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David Trembath & Giacomo Vivanti

**To cite this article:** David Trembath & Giacomo Vivanti (2014) Problematic but predictive: Individual differences in children with autism spectrum disorders, International Journal of Speech-Language Pathology, 16:1, 57-60, DOI: [10.3109/17549507.2013.859300](https://doi.org/10.3109/17549507.2013.859300)

**To link to this article:** <https://doi.org/10.3109/17549507.2013.859300>



Published online: 18 Dec 2013.



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SCIENTIFIC FORUM: COMMENTARY

## Problematic but predictive: Individual differences in children with autism spectrum disorders

DAVID TREMBATH<sup>1,2</sup> & GIACOMO VIVANTI<sup>2,3</sup>

<sup>1</sup>Griffith Health Institute, Griffith University, Gold Coast, QLD, Australia, <sup>2</sup>Olga Tennison Autism Research Centre, La Trobe University, Melbourne, VIC, Australia, and <sup>3</sup>Victorian Autism Specific Early Learning and Care Centre, La Trobe University, Melbourne, VIC, Australia

### Abstract

Camarata highlights the impact that symptom heterogeneity, overlap, and individual differences can have on the accurate early diagnosis of children with autism spectrum disorders (ASD) and measurement of treatment outcomes. Nevertheless, these individual differences may provide avenues for predicting individual responses to treatment with the view to prospectively matching children with ASD to treatments best-suited to meeting their individual needs. This commentary suggests that the behavioural characteristics that are critical to accurate early differential diagnosis of ASD may be poor predictors of outcomes. However, factors that are not unique to ASD may in fact be good predictors of treatment outcomes. This commentary illustrates these points with reference to the results of recent studies demonstrating the problems, and possibilities, that individual differences currently present when it comes to understanding and promoting learning in children with ASD.

**Keywords:** *Autism spectrum disorder, early intervention, prediction, outcomes.*

### Introduction

In recent years, interest has grown regarding the relevance of individual differences in learning and response to treatment amongst children with autism spectrum disorders (ASD). Indeed, it is difficult to find a systematic review or treatment study in the field of ASD published in the past 5 years in which the authors do cite the need to better understand individual differences in response to treatment (e.g., Ganz, Davis, Lund, Goodwyn, & Simpson, 2012; Stahmer, Schreibman, & Cunningham, 2011). Yet the importance of these differences has long been recognized. In fact, Kanner (1943), in his original case series involving 11 children with ASD, noted that:

... the 11 children whose histories have been briefly presented offer, as is to be expected, individual differences in the degree of their disturbances, the manifestation of specific features, the family constellation, and the step-by-step development in the course of years. But even a quick review of the material makes the emergence of a number of essential common characteristics appear inevitable (pp. 241–242).

Seventy years on, Camarata (2014) provides a powerful account of how this complex combination of core difficulties and individual differences cur-

rently impacts diagnostic and treatment science and practices in the field of ASD. He reminds us that the challenges we face cannot be divorced from shifting diagnostic criteria, a push for early diagnosis and intervention, and a policy context in which there is increasing demand for evidence-based decision-making. In this commentary, we suggest that, although these individual differences pose problems for diagnosis and evaluating treatment programs, they may ultimately hold the key to predicting treatment outcomes.

### The problem with individual differences

In the absence of reliable biological markers, diagnosis for children with ASD currently relies on detailed and accurate description of their behaviour. As Camarata (2014) noted, although the task of identifying behaviours relevant to a diagnosis of ASD is relatively simple by the time children start school, identifying the same behaviours in children aged 12–24 months is difficult. Indeed, the push for children to be diagnosed earlier with the view to starting treatment sooner forces clinicians to make decisions about children's development at a stage when they are developing rapidly and, at times, sporadically.

This is a developmental period in which a matter of days can mean the difference between a child “lacking” or “having” a specific behaviour of interest and in which developmental disorders share considerable behavioural overlap. Accordingly, Camarata (2014) highlighted the risks of confusing ASD with speech sound disorder or language delay in the early years, and the need to diagnose based on the specific behavioural markers (e.g., lack of social engagement) that differentiate ASD from other disorders. We agree with Camarata that the task of identifying these ASD-specific behavioural markers may become more difficult due to the heterogeneity of conditions now grouped into the single “entity” of autism spectrum disorders in DSM-5 (Vivanti, Hudry, Trembath, Barbaro, Richdale, & Dissanayake, 2013). Yet, while this potentially frustrating heterogeneity in clinical profiles and symptom presentation poses a challenge for diagnosis, understanding these individual differences in children’s behavioural profiles may be crucial to accurately measuring, and ultimately predicting, treatment outcomes.

### **The potential to predict outcomes**

There is growing awareness within the ASD research community of the limitations of evaluating treatment outcomes based solely on group-level analyses. In our opinion, efforts to understand the mechanisms underlying individual differences in treatment response should be at the top of the autism research agenda, and treatment research should be reframed around this basic question of “what works for whom and why?” Let us consider, for example, two recent, high-profile, randomized controlled treatment trials for children with ASD: the Preschool Autism Communication Trial (PACT; Green, Charman, McConachie, Aldred, Slonims, Howlin, et al., 2010) and the Early Start Denver Model Trial (ESDM; Dawson, Rogers, Munson, Smith, Winter, Greenon, et al., 2010). Based on group-level analyses, the results of the PACT study are generally regarded as negative, while the results of the ESDM trial are regarded as positive (Ozonoff, 2011). However, the results of both studies are potentially equally informative when considered with regard to (a) the hypothesized mechanism of action in each intervention, and (b) the characteristics of children who did and did not respond to treatment in each trial.

The PACT study compared parent-mediated communication-focused intervention delivered in a clinic to treatment as usual in the community in a trial involving 152 pre-school aged children with “core autism” and their parents. Child–parent dyads in the PACT treatment group received 36 hours of 1:1 consultation from a speech-language pathologist over 12 months. Green et al. (2010) reported no difference in autism severity scores (as measured on the Autism Diagnostic Observation Schedule) or

standardized language measures at follow-up, leading the authors to recommend against adding PACT intervention to treatment as usual for the reduction of ASD symptoms. However, there is possibly more to this story. The goal of the PACT intervention was to increase parental sensitivity and responsiveness to children’s communication, which, in turn, was hypothesized to provide enhanced social-communication opportunities. Therefore, the negative group results indicate that this particular mechanism (increased social communication opportunities built on parental responsiveness to children’s cues), is unlikely to be an active ingredient supporting positive treatment outcomes for the majority of children with ASD. However, individual variability in response to treatment, as evidenced by large standard deviations on most measures, suggests that some children responded well to treatment while others made few gains. It would be helpful to know more about the characteristics of children and parents who did and did not respond to treatment, in order to determine whether that particular mechanism is associated with outcomes for some children with ASD, although not the majority. Unfortunately, details regarding individual differences have not yet been reported.

In the ESDM trial, Dawson et al. (2010) delivered an average of 15.2 hours per week of 1:1 early intensive behavioural intervention to 24 children with ASD, aged 18–30 months, over a period of 24 months. A comparison group of 24 children, matched for age, intelligence (IQ), ASD symptom severity, and adaptive behaviour received an average 5.2 hours a week of treatment as usual in the community. At 24 months, the ESDM group had on average increased 17.6 standard score points above baseline compared with 7.0 points in the comparison group. The ESDM group had also maintained their rate of growth in adaptive behaviour, while the comparison group showed greater delays. In considering the findings, we note that the hypothesized mechanism of action was an increased reward value associated with the provision of social learning opportunities, resulting in increased motivation to interact with and learn from others. The positive results at the group level suggest that increased motivation/reward for spontaneous social learning may be an important factor in treatment outcomes for many children with ASD. However, again, there was evidence of variability in individual outcomes. Detailed description of the profiles of responders and non-responders may provide insight into how this particular process may influence treatment outcomes in a particular sub-group of children.

### **Advances in predicting treatment outcomes**

The question of why children respond differently to treatment is often overlooked, but it is a critical. Available information on the characteristics of these

children is very limited, with most studies indicating that children with lower IQ, or intellectual disability, are less likely to undergo positive gains (Howlin, 2003). However, findings from single case experimental research involving children with intellectual disability and complex communication needs (e.g., Trembath, Balandin, Togher, & Stancliffe, 2009; van der Meer, Didden, Sutherland, O'Reilly, Lancioni, & Sigafoos, 2012) clearly demonstrate that, even among a group of children with equally impaired cognition and communication, individual responses to the same treatment often differ markedly. To understand and learn from individual differences in treatment outcomes, we need to focus on more specific predictor variables that are based on hypothesized "active ingredients" of intervention programs.

In an attempt to identify specific factors that predict treatment outcomes for children with ASD, Vivanti, Dissanayake, Zierhut, and Rogers (2012) examined learning profiles association with differing responses to the Early Start Denver Model (ESDM) delivered in a group-based early intervention setting. The participants were 21 children with ASD who received between 15–25 hours of ESDM per week, delivered by a multidisciplinary team, over a period of 12 months. The results indicated that individual differences in the children's ability to engage in functional use of a set of common objects, their ability to infer another person's goal-directed actions (using eye tracking), and their propensity to imitate another person's actions were highly associated with differential outcomes in both Non-Verbal and Verbal sub-scale scores as measured on the Mullen Scales of Early Learning (MSEL; Mullen, 1995). To illustrate, the Functional Use of Objects accounted for ~70% of the variance in Visual Reception gains. The children's ability to infer another person's goal-directed actions based on the person's eye gaze explained ~30% of the variance in Receptive Language gains. However, children's scores on a social attention eye-tracking task did not predict outcomes, suggesting that characteristics associated with ASD diagnosis may not be good predictors of treatment outcomes.

Vivanti et al.'s (2012) findings add to a growing body of literature indicating an association between object use and response to treatment in children with developmental disabilities. Yoder and Stone (2006), for example, conducted a randomized group experiment comparing the effectiveness of the Picture Exchange Communication System (PECS) with Responsive Education and Pre-linguistic Milieu Teaching (RPMT) for young children with ASD. They reported an association between object exploration (the number of objects touched during a play assessment) and response to intervention, whereby children who began the study with high levels of object exploration benefitted more from PECS than RPMT, whereas the opposite was true for children who began with low levels of object exploration. More recently, Fey, Yoder, Warren, and Bredin-Oja

(2013) reported an association between object play and treatment intensity in a study of 64 children with developmental disabilities who received Milieu Communication Teaching, whereby children who played with more objects at baseline benefitted more from high- than from low-intensity treatment. Importantly, the participants included children with and without ASD, suggesting that object exploration holds some value in predicting treatment response, irrespective of diagnosis.

### Implications for research and practice

Put together, the findings of these studies imply a need to distinguish between features that are relevant for diagnosis (where homogeneity is crucial) vs features that are relevant for prognosis (where individual variability is more important than average response) when it comes to research involving children with ASD. It appears that symptoms and impairments that are critical for accurate early diagnosis (e.g., behaviours that distinguish ASD from other conditions) such as social attention may be less relevant to predicting treatment outcomes. Conversely, behaviour characteristics that do not reliably distinguish ASD from other conditions, such as poor imitative abilities and poor functional play, appear to be relevant for treatment outcomes in ASD and other developmental disabilities (Poon, Watson, Baranek, & Poe, 2012; Vivanti et al., 2012). Moreover, factors that appear to be associated with positive vs poor treatment outcomes might be different across ASD sub-groups and across treatment programs.

In considering how the study of individual differences in children with ASD may inform treatment research, Camarata (2014) noted that "when the autism symptomology is precise and the interventions match the child's traits, one could plausibly hypothesize that such a study would be more likely to yield interpretable results" (p. 7). Our view is that early emerging ASD diagnostic features (i.e., the unifying features that underlie all children in the spectrum) are highly relevant to diagnosis and essential to accurately characterizing children for the purposes of treatment research. However, we suggest that the magnitude or strength of these "diagnostic" features may not relate strongly to treatment outcomes. Conversely, other features that may or may not be specific to children with ASD (e.g., object use), and that are not shared by all individuals on the spectrum, may prove critical to predicting treatment outcomes in the future and prospectively matching children to treatments most likely to suit their individual learning profiles. This line of investigation requires a new focus on the active ingredients that are supposed to promote treatment changes and a fine grained investigation of heterogeneity in response to treatment, with a particular focus on profiles of children who show the least response.

**Declaration of interest:** The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

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