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Attributing social and physical meaning to ambiguous visual displays in individuals with higher-functioning autism spectrum disorders

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Abstract

The weak central coherence (WCC) account of autism characterizes the learning style of individuals with this condition as favoring localized and fragmented (to the detriment of global and integrative) processing of information. This pattern of learning is thought to lead to deficits in aspects of perception (e.g., face processing), cognition, and communication (e.g., focus on disjointed details rather than "gist" or context), ultimately leading to social impairments. This study was carried out to examine whether WCC applies to social and to non-social aspects of learning alike, or, alternatively, some areas of learning (e.g., physical reasoning) are spared in autism. Heider and Simmel's (1944) classic social animation as quantified in the Social Attribution Task (SAT) (Klin, 2000) and a novel animation involving physical reasoning (the Physical Attribution Task; PAT) were used to test the domain specificity of the WCC hypothesis. A pilot study involving a reference group of typically developing young adults and a group of individuals with higher-functioning autism spectrum disorders (ASDs) revealed gender differences in the reference group in regards to performance on the PAT (males outperformed females). In a follow-up case-control comparison involving only males where the ASD group was matched on age and IQ to a typically developing (TD) group of children, adolescents, and adults, the ASD group showed lower SAT scores and comparable PAT scores relative to the TD group. The interaction of diagnostic group by task was highly significant, with little overlap between the groups in the distributions of SAT minus PAT scores. These results indicated preserved integrative skills in the area of physical attribution in the ASD group, thus failing to support the WCC account as a domain-independent (or more general) model of learning in autism, while highlighting the centrality of the social deficits in the characterization of learning style in the autism spectrum disorders.

Keywords: Autism; Weak central coherence; Social attribution; Physical attribution

1. Introduction

Given the heterogeneity in manifestation of the autism spectrum disorders (ASDs), neurobiological research requires the isolation of more specific phenotypes that can be pursued with neuroscience tools (Dawson et al., 2002). Among the most influential psychological phenotypes available is the weak central coherence (WCC) account of autism (Happé, 1999). In a seminal contribution, Frith (1989) suggested that individuals with autism have a marked tendency to process incoming stimuli in a fragmented fashion, focusing on details (localized processing) rather than integrated and meaningful wholes (configural processing), failing, as it were, to interpret stimuli in terms of gist and context. This hypothesis has strong face validity given that over-focus on details to the expense of integrated meaning and context is one of the hallmarks of autism in multiple domains. This has been experimentally shown in a number of areas, ranging from perception and grapho-motor execution (e.g., Mottron & Belleville, 1993; Plaisted, 2001; Plaisted, Saksida, Alcantara, & Weisblatt, 2003), to visual-spatial constructional tasks (e.g., Jolliffe & Baron-Cohen, 1997; Shah & Frith, 1983, 1993) to language understanding (e.g., Frith & Snowling, 1983; Happé, 1997; Jolliffe & Baron-Cohen, 1999) and memory (e.g., Hermelin & O'Connor, 1967; Tager-Flusberg, 1991).

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The WCC hypothesis has several implications to our understanding of autism. First, it delineates an internal social world that is piecemeal and disjointed, lacking the overall coherence that defines social context and social meaning. Therefore, while the account concerns all domains of learning in autism, it also has immediate relevance to the core social disability in autism. Indeed, WCC reflects the first clinical observations (Kanner, 1943) and experimental findings (Scheerer, Rothmann, & Goldstein, 1945) of children with autism. Second, contrary to psychological theories that focus only on deficits in autism, this account also allows to examine assets commonly seen in individuals with this condition, that is in situations in which a preference for detailed or localized processing can be seen as an advantage in task performance. This is the reason why Frith and Happé (e.g., Frith & Happé, 1994; Happé, 1999) prefer to call WCC a cognitive style rather than a cognitive deficit. In fact, several studies examining WCC in individuals with autism tend to report superior abilities in some areas of task performance such as the Wechsler subtest of Block Design or the Embedded Figures Test (Jolliffe & Baron-Cohen, 1997; Shah & Frith, 1993). The WCC hypothesis also provides a theoretical framework to examine extreme cases of special abilities in individuals with autism, such as savant skills (see Hermelin, 2001). Third, WCC provides a psychological framework to examine new neurostructural and neurofunctional findings in autism, including findings of accelerated brain growth in autism (e.g., Courchesne, Carper, & Akshoomoff, 2003), of larger brains with abnormal morphometric distributions (e.g., Courchesne, Redcay, & Kennedy, 2004), and of reduced functional connectivity and synchronization in key psychological domains (e.g., Just, Cherkassky, Keller, & Minshew, 2004).

Despite the accumulating body of evidence in support of the WCC hypothesis, it has not gone unchallenged. Some studies have failed to corroborate the local vs. global cognitive style in visual-spatial constructional tasks (e.g., Mottron, Burack, Stauder, & Robaey, 1999; Ozonoff, Strayer, McMahon, & Filloux, 1994), whereas other studies helped refine the hypothesis, particularly in the perceptual domain (e.g., Mottron & Burack, 2001; Plaisted et al., 2003). It is now clearly the case that individuals with autism are able to process more integrated meaning in some cases (e.g., Snowling & Frith, 1986), particularly if the task is made explicit to them. This led Happé (2005) to suggest that the WCC cognitive style in individuals with autism is best characterized as the "spontaneous approach or automatic processing preference of people with autism," and is thus "best captured in open-ended tasks" (p. 641). This is critical since (1) individuals with autism are known to perform better in explicit tasks that can be reduced to a "close domain" problem-solving situation than in more naturalistic, spontaneous or "open domain" situations (e.g., Klin, Jones, Schultz, & Volkmar, 2003), and (2) real-life learning about the inanimate as well as the social world takes place in situations that are much more similar to "open domains," which is where individuals with autism show their greatest degree of disability (Klin, Jones, Schultz, Volkmar, & Cohen, 2002a). In other words, the fact that they may be able to process information more holistically in some situations does not invalidate the hypothesis.

Nevertheless, most studies of WCC in autism have involved just such "close domain" situations. And yet, the clinical literature is replete with examples of fragmented processing in real-life adaptation of individuals with autism. For example, going into a high-school cafeteria and trying to make sense of what is going on there, there is a need to listen to what people are saying (i.e., their words), how they are saying it (e.g., their facial and bodily gestures, voice inflection, stress, and volume), what are the reactions of others to the people speaking, are there any particular props contextualizing the setting, background information about the situation (e.g., people's typical intentions, date and time in the day) among a host of other factors. Individuals with autism are very likely to overly focus in a number of isolated features of this complex situation, thus failing to infer overall context, responding in irrelevant or overly literal fashion, or otherwise ignoring essential elements.

It is of interest that a similar situation applies to another influential psychological hypothesis of autism, namely theory of mind (ToM) (Baron-Cohen, 1995). While a large number of individuals with autism fail ToM tasks, some, particularly those without cognitive deficits, can solve such problems at relatively high levels (e.g., Bowler, 1992; Dahlgren & Trillingsgaard, 1996), and yet have more difficulty with less explicit tasks (Volkmar, Lord, Bailey, Schultz, & Klin, 2004). One study (Klin, 2000) utilized a classic animation in which geometric shapes moved and acted like humans (Heider & Simmel, 1944) in order to measure how salient the social meaning of this array of ambiguous visual stimuli was to higher-functioning adolescents and adults with autism. Typical viewers immediately recognize the social nature of the cartoon and provide narratives that include a number of social attributions involving relationships portrayed there (e.g., being a bully, being a friend), the meaning of specific actions (e.g., trapping, protecting), and attributions of mental states (e.g., being shy, thinking, and being surprised) to the geometric shapes. By contrast, this study showed that individuals with autism had great difficulty in doing so despite having demonstrated the ability to "pass" higher-order (i.e., "second order"; e.g., Tager-Flusberg & Sullivan, 1994) ToM tasks. Other studies using similar animations reached similar conclusions (Abell, Happé, & Frith, 2000; Bowler & Thommen, 2000). These results have been interpreted to suggest that individuals with autism do not spontaneously search for social meaning in the environment (Klin et al., 2003) or that they may be lacking an "intuitive" theory of mind (Frith & Happe, 1999).

What is of interest is that this set of results could also have been predicted from the WCC hypothesis. But in