RESEARCH

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News and Notes About Scientific Research on ASD and Other Developmental and Behavioral Disorders

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Proposing Four Distinct Subtypes of Autism

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In July of 2023, the Research Newsletter covered prevalence estimates from the Centers for Disease Control and Prevention (CDC; Maenner et al., 2023) from its Autism and Developmental Disabilities Monitoring network (ADDM) project. Autism prevalence was estimated to have increased to 1 in 36 children at the age of 8. The newest prevalence estimates have been released (CDC; Shaw et al., 2025), and autism prevalence was estimated to increase to 1 in 31 children at the age of 8. So, the trend of increased prevalence has continued. Another recently published study has suggested that autism spectrum disorder can be divided into four subcategories (Litman et al., 2025). This interesting study analyzed data from SPARK (https://sparkforautism.org/portal/page/about-spark/). SPARK is an autism research project, funded by the Simons Foundation, aimed at advancing our understanding of the disorder. SPARK has over 150,000 people diagnosed as autistic, as well as over 380,000 first-degree family members, many of whom have shared genetic material.

The Litman et al. (2025) study analyzed data from over 5,300 children in the SPARK database. The data included genetic samples and information gathered from several questionnaire-based assessments (i.e., Social Communication Questionnaire-Lifetime, Repetitive Behavior Scale-Revised, and the Child Behavior Checklist). The questionnaires allow for the identification of the presentation of 239 surveyed items (e.g., challenging behavior, communication skills, social behavior) along with the genetic samples. The results of this research propose that there are distinct characteristics of the individual that correspond to specific patterns of genetic variations. This leads to the suggestion of four subtypes of autism, which are referred to as Autism with:

1. Social and Behavioral Challenges, which presents with social behavioral differences and repetitive behavior, but developmental milestones are similar to those in typically developing children. This is the largest group, 37% of the sample, and often co-occurs with ADHD, anxiety, depression, and/or obsessive-compulsive disorder.

2. Mixed ASD with Developmental Delay, which presents with delays in meeting developmental milestones, along with core autism symptoms, but does not co-occur with anxiety, depression, or disruptive behavior. This group was about 19% of the studied sample.

3. Moderate Challenges, which presents with milder core autism symptoms, usually reach developmental milestones at expected ages but also do not co-occur with psychiatric disorders. This is the second largest percentage of the sample at 34%.

4. Broadly Affected, which presents with more profoundly impacting core symptoms and co-occurring psychiatric conditions. This is the smallest percentage of the sample at around 10%.

The authors stated that they expected "the differences in phenotypes, co-occurring diagnoses and developmental milestones across the four autism classes would correspond to class-specific patterns in genetic signals for common variants." When examining the genetic presentations of those in these categories, various potential mechanisms were suggested. For example, the most profoundly impaired individuals, the Broadly Affected group, were found to have the most unique genetic mutations ("de novo" mutations) that were not present in their parents. The other group noted to show developmental delays, the Mixed ASD with Developmental Delay group was more likely to have inherited rare genetic variations from their parents. So, although both groups present with developmental delays, the genetic mechanisms involved were different. More research is certainly warranted, but these findings suggest subtypes of the disorder may provide different avenues to diagnosing autism and may have treatment implications.

One well-developed line of research, conducted by behavioral researchers, has suggested that there are subtypes of self-injurious behavior (e.g., head banging or otherwise hitting one's self) when self-injury does not have a clear cause. Examples of clear causes of self-injury include when self-injury produces caregiver attention, access to preferred events, or provides escape or avoidance of aversive events. The work by Hagopian and colleagues (2015/2017) has shown that when self-injury does not have a clear social cause and there are clear differences between test and control conditions, then this type of self-injury responds to alternative sources of reinforcement in the environment. These types of treatments are not overly resource intensive. However, if self-injury does not show these clear differences during assessment, then alternative sources of reinforcement alone are rarely effective in intervention. In these cases, additional treatment components are needed, and the treatment requires intensive resources to implement.

Hagopian, L. P., Rooker, G. W., & Zarcone, J. R. (2015). Delineating subtypes of self-injurious behavior maintained by automatic reinforcement. *Journal of Applied Behavior Analysis*, 48(3), 523–543. https://doi.org/10.1002/jaba.236

Hagopian, L. P., Rooker, G. W., Zarcone, J. R., Bonner, A. C., & Arevalo, A. R. (2017). Further analysis of subtypes of automatically reinforced SIB: A replication and quantitative analysis of published datasets. *Journal of Applied Behavior Analysis*, 50(1), 48–66. https://doi.org/10.1002/jaba.368

Litman, A., Sauerwald, N., Green Snyder, L. et al. (2025). Decomposition of phenotypic heterogeneity in autism reveals underlying genetic programs. Nature Genetics, 57, 1611–1619. https://doi.org/10.1038/s41588-025-02224-z

Maenner MJ, Warren Z, Williams AR, et al. (2023). Prevalence and Characteristics of Autism Spectrum Disorder Among Children Aged 8 Years — Autism and Developmental Disabilities Monitoring Network, 11 Sites, United States, 2020. MMWR Surveillance Summary, 72(No. SS-2):1–14. DOI: http://dx.doi.org/10.15585/mmwr.ss7202a1

Shaw KA, Williams S, Patrick ME, et al. (2025). Prevalence and Early Identification of Autism Spectrum Disorder Among Children Aged 4 and 8 Years — Autism and Developmental Disabilities Monitoring Network, 16 Sites, United States, 2022. MMWR Surveillance Summary, 74(No. SS-2):1–22. DOI: http://dx.doi.org/10.15585/mmwr.ss7402a1

Identifying Competing Stimuli in the Treatment of Stereotypy

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Stereotypy is described as a limited and repetitive pattern of behavior and is one of the criteria used to diagnose autism. When stereotypy occurs frequently, it can hinder essential skills, social interactions, and educational goals. Examples of motor stereotypy include hand-flapping, body rocking, and tapping or rubbing objects. Typically, stereotypy persists in the absence of social consequences, suggesting it is likely maintained by automatic reinforcement. Behavior maintained by automatic reinforcement can be challenging to treat because it is maintained by the sensory product it produces. As a result, clinicians cannot easily withhold access to this consequence as they can when behavior is maintained by social consequences (e.g., attention).

Although various interventions have been found effective for treating automatically reinforced behavior, including stereotypy, one of the most common approaches is noncontingent reinforcement (NCR). NCR involves enriching the individual's environment by providing continuous access to a variety of leisure items. NCR is likely effective through response competition. That is, by providing continuous access to competing items, stereotypy decreases because the individual can access alternative reinforcement from engagement with the leisure items.

Before NCR can be implemented, the leisure items must be identified using a specific type of assessment, often referred to as a competing-stimulus assessment (CSA). The purpose of a CSA is to identify stimuli that are associated with low levels of stereotypy and high levels of engagement. In a CSA, each leisure item is presented singly for a trial of a predetermined duration (e.g., three minutes). In addition, a no-stimulus control trial, in which no leisure item is presented, is conducted. This control trial serves as a baseline, allowing for a point of comparison for the other conditions. During each of the trials of the CSA, the implementer does not provide consequences for appropriate engagement or stereotypy. Items that are associated with low or reduced levels of stereotypy and relatively higher item engagement are selected for use during a subsequent treatment. Although a CSA often successfully identifies multiple competing stimuli, it may not do so in some cases. When this occurs, a CSA can be modified to facilitate the identification of effective competing stimuli.

An example of modifying a CSA was illustrated by Leif et al. (2020), who conducted a CSA with four individuals with autism who exhibited automatically reinforced challenging behavior and limited engagement with leisure items. The CSA did not identify any stimuli that effectively competed with their challenging behavior. Leif et al. subsequently modified the CSA by conducting prompting alone and prompting combined with reinforcement for item engagement.

During prompting, the implementer presented a vocal and physical prompt if the participant was not engaged with the item during the 10-second interval. In the prompting with DRA condition, in addition to prompting, a preferred edible was delivered contingent on 10 seconds of continuous leisure item engagement. The CSA, with the prompting and reinforcement modification, was successful in identifying multiple stimuli associated with low levels of automatically reinforced challenging behavior and higher levels of leisure-item engagement. In a subsequent treatment evaluation, Leif et al. found that prompting and reinforcement remained effective in promoting item engagement and decreasing automatically reinforced challenging behavior with the CSA-identified items. In addition, treatment effects maintained at longer session durations and when the reinforcement schedule was thinned.

A noteworthy feature of Leif et al. was that the authors demonstrated how a CSA could be modified, by adding prompting and reinforcement components, to identify effective competing stimuli. Rosenzweig et al. (2023) illustrated another example of conducting a modified CSA to identify leisure-items for use in a subsequent intervention. Four individuals with autism, who exhibited automatically reinforced stereotypy, participated. Rosenzweig et al. conducted a non-modified CSA first to determine if modifications were necessary. For two of the participants, no CSA modifications were needed to identify multiple effective competing items (i.e., those associated with high levels of item engagement and low levels of stereotypy). For the other two participants, additional modifications were necessary. Therefore, the authors conducted a modified CSA with prompting and response interruption. As a result of this modification, three effective competing stimuli were identified. During a subsequent treatment analysis, the authors compared two NCR interventions. In one NCR condition, the effective competing stimuli presented were systematically rotated. In the other condition, prompting of item engagement was conducted. Interestingly, both NCR procedures were effective for the two participants who did not need CSA modifications. By contrast, only the NCR that included prompting was effective for participants who required CSA modifications.

In summary, both Leif et al. and Rosenzweig et al. demonstrated the utility of using a CSA to inform subsequent intervention procedures. Leif et al. found that CSA modifications were necessary to decrease automatically reinforced challenging behavior and increase item engagement for all participants. By contrast, Rosenzweig found that CSA modifications were required for only two participants. Both Leif et al. and Rosenzweig et al. studies showed that the use of a CSA helped identify leisure items and intervention components that can be effective during intervention. In addition, both studies demonstrated the utility of prompting leisure item engagement. Prompting engagement with competing stimuli may decrease automatically reinforced stereotypy by facilitating an alternative appropriate response that may become reinforcing in and of itself.

Leif, E. S., Roscoe, E. M., Ahearn, W. H., Rogalski, J. P., & Morrison, H. (2020). Increasing item engagement and decreasing automatically reinforced problem behavior within a modified competing stimulus assessment. *Journal of Applied Behavior Analysis*, 53(3), 1638–1659. https://doi.org/10.1002/jaba.695

Rosenzweig, J.L., Li Volsi, C.A., de Man, T., & Ahearn, W.H. (2024). Examining procedural variations of delivering competing stimuli in the treatment of stereotypy. *Behavior Modification*, 1-29. https://doi.org/10.1177/01454455241232574
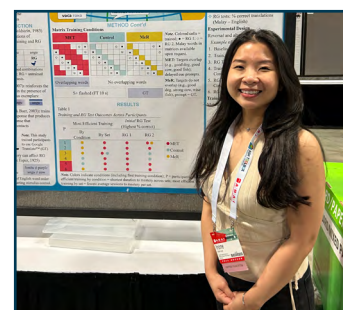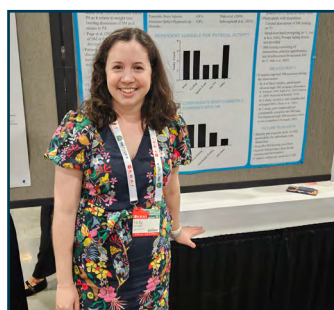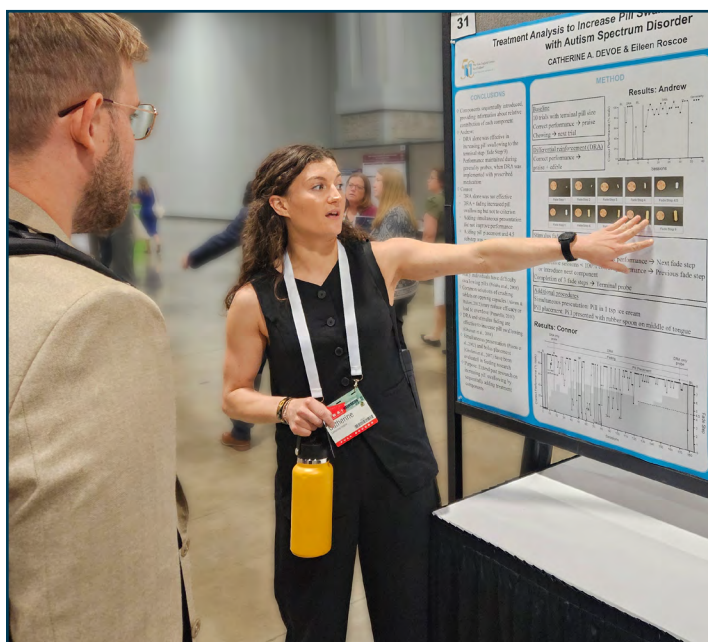
Several NECC researchers attended the Association of Behavior Analysis International (ABAI) conference in Washington, DC, in May of 2025. Some of the titles and abstracts of presentations on various topics are highlighted below.

An Evaluation of Behavioral Skills Training to Teach Phone Safety Skills to Adolescents with Autism Spectrum Disorder

EDITOR'S NOTE:
Teaching socially significant safety skills is a key area of research at NECC. Abigail Kelley presented a poster on using Behavioral Skills Training (BST) to teach adolescents with autism phone safety skills. The training — consisting of written instructions, video modeling, rehearsal, and feedback — resulted in all participants learning to identify and respond appropriately to unsafe text messages. These skills generalized to new teachers and settings and were maintained over time.

ABIGAIL KELLEY (The New England Center for Children) and Amanda Verriden, PhD, BCBA-D, LABA (The New England Center for Children).

Abstract: This study evaluated Behavioral Skills Training (BST) for teaching phone safety skills to adolescents with autism spectrum disorder (ASD). The authors taught three individuals to discriminate between safe and unsafe text messages, and then how to respond using instructions, modeling, rehearsal, and feedback until mastery. They then conducted post-tests and in-situ generalization probes across different people, settings, and text message types to evaluate the effects of BST. All three participants discriminated between safe and unsafe messages and demonstrated the correct safety responses post-BST. One participant required a rehearsal and feedback booster session to achieve mastery. Additionally, all participants successfully generalized the skills with new teachers in new settings and maintained the skills two to five weeks post BST. Interobserver agreement was 94% overall (range, 83% to 100%).

Effects of Mixed-trial and Interspersed-mixed-trial Teaching on the Emergence of Bidirectional Naming

EDITOR'S NOTE:
In addition to research on safety skills, NECC researchers presented a study focused on teaching procedures to increase bidirectional naming — a foundational skill for language development that is often delayed in individuals with autism. This study compared two discrete-trial teaching strategies and found that interspersed tact and listener trials were more efficient and produced stronger emergent responding, suggesting a promising approach for promoting bidirectional naming.
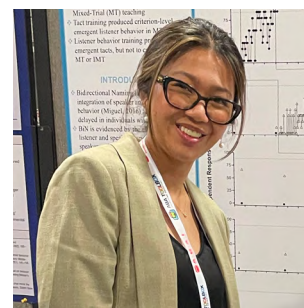
GRACE SMITH (The New England Center for Children) and Cammarie Johnson, PhD, BCBA-D, LABA (The New England Center for Children).

Abstract: Bidirectional naming, a developmental milestone, enables individuals to integrate speaker (e.g., tact) and listener behavior (e.g., auditory-visual conditional discrimination) without direct teaching of both operants, yet it is often delayed in children with autism (Horne & Lowe,1996; Miguel, 2016). Two discrete-trial teaching arrangements, mixed-trial, and interspersed-mixed-trial, were compared in teaching efficiency and in subsequent emergent responding in a 15-year-old male with autism. Using a multiple-baseline-across-sets design, results demonstrated that the interspersed-mixed-trial arrangement

was more efficient (i.e., fewer trials to criterion) in teaching tact and listener responses. Both trial arrangements produced emergent responses; however, more robust, criterion-level emergent listener behavior was shown after tact training compared to the lower-than-criterion emergent tacts after listener behavior training. This finding was replicated across two sets with each operant, one taught with mixed trials and the other with interspersed-mixed trials. Interobserver agreement and procedural integrity data were collected in at least 10% of teaching and 33% of probe sessions and the mean agreement was above 92%. Although replication across more participants is needed, these findings suggest that interspersed tact and listener behavior trials may be more efficient than teaching each operant separately and can promote bidirectional naming.
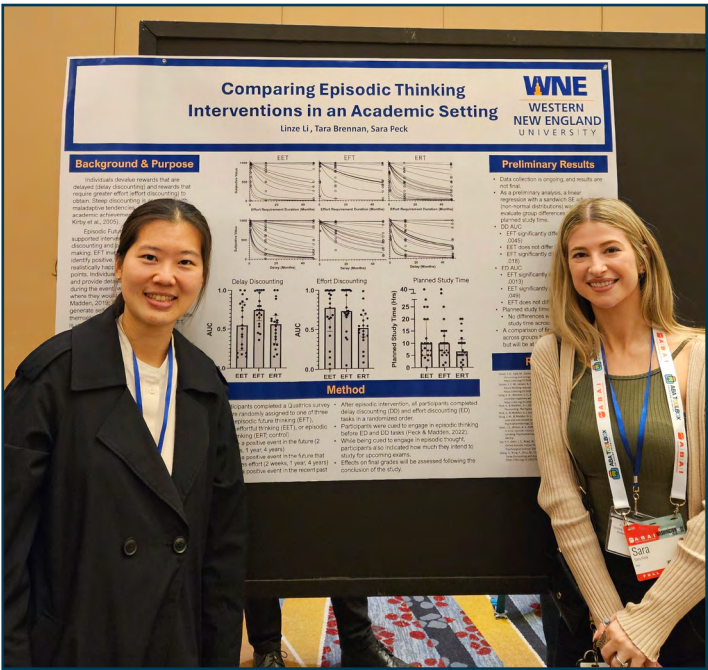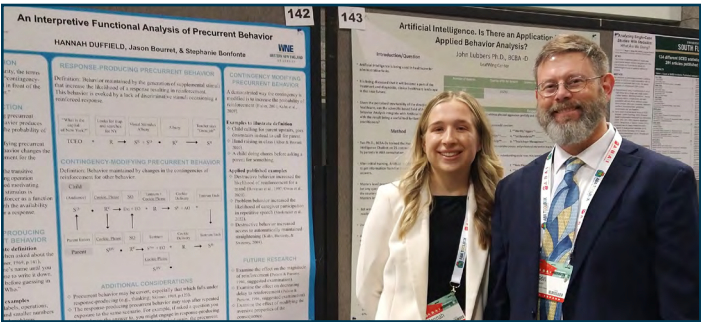
Values-centered Residential Care

EDITOR'S NOTE:
NECC's service model is grounded in the principles of applied behavior analysis and emphasizes compassionate, evidence-based care. In the paper below, Jason Bourret described NECC's residential service model, which provides continuous, values-centered support to children with autism and their families — particularly those facing the challenges of severe behavior.

JASON BOURRET, PhD, BCBA-D, LABA (The New England Center for Children).

Abstract: In this presentation, Dr. Bourret discussed a model of residential service provision for individuals with autism that centers the empowerment and wellbeing of each student and their families. Recent reviews have indicated that over 40% of children with autism may engage in dangerous self-injurious or aggressive behavior. The severity of this behavior may make it very challenging or impossible for some of these children to continue to live safely at home with their parents. Dr. Bourret described The New England Center for Children's (NECC) residential program model that recognizes how traumatic and stressful this can be for children and their families. The presentation also involved a discussion of NECC's educational service provision approach and some of the ways NECC attempts to support students and their families through the challenges that can come with severe and dangerous behavior. Throughout the presentation, Dr. Bourret connected NECC's values and goals to the defining features of applied behavior analysis as articulated by Baer, Wolf, and Risley (1968).

An Experimental Model for the Analysis of Research Assent in Children

Dr. Aida Rodriguez

Dr. Shannon Ward

JAVIER ORTEGA (ECAE), Aida Rodriguez, PhD, BCBA-D (MRC-NECC), Michelle P. Kelly (ECAE), Shannon Ward, PhD, BCBA-D (MRC-NECC), Shaza Mohamed Attia (ECAE), Victoria Nguyen (ECAE), and Sarah C. Mead Jasperse (ECAE).

Abstract: A critical component of conducting behavior analytic research with children is the protection of their rights and promotion of their autonomy. One way to empower children is to incorporate effective assent procedures. In this case, children can assent (agree) to participate in research or dissent (not agree) to participate. There are several factors that may confound the assent process (e.g., availability of other response options, relative preference of the activities). In this experimental study, the authors evaluated several assent-seeking procedures (e.g., verbally asking a child if they want to participate, using a written assent form) and compared the choices made during the assent procedures to subsequent actual engagement with research activities. Twenty young children (under 8 years old) participated. A reversal design was used to compare engagement during conditions in which an alternative activity was available and a condition in which only the research activity was available. Additionally, relative preference for the research activity and the type of assent-seeking procedures were compared across participants. The findings suggest with a reasonable level of confidence that affirmative assent responses correspond with engagement when the research activity is the only option available but may not correspond well when other response options are available.

An Embedded Medical Demand Analysis and Functional Analysis of Challenging Behavior

RONAN BUSTAMENTE (The New England Center for Children) & Eileen Roscoe, PhD, BCBA-D, LABA (The New England Center for Children).

Abstract:Individuals with autism may engage in escape-maintained disruptive behavior during medical procedures, compromising safety and quality of care (Kupzyk & Allen, 2019). Pre-intervention assessments, such as a demand analysis (e.g., Roscoe et al., 2009) and a functional analysis (Iwata et al.1982/1994), can be used to identify behavioral function. Although a demand analysis is typically conducted before the functional analysis, conducting them concurrently may be more efficient. The authors assessed the utility of embedding a demand analysis into the escape functional analysis test condition to address this concern. During the escape test condition of the functional analysis, various medical task steps were singly presented while task cooperation and challenging behavior were measured. Tasks associated with low levels of task cooperation and high levels of challenging behavior were identified as strong establishing operation (EO) tasks. In contrast, those with high task cooperation and low challenging behavior are identified as weak EO tasks. Two individuals with autism, who exhibited disruptive behavior during medical procedures, participated. For both participants, escape was identified as a maintaining reinforcer, and both strong and weak EO task steps of a medical procedure were identified.

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