Research in Developmental Disabilities 34 (2013) 4591–4598

Contents lists available at ScienceDirect

Research in Developmental Disabilities

Re-examining the cognitive phenotype in autism: A study with young Chinese children

Yan Grace Lam *

Hong Kong Institute of Education, Hong Kong

ARTICLE INFO

Article history:
Received 8 August 2013
Received in revised form 21 September 2013
Accepted 23 September 2013
Available online 27 October 2013

Keywords:
Autism
Theory of mind
Executive function
Weak central coherence
Cognitive phenotype

ABSTRACT

Deficits consistently found in autism include an impaired "theory of mind", weak central coherence, and deficits in executive function. The current study examined whether this traditional cluster of symptoms existed in a group of Chinese-speaking children with autism. Sixteen high-functioning, non-retarded children with autism were matched to 16 typically developing (TD) children on gender, non-verbal IQ and age. Non-verbal IQ's of all participants were measured using the Raven Progressive Matrices. Each participant was tested individually on measures of "theory of mind", central coherence and executive function. Results indicated that most, but not all, participants with autism performed significantly poorer on two standard measures of first-order "theory of mind," although there was no significant difference on two other measures of that domain. As expected, they performed significantly worse on executive function tasks. However, the hypothesis of weak central coherence in autism was not substantiated. There was no evidence that these three cognitive impairments co-existed in individuals with autism. More likely, each of these deficits appears singly or in pair instead of forming a cluster.

1. Introduction

The investigation of any neuropsychological disorder can focus on very different levels including behavioral manifestations, core symptoms, cognitive deficits and brain anomalies. Although autism has been relatively well described at the symptom level, the nature of cognitive deficits attributed is unclear and remains debatable. Despite the heterogeneity of symptoms, it is agreed that some behavioral features are universal in all cases of autism (*DSM-IV-TR*, APA, 2000). It is highly plausible that a specific cognitive scheme may underlie these behavioral manifestations of autism. Western studies employing Caucasian children have identified a cognitive phenotype plausibly underpinning autism (South, Ozonoff, & McMahon, 2007). Nevertheless, similar investigations with Chinese children are rare. Therefore, the present study attempts to examine whether certain cognitive deficits exist as a cluster in a group of Chinese-speaking children with autism. These cognitive abilities consistently found to be impaired in autism include lacking a "theory of mind", weak central coherence, and executive function deficit.

The theoretical importance of portraying such particular cognitive scheme can be seen in several ways. First, it provides a relatively refined explanation for the huge individual differences observed in autism; a patient's symptoms can be described, in part, by different loadings for several cognitive deficits. Second, it creates room to generate hypotheses about the neural substrates underlying autism. Third, the phenotype of such a complex disorder must be characterized prior to its genetic analysis (e.g. Holt et al., 2010) or implications of probable etiologies. In fact, this attempt is not unprecedented; similar research effort has successfully discovered a number of distinct symptom clusters in schizophrenia (Liddle, 1996).

* Tel.: +852 29488408; fax: +852 29488454.
E-mail addresses: gylam@ied.edu.hk, geniegrace@gmail.com.

0891-4222/$ – see front matter © 2013 Elsevier Ltd. All rights reserved.
http://dx.doi.org/10.1016/j.ridd.2013.09.039

1.1. The three cognitive deficits of interest

A "theory of mind" represents an implicit capacity to ascribe mental states to self and others (sometime referred to as "mentalise") which is necessary for one to predict and explain actions (Barnes & Baron-Cohen, 2011). The false belief test designed by Wimmer and Perner (1983) have been given to children with autism as well as their normal and mentally retarded counterparts; the "theory of mind" deficit appears to be unique to those having autism. In contrast to mentally retarded and normal developing children, this mentalising ability was consistently found to be impaired in most children with autism (e.g. Colle, Baron-Cohen, & Hill, 2007). This phenomenon has then been vastly investigated in various age groups of the autistic population, and converging findings suggested a "theory of mind" deficit in autism regardless of age (Baron-Cohen, 2000). The "theory of mind" deficit has provided a near-to-perfect account for the social behaviors as well as the deficient pretend play exhibited in autism. Nevertheless, such postulation proves to be limited when attempting to explain savant abilities preserved in a subgroup of individuals with autism. This imperfection has made space for the postulation of weak central coherence.

Frith (1989) defined central coherence as a mechanism that regulates pieced-meal information to attain an integrated, higher-level meaning. She argued that central coherence in information processing is weak in children with autism. This is somehow a convincing account of their failure to apply acquired knowledge sensibly according to contexts but perform better on those tasks that favor a piece-meal processing style, e.g. The Embedded Figure Test (*EFT*; Witkin, Oltman, Raskin, & Karp, 1971).

On the other hand, research findings suggested a plausible relationship between executive function deficits and lacking a theory of mind. Executive function regulates the sequence of maneuvers crucial to problem-solving. These include initial planning, inhibition of inappropriate action, organized search, maintenance of responses, and the flexible use of feedback to modify problem-solving strategy (Goldman-Rakic, 1987). Ozonoff, Pennington, and Rogers (1991) discovered that impaired second-order "theory of mind" and executive function were common among the autistic group, while first-order "theory of mind" deficits were only found in a subset of the sample. A recent study also suggested a plausible relationship between these two deficits (Pellicano, 2007).

These prevalent theories have contributed much insight into how people with autism may perceive the world and the reasons of their bizarre responses. Yet, none of these three is persuasive enough to explain the whole phenotype of the disorder. In this study, these three deficits were postulated to co-exist in autism, and they were examined in a group of young Chinese children with autism. These children were expected to perform significantly less well than their IQ-matched typically developing counterparts on all measures of "theory of mind", central coherence and executive functions.

2. Method

2.1. Participants

The autism group comprised 16 high-functioning, non-retarded children with autism and the control group 16 typically developing (TD) children. The groups were matched on gender, non-verbal IQ and age. The mean ages of the autism and control groups were 8.9 and 8.42 years respectively. The male-to-female ratio in both groups was 3:1. Non-verbal IQ's of all participants were measured using the Raven Progressive Matrices (Raven, 1998). All those who have a score of at least 90 were included in the final sample. Each member of the autism group was closely matched with a member of the typically developing control group on the attained Raven's score. All participants included in the final test have a match and a Raven's score above 90.

Thirty-three children with idiopathic autism were interviewed six months before the actual test was scheduled. They were former members of a playgroup ran by the university psychiatric unit in a local hospital. All children have their diagnoses confirmed again by a clinical psychologist before they were referred to this study. Children were pretested with verbal and non-verbal tasks that required similar verbal skills, but were different from those, in the actual test battery. The Childhood Autism Rating Scale (The CARS; Schopler, Reichler, DeVellis, & Daly, 1980) was used as a screening tool to select participants with similar abilities. Sixteen children were eligible and possessed the adequate verbal (expressive and comprehensive) skills necessary for the accomplishment of tasks employed in this study. They were homogenous in their CARS ratings, intelligence and verbal skills.

Twenty-two normal participants were interviewed. They were volunteers recruited from different primary schools. Only 16 normal participants were selected so that all participants in the autism group have their IQ-matched normal counterparts. Each participant took the same test battery individually in a playroom. Characteristics of those who participated in the final test are summarized in Table 1.

2.2. Measures

2.2.1. "Theory of mind" domain

2.2.1.1. Appearance–Reality task (Baron-Cohen, 1989). This task measured the ability to distinguish between appearance and reality of deceptive-looking objects, e.g. a sponge that looked like a rock. To pass this test, the participant must apply the mental state knowledge to override the object's superficial appearance (see Fig. 1).