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An interview-informed synthesized contingency analysis to inform the treatment of challenging behavior in a young child with autism

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ABSTRACT

Purpose: Experimental Functional analysis (EFA) is considered the “gold standard” of behavioural assessment and its use is predictive of treatment success. However, EFA has a number of limitations including its lengthy nature, the high level of expertise required, and the reinforcement of challenging behaviour. This study aimed to further validate a novel interview-informed synthesised contingency analysis (IISCA).

Methods: An open-ended interview and brief direct observation informed an IISCA for a young boy with autism who engaged in challenging behaviour. Resulting data supported the hypothesis that the target behaviour was multiply controlled by escape from demands and access to tangible items. An intervention comprised of most-to-least prompting, escape extinction, differential reinforcement and a high-probability instruction sequence was evaluated using a reversal design.

Results: This intervention reduced challenging behaviour to low levels and resulted in increased compliance.

Conclusions: Findings support the status of the IISCA as a valid, practical, and effective process for designing function-based interventions.

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Autism; challenging behavior; functional analysis; interview-informed analysis; synthesized contingency analysis

Challenging behavior (CB) occurs commonly among persons with autism spectrum disorder (ASD). McTiernan et al.¹ reported that 93.7% of a sample of 174 children with ASD presented with some form of CB. CB has been found to impede quality of life, to predict parental stress, to reduce societal inclusion, and to negatively impact upon the emotional and physical well-being of both the individual and their family.^{2,3}

The effectiveness of interventions based on the science of Applied Behavior Analysis (ABA) for reducing CB among persons with developmental disabilities has been demonstrated for a variety of topographies of CB including self-injurious behavior⁴ and repetitive, stereotyped behavior.⁵ The effectiveness of behavioral interventions is greater when they are selected utilizing the results of an experimental functional analysis (EFA) than when they are developed without regard for behavioral function.^{6–8} An EFA is an assessment in which environmental variables are systematically manipulated relative to a control condition and the effects of these manipulations on the rate of the behavior under investigation are measured.⁹ This assessment allows for the determination of environmental variables that are contributing to engagement in CB by comparing the rate of behavior during a control condition to the test conditions.

To date, over 400 studies involving individuals with autism utilizing EFAs have been published.¹⁰ An EFA has been shown, repeatedly, to have good internal and external validity that prescribes successful interventions.^{11,12} A meta-analysis of EFA research¹² reported interpretable results that could

inform subsequent treatments in 95.9% of included studies. However, despite EFA's status as the “gold standard” of behavioral assessment¹³, p. 5, a number of limitations to traditional EFAs have been described. These include the lengthy nature of the process, the high level of expertise required, the possible reinforcement of the target behavior, and the purported unsuitability of EFAs for certain behaviors or settings (see¹⁴ for a review). These shortcomings have led to the development and evaluation of a number of variations of EFA.¹⁴

Most recently, Hanley and colleagues¹⁵ have described an interview-informed synthesized contingency analysis (IISCA) that comprises an open-ended interview that probes for information on potential maintaining contingencies, brief direct observation, and a two-condition EFA, in lieu of the traditional four or five condition EFA. The two-condition EFA includes one test condition, which evaluates the effects of the contingency believed to maintain the CB, and one control condition, which does not contain the contingency thought to maintain the CB. If the open-ended interview suggests that contingencies are operating simultaneously (i.e., the behavior is multiply controlled) multiple contingencies are synthesized into one test condition. Therefore, a key feature of the IISCA is that the contingencies that maintain CB are interactive and may not evoke CB when operating in isolation. Hanley et al.¹⁵ reported on the successful use of the IISCA to assess and develop behavioral interventions for several topographies of CB, including verbal and physical aggression. Researchers have begun to further evaluate the utility of the IISCA

process^{16,17} and these studies have generally yielded positive outcomes in terms of reduced assessment duration, socially valid reduction of CB and concurrent increases in alternative, appropriate behavior. However, Fisher and colleagues¹⁸ compared the outcomes of IISCA to those of a traditional EFA. One of the findings identified low levels of agreement between the outcomes produced by the two forms of EFA and caution against its use without further examination of its validity and the accuracy of the outcomes that it produces.

Thus, the aim of the current study was to add to the small body of literature to date describing the use of IISCA for the assessment and treatment of CB and to evaluate the effectiveness of interventions designed directly from it. Specifically, an IISCA was used to assess, and inform the treatment of CB exhibited by a young boy diagnosed with ASD and co-occurring oppositional defiant disorder.

Method

Participant and setting

Dillon was a 4.6 year old boy diagnosed with ASD and co-occurring oppositional defiant disorder. Extant school records reported that he presented with a full scale IQ of 66 and an adaptive composite score of 63 according to the Stanford-Binet Intelligence Scale and the Vineland Adaptive Behavior Scales respectively. The preschool specialized in the delivery of ABA educational interventions overseen by a behavior analyst who held BCBA[®] certification. Dillon attended 5 days per week, for 4 h per day. He had been receiving this ABA educational provision for 8 months prior to participating in the current study. All sessions were conducted in Dillon's classroom within the preschool.

Response measurement and interobserver agreement

The target behavior in the current study was *inappropriate time spent on the floor*, defined as dropping to the floor from a seated or standing position; and/or lying or sitting on the floor during designated work periods or refusing to stand up when asked or prompted to do so. Each instance of CB was separated by Dillon standing up on both feet. Observers used 10 s partial interval recording to measure the percentage of intervals in which the target behavior occurred. *Compliance with demands*, defined as initiation of the requested action within 10 s of the first instruction delivery, and completion of the request within 30 s of initiation in the absence of CB, was also measured during the intervention phase. A percentage of compliance with demands was calculated by dividing the total number of compliant responses by the total number of demands multiplied by 100.

IOA was assessed by having two observers simultaneously but independently collect data on the two target behaviors for 100% of sessions during the IISCA and 21% of treatment sessions. Mean agreement coefficients for inappropriate time on the floor was 98.6% during the IISCA (range, 93.3%–100%) and 99% during the treatment phase (range, 99.8%–100%). Mean agreement coefficients for compliance were 100% during the IISCA and 100% during the treatment phase.

Design

The IISCA¹⁵ was conducted using a multielement design and an ABAB reversal design was used to evaluate the effects of the intervention.

Procedure

Interview-informed synthesized contingency analysis

The IISCA¹⁵ began with a 45-min observation period during which Dillon was observed engaging in his normal school routine and his tutor was asked to provide and remove preferred tangibles, attention and demands. The therapist (first author) observed and recorded CB while the tutor interacted with Dillon. Similarly to Hanley et al.¹⁵ data were collected on the number of CBs observed, functional communicative responses emitted, tolerance of demands, and reinforcement duration. Data were also collected on the type of demands provided, their duration and compliance by Dillon to such demands. Dillon was observed to drop to the floor consistently when demands were presented by the tutor. He would always access tangible items while on the floor and spent long periods in the absence of attention from others. He refused to comply with redirection and did not use any functional communicative response.

Subsequently, 20 questions from the open-ended questionnaire designed by Hanley [see Appendix in 19] was used to conduct an informal interview with Dillon's teacher that was focused on his CB and the circumstances in which it typically occurred. The results of the interview suggested that CB occurred when staff delivered an instruction or interrupted an activity and that both terminating the demand and gaining access to a preferred item or activity were maintaining Dillon's problem behavior.

Preferred tangibles (iPhone, a portable DVD player, popcorn, playdoh, magnet letters and two colored balls) high and low-probability instructions were identified from a paired stimulus preference assessment and the open-ended questionnaire.¹⁹ Low-probability instructions consisted of directions to stand up from the floor and engage in educational activities. These instructions were selected from Dillon's current educational plan which showed that he had not reached the long-term goals but continued to work on the short-term objectives toward those goals. Low-probability instructions showed a daily percentage of responding of below 80% or incomplete responding as a result of Dillon dropping to the floor when the instruction was delivered. These instructions included a visual task (completing a block design), labelling objects and a listener task (identifying objects in a picture book). The high-probability instructions were tasks that had previously been in Dillon's educational plan and were currently targeted as maintenance goals. Daily scores indicated that he continued to respond to these instructions accurately and fluently (80%–100%; within 3 s). Such tasks included gross motor imitation tasks (do this) and one-step directions (e.g., clap hands/touch nose/point to/pick up etc). Preferred tangibles, high and low-probability instructions were the same during the IISCA conditions, baseline and intervention phases.

An IISCA was conducted across one school day. Sessions were conducted in 5 min blocks. The IISCA alternated between one *control* condition, which was conducted first, and one *test* condition, with the availability of the suspected reinforcement contingency differentiating between conditions. In the *control* condition, no demands were made and Dillon had uninterrupted access to an array of preferred items throughout the entire session. As observation and interview data suggested that the behavior was multiply controlled by sources of positive and negative reinforcement, the *test* condition presented a synthesized escape and tangible contingency. These conditions began with a 30 s period of engagement with tangibles before these were removed. Following this, the therapist presented educational activities (demands) to Dillon. Contingent upon the occurrence of CB the therapist immediately terminated the demand, returned the tangible items, and turned away from Dillon for 30 s.

Intervention evaluation

Baseline (A)

Five baseline sessions were conducted, with each session lasting 1 h each day. During baseline sessions, Dillon was presented with educational activities. Contingent on CB, Dillon was asked to stand up from the floor; however, the tutor discontinued educational activities. The instruction to stand was redelivered every minute when Dillon did not comply. Tangibles that were accessible on the floor were available. Access to reinforcement (escape and tangibles) continued as long as Dillon refused to comply.

Intervention (B)

Intervention sessions were conducted 5 days per week, three times each day, and each session was 1 h in duration. At least one intervention session was conducted at the same time of day as baseline sessions. At the beginning of a session the therapist removed any preferred tangible items and presented a high-probability verbal instruction (demands; e.g., “Dillon, clap your hands”) followed by the delivery of a token contingent on compliance (FR1 schedule of reinforcement). A conditioning program for tokens had been implemented 3 months prior to the onset of this study. During the intervention, Dillon gained access to a “break” away from the educational activity and access to preferred tangibles, contingent on earning five tokens for following each verbal instruction provided. Tokens were small colored disks placed on a brightly colored token board with the numbers 1–10. A digital timer indicated the end of each 2 min “break” and the therapist removed any tangible items and delivered a new demand. Two minute breaks were provided based on the average time spent with each reinforcing item during the 45-min observation period.

During intervention sessions, differential reinforcement was utilized. If Dillon engaged in the target behavior the therapist followed him to the floor and immediately re-presented the verbal instruction (demand). Most-to-least prompting was used to guide Dillon to provide the response. Dillon was then asked to “stand up”. Compliance with the verbal instruction “stand up” resulted in both social praise

and delivery of one token. If Dillon did not comply with this instruction and continued to engage in CB the therapist began to deliver a sequence of high-probability instructions using most-to-least prompting procedures, while interspersing the low-probability verbal demand “stand up”. Full physical guidance was used during most-to-least prompting to allow reinforcement delivery and was faded to partial physical guidance and no guidance on the presentation of each successive demand. While engaging in CB, most-to-least prompting to follow the demand earned Dillon one token on a variable ratio schedule of reinforcement (VR5; tokens were delivered for every 3, 5 or 7 correct responses to demands). Contingent on earning five tokens while still engaging in the CB resulted in a 10-s only break without access to any tangible items. Following this 10-s break, instructional demands recommenced. This pattern was repeated until Dillon stood up.

The type of demand during the session, the schedule of reinforcement and the prompt level utilized was progressively altered during the intervention phase. To increase treatment efficacy the intervention began by utilizing a high-probability instruction sequence, a dense schedule of reinforcement for compliance (FR1) and simultaneous prompting procedures to evoke compliance with demand (Sessions 6–47). During the final phase of treatment (Sessions 54–98) both high-probability and low-probability instructions, a variable schedule of reinforcement for compliance (VR5), and a three-step prompting procedure (guided compliance to reduce reliance on physical prompts and allow immediate independent responding) were utilized. Changes to the intervention package were made across sessions following 0–10 min of CB and 90%–100% compliance for three consecutive sessions.

Staff training

The therapist provided training to Dillon’s classroom teacher and tutor regarding implementation of the intervention. This training was comprised of a detailed review and explanation of the intervention, the observation of the therapist implementing the procedure with Dillon contingent on the occurrence of CB, the rehearsal of the intervention and data collection procedures by the staff members, and the implementation of the intervention by each staff member over four consecutive sessions under the therapist’s supervision.

Social validity

To determine the acceptability of the intervention package, Dillon’s teacher and the school’s BCBA[®] completed the Treatment Acceptability Rating Form Revised (TARF-R;²⁰)

Results and discussion

Data obtained from the interview and direct observation supported the hypothesis that Dillon’s CB was maintained by social positive and negative reinforcement contingencies in the form of escape from demands and access to tangible items. Figure 1 presents the rates of CB observed across IISCA conditions. High rates of CB were observed exclusively in the test conditions when CB resulted in escape from demands and access to tangible items ($M = 86.67\%$), while CB was at zero

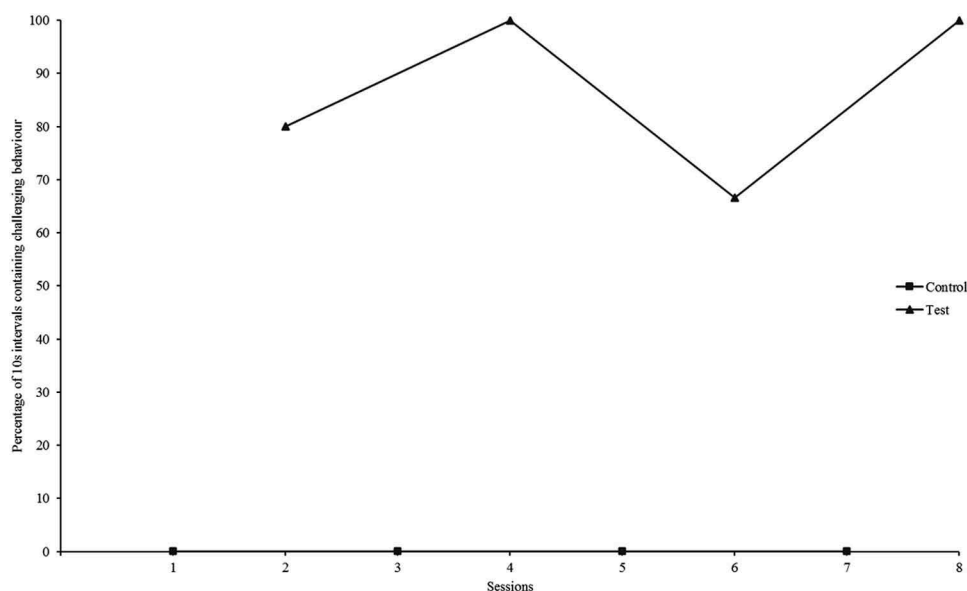


Figure 1. Outcomes of the Interview-informed Synthesised Contingency Analysis for Dillon's challenging behaviour.

levels during the control conditions which were free from demand and during which preferred tangibles were non-contingently available.

CB and compliance across the baseline and intervention phases are depicted in Figure 2. During the initial baseline phase, high levels of CB ($M = 70\%$) and low levels of compliance ($M = 29.21\%$) were observed. Across intervention sessions, CB decreased to lower levels ($M = 17.39\%$) and compliance increased significantly ($M = 89.29\%$). A reversal to baseline conditions resulted in an increase in the level of CB ($M = 39.91\%$) and a decrease in the level of compliance ($M = 73.33\%$) indicating a functional relationship between the intervention and CB. When the intervention package was reintroduced the CB decreased once again ($M = 5.01\%$) and compliance increased to high levels ($M = 97.60\%$). CB remained low and compliance remained high as demands were increased and the rate of reinforcement with tokens decreased from a FR1 (Session 6) to a VR5 (Session 54) and Dillon's classroom teacher and tutor began to serve as therapists (Session 19), and as the regular classroom schedule was reintroduced (Session 72).

Results from the TARF-R²⁰, completed by Dillon's teacher and the school's BCBA[®], indicated that the intervention procedures were perceived as highly acceptable by both staff members ($M = 97$). Both staff members reported finding the intervention package acceptable and effective, and they also indicated a willingness to change their routines in order to continue the delivery of the intervention.

The primary aim of this research was to add to the small body of literature describing the use of the IISCA¹⁵ to ascertain behavioral function and guide the development of function-based behavioral interventions. Data obtained from the IISCA and treatment evaluation conducted for the severe CB of a young boy with ASD and oppositional defiant disorder indicate that the intervention package informed by the results of the IISCA was both a socially acceptable and effective

method for decreasing escape behavior and increasing compliance. Prior to the intervention, inappropriate time spent on the floor often preceded other CB (e.g., skin picking, urination, spitting, removing shoes, and blowing mucous from the nasal cavity). Pre-intervention these instances of severe CBs occurred more than 30 times per day. Post-intervention these CBs no longer occurred supporting the idea of targeting precursors to more severe CB in clinical practice.²¹

The findings of the current study replicate and extend previous work on the efficacy of an IISCA to produce individualized function-based interventions that cause meaningful improvements in CB.^{15–17} These findings are positive given that researchers and practitioners alike may shy away from the other more traditional EFA processes as they may be considered time-consuming, complex, and risky.^{14,22} This study found the IISCA offers a fast, practical and reliable method to determine the function of CB and to provide guidance for treatment development. It may be particularly useful when a function-based intervention is promptly required to reduce severe CB. Prior to intervention, Dillon was engaging in CB for over half of the school day. His academic work program had been placed on hold and the targeted behavior of dropping to the floor often acted as a precursor for other serious CBs. The expedited IISCA allowed for the implementation of an intervention and effective remediation of the target behaviors as well as a decrease in more disruptive and dangerous behavior.

The current study had several limitations that must be noted. First, data on the generalization of treatment effects across settings (e.g., in the home, in the community) was not collected so it is not possible to determine if improvements in CB were confined to the school setting in which the intervention was delivered. Second, research^{23,24} has demonstrated greater treatment efficiency when functional communication training is included within a treatment package. Teaching a functional alternative response to the CB, such as a communication response, may have decreased the participant's CB

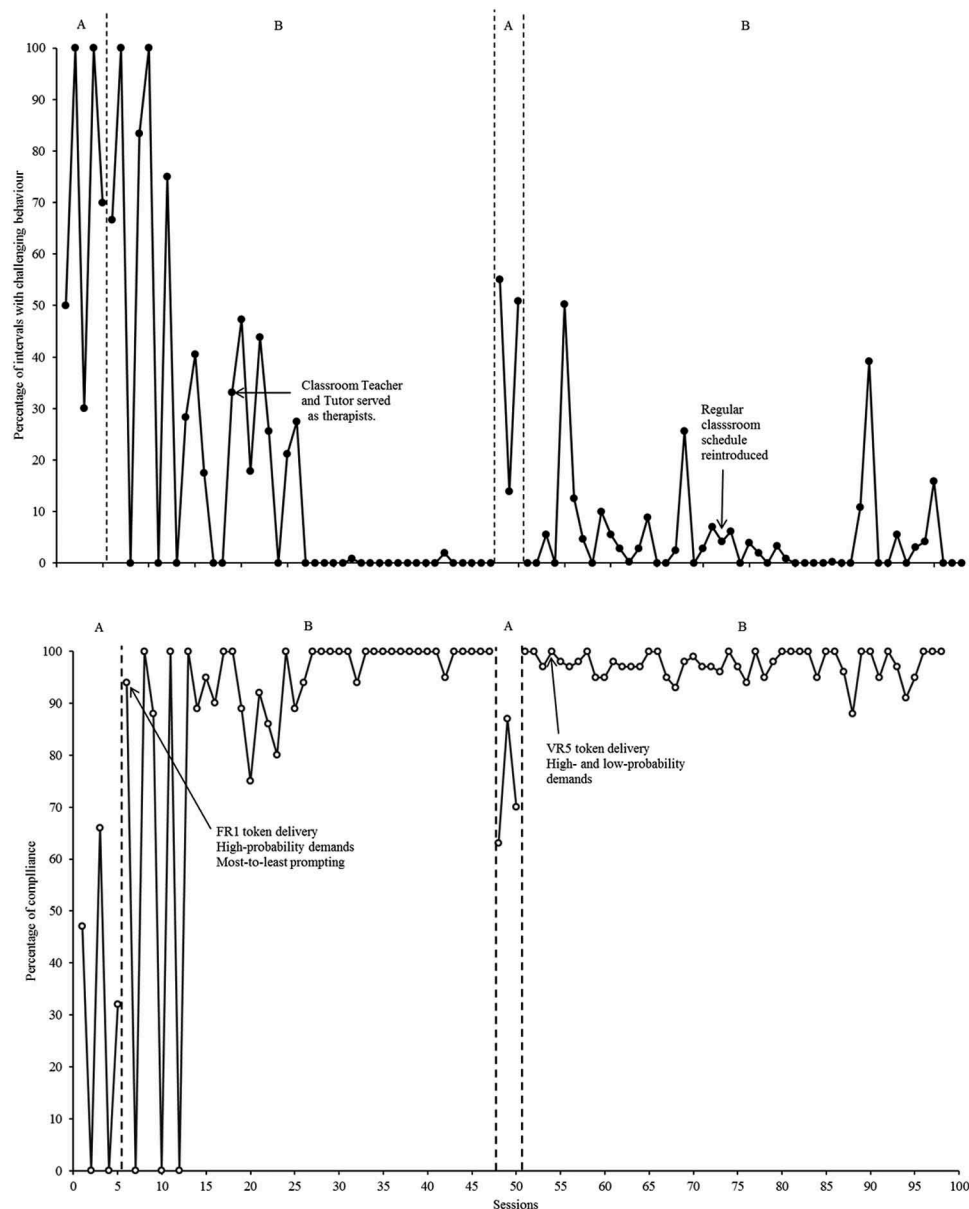


Figure 2. Percentage of challenging behaviour (top panel) and compliance (lower panel) across baseline and intervention conditions for Dillon.

more quickly¹⁵ and future research should explore this possibility. Third, although the study involved collaboration with multiple members of Dillon's educational team, the supervising BCBA[®] only played a role in the delivery of the intervention and not in its design. Training staff in the interpretation of IISCA outcomes and subsequent behavioral interventions may be important for clinically relevant applications in future. Fourth, a variable ratio schedule was employed with token delivery during the intervention. However, data on the procedural fidelity of the implementation of this schedule of reinforcement were not collected and therefore it is difficult to determine how schedule thinning played a role in the intervention package. In addition, tokens were also delivered during most-to-least prompting when the participant was engaging in CB. Token exchange resulted in differential reinforcement for compliance producing either a 2-min break with access to tangibles (no CB occurring) or a 10-s break

with no access to tangibles (CB occurring). It is unclear therefore, whether praise alone would have produced the same outcomes. Future researchers may consider a component analysis to determine which specific variables alter the effectiveness of such an intervention. Finally, this study described the IISCA process and intervention for a single participant and therefore, the external validity of the results may be questioned.

Fisher and colleagues¹⁸ have recommended caution in the utilization of the IISCA as their research suggested low levels of agreement between IISCA outcomes and those of other traditional EFAs. Additionally, they cautioned that the IISCA may overestimate the frequency of multiply controlled behavior and result in test conditions examining a contingency that does not actually maintain CB. The targeted behavior in the current study was suggested by the IISCA to be multiply controlled by social positive and negative

reinforcement contingencies and these were synthesized within one test condition within the IISCA. While it remained unknown whether Dillon's CB was exclusively sensitive to either contingency it was deemed less important to assess the independent contributions of each contingency and more important to promptly implement a function-based intervention to decrease Dillon's severe CB. Scholars have emphasized that the validity of an EFA should be judged by the success of the intervention that arises from it.²⁵ In this respect, a growing body of research, including the current study, support the validity of the IISCA. However, it is imperative that future research further assess the correspondence between other types of EFAs and IISCAs and continue to explore the validity of the IISCA through the experimental evaluation of treatments prescribed by its results.

This study contributes to a growing body of literature that suggests that the IISCA is a fast, practical, reliable and effective EFA process that can: (a) successfully identify the contingency maintaining CB, (b) be easily conducted within typical service settings without any specialized equipment and, (c) be used to design individualized, function-based behavioral intervention packages that can successfully reduce or eliminate severe CB in individuals with ASD.

Declaration of Interest

This research was conducted at Trinity College Dublin, the University of Dublin. The authors report no conflicts of interest.

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