and Embedding Demands in Contexts Associated with Positive Reinforcement.

McGill (1999) provided a MO interpretation of non-contingent escape (NCE) as an intervention for problem behavior and studies to have examined this intervention were cited in his paper (e.g., Vollmer, Marcus, & Ringdahl, 1995). The current review identified a number of studies that demonstrated the use of providing breaks from aversive demands on a fixed-time schedule. These studies have shown variants of this intervention to be effective in reducing the escape-maintained behavior of individuals with intellectual and developmental disabilities (Aikman, Garbutt, & Furniss, 2003; Kodak, Miltenberger, & Romaniuk, 2003; Wesolowski, Zencius, & Rodriguez, 1999), typically developing children undergoing dental treatment (O'Callaghan, Allen, Powell, & Salama, 2006), and an older adult with Alzheimer's disease (Baker, Hanley, & Mathews, 2006).

In his review, McGill (1999) noted that embedding a demand within a context containing preferred events or activities, such as storytelling (Carr, Newsom, & Binkoff, 1976), social comments (Kennedy, Itkonen, & Linquist, 1995) or following *high p* demands[2] (Mace & Belfiore, 1990) could reduce the occurrence of escape-maintained problem behavior. This important area of research has continued to attract attention in the literature. Research has continued to demonstrate the positive influence of preceding a *low-p* request with a request that is highly likely to be complied with for problem behaviors maintained by escape (Patel et al., 2006). A number of studies have demonstrated that presenting demands within the context of an ongoing preferred activity may reduce the occurrence of escape-

[2] Involving the presentation of a demand assocaited with a high probability of compliance prior to the presentation of a demand with low probability of compliance

maintained problem behavior (Carey & Halle, 2002; Wilder, Normand, & Atwell, 2005). Similarly manipulations made to the quality of attention available during demands (Call, Wacker, Ringdahl, Cooper-Brown, & Boelter, 2004; Gardner, Wacker, & Boelter, 2009) or preference for the specific materials (e.g., toys; Boelter et al., 2007; Harding et al., 1999) used in demand procedures have been shown to influence escape-maintained problem behaviors. Harding et al. (1999) adopted a concurrent choice procedure to examine the influence such manipulations had on problem behavior and response allocation. Interestingly, one participant allocated her responses to conditions in which the manipulation of a highly preferred toy was used for instructional activities and this was associated with higher task completion and lower levels of problem behavior. However, for another participant a similar manipulation increased rates of problem behavior and reduced task completion, suggesting it was aversive. Indeed, for some individuals restricting access to preferred items during demand presentation has been shown to evoke escape-maintained problem behaviors (Call, Wacker, Ringdahl, & Boelter, 2005). It may be that the restricted nature of interactions with the highly preferred toy in the Harding et al. study served to establish this manipulation as aversive.

Other studies have examined providing non-contingent access to attention or tangibles on either a fixed interval or variable interval schedule (Ingvarsson, Hanley, & Welter, 2009; Ingvarsson, Kahng, & Hausman, 2008; Lomas, Fisher, & Kelley, 2010; Long, Hagopian, DeLeon, Marhefka, & Resau, 2005; Reed et al., 2004). These studies have reported somewhat mixed results. For example, Lomas, Fisher and Kelley (2010) reported that providing access to praise and food on a variable interval schedule reduced the problem behavior of three participants with Autistic Spectrum Disorder but only improved the compliance of one participant. Whilst Ingvarsson et al. in two related studies have noted the benefits of providing non-contingent access to food tangibles, they reported that the density

of NCR had little impact on compliance or problem behavior (Ingvarsson, Kahng, & Hausman, 2008); they also reported minimal difference between NCR and providing reinforcement contingent on compliance (Ingvarsson, Hanley, & Welter, 2009). Reed et al. (2004) reported the NCR only reduced problem behavior when combined with escape extinction, suggesting that for some individuals at least, NCR may not be sufficient to achieve behavioral change.

This body of research suggests ways in which the aversiveness of a demand may be altered by manipulating either the preceding or ongoing nature of an activity by introducing potential sources of positive reinforcement. Whilst such a manipulation may have unintended consequences for some children (e.g., Harding et al., 1999), this form of intervention may be an important consideration in applied contexts. This may be especially important to consider in situations where an individual is considered to be in a 'bad mood' and may be more likely to present with problem behaviors following a demand (Carr, McLaughlin, Giacobbe-Grieco, & Smith, 2003). In relation to assessment, it seems important that the quality of attention provided during demands and preference for task materials is controlled. Studies appear to show that providing access to 'high quality' attention or to highly preferred materials may alter the probability of escape maintained problem behavior. Likewise, it is possible that providing access to highly preferred materials during demand activities could restrict the way in which a child interacts with them and could thereby evoke tangible-maintained problem behavior. Within-session analyses would be an important means of examining such relations where they are suspected to exist.

Concluding Comments.

Over the past decade there have been considerable developments in the investigation of MOs and in the role played by such variables in problem behavior maintained by negative

reinforcement. The terms used to describe motivative events have evolved, as have the methods used to investigate their effects. This endeavour has served to facilitate the incorporation of MOs into the functional analysis of problem behavior and has been beneficial in developing the understanding of negatively reinforced problem behavior. The implications of these developments for the assessment, treatment and study of negatively reinforced problem behavior have been outlined throughout this review.

The findings of the review highlight the importance of attending to the person in their environmental context and to the interplay between the two (see Figure 1). The review has highlighted a number of environmental and person-level variables that could be considered to act as 'risk markers' for negatively reinforced problem behavior. The risk of negatively reinforced problem behavior will be elevated in certain environmental contexts (for example, environments in which aversive stimuli are not embedded in a 'positive' context, environments lacking opportunities for choice or control)[3]. Likewise, there appears to be certain person-level variables that are associated with a heightened propensity to display negatively reinforced problem behavior under certain environmental conditions (for example, the presence of specific phenotypes associated with genetic syndromes and health conditions or the absence of certain behavioral repertoires). Whilst ameliorating environmental MOs may be sufficient to reduce negatively reinforced problem behavior for many individuals, in cases where person-level variables play a role then their interplay with environmental factors will need to be targeted in treatment (Carr & Smith, 1995). Such interventions may take the form of adapting the environment in order to fit the needs of the individual (for example, by reducing the presentation of specific aversive stimuli, such as eye contact in fragile X syndrome) or adapting the person to meet the needs of the environment (for example, adding

[3] The current review has also demonstrated that many of these 'risk markers' are highly idiosyncratic and may to a large extent be dependent on the person's specific learning history.

ear plugs to reduce the impact of noise in Williams syndrome or teaching specific behavioral repertoires to the individual).

As has been highlighted in the review, there are several areas where future research is needed in order to continue this advancement. The developments that have taken place over the past decade, however, provide a firm foundation on which further developments can be built. The close connections between basic and applied research, encouraged by the advent of functional analysis (Mace, 1994), will continue to be of critical importance in the future investigation of the effects of the MO on negatively reinforced problem behavior.

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Table 1. Summary of Criteria for Single-Case Designs that Meet Evidence Standards (With or Without Reservation). What Works Clearing House (Kratochwill et al., 2010).

Standard	*Outcome and Critieria*
1. The IV (intervention) must be systematically manipulated with the researcher determining when and how the IV conditions change[4]	Meets evidence standards *with* or *without* reservations (indicate which)[5] Does not meet Evidence Standards
2. Each outcome variable must be measured systematically over time by more than one assessor, and the study needs to collect inter-assessor agreement in each phase and on at least twenty percent of the data points in each condition (e.g., baseline, intervention) and the inter-assessor agreement must meet minimal thresholds.	Meets evidence standards *with* or *without* reservations (indicate which)[6] Does not meet Evidence Standards
3. The study must include at least three attempts to demonstrate an intervention effect at three different points in time or with three different phase repetitions.	Meets evidence standards *with* or *without* reservations (indicate which)[7] Does not meet Evidence Standards
3. For a phase to qualify as an attempt to demonstrate an effect, the phase must have a minimum of three data points.	Meets evidence standards *with* or *without* reservations (indicate which)[8] Does not meet Evidence Standards

[4] Added by author "in cases where manipulations are made that could introduce a confounding variable (e.g., use of non-trained individuals as interventionists) then efforts to control for these potential confounds should be made (e.g., use of treatment integrity data). In cases where standard not met then reject"

[5] If standard not met then reject

[6] Must have collected for at least 20% of intervals, for each case on each outcome variable. If not then reject. Minimum acceptable range from 0.8-0.9 for percentage agreement and 0.6 if using kappa statistic.

[7] If standard not met then reject. Examples of designs not meeting this standard include AB, ABA, and BAB designs.

[8] To *Meet Standards* a reversal /withdrawal (e.g., ABAB) design must have a minimum of four phases per case with at least 5 data points per phase.
To *Meet Standards with Reservations* a reversal /withdrawal (e.g., ABAB) design must have a minimum of four phases per case with at least 3 data points per phase. Any phases based on fewer than three data *points cannot* b*e used to demonstrat*e existence or lack of an effect.
To *Meet Standards* a multiple baseline design must have a minimum of six phases with at least 5 data points per phase. To *Meet Standards with Reservations* a multiple baseline design must have a minimum of six phases with at least 3 data points per phase. Any phases based on fewer than three data points *cannot* b*e used to demonstrat*e existence or lack of an effect.
An alternating treatment design needs *five repetitions* of the alternating sequence to *Meet Standards.* A design with four repetitions would *Meet Standards with Reservations*, and a design with fewer than four repetitions *Does Not Meet Standards.*

Table 2. Studies that Demonstrate the Influence of MOs for Novel Sources of Negative Reinforcement

Study	Participants (age, diagnoses)	DV	Functional assessment[9]	IV	Design	Experimental standards met	Findings
LaRue et al (2011)	*Lauren* (2yrs) *George* (5yrs) *Carl* (18mths) *Charles* (5yrs) *Frank* (21mths)	Inappropriate behaviour ***	ABC analysis	Comparison between control, attention and escape conditions of functional analysisduring mealtime	Pairwise multi-element design (except Charles, ABAB reversal)	Standard 1- Y Standard 2- Y Standard 3: Y Standard 4: Y (Frank, Charles), R (Carl), N (Lauren, George)	All participants presented with inappropriate behaviour maintained by escape from food
Rivas, Piazza, Patel, & Bachmeyer, (2010)	*David* (4yrs, failure to thrive) *Ashley* (5 mths, typical cognitive development, failure to thrive) *Oliver* (10mths, typical cognitive development, failure to thrive)	Inappropriate mealtime behaviour ***	ABC analysis	Phase 1: Comparison of: 1) spoon at distance, 2) spoon at lips.. Phase 2 (David/Ashley): A phase- fading spoon distance Vs. B phase- fading plus escape extinction Oliver: A phase- Lips baseline Vs. B phase- comparison of escape	Phase 1: Alternating treatment (all participants for distance analysis) Phase 2: Reversal (ABAB- David/Ashley) and with embedded	Standard 1-Y Standard 2-Y Standard 3–Y Standard 4-Y	Rates of inappropriate mealtime behaviour higher in condition where spoon placed to lips. Fading plus escape extinction was more effective than fading alone (David/Ashley) or escape extinction alone (Oliver)

[9] ABC analysis refers to an experimental comparison between at least one test and control condition whereby both antecedents and consequence conditions are manipulated. Antecedent analysis refers to an experimental comparison between at least one test and control condition whereby antecedents only have been manipulated. Descriptive assessment refers to an observational, non-experimental assessment of problem behaviour. Indirect assessment refers to assessments informed by caregivers/teachers. Function inferred by topography refers to studies whereby behavioural topography has been used to make an inference regarding behavioural function (i.e., food refusal). In studies where multiple methods of functional assessment were included then the method with the highest level of control is reported herein.

				extinction alone Vs. escape extinction plus fading	alternating treatments design (Oliver)		
Tiger, Fisher, Toussaint, & Kodak (2009)*	*Jimmy* (13yrs, autism)	Aggression	ABC analysis	Compared 'social escape' Vs. 'no interaction' condition.	Multi-element	Standard 1- Y Standard 2- Y Standard 3: Y Standard 4: R	Demonstrated an escape from attention function to the behaviour.
Roscoe, Rooker, Pence, & Longworth, (2009)	*Steve* (14yrs, autism) *Jill* (10yrs, Smith-Magenis syndrome) *Candace* (10yrs, autism) *Tyler* (22yrs, profound intellectual disabilities)**	Aggression (Steve, Candace) Property destruction (Tyler) SIB (Jill) ***	ABC analysis	Phase 1: Demand assessment Phase 2: Comparison of attention Vs. control Vs. low p demand Vs. high p demand conditions	Multi-element design	Standard 1- Y Standard 2- Y Standard 3- Y Standard 4- R [Steve and Jill], N [Candace and Tyler]	Low p demands evoked higher rates of CB for 3 participants.
Bachmeyer et al (2009)	*Mathew* (4yrs, developmental delay) *Ella* (4yrs, developmental delay) *Tyler* (5yrs, typically developing) *Savannah* (3yrs, developmental delay)	Inappropriate mealtime behaviour ***	ABC analysis	Compared control, attention and escape conditions during food presentation.	Pair-wise, multi-element design.	Standard 1- Y Standard 2- Y Standard 3-Y Standard 4- Y [Tyler & Savannah], N [Mathew & Ella]	Behaviour occurred at higher rates in the escape and attention conditions

Hagopian, Bruzek, Bowman, & Jennett (2007)	*Perry* (12yrs, moderate intellectual disabilities, autism) *Maxwell* (6yrs, moderate intellectual disabilities, autism), *Kelly* (12yrs, autism,) **	Problem behaviour	ABC analysis	Study 1 (Perry and Maxwell): Comaprison of control condition Vs. 'do' mands (interrupted ongoing activity) with escape contingency Study 2: Kelly. Comaprison of 'Do' requests Vs. 'Don't requests (e.g., 'you can't sit here')	Study 1: Multi-element (Perry), reversal (Maxwell) Study 2 Multi-element (Kelly)	Standard 1-Y Standard 2 –Y Standard 3-Y Standard 4-Y	Study 1. Problem behaviour occurred at higher rates in the interruption condition. Study 2: 'Do' and 'don't' requests were found to evoke problem behaviour.
Baker, Hanley & Mathews (2006)*	*Participant* (96 yrs, Alzheimer's dementia)	Aggression	ABC analysis	Phase 1: Setting analysis. Bathroom routine Vs. recreational routine. Phase 2. Comparison of a) escape, b) attention and c) control during bathroom routine	Multi-element	Standard 1- Y Standard 2- Y Standard 3- Y Standard 4- Y [phase1], R [phase 2]	Phase 1: Aggression occurred only in bathroom routine. Phase 2: Elevated ratesin escape condition and also attention condition.
Buckley & Newchok (2006)	*Billy* (7yrs, pervasive developmental disorder)	Disruption	ABC analysis	Comparison of:1) Leisure, 2) differing genres of music from a tape with escape, 3) differing genres of music from a CD with escape	Multi-element	Standard 1- Y Standard 2- Y Standard 3-Y Standard 4- Y	Differentially high levels of disruption occurred during the tape condition, irrespective of music genre.
Piazza et al (2003)	5 females (aged 1-2yrs) 10 males (aged 1-7yrs)	Inappropriate behaviour	ABC analysis	Functional analysis of inappropriate mealtime behaviour including control, tangible, escape and	Reversal design	Standard 1- Y Standard 2- Y Standard 3- N Standard 4- Y	9 of 10 children who displayed problem behaviour during functional analysis were found to at least in part be escape-maintained

				attention conditions			
Moore & Edwards (2003)*	*Edgar*, (9yrs, severely emotionally disturbed) *Morris*, (7yrs, cognitive and academic abilities in average range) *Jacob*, (17yrs) *Robert* (7 yrs)	Problem behaviour ***	ABC analysis	Phase 2. Comparison of; 1) low attention/easy demand, 2) low attention/difficult demand, 3) high attention/easy demand, 4) high attention/difficult demand. Escape contingency. Phase 3. Compared; 1) praise for engagement, 2) encouragement for disengagement, 3) reprimand for disengagement.	Multi-element	Standard 1-Y Standard 2- Y Standard 3- Y Standard 4- R [phase 3, Edgar], N [all other data sets]	Phase 2. Edgar and Morris showed higher rates of problem behaviour in both high attention conditions. Phase 3. Edgar and Morris: higher rates of problem behaviour and lower rates of engagement when praise was provided for engagement. Converse when the teacher attended to disengagement.
Hagopian, Wilson & Wilder (2001)	*Preston* (6-yrs, autism and mild intellectual disability)**	SIB, aggression, disruption, spitting	ABC analysis	Phase 1. Functional analysis. Phase 2. Functional analysis with 'escape from attention condition'.	Multi-element	Standard 1- Y Standard 2- Y Standard 3- Y Standard 4- Y	Phase 1. High rates of problem behaviour in play condition. Phase 2. Showed elevated rates of problem behaviour in escape from attention condition.

McCord, Iwata, Galensky, Ellingson, & Thomson (2001)	*Debbie* (43yrs, autism, profound intellectual disability) *Sarah* (41yrs, severe intellectua disability) **	Problem behaviour	ABC analysis	Phase 1: Noise avoidance ssessment. Compared noises identified as potential EOs Vs. control (white noise, & man talking in normal conversational tones). Escape contingency. Phase 2: Functional analysis (Debbie and Sarah). Compared noise condition Vs. play and no interaction conditions. Phase 3: Treatment analysis. Comparison of extinction alone (baseline) against stimulus fading plus extinction (intervention).	Multi-element (Phase 1 and Phase 2) Multiple baseline across participants (Phase 3)	Standard 1- Y Standard 2- Y Standard 3-N (phase 3) Standard 4- N (phases 1,3) Y (phase 2, Sarah); R (Debbie)	Phase 1: Specific noises evoked problem behaviour for Debbie and Sarah. Phase 2: Functional analysis verified that problem behaviour miantained by escape from noise. Phase 3: Treatment analysis demonstrated that stimulus fading combined with extinction reduced the occurrence of problem behaviour for Debbie. A DRO component needed to be added for Sarah.
McCord, Thomson & Iwata (2001)	*Hayden* (27yrs, profound intellectual disability) *Michael* (38yrs, profound intellectual disability) **	SIB	ABC analysis	Comparison of: 1) activity initiation, no location change, 2) activity initiation, location change, 3) activity termination, no location change), 4) activity termination, location change, 5) location change, no activity	Multi-element	Standard 1- Y Standard 2- Y Standard 3: Y Standard 4: Y	Hayden: SIB maintained by avoidance of location change, regardless of pre- or post activity Michael: as above, but also served the function of escape from ongoing tasks and avoidance of task initiations

Moore, Edwards, Wilczynski, & Olmi (2001)	*Participant 1* (4 yrs, boy) *Participant 2* (5 yrs, boy) *Participant 3* (9yrs, girl) *Participant 4* (9yrs, boy)	Problem behaviour ***	Antecedent analysis	Care-giver presented antecedent conditions. 1) Free play. 2) High difficulty demand. 3) Low difficulty demand. 4) High attention, 5) Low attention	Brief multi-element with ABAB reversal probes	Standard 1-Y Standard 2- Y Standard 3- Y Standard 4- N	Participants 3and 4 demonstrated higher levels of problem behaviour in high attention condition demonstrated.
Oliver, Oxener, Hearn, & Hall, (2001)	*Alex* (14 yrs, diagnosed with intellectual disability) **	Hairlicking, biting, kicking, scratching, vocalisations, inappropriate touching, pushing, hitting, spitting, grabbing, hairpulling	Antecedent analysis	Phase 1: Comparison of 1) Close proximity: 2) 2m proximity	Alternating treatment design	Standard 1- Y Standard 2-Y Standard 3-Y Standard 4-Y	Differentiation between the conditions irrespective of social contact (i.e., proximity appeared to be primary controlling variable)
Levin & Carr (2001)	*Jack* (6 yrs, autistic spectrum disorder, IQ 37) *Luis* (5 yrs, autistic spectrum disorder, IQ 56) *Manny* (7 yrs, autistic spectrum disorder, IQ 40) *Bess* (6 yrs, autistic spectrum disorder, IQ 47)	Problem behaviour ***	ABC analysis	Compared:1) Preferred food Vs.2) non-preferred food. Escape contingency.	ABAB	Standard 1-Y Standard 2-Y Standard 3-Y Standard 4-Y	High levels of problem behaviour and low levels of food consumption in non-preferred conditions.

O'Reilly, Lacey, & Lancioni, (2000)	*Eilis* (5yrs, Williams syndrome, moderate intellectual disability)	Problem behaviour (and pain behaviour)	ABC analysis	Functional analysis introduced under three different contexts. 1) No noise, 2) Noise, 3) Noise with ear plugs	ABABCBC reversal design with embedded multi-element	Standard 1-Y Standard 2- Y Standard 3-Y Standard 4-Y	Problem behaviour occurred in the demand condition at differentially higher rates under contexts of high noise. Pain behaviours were present when noise high and no plugs

Table 3. Studies that Demonstrate the Influence of Biological Variables on Negatively Reinforced Problem Behaviour

Study	Participants (age, diagnoses)	DV	Functional assessment	IV	Design	Experimental standards met	Findings
Kelley, Fisher, Lomas, & Sanders, (2006)	*Jake* (11yrs, moderate intellectual disabilities, ADHD)	Destructive behaviour ***	ABC analysis	Placebo Vs. amphetamine during demand condition	Reversal ABABABABA (double blind design)	Standard 1-Y Standard 2-Y Standard 3-Y Standard 4-Y	Destructive behaviour occurred at near zero levels and higher levels of compliance when given amphetamine
Crossland et al (2003)	*Reggie* (6 yrs, autism, profound intellectual disabilities, and fragile X syndrome) **	Destructive behaviour	ABC analysis	Functional analysis conducted during trial of risperidone	Reversal ABA design with embedded multi-element design	Standard 1-N Standard 2-Y Standard 3-N Standard 4-N	Risperidone correlated with a reduction in escape maintained problem behaviour and increase in compliance, no influence on tangible-maintained probelm behaviour.
O'Reilly, Lacey, & Lancioni, (2000)	*Eilis* (5yrs, Williams syndrome, hypercalcemia, moderate intellectual disability)	Problem behaviour (and pain behaviour)	ABC analysis	Functional analysis introduced under three different contexts. 1) No noise, 2) Noise, 3) Noise with ear plugs	ABABCBC reversal design with embedded multi-element	Standard 1-Y Standard 2- Y Standard 3-Y Standard 4-Y	Problem behaviour occurred in the demand condition at differentially higher rates under contexts of high noise. Pain behaviours were present when noise high and no plugs
O'Reilly & Lancioni (2000)	*Sarah* (4yrs, moderate intellectual and developmental disability)	SIB, aggression	ABC analysis	A phase; demand conditions after nap B phase; demand conditions no nap	Naturally occurring reversal ABAB	Standard 1- N Standard 2-Y Standard 3- Y Standard 4- N	Sleep deprivation increased the occurrence of SIB, whilst having no apparent effect on aggression. Both members of same response class.
Carr,	Four females with	Problem	Antecedent	Comparison of four	Multi-element	Standard 1-N	All participants showed higher

McLaughlin, Giacobbe-Grieco, & Smith (2003)	moderate-severe intellectual disabilities (age range 26 yrs-31yrs)**	behaviour	analysis	conditions; A) Menses plus demands, B) Menses without demands, C) No menses plus demands, D) No menses, no demands.	embedded within a naturally occurring reversal	Standard 2-Y Standard 3-Y Standard 4-N	levels of problem behaviour occurring in the menses plus demands condition of the analysis.
Aggregate Studies							
Langthorne et al (2011)	8 boys with fragile X syndrome (age range; 8-15 yrs)	Problem behaviour	ABC analysis	Examination of function served by problem behavioural of group of 8 children with fragile X syndrome	Descriptive study	N/A	5 of the 8 children displayed at least one topography of problem behaviour maintained by escape from aversive stilmuli (demands or attention).
Strachan et al (2009)	7 boys and 5 girls with Angelman syndrome (age range 5-11yrs)	Aggression	Antecedent analysis	Examination of function of problem behaviour of 12 children with Angelman syndrome	Descriptive study	N/A	8 of the 10 participants who displayed aggressive behavior did so in the high attention condition and four out of ten in demand condition.
Zarcone et al (2004)	8 children and 5 adults with autism and other developmental disabilities.	Destructive responses	ABC analysis	Functional analysis conducted during a medication trial of risperidone.	Multi-element design within a double-blind, placebo-controlled trial	N/A	Idiosyncratic repsonses for escape-maintained behaviours across different individuals.

Table 4. Studies that Demonstrate the Influence of Adding Potential Sources of Positive Reinforcement to the Demand Context as a MO for Negatively Reinforced Problem Behaviour.

Study	Participants	DV	Functional assessment	IV	Design	Experimental standards met	Findings
Lomas, Fisher, & Kelley (2010)	*Sam* (8yrs Asperger, ADHD, mild developmental disabilities) *Aaron* (8yrs, autism) *Mark* (9yrs, autism)	Problem behaviour ***	ABC analysis	A- demand baseline B - praise and edible tangible on VT 15s schedule	Reversal ABAB	Standard 1-Y Standard 2-Y Standard 3-Y Standard 4-Y	Reduction in problem behaviour for all participants. Compliance increased for Aaron only
Ingvarsson, Hanley, & Welter (2009)	*Erika* (3 yrs) *Mark* (3 yrs) *Jason* (3 yrs)	Disruptive behaviour, Problem behaviour ***	ABC analysis	During demand presentation compared contingent reinforcement Vs. non-contingent reinforcement les.	Erika (alternating treatments design) Jason, Mark ABA with embedded alternating treatment design	Standard 1-Y Standard 2-Y Standard 3-N Standard 4-Y	Non-continegnt reinforcement effective in reducing problem behaviour for two participants (Erika and Mark) and increasing compliance
Gardner, Wacker, & Boelter, (2009)	*Kurtis* (8yrs) *Carter* (6yrs)	Inappropriate behaviour	ABC anlaysis	Comparison of functional analysis conditions (attention, demand, free play) all conducted by parents and described as including 'low quality attention'.	Brief multi-element design	Standard 1-N Standard 2-Y Standard 3-N Standard 4-N	Inappropriate behaviour at higher levels in low quality attention demand condition than high quality attention demand condition.
Ingvarsson, Kahng, & Hausman (2008)	*Manuela* (8 yrs, autism, moderate intellectual	Problem behaviour ***	ABC analysis	A-demand baseline Vs. NCR (food tangibles) delivered at	ABAB (with embedded alternating	Standard 1-Y Standard 2-Y Standard 3-Y	NCR reduced occurrence of problem behaviour and increased compliance in

	disabilities)			both high density and low density	treatments design)	Standard 4-Y	comparison to baseline. Minimal difference between providing NCR at high or low density
Boelter et al (2007)	*James* (4 yrs, ADHD)	Disruptive behaviour***	Indirect	Demand that required manipulation of high Vs. low preference toys	Multi-element probe design with reversals	Standard 1-Y Standard 2-Y Standard 3-Y Standard 4-N	Higher rates of disruptive behaviour and lower accuracy in demand conditions that involved manipulating low preference toy.
Patel et al (2006)	*Kisha* (2 yrs, developmental delay) *Simone* (2 yrs, mild developmental delays)	Inappropriate behaviour **	Topography	Kisha- comparison of extinction + preceding low p demand with high p demand Vs. escape extinction on its own [B phase] Simone-A- escape baseline, B- Intervention phase 1) escape extinction Vs. 2) escape extinction with high-p demand preceding low-p demand.	Kisha (Reversal design, ABABA) Simone (alternating treatment design embedded in ABAB reversal design)	Standard 1-Y Standard 2-Y Standard 3-Y Standard 4-Y	Lower rates of inappropriate behaviour and higher rates of food acceptance occurred for Kisha under high p conditions High p demands plus extinction served to reduce problem behaviour for Simone. Both interventions increased acceptance.
Call, Wacker, Ringdahl, & Boelter (2005)	*Kevin* (2yrs)	Aggression	ABC analysis	Combined demand + restricted tangible. condition as part of	Multi-element	Standard 1-Y Standard 2-Y Standard 3-Y	Higher rate of problem behaviour in combined

				functional analysis.		Standard 4-Y	condition.
Long, Hagopian, DeLeon, Marhefka and Resau (2005)	*Trent* (9yrs, autism, severe intellectual disabilities) *Marsha* (19yrs, profound intellectual disbaility) *Janelle* (5yrs, profound intellectual disability)	SIB, aggression, disruption	ABC analysis	Comparison of competing stimuli Vs. baseline during hygene-related demands	ABAB	Standard 1-Y Standard 2-Y Standard 3-Y Standard 4-Y	Problem behaviours reduced during presentation of competeing stimuli
Wilder, Normand, & Atwell (2005)	*Raley* (3yrs, autism)	SIB ***	Brief ABC analysis	A phase (baseline escape) Vs. B phase (as above but continuous access to preferred video)	ABAB design	Standard 1-Y Standard 2-Y Standard 3-Y Standard 4-R	Lower levels of SIB and higher levels of acceptance in video conditions
Reed et al (2004)	*Jansen* (1 yr) *Nate* (1yr) *Jaden* (3yrs, developmental delay) *Abbott* (4yrs, Pierre Robin syndrome)	Inappropriate behaviour, Negative vocalisations	Topogrpahy	A phase: comparison between two conditions 1) escape baseline Vs. 2) NCR with escape B phase: involved comparison between 1) escape extinction Vs. 2) NCR] with escape extinction	Multi-element design embedded within an ABAB reversal	Standard 1-Y Standard 2-Y [except Abbott drinking data] Standard 3-Y Standard 4-R	NCR alone did not lead to decreases in inappropriate behaviour.
Call, Wacker, Ringdahl, Cooper-Brown, & Boelter (2004)*	*Andy* (6 yrs) *Zach* (8yrs) *Jacob* (5 yrs)	Non-compliance (off task behaviour and problem	ABC analysis	Analysis of effects of providing attention concurrent with demands	Brief multi-element design	Standard 1-Y Standard 2-Y Standard 3-N	Appeared to be lower rates of problem behaviour in demand + attention

Phase 2		behaviour)				Standard 4-N	condition for Zach only.
Carey & Halle (2002)	*Steve* (12yrs, severe intellectual disability)**	SIB	ABC analysis	Embedding demands in context of preferred activity (listening to music)	Multi-element	Standard 1-Y Standard 2-Y Standard 3-Y Standard 4-Y	Lower escape-maintained behaviour when demands presented with music.
Harding et al (1999)	*Susan* (4 yrs, autism and developmental delays) *Kyle* (4 yrs, behavior disorder)	Problem behaviour ***	ABC analysis	Susan ([A] Alone with low preference toy Vs. Instruction with high preference toy. [B] Alone with high preference toy Vs. instruction with low preference toy) Kyle ([A] Alone with low preference toy Vs. Instruction with high preference toy. [B] Alone with high preference toy Vs. instruction with low preference toy, [C] Alone with high preference toy Vs. instruction with high preference toy)	Concurrent schedules combined with reversal design Susan (ABABA) Kyle (ABACB)	Standard 1-Y Standard 2-Y Standard 3-Y (Susan), N (Kyle) Standard 4-R (Kyle, Susan)	Susan's time allocation in comparison A was directed towards parent attention with instructions and a highly preferred toy, associated with high task completion and low problem behavior. During comparison B, Susan chose the area that allowed her to escape from instructions while gaining access to the highly preferred toy. Kyle avoided instructions associated with a highly preferred toy and was more likely to display problem behavior under such conditions. With a less preferred toy, he was more likely to comply with parental instructions and less likely to display problem behavior.

Table 5. Studies that Demonstrate the Influence of Alterations to Parameters of Task Difficulty/Preference as an MO for Negatively Reinforced Problem Behaviour.

Study	Participants	DV	Functional assessment	IV	Design	Experimental standards met	Findings
Reichle, Johnson, Monn, & Harris, (2010)*	*Mark* (4 yrs, autism, severe cognitive delay) *Pete* (4 yrs, ASD)	Challenging behaviours***	Antecedent analysis	Comparison of 1) tasks associated with approach 2) tasks never approached	Alternating treatments design	Standard 1-Y Standard 2-Y Standard 3-Y Standard 4-Y	Lower rates of problem behaviour and higher rates of engagement in task condition associated with approach in classroom
Butler & Luiselli, (2007)*	*Michelle* (13yrs, autism)	Problem behaviour	ABC analysis	Comparison of three different requests of differing difficulty	Multi-element	Standard 1-Y Standard 2-Y Standard 3-Y Standard 4-N	Difficult task associated with high rates of problem behaviour.
Call, Wacker, Ringdahl, Cooper-Brown, & Boelter, (2004) *	*Daisy* (4yrs) *Andy* (6 yrs) *Zach* (8yrs) *Jacob* (5 yrs)	Non-compliance	ABC analysis	Analysis of 1) decreased amount of demands, 2) decreased difficulty (Zach, Jacob, and Andy), and 3) decreased difficulty of demands plus attention (Daisy and Jacob).	Brief multi-element design	Standard 1-Y Standard 2-Y Standard 3-N Standard 4-N	Decreasing difficulty and amount reduced non-compliance for all except Andy.
Reichle & McComas (2004)	*Timothy* (12yrs, cognitive delay)	Challenging behaviour	Antecedent analysis	Comparison of 1) 'easy' task Vs. 2) 'difficult' task	ABAB reversal using single probes	Standard 1-Y Standard 2-N Standard 3-Y Standard 4-N	Higher levels of problem behaviour in 'difficult' task condition
Moore & Edwards	*Jacob* (17 yrs) *Robert* (7 yrs)	Problem	ABC analysis	4 conditions compared 1) easy task/high	Multi-element	Standard 1-Y Standard 2-Y	Task difficulty appeared to be primarily related to problem

(2003)*	*Edgar* (9yrs) Morris (7 yrs)	behaviour		attention, 2) easy task/low attention, 3) hard task/low attention, 4) hard task/high attention		Standard 3-Y Standard 4-N	behaviour for both Robert and Jacob.
McComas, Hoch, Paone, & El-Roy (2000)	*Eli* (8yrs, autism, developmental disabilities)	Destructive behaviour	ABC analysis	Comparison of 1) Instructional strategy (e.g., calculator, number lines) Vs. 2) no strategy	Multi-element	Standard 1-Y Standard 2-Y Standard 3-Y Standard 4-Y	Higher rates of problem behaviour and lower rates of compliance in conditions in which there was no instructional strategy present
Lee, Sugai, & Horner (1999)	*Bill* (9 yrs, specific learning difficulties) *Matt* (9 yrs, ADHD)	Problem behaviour Off task behaviour *	Descriptive assessment Antecedent analysis	Comparison of easy Vs. difficult tasks	ABA reversal	Standard 1-Y Standard 2-Y Standard 3-N Standard 4-Y	Higher problem behaviour an lower compliance during difficult tasks Intervention focused on teaching component skills reduced problem behaviour.
Lalli, Kates & Casey (1999)	*Jake* (11yrs, mild intellectual disabilities) *Mark* (10 yrs, mild intellectual disabilities)**	Aggression*	Brief ABC analysis	Comparison of different task associated with problem behaviour.	Brief probe multi-element	Standard 1-Y Standard 2-Y Standard 3-N Standard 4-N	Spelling task evoked problem behaviour for each child. Skills teaching led to improvements in accurate responding and reduction in aggression.

Table 6. Studies that Demonstrate the Influence of Altering the Schedule of Demands as an MO for Negatively Reinforced Problem Behaviour

Study	Participants (age, diagnoses)	DV	Functional assessment	IV	Design	Experimental standards met	Findings
Baker, Hanley, & Mathews (2006)* Phase 3	*Participant* (96 yrs, Alzheimer's dementia)	Aggression	ABC analysis	Non-contingent escape Vs. contingent escape	ABA	Standard 1-Y Standard 2-N Standard 3-N Standard 4-Y	Problem behaviour occurred at lower rates in the non-contingent escape condition
O'Callaghan, Allen, Powell, & Salama, (2006)	Five typically developing children, ranging from 4 to 7 years old. 3 girls (Melissa, Tanya, Elaine) and 2 boys (George, Kevin)	Disruptive behaviour	Topography	Comparison of; 1) routine restoratice dental treatment and 2) Non-contingent escape	Multiple baseline design (across participants)	Standard 1-N[10] Standard 2-Y Standard 3-Y Standard 4-Y	Four children showed reductions following the introduction of NCE.
Aikman Garbutt, & Furniss (2003)	*Beth* (8yrs, severe developmental disabilities)	Screaming and throwing	Descriptive assessment	Comparison of probes involving continuous demands Vs. intervention whereby five minutes of demand were followed by 5 minutes of play.	Brief multi-element probe	Standard 1-N[11] Standard 2-N Standard 3-N Standard 4-N	Higher levels of throwing and screaming in 'high' continuous demand condition Vs. intervention condition.

[10] IV is different across each 3 minute session. Different procedures (and MOs) according to different visits. Unclear whether change is due to IV or confound (i.e., procedures different within and between each visit).

[11] Teacher as interventionist but no fidelity measure

Kodak, Miltenberger, & Romaniuk (2003)	*Andy* (4yrs, autism) *John* (4yrs, autism)	Disruptive behaviour ***	Unclear	Baseline escape condition Vs. Intervention: comparison of two conditions: 1) non-contingent escape 2) DNRO	Multiple-baseline across participants with embedded alternating treatment design.	Standard 1-Y Standard 2-Y Standard 3-N Standard 4-N	NCE led to reductions in esacpe maintained problem behaviour and increases that were similar in magnitude to DNRO in comparison to baseline.
Wesolowsk, Zencius, & Rodriguez (1999)	*Jim* (19yrs, traumatic brain injury to frontal lobes) Ralph (16 yrs, traumatic brain injury to frontal lobes) Mark (24yrs, traumatic brain injury to frontal lobes)	Frequency of unauthorised breaks	Topography	Baseline: 2x15 minute breaks/day during vocational instruction Intervention: 5x 10 minute breaks/day during vocational instruction	Multiple-baseline across participants	Standard 1-Y Standard 2-Y Standard 3-Y Standard 4-Y	Introduction of regular schedule of breaks reduced unauthorised breaks of all three participants.

Table 7. Studies that Demonstrate the Influence of Altering the Level of Predictability, Control or Choice on Negatively Reinforced Problem Behaviour

Study	Participants (age, diagnoses)	DV	Functional assessment	IV	Design	Experimental standards met	Findings
Reichle, Johnson, Monn, & Harris (2010) *	*Mark* (4 yrs, autism, severe cognitive delay) *Pete* (4 yrs, ASD)	Challenging behaviour***	Direct observation	Comparison of explicit Vs. general delay cue	Alternating treatments design with changing criterion	Standard 1-N[12] Standard 2-Y Standard 3-Y Standard 4-Y	Both participants showed greater reductions in problem and increases in work completed following the use of explicit delay cues.
Newman, Needelman, Reinecke, & Robek (2002)	3 males with autism. (Andy, Carl, Paul) Age range 7-12 yrs	Competing behaviour ***	Indirect	Comparison of: 1) Teacher selection of reinforcers and task order during discrete trial teaching Vs. 2) student selection	Alternating treatment design	Standard 1-Y Standard 2-Y Standard 3-Y Standard 4-Y	No difference between conditions for percentage correct. Higher rates of competing behaviours occurred in teacher selection conditions than student selected.
Romaniuket al (2002)	*Brooke* (7 yrs, Cerebal Palsy, moderate cognitive impairments) *Maggie* (10 yrs, autistic disorder, IQ score in low-average range) Gary (7yrs, moderate	Problem behaviour	ABC analysis	Brooke, Gary, Maggie: Comparison of two conditions: 1) choice Vs. 2) no	Reversal; ABAB (Brooke, Gary) ABABAB (Maggie) Multi-element	Standard 1-Y Standard 2-Y Standard 3-Y Standard 4-Y (Brooke, Gary,	Lower rates of problem behaviour occurring in the choice condition. Unlike 3 participants with attention-maintained behaviour.

[12] Alternating treatments design but two different tasks and different criterion between two conditions means not comparing like with like

	intellectual disability) *Katie* (8 yrs, mood disorder unspecified, moderate cog impairment) **			choice Katie[13]: Compared above for both attention and escape-maintained behaviour.	(Katie)	Katie), N (Maggie)	Katie showed a reduction in escape-maintained but not attention-maintained behaviour .
McComas, Hoch, Paone, & El-Roy, (2000) *	*Charlie* (8 yrs, developmental disabilities, autism) *Ben* (9 yrs, developmental disabilities, autism)	Aggression, SIB ***	ABC functional analysis	Charlie: Compared: 1) choice over sequence of tasks, 2) no choice. Ben:Compared: 1) Non-repeated task (given worksheets not previously completed), 2) Repeated task (given worksheets already completed)	Multi-element	Standard 1-Y Standard 2:Y Standard 3-Y Standard 4-Y	Charlie: Some evidence of differentiation for SIB, however DRO added to reduce SIB to acceptable levels. No influence on compliance. Ben: higher aggression in repeated task condition. No difference for compliance.

[13] who also displayed attention-maintained problem behaviour

Table 8. Studies that Demosntrate the Influence of Manipulating Pre-session Conditions as an MO for Negatively Reinforced Problem Behaviour

Study	Participants (age, diagnoses)	DV	Functional assessment	IV	Design	Experimental standards met	Findings
Rispoli et al (2011)	*Rusty* (9 yrs, autism)	Problem behaviour***	ABC analysis[14]	Comparison of; 1) pre session access to tangibles Vs. 2) pre-session no access during classroom instruction.	Multi-element	Standard 1-Y Standard 2-Y Standard 3- Y Standard 4- Y	Higher level of problem behaviour (and lower levels of engagement) occurring following pre-session no access conditions.
McComas, Thompson, & Johnson (2003)	*Stan* (10 yrs, mild to moderate intellectual disabilities) *Abe* (11yrs, autism and moderate to severe intellectual disabilities) *Ari* (12 yrs, Down Syndrome, and moderate intellectual disabilities)	Problem behaviour	ABC analysis	Comparison of 1) pre session attention Vs. 2) pre-session no attention	Multi-element	Standard 1-Y Standard 2-Y Standard 3- Y Standard 4- Y (Abe), N (Stan, Ari)	No relation between pre-session manipulation and escape maintained behaviour for Stan, Abe and Ari.

[14] Indicated behavior maintained by both access to tangibles and escape from instructional demands.

Ray & Watson (2001)	*Kevin* (5yrs, IQ in low-average functioning) *Arthur* (5yrs, average IQ functioning)	Aggresion	ABC analysis	Descriptive assessment of temporally distant events (TDE) on results of functional analysis, through use of checklist. TDE identified for Kevin was waking late, TDE identified for Arthur was nocturnal enuresis.	N/A	Descriptive study	Higher levels of problem behaviour occurring in escape condition on those days in which the TDE was present
O'Reilly (1999)	*Jeff* (31yrs, severe intellectual disability)	SIB	ABC analysis	Comparison of; 1) left alone for 30 mins, 2) 30mins of demands Followed by functional analysis conditions conducted in adjacent room by a different individual.	ABAB with embedded multi-element design	Standard 1-Y Standard 2-Y Standard 3- Y Standard 4- Y	Problem behaviour at elevated rates in the demand condition irrespective of prior social context. However, rates of escape-maintained behaviour higher following pre-session demands than pre-session alone conditions.

Table 9. Studies that Examined the Influence of Altering the Mode of Demand Presentation as an MO for Negatively Reinforced Problem Behaviour

Study	Participants (age, diagnoses)	DV	Functional assessment	IV	Design	Experimental standards met	Findings
Tiger, Fisher, Toussaint, & Kodak (2009)*	*Carl* (10yrs, intellectual disability) **	Problem behaviours	ABC analysis	3-step prompting procedure Vs. verbal prompting procedure.	ABAB reversal with embedded multi-element	Standard 1-Y Standard 2-Y Standard 3-Y Standard 4-Y	Problem behaviours occurred at zero rates when graduated 3- step prompting procedure adopted.
Butler & Luiselli (2007)*	*Michelle* (13yrs, autism)	Problem behaviour	ABC analysis	Comparison of influence of effect of 5 different individuals presenting request associated with problem behaviour.	Multi-element	Standard 1-Y Standard 2-Y Standard 3-Y Standard 4-N	Problem behaviours more likely to occur with individuals whom the participant had a longer learning history with than with individuals who had only recently begun working with the participant.
Boelter et al (2007) * Phase 3	*James* (4 yrs, ADHD) *Marcus* (3 yrs, , ADHD, mild developmental delay) *Beto* (6yrs, autism*)*	Disruptive behaviour***	Indirect	Manipulation of number of steps to directives (1 step Vs. 3 step) when completing preferred (James, Marcus) or non-preferred (Beto) tasks	Multi-element probe design with reversals	Standard 1-Y Standard 2-Y Standard 3-Y Standard 4-N	Beto. Higher rates of disruptive behaviour and reductions in accuracy under 3 step conditions when completing non-preferred task Marcus and James. No effect of manipulating number of steps on disruptive behaviour, higher rates of accuracy under 1 step conditions.

Crockett & Hagopian (2006)	*Chuck* (19 yrs, Nager's Syndrome, mild intellectual disabilities) **	Destructive behaviour ***	ABC analysis	Comparison of 3-step prompting procedure to initial verbal prompt at onset of the session	Multiple baseline (across tasks)	Standard 1-Y Standard 2-Y Standard 3- N Standard 4- Y	Reduction in destructive behaviour to zero rates following introduction of modified prompting procedure. Increase in number of tasks completed.
Peyton, Lindauer, & Richman, (2005)	*Suzie* (10yrs, autism and developmental delays)	Non-compliant vocal behaviour***	ABC analysis	Comparison of directive prompts (e.g., "show me the X") Vs. non-directive prompts (e.g., "I wonder where the X is").	Multi-element	Standard 1-Y Standard 2-Y Standard 3- N Standard 4- R	Reduction in non-compliant vocal behaviour to near zero levels in non-directive prompting conditions. No influence on actual levels of compliance
Borrero, Vollmer and Borrero (2004)	*Tobias* (13yrs, moderate intellectual disabilities)	Aggression	ABC analysis	Comparison of abrasive Vs. neutral prompts during demand sequence of functional analysis	Pairwise multi-element	Standard 1-Y Standard 2-Y Standard 3-Y Standard 4- R	Problem behaviour more likely to occur following abrasive prompts
Northup, Kodak, Lee, & Coyne, (2004)	*Marie* (5yrs, ADHD)	Inappropriate behaviour	ABC analysis	Manipulated description of contingency. Phase 2 a) "taking a break" Vs. b) "time out". Phase 3 compared a) no description Vs. b) "time out"	Multi-element	Standard 1-Y Standard 2-Y Standard 3- Y Standard 4- R (phase 2), Y (phase 3)	Inappropriate behaviour at near zero rates when escape continegncy verbally described as "time out". Higher rates of inappropriate behaviour in other conditions.

Stichter, Sasso & Jolivette (2004)	*Josh* (7 yrs, emotional and behavioural difficulties)	Aberrant behaviour Off-task behaviour	Antecedent assessment	Phases 1-3 manipulated combinations of: 1) background noise, 2) social contact, 3) task structure. Phase 4: High structure Vs.control. Compared under conditions of 'moderate' noise and social contact.	Phase 1: non-experimental ABCDEF Phase 2: ABA Phase 3: ABCDED Phase 4: ABAB	Standard 1-N[15] Standard 2-Y Standard 3- Y (phase 4 only) Standard 4- R (phase 4 only)	High structure appeared to reduce levels of off-task behaviour but no clear effect on levels of aberrant behaviour.
Carr, Smith, Giacin, Whelan, & Pancari (2003)	5 males (age 30-48 yrs, autism and mild-profound intellectual disabilities) 3 females (age 29-48yrs, 1 with autism, moderate-profound intellectual disabilities)	Problem behaviour***	Antecedent analysis	Comparison of 6 conditions: A) Good mood, plus demands B) Good mood, no demands C) Neutral mood, plus demands D) Neutral mood, no demands E) Bad mood, demands F) Bad mood, no demands	Multi-element manipulation of demand Vs. no demand conditions embedded within naturally occurring variation in 'mood'	Standard 1-N Standard 2-Y Standard 3-Y Standard 4-Y	For all participants greater percentage of sessions were terminated due to problem behaviour in demand probe when participants had been rated as being in a 'bad mood'
Ebanks & Fisher (2003)	J*im*, (19 yrs, intellectual disabilities and pervasive developmental	Destructive behaviour	ABC analysis	Standard corrective prompting procedure against antecedent	ABAB reversal	Standard 1-Y Standard 2-Y Standard 3- Y	Destructive behaviour reduced to zero rates in antecedent prompting condition.

[15] No measure of treatment integrity despite using peer as 'change agent' in natural settings

	disorder)			prompting procedure.		Standard 4- R	
Asmus et al (1999)	*Luke* (3 yrs, moderate intellectual disability) *Todd* (4 yrs, XYY syndrome, moderate intellectual disability) Trevor (5 yrs, moderate-severe intellectual, ADHD)	Aberrant behaviour***	Antecedent analysis (all participants) ABC analysis (Todd, Trevor)	Phase 1: Antecdent functional analysis. Task instruction Vs. free play Phase 2: Examined effects of manipulating familarity of 1) task instructions, 2) therapist, 3) setting.	Combination multi-element and reversal.	Standard 1-Y Standard 2-Y Standard 3- Y Standard 4- R	Results of phase 1: indicated that presence of task instructions themselves and not materials/setting or therapist that associated with aberrant behaviour. Results of phase 2: Unfamiliar tasks quickly acquired aversive properties.Except for one task with 1 child, aberrant behavior regardless of the tasks, therapist or setting.

*Study also involved additional experimental manipulation reported elsewhere in the review.

** Measures of compliance also included in study.

***Terms ‘mental retardation’ or ‘mental impairment’ replaced with ‘intellectual and developmental disability’.