Commentary: Complementary approaches to the developmental cognitive neuroscience of autism – reflections on Pelphrey et al. (2011)

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Autism spectrum disorders (ASDs) are currently defined on the basis of observable behavior, with diagnostic criteria allow for enormous heterogeneity. In principle, two hypothetical individuals can receive a diagnosis of “autistic disorder” despite evidencing entirely non-overlapping symptoms. There is a growing sense that this heterogeneity stands as a major obstacle to further progress in understanding the causes of ASDs. In the current issue, however, Pelphrey, Hudac, Schulz & Vander Wyk (2011) argue that researchers have “over-emphasised the heterogeneity in ASD” by failing to recognize “the homogeneity of core disruptions in social information processing”. Focusing on brain regions implicated in social cognition, they suggest, will “constrain” the heterogeneity problem. In what follows, I outline some of the challenges for this approach to autism and advocate a complementary research strategy that seeks instead to capitalize on autistic heterogeneity.

Autism is classified as a pervasive developmental disorder, affecting multiple aspects of cognition and behaviour. While it makes sense to constrain the research question by seeking a good explanation of a specific aspect of the disorder, this is not the same as constraining autism itself. Some form of social impairment is required for an autism diagnosis, entailing that social dysfunction is a universal amongst diagnosed individuals. Although Pelphrey et al. (2011) acknowledge that the nature of this social impairment can vary considerably, they suggest that the underlying neurobiological mechanisms may be common to all or most individuals on the autism spectrum. Given the complexity of our social cognitive apparatus and the many potential ways in which its development could go awry, strong evidence is required before such an assertion can be made.

Pelphrey and colleagues’ review centres on a series of functional imaging studies investigating the neural correlates of social cognition in typical development and autism. Although these studies are each important in their own right, they do not directly address the issue of heterogeneity. First, participation in these studies was limited to high functioning adolescents or young adults with autism. There are obvious practical reasons for this restricted sampling, but it would be a mistake to assume that differences identified in this high-achieving subgroup would necessarily be mirrored in other ASD subgroups. A pertinent illustration comes from Norbury et al. (2009), who replicated earlier findings that autistic adolescents with age-appropriate language skills spent reduced time fixating on the eye region of characters in a movie clip. Crucially, however, this reduction in eye gaze was not apparent in a second subgroup of autistic adolescents who had a history of language impairment; their eye-movements were indistinguishable from those of their typically developing peers. A second concern is that Pelphrey et al. rely exclusively on group averages. They show that activation of the amygdala and posterior superior temporal sulcus is significantly reduced in autism in certain experimental contexts. However, they do not show that this is true of all or even the majority of the individuals, even within the confines of their narrowly defined autism subgroup. Statistically significant group differences can be driven by a relatively small minority of participants and so homogeneity needs to be ascertained rather than merely assumed.

In my view, the problem is not that researchers have “over-emphasized” autistic heterogeneity but rather that the group-matching designs commonly employed in autism research are inadequate to deal with this heterogeneity. Thus, in addition to asking whether or not our autism group are impaired on a particular test, my colleagues and I now specifically aim to identify those individuals within our autism group who experience significant difficulties and ask what differentiates them from other group members who do not. Applying a similar strategy to functional imaging research could pay rich dividends. Rather than simply asking whether a particular region is over- or under-activated in autism and treating the group mean as representative of the entire autism population, researchers should also ask what differentiates autistic individuals with, for example, an underactive amygdala, from those who show normal or enhanced activity.

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Pelphrey et al. also touch upon the issue of overlap between autism and other neurodevelopmental disorders, particularly schizophrenia. Autism was, of course, originally conceived as a form of childhood schizophrenia and numerous authors have pointed out the similarity between the two disorders in terms of behavioural features and potential cognitive, neural, and genetic causes. Pelphrey et al. review a study showing similar patterns of atypical social brain activation in autism and paranoid schizophrenia. While they suggest that activity in right posterior superior temporal sulcus may differentiate schizophrenia, they again stress that ASD and what separates ASD from other neurodevelopmental disorders. In an early version of the connectivity account of autism, my colleagues and I postulated a disruption to the normal cycles of synaptic proliferation and pruning occurring during infancy (Brock, Brown, Boucher & Rippon, 2002). In contrast, schizophrenia has been attributed to disruptions affecting later cycles following an initial period of relatively normal development (e.g. Hoffman & McGlashan, 1997). Such differences in neurodevelopmental timing are likely to have major implications for cognitive development and clinical outcomes, even if the brains of adults with autism and schizophrenia share some superficial similarities.

Thus, as Pelphrey et al. argue, there is an urgent requirement for more research on early brain development in autism. Given the wide individual variation and nonlinear trajectory of brain development, in typical development as well as autism, longitudinal rather than cross-sectional designs are likely to be most informative. It would, however, be a mistake to focus on the development of the social brain in isolation. The functional role of a particular cortical region is defined by its connections to other parts of the nervous system (Passingham, Stephan & Kötter, 2002), so an adequate theory of emerging functional specialization in autism will probably require a synthesis of contemporary accounts emphasizing particular nodes of the brain’s network (such as the pSTS) with theories that focus on the connections between the nodes.

In sum, Pelphrey et al. (2011) provide an excellent overview of their own groundbreaking functional imaging research, which has afforded many important insights into the workings of the social brain. They also provide some timely criticism of the connectivity account of autism and the challenges that must be addressed in further specifying what is currently an explanatory framework rather than a fully-fledged theory. Nevertheless, it is important to recognize that the ‘social brain’ account of autism faces exactly the same set of challenges.

In criticizing the connectivity account, Pelphrey et al. imply that any theory of autism should strive to explain “what is common among individuals with ASD and what separates ASD from other neurodevelopmental disorders”. However, as we prepare to move from DSM-IV to DSM 5 and the boundary between “autism” and “not autism” shifts once again, now is perhaps an opportune moment to reconsider the merits of a purely categorical approach to autism research. Studies showing significant group differences are an important starting point, demonstrating that some individuals with autism are atypical with respect to the measure of interest. Nevertheless, a complementary approach that embraces individual differences may ultimately provide a more complete and integrated picture of the neurodevelopmental origins of autism.

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