

Thinking and Learning in HFA and Asperger Syndrome

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Learning

(Reitzel & Szatmari, 2003)

- Learning is an incredibly complex task and can be particularly challenging for individuals with ASD
- In the classroom, the demands of the curriculum, the limitations of the physical setting and of the materials, and the expectations of dedicated teachers can all have an influence on how children with ASD learn
- As a result, children with ASD often experience considerable stress in the classroom (and in the overall school environment)

Cognitive Patterns Noted for Adolescents and Adults with ASD

(Minschew & Williams, 2008)

- Cognitive strengths found in studies
 - Basic attention
 - Sensory perception
 - Elementary motor
 - Simple memory
 - Formal language
 - Rule learning
 - Visuospatial processing
- Cognitive weaknesses
 - Higher cortical sensory perception
 - Complex/skilled motor movements
 - Memory for complex material
 - Higher-order language skills
 - Flexibility
 - Concept formation

Restricted, Repetitive, Circumscribed Interests

(Boutot & Myles, 2010; DSM IV)

- The individual with ASD may exhibit:
 - Interests that are narrow in focus, overly intense, and/or unusual--strong focus on particular topics to the exclusion of other topics, difficulty “letting go” of special topics or activities, interference with other activities, interest in topics that are unusual for age, excellent memory for details of special interests
 - Unreasonable insistence on sameness and following familiar routines—want to perform certain activities in exact order, easily upset by minor changes in routine, need for advanced warning of any changes, becomes highly anxious or upset if routine or rituals are not followed

Restricted, Repetitive, Circumscribed Interests (Boutot & Myles, 2010; DSM IV)

- The individual with ASD may exhibit:
 - Repetitive motor mannerisms—flapping hands when excited or upset, flicking fingers in front of eyes, odd hand postures or other hand movements, spinning or rocking for long periods of time, walking and/or running on tiptoe
 - Preoccupation with parts of objects—uses objects in unusual ways rather than as intended, interest in sensory qualities of objects, likes objects that move, attachment to unusual objects

Three Theories of Autism

- Theory of Mind
- Executive Function
- Central Coherence

Theory of Mind

- The understanding that other people have thoughts, beliefs, ideas, feelings, desires, etc..., that influence their behavior
- “the ability to attribute knowledge, feelings, and intentions to others.” (de Waal, Good Natured, 232)
- “our ability to explain and predict other people’s behavior by attributing to them independent mental states, such as belief and desires.” (Gallagher & Frith, Functional Imaging of “Theory of Mind”, 77.)

Theory of Mind

- Theory of mind “...refers to two important abilities, (a) the capacity to recognize the thoughts, beliefs, and intentions of others and understand that these mental states are different from our own; and (b) using this understanding to predict the behavior of others.”
(Carnahan & Williamson, 2010)

Mental States

- Purpose of intention
- Knowledge
- Belief
- Thinking
- Trusting
- Wanting
- Guessing
- Doubt
- Pretending
- Deceit
- Feeling

Theory of Mind: AKA

- Mental state attribution
- Mindreading
- Mentalizing
- Perspective taking
- Empathic accuracy

Theory of Mind and ASD

- May have difficulty understanding that others have thoughts, feelings, ideas, etc...
- May have difficulty taking into account others thoughts, feelings, ideas, etc..., when communicating or interacting with them
- May have difficulty appreciating/valuing others thoughts, feelings, ideas, etc...
- May have difficulty taking the perspective of others during a conversation.
- May believe that others have the same thoughts and opinions that they do (Boutot & Myles, 2010)
- May have difficulty understanding why others would make a particular choice or do something because they themselves would not do so (Boutot & Myles, 2010)

Central Coherence

(Carnahan & Williamson, 2010)

- “...typically developing individuals focus on meaning or the big picture of events at the expense of small details.”
- “Our primary goal when presented with an event, concept, or task is to understand the central tenets and create meaning from the smaller parts.”

Central Coherence and ASD

- Individuals with autism have a strength in the ability to focus on the detail, but have more struggles with perceiving the whole, essence, or entirety of a situation.
- Some individuals with ASD may attend to irrelevant features of materials or the environment to the exclusion of more salient features
- These individuals may attend to specific parts or aspects of a situation without regard for the context within which the situation occurred. (Carnahan & Williamson, 2010)

Executive Function in ASD

- The neural system or systems underlying executive functions are responsible for the broad skills of organization, regulation, and awareness. (Killiany et al., 2005)
 - Organizational skills include: guiding attention, concentration, making decisions, planning, and sequencing
 - Regulational skills include: initiating behavior, repeating responses, and controlling anger, inhibiting irrelevant responses
 - Awareness skills include: recognizing deficits in oneself, complying to the social norm, and using feedback to regulate behavior

Executive Functions

For general learning, attention must be guided appropriately, irrelevant responses must be inhibited, rules must be extracted from examples and goals must be generated as a task is executed (Volkmar et al., 2004)

Executive function in ASD

(Tager-Flusberg, 2010; Boutot & Myles, 2010)

- Executive function impairments are found among range of children with ASD, and other disorders (e.g., ADHD):
 - Working memory
 - Planning and Organization skills
 - Inhibiting prepotent response
 - Shifting sets
 - Monitoring actions
 - Metacognition
 - Problem solving
- Executive functions generally controlled by frontal lobes

ASD in the Classroom and on the Playground

(Tager-Flusberg, 2010; Boutot & Myles, 2010)

- Poor organization skills
- Difficulty understanding language arts/history narratives
- Asking and answering questions
- Tangential/off-topic discussions
- Perseveration
- Behavior is rigid and inflexible (e.g., routines must be followed exactly)
- Slow reaction time
- Lack of spontaneity
- Difficulty with impulsivity or distractibility, particularly when encountering new situations

(Mesibov & Shea, 2008)

- Difficulty with (generating), combining or integrating ideas
- Difficulty with sequencing and organizing ideas, materials, and activities
- Difficulties with time concepts—includes moving too quickly or too slowly for environment; have difficulty recognizing the beginning, middle or end of an activity
- Become attached to routines, so that activities may be difficult to transfer or generalize from the original learning situation, and disruptions can be upsetting, confusing, or uncomfortable
- Very strong interests and impulses to engage in favored activities

Cognitive

- Intellectual testing
- Attention
- Perception
- Information Processing
- Memory
- Language
- Abstract Thinking
- Social Cognition—emotion, facial perception
- Academic Skills

Intellectual Testing

- Wide scattering of skills
- Tend to perform best on intellectual tasks requiring visuospatial reasoning, attention to detail and rote memory
- Tend to have more difficulty with tasks requiring use of language, abstract reasoning, and integration/sequencing of information
- Performance IQ generally higher than Verbal IQ (up to 15% of individuals with ASD demonstrate higher Verbal IQ than Performance IQ)
- Comprehension subtest often the lowest verbal score (Prior & Ozonoff, 2007)
- Uneven neurocognitive profiles noted during testing

Perception

(Bryson, 2005)

- “Hypersensitivity to sensory input results in states of overarousal and the adoption of an overly narrow beam of attention.”
- “Hypersensitivity to sensory stimulation, whether novel, unpredictable, or otherwise experienced as intense or disturbing, may induce a state of overarousal, such that the mind is obstructed by the senses, and information uptake is incomplete or distorted.”
- “In an attempt to offset states of overarousal, information uptake may be further restricted by the adoption of overly narrow focus of attention.”

Attention

(Prior & Ozonoff, 2007; Carnahan & Williamson, 2010)

- Difficulty disengaging attention from one stimulus and moving it to another.
 - They may remain “stuck” on one of two competing stimuli.
 - May take longer to disengage attention
- Difficulty shifting attention between sensory modalities (may have a preference for one modality over others)
- Attention may be described as “overly focused” (may focus on a limited number of environmental cues at a time)
- Deficits in size of attentional “spotlight”

Attention

- May have relatively intact abilities to sustain and use selective attention
 - Ability to sustain attention, and engage the use of selective attention may depend on modality (visual vs. auditory), interest (high vs. low preference), and/or intensity of stimuli (high intensity stimuli may engage overarousal, while low intensity stimuli might not be perceived adequately to be attended to)
- May use different neural networks to accomplish tasks (this may result in less efficient system)

Information Processing

- Preference for sequential/analytical (rather than holistic, gestalt, synthetic, simultaneous, or parallel) information processing style
- Preference for filing information in separate, rather than conceptually or semantically-related, folders
 - This results in precision at the expense of categorization and generalization
- Preference for visual modality—“Thinking in Pictures”
- Less likely to engage in top-down processing necessary for making connections and understanding the big picture (Carnahan & Williamson, 2010)

Information Processing

- Difficulty with processing information in two modalities at the same time (i.e., visual, auditory)
- Difficulty with completing two tasks (multitasking) at the same time (i.e., reading the board and copying what is on the board onto a piece of paper)
- Difficulty with processing large amounts of information/difficulty identifying the salient information in a large amount of information
- Difficulty with processing speed (may require longer to process information)

Information Processing

- “The significant focus on details makes it difficult to integrate information for meaningful purposes and comprehension...stimulus overselectivity inhibits their ability to attend to and process important aspects of the educational environment.” (Carnahan & Williamson, 2010)

Multi-Tasking in School

(Minsheu & Williams, 2008)

- Teacher talks while she writes on the board
- People speak words in combination with the tone of their voice, facial expressions, eye gaze, gestures and other body language
- Student follows along in the book while “listening” to the person reading
- Student walks down the hall talking to a friend while making her way to class

Memory

“The neural system or systems underlying memory function are responsible for receiving, storing, and making available vast quantities of diverse information.” (Killiany et al., 2005)

Relatively Intact Memory Skills

- Intact immediate/short term memory skills
- Relatively good performance on visuospatial reasoning
 - Able to recall static visual information following a delay
 - May recall facts better when presented visually rather than auditorally
- Learning and retaining simple motor patterns
- Rote memory skills (repeat back lists of facts)
- Recognition memory--Cued recall better than free recall
- Tend to demonstrate strong recency effects in memory

Memory Skills Which May Demonstrate Some Deficit

- Working memory
- Difficulty recalling auditory-verbal material following a delay
- Difficulty recalling complex information, information that requires more processing, and/or information that lacks meaning for them
- What is seen as a memory problem may relate to difficulties with information processing and organization
- The ability of people with autism to use meaning, structure (context), and semantic cues in recall may be poorer, but it is by no means absent
- Autobiographical and episodic memory- tendency to remember facts of events and miss the “gist,” or emotional content, of social interaction.

Language and ASD

- Many times have relatively good basic grammar skills:
 - Syntax
 - Vocabulary/Semantics
- Known for formal, pedantic styles of speech which take little account of the listener's feelings or interests (Prior & Ozonoff, 2007)
- Some studies have shown better language skills for individuals with Asperger Syndrome than HFA
- May have areas of deficit/weakness:
 - May have difficulties understanding some functional words while have advanced knowledge of some words in specific areas of interest
 - May demonstrate a lack of reciprocity, fewer personal experience stories, and/or bizarre language or non-contextual utterances.

Language and ASD

- Difficulty noted across many areas of language areas:
 - Voice quality and intonation patterns
 - Pragmatic impairments
 - Difficulty understanding complex grammatical constructions—information processing demands are greater for more complex sentences (i.e., Before you start working, open your books to page 73)
 - Difficulty understanding abstract and inferential language
 - Difficulty integrating the intended message with the words and sentences that would clearly express their idea—difficulty coherently expressing themselves

Voice Quality and Intonation Patterns

- “Speech of individuals with ASD has been described as strikingly atypical, and these abnormalities appear to persist through adulthood” (Tager-Flusberg, 2005)
- Speech may be monotonous, or it may have a more melodious sing-song pattern
- Atypical pitch patterns may be present
- Problems may be noted in volume (too loud or too soft) and voicing (may whisper or be strident)

Pragmatic Impairments

- Some individuals with ASD demonstrate:
 - Little, to no, interest in other people
 - Difficulty initiating or maintaining eye contact
 - Difficulty with joint attention tasks
 - Difficulty initiating, maintaining, repairing, and terminating conversational topics
 - Difficulty with turn taking
 - More prone to pragmatic violations, including bizarre and inappropriate utterances, less able to take into account the listener's needs and current level of knowledge
 - Some individuals develop routines, and provide rote, simple responses

Study of Sentence Comprehension

(Minshew & Williams, 2008)

- Individuals with ASD who were studied demonstrated:
 - Increased brain activation in the surface gray matter that processes word meaning
 - Decreased brain activation of the surface gray matter area that processes the meaning of sentences
 - Reduced functional connections among 10 pairs of cortical regions that participate in language function
 - Reduced synchrony between the activity of the region pairs
 - Overall, the pattern means that the brain regions were not working together to support language function

Abstract Language

- Prone to literal interpretation of language
- Individuals with ASD may demonstrate more difficulties with abstract and inferential language, including:
 - Idioms
 - Figurative Language—metaphors, simile, exaggeration
 - Ambiguity and inference
 - Irony and sarcasm
 - Humor
 - Mental states/Perspective taking
 - Deceit/lies

Abstract Thinking

- Individuals with ASD are often described as being concrete, literal thinkers
- Difficulty understanding and processing abstract concepts and ideas

Social Cognition

- Knowing how the social world works (Goleman, 2006)

Social Cognition

(Shaked & Yirmiya, 2003; Boutot & Myles, 2010)

- Children with ASD demonstrate difficulties with:
 - Relationships with peers—may relate better to those older or younger than themselves
 - Participating in reciprocal conversations
 - Using nonverbal communication cues within social exchanges—e.g., eye contact, gestures, facial expressions
 - Demonstrating empathy
 - Joint attention
 - Understanding other's thoughts, feelings, ideas, etc...
 - Difficulty predicting others' behavior
 - Personal space boundaries
 - Groups and cooperating in games

Social Cognition and ASD

- Tendency to do better on explicit tasks of social reasoning, than on actual performance during naturalistic situations (Klin et al., 2003)
- May use peripheral, rather than direct, eye gaze to monitor

Emotion

- Some individuals with autism may have under-expression of emotion
- Some individuals with autism may have expression of emotion that is atypical, or asynchronous, with the felt emotion (i.e., smiling when upset, neutral or negative resting face, use of hand flapping to express anger)
- May have difficulty with the regulation of emotion (i.e., emotions may get “too big,” and/or they may be overly susceptible to taking on the emotions of those around them/”emotional contagion”)
- Emotion may be poorly modulated by thought

Emotion

- Extreme emotion may result in catatonic-like freezing
- May have difficulty reading emotion in others
 - May occur along multiple channels, including: reading emotion from facial expression, comprehending emotion from the prosody of others, interpreting emotion from body language, determining emotion from body motion (biological motion)
- May have difficulty coordinating emotions

Face Perception

- Mechanisms underlying face perception may be different in ASD
 - Will use part of brain that processes objects rather than parts of brain that process facial features (i.e., fusiform gyrus)
- May gaze away from the face while someone is speaking—tendency to focus/gaze on objects rather than face for some individuals with ASD

Academic Skills

(Prior & Ozonoff, 2007)

- Generally, those academic skills requiring primarily rote, mechanical, or procedural abilities are generally intact
- Those requiring more abstract, conceptual, or interpretive abilities are typically more deficient
- May have difficulty making switch from skills focused on early in schooling to those focused on later in schooling (e.g., Learning to read to reading to learn)
- Individuals with ASD may perform as well as peers until grade levels in which abstractive, interpretive skills are emphasized, at which point they may fall behind

Reading

- Tend to perform better on tests of single word oral reading, nonword reading, spelling—phonological decoding skills intact, may demonstrate advanced knowledge of grapheme-phoneme correspondence rules (Prior & Ozonoff, 2007)
- Perform less well on measures of reading comprehension
- Difficulty comprehending reading material that requires the understanding of motives, plans, goals, and deceit (Paul, 2007)
- Variability in skill development and performance is very common

Reading

(Carnahan & Williamson, 2010)

- Difficulties with Theory of Mind impacts on reading in the following fashions:
 - Tendency toward literal interpretations (because cannot take the perspective of speaker)
 - Perspective taking is important to “make sense of the actions of characters in a story” Understanding how and why a character behaves in a certain way is crucial for accurate comprehension
 - Understanding that different characters have different perspectives and shifting between those perspectives is how we come to understand text
 - Failure to recognize each character’s perspective makes it difficult to make inferences or reconcile actions and behavior while reading

Reading

(Carnahan & Williamson, 2010)

- Difficulties with Executive Functions impacts on reading in the following fashions:
 - “...while individuals with ASD are able to access background knowledge, applying relevant knowledge across texts may be challenging.”
 - “In the case of reading comprehension, integrating text with relevant previous experience is crucial.”
 - “True comprehension requires attention to some details with little regard for others. However, comprehension is not simply attention to detail. As we read, we monitor our comprehension and self-correct as necessary.

Reading

(Carnahan & Williamson, 2010)

- Difficulties with Central Coherence impacts on reading in the following fashions:
 - “Students with ASD demonstrate attention to and memory for specific details and rote facts over conceptual or “big picture” ideas.”
 - “When reading, many minor details are parsed out as we come to understand the essence of a story or passage. However, until the big idea forms, it is often necessary to hold smaller details in our working memory.”

Mathematics

- Tend to do well on tests of arithmetical calculation/math computation tasks (Prior & Ozonoff, 2007)
- Difficulties include: (Baker, 2007)
 - Math is compact so that every number and symbol is critical to understanding
 - Math statements have a high level of abstraction
 - Directionality issues: not always read from left to right
 - Receptive and expressive language deficits can impact on learning from discussion
 - May have difficulty processing information

Reading for Meaning in Mathematics

(Baker, 2007)

- Reading for meaning occurs when...
 - Students are continually predicting, confirming, self-correcting, and reprocessing mathematical information
 - Students have formed prior knowledge schemas, have acquired prerequisite skills, and have a developed number sense
 - Students are engaged with the purpose of problem solving

Brain Patterns

- Underdevelopment of the connectivity of the neural systems for autism has been suggested by studies
- Neural systems of individuals with autism have fewer and smaller centers to call upon in the brain and less flexibility to do so. Hence, when the environmental demands change and different abilities are needed to address these demands, the brain in autism has less flexibility and smaller resources to draw upon.
- Brain regions do not always work in synchrony or harmony.

Brain Patterns

- Use of different neural mechanisms
 - Sentence completion tasks—use of word meaning regions of the brain
 - Facial perception tasks—use of the object meaning regions of the brain
 - Behavioral performance may be similar, but differences in neural mechanisms may impact capacity for performance

Brain Patterns

- Use of different neural mechanisms
 - May use lower level visual abilities rather than higher level abilities to perform certain tasks
 - While monitoring a group of letters, control group had activation in the left executive and left language areas of the brain while the group with ASD displayed brain activation in both posterior visual and right executive areas.
 - Can be seen as a strength, as the individual with ASD may not have to use language to guide certain functions/behaviors (i.e., as in later require attention to detail such as analyzing satellite maps, screening luggage)