Autism is characterized by severe deficits in a range of social skills and behaviors. In many ways it is possible to think of autism as a social learning disability. However, other disorders of childhood, especially other developmental disabilities, also affect social development. In addition, there is a growing consensus that children with autism represent a heterogeneous group. Thus, one can view autism as a collection of phenotypes, perhaps varying along a continuum, perhaps having multiple etiologies with converging characteristics, or perhaps having divergent phenotypes from common etiologies. So it is a daunting task to identify a narrow range of characteristics that can help physicians screen for the disorder.

With these caveats in mind, several features of autism are unique to the disorder. They appear to be good indicators of autism in early life, and offer insight into both the severity and quality of the social deficits in autism. In this brief paper, I will focus mainly on one aspect of social functioning in autism; namely, deficits in joint attention. However, I will also briefly review other “hot topics” in autism research, including deficits in social cognition (including theory of mind), executive functions, and central coherence. Each of these concepts will be considered in relation to the joint attention deficits seen in autism.

**Joint Attention**

*The Normal Case*

Joint attention is a family of social abilities (“social pragmatic abilities”) that help individuals regulate, respond to, and engage in social interactions with others. Of particular interest to the study of autism are **joint attention behaviors (JA)** that regulate social interactions between a child, an interactive partner, and other aspects of the environment. These types of joint attention events are termed triadic social interactions.

Throughout the first two years of life, infants develop increasingly complex nonverbal, vocal, and (sooner for some than others) verbal skills that can be deployed to meet the demands of social interactions. There are a number of different ways to view the repertoire of social pragmatic behaviors in this early developmental period. Infants may initiate social interactions, or respond to social bids of others. Social-communication episodes may also vary with respect to communicative function. (Figure 1) Children may use nonverbal behaviors to request an object out of reach, or they may request help with an object. The means to this social end may vary, with some acts involving pointing, others involving eye contact, others simply a reach, and some combining a number of behaviors. Whatever the form, however, these behaviors serve as requests, for they have some instrumental value and function to elicit aid from a social partner.

Other behaviors coordinate attention between a child, a social partner and the environment in order to share social information. These acts do not have the same instrumental function as requests and instead serve a social-affiliative or commenting function. Indeed, these acts are sometimes termed “protodeclarative.” In this paper I call these acts “joint attention” acts. More specifically, infant-initiated joint attention acts are termed **initiating joint attention (IJA)**. The responsive form of this class of social pragmatic behavior is termed responding to **joint attention (RJA)** and reflects the ability of infants to orient their gaze or focus of attention to that of a social partner, as when an infant looks to where an adult is pointing.

**Joint Attention in Autism**

Autism is characterized by severe deficits in both IJA and RJA. Children with autism show deficits in the frequency and complexity of joint attention behaviors, as well as differences in the qualitative patterns of strengths and weaknesses in joint attention as related to other social pragmatic behaviors. Autism is characterized by generally poor social and communication skills. But there is a particular weakness in IJA and RJA skills. Thus, children with autism show severe deficits in the frequency with which they **initiate joint attention bids (IJA)** as well in their ability to monitor and respond to **joint attention bids of others (RJA)**. These deficits contrast with a relative sparing of requesting skills.

This is not say that the children with autism show completely normal and age-appropriate abilities to request and to make their needs known. Indeed, children with autism may show deficits in the complexity of requests (e.g., failure to use pointing or poor coordination of eye contact, vocalizations, and other communicative means when making requests). Instead, the pattern of social pragmatic skills seen in autism, particularly in young children with autism, reflects a greater propensity to regulate the behavior of others for instrumental gain and a diminished tendency and/or ability to coordinate attention with others for social affiliative functions.

Such patterns of social and communicative abilities can be seen through behavior observation and are evident in parents’ descriptions of their children. How do we observe these behaviors in the laboratory or clinic? In the laboratory, we stage a semi-structured play session where a clinician presents a series of toys and games designed to elicit requesting and joint attention behaviors. The clinician will present a toy that creates a spectacle, like a wind-up toy. While this toy is active (e.g., moving about, hopping, making noises, etc), a typically developing infant may point, alternate gaze with...
the examiner, smile, and/or vocalize, all in the service of coordinating attention between themselves, the adult, and the toy. When the infant touches the object, s/he may even hold it up to show it to the adult. These are all bids of joint attention (specifically, IJA). When the toy stops, the infant may use eye contact to indicate that the adult should activate the toy again. More complex requests may involve points, eye contact, or even the child giving the toy to the adult. At other times, the infant may point to an object out of reach to request a new toy. Typically developing infants display both IJA and requests with some frequency, even in interactions with an unknown adult in a laboratory. In contrast, IJA acts are rare for young children with autism, whereas rudimentary requesting behaviors would be much more likely.

Joint attention deficits are important to our understanding of autism and to the identification and diagnosis of the disorder. The diagnostic criteria for autism (i.e., ICD-10 and DSM-IV) reveal a number of symptoms that are more or less reflective of deficits in joint attention. These deficits are among the earliest appearing symptoms and are strongly represented in the scoring algorithms of screening and diagnostic instruments. Joint attention deficits are related to the overall severity of symptoms in autism and to cognitive and language development in this population. Clinical experience indicates that this is a particularly difficult set of abilities to remediate through intervention, although recent efforts have targeted joint attention skills in interventions for young children with autism.

**Social Cognitive Deficits in Autism**

A large body of literature on Theory of Mind (ToM) probes the ability of individuals to reason about the intentions and beliefs of others. A seminal paper by Baron-Cohen and colleagues reported that individuals with autism were unable to reason about the false beliefs of protagonists in a series of vignettes. This deficit has been widely replicated in subsequent research. One influential theory argues that ToM abilities are rooted in a discrete information-processing ability that allows children to represent the thoughts of others.

Theoretical links between social cognition and joint attention include propositions of JA as a precursor to ToM abilities as well propositions that JA is an early form or behavioral indicator of ToM. There is a general assumption that for children to engage in acts of JA they must understand that the other has a unique point of view. JA and ToM have been argued to recruit a common cognitive module that lets an individual represent the thoughts and beliefs of others, with JA involving a more basic and rudimentary form of understanding than later developing ToM abilities. Such a view postulates that autistic deficits in pretend play, an additional marker of autism in early childhood, also share this requirement for representational thought.

Despite these theoretical links, there is little empirical evidence for the link between JA and ToM, in spite of some longitudinal links that have been reported.

**Executive Function Deficits.**

Executive functions (EF) are a broad class of cognitive abilities involved in the regulation of thought and action. This class of higher cognitive abilities supports such functions as strategic planning, impulse control, working memory, organization of mean-end behaviors, and flexibility in thought and action. The frontal lobes are heavily involved in these processes.

Deficits in EF are well replicated in children with autistic disorder. However, research indicates that autism is related to a specific pattern of deficits in executive skills; i.e., deficits in planning efficiency and perseverative responses that indicate difficulties in shifting response set. These patterns have been found to differentiate the executive performance of autistic individuals from those with ADHD and other neurodevelopmental disorders. Children with ADHD are most likely to show deficits in response inhibition, whereas autistic individuals tend not to show evidence of such dysfunction on EF batteries.

An important issue for the EF deficits in this population is their developmental course. Ozonoff and colleagues have reported that deficits in planning efficiency and set shifting, purportedly related to prefrontal functioning, were of greater magnitude for older than for younger individuals. This is consistent with the view that frontal lobes (and EF) are late to mature and suggests that floor effects may mask the appearance of such deficits at younger ages.

While EF deficits are most robustly seen in older and higher functioning individuals, at least one report documents increased perseverative responses on an object search task in preschool age children with autism. Thus, it may be that early EF deficits may be seen with appropriately sensitive tasks. An interesting trend from the
studies of EF skills in younger children with autism is that performance differences on EF tasks appear to be related to early JA abilities. In short, there may be a syndrome-specific set of EF deficits in autism, at least some aspects of which may be related to JA.

Central Coherence

Frith and Happé proposed the concept of central coherence as an addition to the ToM approach in understanding the cognitive style of individuals with autism. Central coherence (the tendency to integrate information to form a whole, coherent meaning) reflects a cognitive style that allows one to “see the forest for the trees.” The central coherence theory is intended to help explain aspects of autistic functioning that are not well explained by ToM deficits; namely, the tendency to focus on local features of the environment. In part, this theory was also intended to help explain why individuals with autism perform better on certain cognitive tasks; e.g., the embedded figures task, where an individual is required to identify a figure (e.g., a triangle) embedded in a meaningful picture. A local processing style is thought to favor this task and is predicted to result in faster responses (i.e., shorter latencies to find the target).

Empirical research on this concept is limited. Nonetheless, studies have found evidence for a preference for local versus global processing style in young children with autism (i.e., under age 5 years), and examined this construct in relation to JA skills. There is also some evidence that relatives of children with autism (i.e., parents and siblings) may show a tendency towards this local processing style. One obvious question is whether this processing style is related to, or perhaps a different level of explanation of, the executive dysfunctions described above. Very little data can be brought to bear on this question. One study has indicated that EF deficits and weak central coherence may be independent features of autism, but this hypothesis remains unresolved.

A second question is whether weak central coherence is related to the social deficits seen in autism, and to deficits in JA. It has been suggested that weak central coherence limits an individual’s ability to integrate aspects of the social world into a meaningful whole. Some preliminary evidence suggests a relationship between central coherence and ToM abilities in typically developing and autistic children. In addition, one report on JA and central coherence in children with autism and a comparison sample with developmental delay did not find evidence for a link between joint attention and central coherence. Although it was not clear that the JA measure was an appropriate test of the JA deficit in autism, these results raise the hypothesis that weak central coherence may be independent of other social and cognitive deficits seen in autism.

Summary

This review has touched on selected hot topic issues in autism research. There are other exciting developments in the field, including advances in neuroimaging and genetics. Such advances notwithstanding, an understanding of the social and cognitive features of autism reviewed here has great importance. For example, research in our laboratory is focused on identifying factors that may underlie the JA deficit in autism. A better understanding of these factors would improve predictions about the presentation of the disorder in early infancy, as well as better target interventions on pivotal skills and behaviors.

In addition to implications for research, concepts such as JA, ToM, EF, and central coherence can help health care providers develop a fuller picture of both the strengths and impairments that characterize autism spectrum disorders. This can help providers better understand autism not as a collection of isolated symptoms, but as a description of a population of children with syndrome-specific strengths and weakness.

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References

21. Tomasello M. Joint attention as social
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