D

DA

► Dynamic Assessment

Daily Activities

► Daily Routines

Daily Living Skills

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Synonyms

Activities of daily living; Daily self-care activities; Home living skills; Self-care; Self-help

Definition

The term "daily living skills" refers to a wide range of personal self-care activities across home, school, work, and community settings. Most daily living skills, like food preparation and personal hygiene, need to be performed on a regular basis to maintain a reasonable level of health and safety. Adaptive functioning, or an individual's ability to care for self and function independently, is a primary consideration when supporting individuals with autism and other disabilities. Daily living skill activities include:

- Personal hygiene and grooming
- Dressing and undressing
- Meal preparation and feeding
- Mobility and transfer
- Toileting
- Housekeeping
- Laundry
- Home safety
- Health and medication management
- Leisure time and recreation

Children's abilities to care for themselves have been found to correlate with intellectual functioning and may be a strong predictor of future independence (Carter, Gillham, Sparrow, & Volkmar, 1996). Individuals who cannot independently carry out these necessary self-help routines are at greater risk for long-term institutionalization, require more intensive living supports, and are less likely to be employed (Wehman & Targett, 2004). Assessing adaptive functioning is required when measuring intelligence, diagnosing intellectual disability, and determining appropriate treatment goals (Goodlin-Jones & Solomon, 2003). The most widely used instrument to assess adaptive behavior functioning

F.R. Volkmar (ed.), *Encyclopedia of Autism Spectrum Disorders*,
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is the Vineland Adaptive Behavior Scales (Sparrow, Balla, & Cicchetti, 1984). Selecting skills to teach should focus on the priority tasks required for independent domestic and community living (Wehman & Targett, 2004; National Research Council, 2001). Daily living skills are usually taught using strategies from applied behavior analysis, specifically task analysis, shaping, chaining, and positive reinforcement. Teaching individuals with autism to generalize learned tasks across settings, people, and materials remains an important aspect of intervention planning when teaching daily living skills.

See Also

- ▶ Adaptive Behavior
- ▶ Adaptive Behavior Scales
- ▶ Chaining
- ▶ Functional Assessment and Curriculum for Teaching Everyday Routines
- ▶ Functional Life Skills
- ▶ Independent Living
- ▶ Positive Reinforcement
- ▶ Task Analysis
- ▶ Vineland Adaptive Behavior Scales

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Daily Routines

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Synonyms

Activity schedules; Daily activities; Routine events; Schedules; Visual schedules

Definition

Daily routine is a schedule, custom, or habit that is known to occur similarly on a daily frequency. Daily routines are often preferred by children and adults diagnosed with autism in order to structure their day and provide predictability. Daily routines can be inherently known by the individual without support or review by an outside person, or are scheduled out by another and presented verbally or visually. Visual schedules are often used to act as an aid in conveying the day's event and are often presented pictorially (as with picture icons) or in written form (as in a checklist). Consistent use of daily routines often helps reduce problematic behavior due to issues with transition from activity to activity. Daily routines can be expanded to teach and/or guide most events that occur daily on a large scale (i.e., activities to occur from morning to night) or for specific events (e.g., hand washing, putting away laundry).

See Also

- ▶ Adaptive Behavior
- ▶ Daily Living Skills
- ▶ Functional Assessment and Curriculum for Teaching Everyday Routines
- ▶ Functional Life Skills
- ▶ Prompt Hierarchy
- ▶ Prompting
- ▶ Visual Schedule
- ▶ Visual Supports

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Daily Self-care Activities

► Daily Living Skills

DAISI

► Detection of Autism by Infant Sociability Interview

DAMP

► Deficits in Attention, Motor Control, and Perception

DAMP Syndrome

► Deficits in Attention, Motor Control, and Perception

DAP:IQ

► Human Figure Drawing Tests

DAS

► Differential Ability Scales (DAS and DAS-II)

DAS-II

► Differential Ability Scales (DAS and DAS-II)

DDST

► Denver Development Screening Test (DDST)

Deaf-Blind

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Synonyms

Sensory impairment

Short Description or Definition

Deaf-blind individuals have varying degrees of a combination of both hearing and visual impairments. In the United States, the legal definition of blindness is 20/200 in the better eye. An individual with a threshold exceeding 90 dB HL is considered to be deaf. Individuals who are deaf-blind have communication as well as mobility deficits. This dual sensory impairment results in the inability to use one sensory modality to compensate for the other. Services required for individuals who are deaf-blind are different than those required for individuals who are either deaf or blind. Communication and language development are the primary deficits

in individuals with deaf-blindness; however, development of social-affective, cognitive, and motor skills is also affected. Individuals with deaf-blindness also exhibit stereotyped behaviors, similar to those seen in children with autism spectrum disorders.

Categorization

Deaf-blindness may be congenital or acquired resulting in a heterogeneous population. It is important to differentiate between these two groups; those with congenital deaf-blindness have additional handicaps and typically require a substantially greater amount of rehabilitation, including programs that are individually tailored (Rönnberg & Borg, 2000).

Epidemiology

It is estimated that approximately 10,000 children (ages birth to 22 years) in the United States are classified as deaf-blind (Rönnberg & Borg, 2000; The National Consortium on Deaf-Blindness [NCDB], 2008). The adult deaf-blind population numbers are estimated at 35–40,000 individuals (Watson, 1993).

Congenital deaf-blindness may be caused by hereditary or chromosomal syndromes and disorders, prenatal or congenital complications, complications of prematurity, and undiagnosed causes. Some common hereditary or chromosomal causes are CHARGE syndrome, Usher syndrome, and Down syndrome. Cytomegalovirus (CMV) and microcephaly are some prenatal or congenital complications that may lead to deaf-blindness. In the past, maternal rubella was the leading cause of deaf-blindness. The majority of cases of deaf-blindness are acquired; a variety of causes are responsible such as meningitis, inflicted brain damage, and aging of the sensory organs (Rönnberg & Borg, 2000).

There have been very few reports on the combined disorders of autism and deaf-blindness. The prevalence of deaf-blind individuals with autism is unknown, although it is estimated to be small. Further, because etiological factors and symptoms such as impaired social interaction and communication impairment are associated with both disorders, it is challenging to differentially diagnose between the two.

Natural History, Prognostic Factors, and Outcomes

The history of service for the population of individuals with deaf-blindness is sharply divided between the pre- and post-rubella epidemic of 1964–1965. The first citations of education with this population appeared in the mid-1800s with Laura Bridgman described as the first deaf-blind individual to learn language at the Perkins School for the Blind. Helen Keller was an even more recognized and influential figure in the success of educating deaf-blind individuals. However, even through the 1960s, limited education was available for this population, and individuals were often placed in residential schools or asylums. Congressional legislation, approved in the 1970s and beyond, which mandated education for children with disabilities, had a significant effect in advancing the education of this population (NCDB, 2012).

Clinical Expression and Pathophysiology

This severe sensory deficit results in communication disorders and subsequent handicaps in education, social and cultural development, and the acquisition of information. The tactile sense is commonly utilized by these individuals for communication as well as for feelings of security and control. Other methods of compensation include use of the cutaneous senses and vibration for sound localization. Few studies have explored the psychosocial aspects of being deaf-blind and those that do typically focus on adaptation. Depression in adolescents and psychosis has been reported (Rönnberg, Samuelsson, & Borg, 2002).

Evaluation and Differential Diagnosis

The evaluation process for deaf-blindness is focused on determining the extent to which the auditory and visual systems are impaired. Since the characteristics of deaf-blindness are similar to those of autism spectrum disorders, determining if comorbid autism spectrum disorders exist can be challenging. These individuals are also typically difficult to test; therefore, identification is further complicated and standardized tests are nonexistent (Vernon, 2010). There tends to be an overdiagnosis of autism in individuals with deaf-blindness leading to unsuitable intervention (Hoevevnaars-van den Boom, Antonissen, & Vervloed, 2009). These authors studied 10 individuals with deaf-blindness and intellectual disability in order to determine if they could differentiate which of these individuals also had autism (which had been previously diagnosed). They utilized an instrument that they had developed specifically for this purpose. Results indicated the presence of a significantly greater number of impaired behaviors among the individuals with autism in reciprocity of social interaction, quality of initiatives to contact, and use of adequate communicative signals and functions. The authors concluded that their instrument has promise in terms of its utilization in identifying individuals with autism within the deaf-blind population. Operant conditioning techniques have also been used successfully in the assessment of this population (Rönnberg & Borg, 2000).

Treatment

Treatment for deaf-blindness is typically focused on improving the communication, self-help skills, and mobility of the individual. Since great variability exists from individual to individual, it is imperative to establish the degree to which either the auditory system, visual system, or both can be utilized to enhance communication. The predominant therapeutic model is behavior modification (Rönnberg & Borg, 2000). It is recommended that the curriculum addresses five main areas: (1) communication skills, (2) cognitive development, (3) social and emotional development, (4) motor and self-care skills, and (5) sensory development (Murdoch, 1986).

Research conducted on communicative and linguistic treatment primarily focuses on the "Tadoma" method in which the Tadoma user places his/her hand on the speaker's face in a proscribed position. Through the use of perceptual cues, skilled Tadoma users are able to achieve a relatively high level of comprehension of spoken speech. Intelligibility of their speech production is 60–70%; however, the rate of speech is slower by about 50%. Other methods of communication include the T-code, sign language, and textured symbols (Rönnberg & Borg, 2000).

See Also

- ▶ Blindness
- ▶ CHARGE Syndrome
- ▶ Deafness
- ▶ Sensory Processing
- ▶ Sensory Stimuli

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Deafness

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Synonyms

Profound hearing impairment

Short Description or Definition

"Deafness" is a term that has varying definitions but is characterized by severe-to-profound deficits in the ability to hear. Deaf with a capital "d" is a term used to describe individuals with severe-to-profound hearing loss resulting in little to no usable hearing, even with the use of amplification devices (i.e., hearing aids, assistive listening devices, etc.). Furthermore, individuals who are Deaf belong to the Deaf culture which uses American Sign Language (ASL) as their primary mode of communication. Deaf with a lowercase "d" refers to individuals with severe-to-profound hearing loss who use amplification devices and use oral communication as their primary mode of communication.

Categorization

Degrees of Hearing Impairment in dB HL

Normal	−10 to +15
Minimal	16–25
Mild	26–40
Moderate	41–55
Moderately severe	56–70
Severe	71–90
Profound	91+

Epidemiology

According to the National Institute of Deafness and Other Communication Disorders (NIDCD, 2010), approximately 2–3 in every 1,000 children born in the United States are born with deafness or some degree of hearing impairment. Hearing loss occurs in approximately 18% of 45- to 64-year-olds, 30% of 65- to 74-year-olds, and 47% of 75-year-olds and older. More systematic research needs to be done regarding the incidence and prevalence of deafness in the population with autism.

Natural History, Prognostic Factors, and Outcomes

Individuals with severe-to-profound hearing loss are not able to hear speech sounds and most environmental sounds without amplification. If individuals with this degree of hearing loss are not treated in the first year of life, severe speech and language delays may occur. Furthermore, learning and attention disorders may often arise. Individuals with severe-to-profound hearing impairment likely need hearing aids or cochlear implants, speech and auditory training/therapy, and special education services.

Prior to the onset of the Early Detection and Intervention (EDHI) program in the late 1980s/early 1990s, children with hearing impairment were not typically diagnosed until age 2 or 3 years when speech and language delays were apparent. Since the beginning of the EDHI

program, children with hearing impairment are being identified and treated earlier which is important for speech and language development (either spoken language or American Sign Language (ASL)). Early detection and intervention are critical because a sensitive period exists for speech and language development. The first few years of life is when the foundation for speech and language is established, and if this period is missed due to an unidentified severe-to-profound hearing loss, the child will not acquire speech and/or language. The development of oral speech and language is possible with appropriate amplification or cochlear implantation in conjunction with speech and language therapy.

In postlingually deafened adults, appropriate amplification is critical to their ability to communicate with spoken language. In order to perceive what is being said, as well as monitor what their own speech, these individuals need to be fit with hearing aids, and/or assistive listening devices, or with cochlear implants.

Clinical Expression and Pathophysiology

Deafness occurs as a result of a sensorineural or mixed (conductive and sensorineural) hearing loss. Conductive hearing losses are those that occur due to pathology in the outer or middle ear. Conductive hearing losses alone only result in at most; moderate hearing losses, however, in conjunction with sensorineural hearing losses can result in severe-to-profound hearing loss. Sensorineural hearing losses occur as a result of pathology (typically hair cell loss) in the cochlea or auditory nerve fibers.

Deafness can be either congenital or acquired. Congenital deafness can be the result of genetic factors, maternal illness, and/or infection. Some examples of syndromes associated with hearing impairment are CHARGE syndrome, Usher syndrome, and Waardenburg's syndrome. Examples of maternal illness and/or infection include rubella, cytomegalovirus (CMV), diabetes, hypoxia, syphilis, and toxemia. Acquired deafness may be the result of ototoxic medications, infection, meningitis, and encephalitis, or the cause may be unknown. Depending on the cause of the hearing loss, the impairment may, or may not, be progressive in nature. Once hearing impairment is established, annual hearing evaluations are generally recommended.

Evaluation and Differential Diagnosis

The goal of hearing evaluations is to assess the outer, middle, and inner ears. The audiologist will first perform otoscopy to determine if the outer ear (pinna and external auditory meatus) and tympanic membrane have normal appearances. Then tympanometry is completed to determine the status of the middle ear. Finally, behavioral and/or electrophysiologic testing is completed to determine hearing sensitivity at the frequencies important for speech. In behavioral testing, the goal is to complete a pure-tone audiogram which is a graphical depiction of the hearing thresholds of the octave frequencies from 250 to 8,000 Hz. Speech reception threshold and word recognition testing are also done to determine threshold to speech stimuli as well as how accurately words are perceived.

The type of hearing evaluation one undergoes depends on a number of factors, including age and ability to respond to the tonal and speech stimuli. Evaluation methods can be either behavioral or electrophysiologic. Behavioral tests require the listener to respond in some way to the tonal or speech stimuli (i.e., raise hand, turn head, repeat back words, etc.). Some examples of behavioral test procedures are behavioral observation audiometry (BOA), visual reinforcement audiometry (VRA), conditioned play audiometry, and standard audiometry. Behavioral observation audiometry occurs when the audiologist plays tonal and speech stimuli through the sound field or headphones and then watches for a response from the individual. This response might be the cessation of crying or cooing, eyes widening, or turning the head. Visual reinforcement audiometry occurs when lighted puppets positioned in boxes directly above the left and right speakers in the booth are illuminated when the stimulus is presented. This is done repeatedly until the individual is trained to look in the

direction of the stimulus. During the actual testing, the stimuli are presented and the light is turned on only after the individual turns and looks toward the light. In conditioned play audiometry, hearing thresholds are obtained by using toys such as blocks. For example, the individual is trained to drop a block in a bucket every time they perceive the beeping sound. Finally, hearing thresholds using standard audiologic procedures are obtained by having the individual raise their hand or push a button every time they perceive the tonal stimuli.

Physiologic tests, like the otoacoustic emissions (OAEs) and auditory brainstem response (ABR), do not require a behavioral response from the listener and are thus commonly used in newborn hearing screenings, infant hearing tests, as well as hearing tests on individuals who are unwilling, or unable, to respond to behavioral tests. Otoacoustic emissions are generated by the hair cells in the cochlea, so if the hair cells are absent or not functioning properly, the otoacoustic emissions will be absent or reduced. Otoacoustic emissions are often used along with ABR in populations, such as those with autism, that cannot participate in behavioral testing, to differentially diagnose cochlear hearing loss from neural hearing loss.

Treatment

In Deaf populations, no "treatment" is sought since deafness is not considered a problem. Individuals who are Deaf are taught American Sign Language (ASL) and become immersed in Deaf culture. These individuals use manual communication to interact in society.

Individuals who are deaf will often use hearing aids and/or assistive listening devices. With the advancement in technology, individuals who do have a severe-to-profound hearing loss and who do not receive benefit from amplification may get cochlear implants. Children as young as 12 months can receive cochlear implant surgery. Either method (hearing aids or cochlear implantation) must be combined with speech and language therapy in order to train the system to listen as well as produce intelligible speech.

Prognosis, evaluation methods, and treatment of individuals with autism and deafness are contingent upon a number of factors. Some of these factors include the severity of autism, etiology of the hearing loss, comorbid disorders, mode of communication, and candidacy for hearing aids and/or cochlear implants. Ultimately, a collaborative approach should be taken when treating individuals with autism and deafness.

See Also

- ▶ American Sign Language (ASL)
- ▶ Auditory Brainstem Response (ABR)
- ▶ Auditory System
- ▶ Cochlea
- ▶ Hearing

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Declarative Memory

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Synonyms

Explicit memory

Definition

Declarative memory is a type of long-term memory and is memory for facts, data, words, etc. Declarative memory can be divided into three categories: episodic, semantic, and lexical. Episodic memory includes memory for personal

events or experiences. Episodic memory is primarily learned consciously and is linked to a certain time and place. Examples include specific events such as walking to the store or cooking dinner. Semantic memory refers to general knowledge or facts, independent of experience. Examples include facts about historical events or types of cars. Lexical memory is the knowledge for words. It has been observed that some individuals with autism have enhanced semantic and lexical memory abilities.

See Also

- ▶ Episodic Memory
- ▶ Explicit Memory
- ▶ Memory
- ▶ Semantic Memory

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Decoding Skills

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Synonyms

Word recognition

Definition

Decoding refers to the word recognition processes in which written words or print are transformed into spoken words. This process is commonly referred to as "sounding out words." Proficient decoding requires rapid letter recognition, knowledge of sound-letter correspondences, phonemic awareness, and word attack skills (i.e., analysis/segmenting and synthesis/blending of the letter-sound correspondences). Accurate and fluent decoding allows for comprehension of words both in isolation and in context.

Many individuals with autism spectrum disorders (ASD) are able to mentally represent at least some single word meanings; that is, read words in isolation and understand their meanings. Some individuals with ASD spontaneously read words with excellent proficiency at an unexpectedly early age (referred to as hyperlexia); however, it is the ability to read beyond decoding individual words (i.e., reading in context) that presents greater difficulty for individuals with ASD.

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Deep Pressure Proprioception Touch Technique

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Synonyms

Wilbarger protocol

Definition

Deep pressure proprioceptive touch technique (DPPT): Previously known as the Wilbarger Protocol, DPPT was developed by two occupational therapists, Patricia and Julia Wilbarger, to address sensory defensiveness. This technique requires specific training and includes three parts where first a client's arms, back, and legs are brushed firmly with a soft bristled brush similar to a surgical brush. Then joint compressions are applied at specified joints throughout the body, and finally a sensory diet is prescribed to address sensory defensiveness. This technique has been effectively used to reduce sensory defensiveness and has been linked to bringing salivary cortisol levels closer to normal values in children with sensory processing deficits. The cortisol levels have been used as a measure of stress in children, and with the use of the DPPT, the levels of cortisol approached a normal level. The recommended frequency for this technique is every 2 h during waking hours for 2 weeks to see diminished sensory defensive behaviors.

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Deficits in Attention, Motor Control, and Perception

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Synonyms

DAMP; DAMP syndrome

Definition

DAMP syndrome is a diagnostic concept developed by Gillberg and colleagues in Sweden and used more frequently in Scandinavia. The term refers to a disorder in which aspects of attention deficit disorder and motor coordination difficulties are present. A close link to PDD-NOS/autism spectrum disorder has been suggested (Gillberg, 1993; Kadesjoe & Gillberg, 1999). One complexity in this regard is the potential for attentional difficulties to lead to problems with peers and social interaction; this is particularly the case if some degree of language difficulty is involved (Towbin, 2005). Issues of diagnosis can also be complex in children with significant intellectual disability, attentional, and motor problems, although it has been suggested that the DAMP concept be restricted to cases where the individual has an IQ no lower than the mild-moderate range of disability.

See Also

- ▶ Attention Deficit/Hyperactivity Disorder
- ▶ Developmental Coordination Disorder
- ▶ Pervasive Developmental Disorder Not Otherwise Specified

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DeGangi-Berk

▶ DeGangi-Berk Test of Sensory Integration

DeGangi-Berk Test of Sensory Integration

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Synonyms

DeGangi-Berk; TSI

Description

This assessment tool offers an objective method to examine the sensory functioning of children aged 3–5 years. This 36-item assessment published in 1983 intended to provide an objective method to determine whether, and to what extent, a preschool child had sensory processing deficits so that the practitioner did not need to rely on clinical judgment alone. At that time, there were only measurements of motor functioning with no other instrument sufficiently sensitive to determine if these motor issues were cause by an underlying sensory integrative difficulty.

Once the items are scored, they are calculated to establish an overall score of sensory integrative functioning (total test score), as well as a score within each of the following subdomains of sensory integration:

1. Postural control
2. Bilateral motor integration
3. Reflex integration

The above subdomains were identified for inclusion "because of their clinical significance in the development of sensory integrative functions in the preschool child" (DeGangi & Berk, 1983, p. 1). Table 1 outlines the components of each subdomain.

This tool was designed to be implemented by occupational or physical therapy practitioners given their training and educational background in the interpretation of sensory integrative information and test results. Therefore, it is suggested that a practitioner outside of these fields (i.e., special educators or motor development specialists) seek the assistance of an occupational or physical therapist for the interpretation of the test scores.

With a baseline understanding of sensory processing, implementers should allow 2 h to learn the items prior to implementation. The assessment manual is easy to follow, and the specific instructions for item implementation are outlined with pictures to assist. A score of 0 through 1, 2, 3, or 4 is received depending on the child's response to each item and the quality of the performance indicating that the skill has been developed. The higher the score indicates a more integrated, organized, or normal response. Lower scores qualify the child's responses, for example, unable to hold, loses grasp, does not cross [midline], no resistance, slight to moderate flexion of the elbow, etc.

The score tallies in each subdomain then result in a "normal," "at risk," or "deficient" score profile for a total test score, postural control score, bilateral motor integration score, and a reflex integration score (which is only counted toward

DeGangi-Berk Test of Sensory Integration, Table 1 TSI subdomains of sensory integration. All information taken from TSI test manual (p. 1–2)

Sensory integrative subdomain	Names of individual tests	Description and significance
Postural control	• Monkey task • Side-Sit cocontraction • Prone on elbows • Wheelbarrow walk • Airplane • Scooter board cocontraction	• Stabilization of the next, trunk, and upper extremities • Muscle cocontraction of the neck and upper extremities • Includes antigravity postures
Bilateral motor coordination	• Rolling pin activity • Jump and turn • Diadochokinesis • Drumming • Upper extremity control	• Emphasizes bilateral motor coordination • Includes components of laterality including trunk rotation, rapid unilateral and bilateral hand movements, and crossing the midline • Includes stability of the upper and lower extremities in bilateral symmetrical postures and disassociation of trunk and arm movements
Reflex integration	• ATNR – asymmetrical tonic neck • STNR – symmetrical tonic neck • Diadochokinesis	• Quadruped position to observe asymmetrical and symmetrical tonic neck reflexes and associated reactions of the upper extremities

the total test score). Score ranges for the varying age ranges are provided on the score sheet which makes scoring very clear. This criterion-referenced assessment tool offers clinicians working with this population of children a structured and organized method to assess sensory integrative functions in children with delays in sensory, motor, and perceptual skills, or children suspected of having learning problems.

Historical Background

Georgia DeGangi, PhD, OTR (occupational therapist who now practices in clinical psychology) and Ronald Berk, PhD (professor of educational research at Johns Hopkins University at the time and authored the 1980 book titled: *Criterion Referenced Measurements: State of the Art*) developed this objective tool to observe and measure the sensory integrative processes in preschool children, specifically the vestibularly based functions of postural control, bilateral integration, and reflex integration. It was thought that difficulties in sensory integrative processing in preschool children could result in fine or gross motor delays, poor balance, poor hand use, distractibility, and/or visual-spatial organization later in the school years. Rather than wait for these secondary issues to arise, it was thought that intervention could addressed/remediated the sensory concerns before secondary issues arose. This thought, based on sensory integration theory (Ayres, 1964, 1972, 1979), continues today. A fuller description of Ayres' theory of sensory integration can be found in the links below titled Ayres, A. Jean, sensory processing, and sensory integration therapy.

Psychometric Data

DeGangi began developing test items in 1978, completed psychometric studies, revised the test and the items, completed several rounds of reliability and validity testing, and ultimately identified 73 items. After additional item analysis, which discarded items that did not well discriminate typical from delayed children or were not sufficiently sensitive to typical developmental in these age ranges, only 36 items remained.

The test manual specifically outlines each step of the sampling and statistical procedures. However, it should be noted that there were some sampling difficulties resulting in a disproportionate number of 3–4-year-old children and a low sample population (n). The authors therefore suggest that further

DeGangi-Berk Test of Sensory Integration, Table 2 DeGangi-Berk TSI assessment review form

Test name: DeGangi-Berk Test of Sensory Integration (TSI)
Author(s): Georgia A. DeGangi PhD, OTR and Ronald Berk, PhD
Publisher: Western Psychological Services, 625 Alaska Ave, Torrance, CA 90503; 800-648-8857
Technical information: 2 h of practice before administering
Age range(s): 3–5 years old
Assessment type: Criterion referenced
The following information was obtained from the TSI Manual
Reliability: 1. Interobserver reliability: Two pairs of examiners were used. Difficulties with implementing repeat testing procedures resulted in a low number in the sample and not fully representative of each age group (i.e., no 5-year olds). Intraclass correlations were .80 and above for postural control, bilateral motor integration, and the total test; and coefficients for the dependability of each observer ranged from .67 to .79 for those same categories. Reflex integration was low within each pair of examiners as well as inconsistent between two pairs of raters. 2. Decision-consistency reliability: The p_o index of decision consistency was used determine "the proportion of children classified as normal and delayed on repeated testings" indicating a degree of confidence for the decision (i.e., the stability of the decisions). A sample of 23 "normal" and 6 "delayed" 3–5-year-old children (10 boys and 19 girls) were tested twice during a 1-week retest interval. Utilizing three observers, the p_o estimates for the three subtests and the total test ranged from 79–93% with the lowest in reflex integration. However, standard error was large and thought to be the result of the small sample size. 3. Test-retest reliability: The Pearson correlation coefficients between test and retest scores for each subtest and the total score for a period of 1 week ranged from .85 to .96. Postural control was the least stable with anticipation/familiarity with the task thought to be an influence in the second testing, whereas bilateral motor integration and reflex integration, requiring more automatic responses, were thought to be less susceptible to performance changes on test-retest.
Validity: 1. Content validity: A two-stage judgmental review occurred to determine test validity. • *Item-behavior congruence*: Item-behavior congruence and representativeness was rated by eight judges (occupational therapists). The degree of congruence between the items and the subdomain was rated either as poor, moderate, or high for each item. A rating of "high" was obtained for all items in postural control and reflex integration, and for all but one judge for bilateral motor integration. • *Representativeness*: Twelve judges were asked: Is each collection of items representative of its respective subdomain of behaviors? A score of "high" was obtained by all judges for postural control and 87% of the judges for the bilateral motor integration and reflex integration (with the other 13% scoring as "moderate"). 2. Construct validity: Construct validity evidence was found within the item, subtest, and test, and because the specific use of the test score was to identify normal vs. delayed, this was the primary focus of the analysis. Total of 139 children in the sample. • *Item validity*: The effectiveness of each item was found by computing a discrimination index (DIS) displaying the difference between the mean score for each item in the normal and delayed groups. Statistical significance was then computed using a *t* test and the magnitude of the significance computer via effect size (*d*). Out of the original 73 test items, 37 were taken out after item analysis since they did not discriminate between the groups of delayed and normal, or were not sensitive to the normal developmental status of this population. • *Decision validity*: The cut-off scores for this tool, and therefore the focus of these analyses, were to minimize the false normal error rate as this was thought to be the most serious of errors. The total test and the three subtests' error rate ranged from 4 to 9%. The error rate for false delayed ranged from 10 to 26% for all test scores. Sensitivity and specificity were calculated with scores of 71% and 85%, respectively, for the total test. • *Test structure*: Moderately low subtest correlations (.39–.65) confirms that each subtest is measuring different vestibularly based functions, thus supporting the structure of the test. The correlation of the subtests to sensory integration as a whole ranges from .64 to .93. There was also support that the subdomains of postural control and bilateral motor integration were more vital to overall sensory integration than reflex integration.
Testing procedures
Obtaining information: Thirty-six items should be administered individually and in one sitting; items should be administered exactly as described in the order presented in the manual. **Time to administer:** 30 min **Time to score:** 10 min **Materials included in the test kit?** _X_ yes ____ no **Additional materials needed:** 10 × 15 ft space, table and chair, masking tape, pencil without eraser, switch-back stopwatch, 3-ft-long wooden dowel, rolling pin, carpeted scooter board, plastic hula hoop, and floor mat

(*continued*)

DeGangi-Berk Test of Sensory Integration, Table 2 (continued)

Test name: DeGangi-Berk Test of Sensory Integration (TSI)
Is the tool easy to learn and administer? __X_ yes ____ no **How much training or practice is required?** 2 h **Who can administer the test?** Designed for implementation by occupational therapists and physical therapists; can be implemented by special educators or motor development specialists but seeking an occupational or physical therapist to interpret whether the score is recommended as they have training and education in sensory processing. **Is the manual easy to follow/understand?** __X_ yes ____ no **Are the forms easy to follow/understand?** __X_ yes ____ no The forms are very clear, easy to follow while administering, and can be quickly scored in a very objective manner.
Domains: Postural control, bilateral integration, and reflex integration

research with a more representative sample would improve the utility of the tool and the generalizability of the findings.

Table 2 outlines the components of the assessment process including the psychometric procedures associated with the development of this criterion-referenced assessment tool. In summary, the total test score can be used reliably and validly for screening decisions, and the postural control score and bilateral motor integration score can be used reliably and validly for diagnostic decisions based on the following information:

1. Domain validity: The total test had a high degree of domain validity.

   > Consensus among therapists that the items measure the behaviors they were designed to measure, and that the collection of items composing each subtest was representative of the behaviors defined by the subdomains. (DeGangi & Berk, 1983, p. 40)

2. Construct validity:
   - Total test score can be used for screening decisions with better that 80% accuracy and a 9% false normal error rate.
   - Postural control and bilateral motor integration subtests were extremely accurate.
   - Reflex integration was the least effective subtest.
3. Interobserver reliability:
   - Very reliable for postural control, bilateral integration, and total sensory integration behaviors.
   - Considerable subjectivity for reflex integration behaviors.
4. There were high levels of classification consistency in the identification of the classification designated for each item.
5. Test-retest reliability:

   > The results provided substantial evidence of the stability of sensory integrative functions for a 1-week re-test interval using a homogeneous preschool sample. (DeGangi & Berk, 1983, p. 41).

Clinical Uses

Any assessment tool should be used in combination with other tools in order to gain the most comprehensive picture of a child's functioning. The DeGangi-Berk TSI was intended to provide information related to the three subdomains noted above as these categories of sensory integrative functioning were thought to have a strong impact on the development of sensory integrative functions in the preschool child. The intent was to administer this assessment to children with delays in sensory, motor, and perceptual skills, or to children suspected of having learning problems.

This tool continues to be utilized today in clinical practice as it is a structured and organized method to investigate the sensory processing abilities in this age group.

See Also

- ▶ Ayres, A. Jean
- ▶ Evaluation of Sensory Processing
- ▶ Occupational Therapy (OT)

- ▶ Sensory Diet
- ▶ Sensory Integration and Praxis Test
- ▶ Sensory Integration (SI) Therapy
- ▶ Sensory Processing
- ▶ Sensory Processing Assessment
- ▶ Sensory Processing Measure
- ▶ Sensory Processing Measure: Preschool (SPM-P)
- ▶ Test of Sensory Functioning in Infants

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Deictic Terms

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Synonyms

Deixis

Definition

Deictic terms are words whose meaning shifts depending on the point of view of the speaker. Examples of deictic terms include "this/that," "here/there," "I/you," and "my/your." While some personal pronoun contrasts ("I/you," "my/your") are expected to develop before 3 years of age, many typically developing children continue to have difficulty with spatial contrast deictic terms ("this/that," "here/there") into the early school age years. This difficulty is thought to be related to the shifting quality of the referents for these terms. That is, "I" does not refer to any particular person, but to the person who happens to be talking at a given time. When that person stops talking, the referent for "I" shifts to the next speaker. "Here" refers not to a specific location, but rather to a place near the speaker. What is "here" for the speaker may be "there" for the listener. This shifting reference is thought to cause special difficulty for speakers with ASD, due to their difficulties with flexibility and change. But it is important to note that young children with typical development can also find these forms difficult.

See Also

- ▶ Pronoun Errors
- ▶ Pronoun Reversal
- ▶ Pronoun Use

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Deixis

- ▶ Deictic Terms

DEL22q13.3 (Entrez Gene, OMIM, Uniprot)

► SHANK 3

Delaware Autism Program

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Major Areas or Mission Statement

The Delaware Autism Program (DAP) is one of the largest public school programs in the United States specializing in educating children and adolescents with an Autism Spectrum Disorder (ASD). In 2010, it served more than 800 students between 2 and 21 years of age, in the full range of settings (residential programs, separate schools and settings, and integrated school and community sites) in six affiliated school districts. DAP sites employ than 450 staff, including teachers, assistants, specialists (psychologists, speech language pathologists, occupational therapists, nurses, etc.), and administrative and support staff.

Landmark Contributions

Elements of DAP have been described in various book chapters (Battaglini & Bondy, 2006; Bondy, 1996; Bondy & Frost, 1994; Bondy & Frost, 1995; Doehring & Winterling, 2011). The Picture Exchange Communication System (PECS) (Frost & Bondy, 2000) was first developed by Andy Bondy and Lori Frost during their tenure at DAP, together with the involvement of other DAP staff. Statewide directors have included Dr. Andy Bondy (1981–1997), Dr. Peter Doehring (1999–2008), and Dr. Vincent Winterling (2009–present).

Major Activities

DAP is public school program that presently consists of affiliated programs in 6 of the 19 school districts (Local Education Agencies, or LEA) across the three counties in the State of Delaware, plus other specialized services and supports provided through the Office of the Statewide Director. As a public school program, DAP's services are fully funded by the LEA and the State Education Agency (SEA), at no cost to parents. The six affiliated programs share many key elements, including: (a) programs for children 2 up until 21 years of age, across the autism spectrum; (b) settings ranging from full inclusion to separate classroom for children with ASD, including extended school year services; (c) reliance on teaching methods based on principles of Applied Behavior Analysis (ABA), including PECS; (d) a high staff to student ratio to support more individualized teaching and community integration; (e) opportunities for parents to create local Parent Advisory Committees (PAC) to provide input to the LEA, SEA, and Office of the Statewide Director; and (f) expectations that staff complete a core training program, which for teachers includes a 15 credit graduate teaching certificate in autism. Many of the programs also coordinate with other organizations (daycares, vocational settings, institutes of higher education) to provide community-based services. Three of the six programs operate county centers which provide services to students with more challenging educational and behavioral needs. Through an agreement with the SEA, the Office of the Statewide Director provides services across the state, including: (a) management of extended educational services (part-time residential programming in community-based settings) and extended support services (in-home respite provided to parents for a nominal co-pay); (b) leadership of various statewide committees that provide consultation to LEAs regarding educational programming, to coordinate parent input from the PACs, and provide independent peer review of the assessment and intervention for students with very challenging behaviors; and (c) coordination of staff training specific to ASD. DAP was established in 1976 after parents helped to pass

laws defining many of the core elements of the program (specialized positions like the Statewide Director, specialized services like extended educational and support services, additional staffing, extended school year, statewide committees, etc.).

See Also

- ▶ Applied Behavior Analysis
- ▶ Educational Interventions
- ▶ Free Appropriate Public Education
- ▶ Individual Education Plan
- ▶ Local Educational Authority
- ▶ Picture Exchange Communication System
- ▶ Regional Centers
- ▶ Statewide Service Programs

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Delay, Deviance Versus

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Definition

Delay versus deviance refers to a debate about the nature of development in autism and other disorders. In general, a child who exhibits a developmental delay follows a progression of development found in the general population, but progress in development at a slower rate. In contrast, a child who exhibits deviance follows a progression of development that is different both in rate and sequence of progression. There is evidence to suggest that children with autism may follow a developmental progression that includes elements of both delay and deviance. In many children with autism, language development is often delayed but occurs in a progression similar to children with typical development. In other children, language development may also include deviant characteristics (e.g., echolalia). Many children with autism demonstrate deviance in the development of social and pragmatic skills. For example, some children with autism demonstrate deviance in the development of social behaviors such as joint attention.

See Also

- ▶ Speech Delay

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Delayed Echolalia

▶ Echolalia
▶ Movie Talk

Delusion of Doubles

▶ Capgras Syndrome

Delusion of Duplicates

▶ Capgras Syndrome

Delusion of Negative Doubles

▶ Capgras Syndrome

Delusion of Substitution

▶ Capgras Syndrome

Delusional Hypoidentification

▶ Capgras Syndrome

Demand

▶ Mands

Dementia Infantilis

▶ Childhood Disintegrative Disorder (Heller's Syndrome)

Dendrite

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Definition

A dendrite is one of the four main parts of neurons, which also include the cell body, the axon, and the axon terminals. The dendrite is the part of the neuron that receives incoming signals from other neurons. The signals come in the form of neurotransmitters that cross the area of the synapse between one neuron and another neuron's dendrites. Neurotransmitters bind to receptors on the dendrites, and then the signal passes though the neuron to the cell body. Dendrites may have extensive branching, and each neuron often has multiple dendrites.

The number of dendrites and thus the number of synapses vary with the functions of a neuron. The dendrites of one neuron may receive signals from thousands of other neurons. That one neuron then integrates many signals received and responds accordingly.

See Also

▶ Neuroanatomy
▶ Neurochemistry
▶ Neurotransmitter
▶ Purkinje Cells

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Denver Development Screening Test (DDST)

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Synonyms

DDST; Denver II

Description

The Denver Developmental Screening Test, first published in 1967 (Frankenburg & Dodds, 1967), was one of the first screening tools developed to identify young children at risk for developmental delay and disability. It's format was similar to the construction of pediatric growth charts, with 105 developmental items for children from birth to 6 years of age aligned chronologically along horizontal age lines, divided into four discrete developmental domains: personal-social, fine motor-adaptive, language, and gross motor. Bar graphs for each developmental item reflect the ages at which 25%, 50%, 75%, and 90% of typically developing children in the standardization sample completed the task. Because of criticisms related to low sensitivity in identifying children with speech and language delays, it was revised to add more language items, restandardized, and remarketed as the Denver II in 1992 (Frankenburg, Dodds, Archer, Shapiro, & Bresnick, 1992), retaining a similar format to the DDST. Both are administered by individuals who have trained to proficiency using training tapes/DVD or the administration manual, with standardized toys such as blocks, rattles, and pictures included in the toolkit. It is estimated to take 10–20 min to administer and score. Several options regarding item administration were developed and evaluated. The most commonly used approach in primary care settings included administering at least three items in each domain whose bar graphs are closest to but completely to the left of the age line, indicating items that over 90% of typically developing children should be able to do by that age. Any of these items not successfully completed are considered a delay; items where the age line passes through the 75–90% section of the bar graph which the child cannot accomplish are scored "cautions," and an algorithm for determining normal, abnormal (two or more delays), and questionable (two cautions or one delay) results is provided in the manual.

Historical Background

The DDST is most important for its historical background rather than as a currently recommended screening tool. It was the first developmental screening tool for young children that was widely marketed to the primary care medical community as well as child care providers and other child health professionals. It played a significant role in widespread recognition of the importance of early identification and intervention from a public health and primary care perspective. The role of parents as accurate observers of their children's behaviors was also recognized by the developers of the DDST and subsequent screening materials such as the Denver Prescreening Developmental Questionnaire and the Denver II. The DDST and Denver II became widely used in the United States and internationally, being translated and restandardized in many countries.

Psychometric Data

The DDST was originally standardized on 1,036 children from Denver, age 1–72 months, with reported co-positivity scores of .92 and co-negativity scores of .99, using the Bayley Mental and Psychomotor Scales and Stanford-Binet Intelligence Scales as criterion tests. Subsequent studies of concurrent and predictive validity, reviewed by Meisels (1989), found that while the specificity remained high (.87–1.0), the sensitivity was unacceptably low (.13–.46), particularly when children

were reevaluated 14 months to 6 years later (.18). The Denver II was standardized on 2,096 children 0–6.5 years of age, half from Denver and half from rural Colorado. Inter-rater reliability and test-retest validity were reported to be .90 or greater (Frankenburg et al., 1992). Subsequent studies showed that, with these revisions, the Denver II had acceptable sensitivity of .83 reported by Glascoe et al. (1992), but specificity dropped to .43, shifting concerns about the DDST failing to identify children with significant delays to concerns about overreferral of typically developing children using the Denver II.

Clinical Uses

The Denver II is still marketed by Denver Developmental Materials Inc. However, it is not included in the most recent American Academy of Pediatrics guidelines for general developmental surveillance and screening as a recommended tool (2006) nor in the AAP guidelines for ASD screening (2007), as it has never been evaluated as a screening tool for ASD. Its format, however, continues to be useful for pediatric educators as a way of visually illustrating the importance of assessing different developmental domains simultaneously in individual children, of tracking development over time, and of showing the variability in ages at which different developmental items "typically" occur.

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Denver II

▶ Denver Development Screening Test (DDST)

Denzapine

▶ Clozapine

Deoxyribonucleic Acid

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Synonyms

DNA

Definition

The instructions for the development and functioning of a living organism are contained in a molecule called deoxyribonucleic acid (DNA) which is a nucleic acid. The instructions are spelled out in a sequence or code of four chemical units called nucleobases (or bases for short). These are adenine, cytosine, guanine, and thymine, abbreviated as A, C, G and T, respectively. DNA is contained within nearly every cell of the human organism. Certain segments of the DNA molecule called genes contain the code for creating the components of cells, most importantly, molecules called proteins (Alberts, Bray, et al., 2002). James Watson and

Francis Crick described the molecular structure of DNA in 1953 (Watson and Crick, 1953).

DNA is passed from one generation to the next. In humans, the DNA molecule is divided up into a set of smaller pieces corresponding to chromosomes. Humans inherit 23 chromosomes from each parent, 22 of them are referred to as autosomes and are numbered 1–22 and one is called a sex chromosome and is either a chromosome X or a chromosome Y. Thus, normal human cells contain 44 autosomes and 2 sex chromosomes. The chromosomes are paired in each cell. For example, each cell will contain two copies of chromosome 1, one from the mother (the maternal chromosome) and one from the father (the paternal chromosome). Each of a pair of autosomes will generally contain the same genes. However, the sequence of DNA at each of the genes will often vary slightly between individuals, and it is also now clear that the structure of the chromosome, so-called copy number variations (CNVs), is also part of the normal complement of human genetic variation.

A change in the sequence or structure of DNA which results in a deviation from the agreed upon reference genome may be referred to in various ways, including an allele, a variant, a variation, a polymorphism, or a mutation. Typically, the word polymorphism is used when one is referring to a change that is present in a percentage of the population and mutation is taken to mean that the variation is rare and relates to a disease or phenotype.

See Also

- ▶ Chromosomal Abnormalities
- ▶ Copy Number Variation
- ▶ Dizygotic (DZ) Twins
- ▶ Karyotype
- ▶ Monozygotic (MZ) Twins

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Depade

- ▶ Naltrexone

Depakene

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Synonyms

Divalproex; Valproic acid

Indications

Valproic Acid: Valproic acid is a simple carbonic acid. It is available in several preparations including divalproex and valproic acid. It appears to exert its beneficial effects by interfering with the repetitive firing of neurons. This appears to be especially relevant for its treatment of seizures. Valproic acid is approved for the treatment of seizures, migraine, and for the treatment of bipolar disorder.

Clinical Use (Including Side Effects)

It has been studied in children and adults with bipolar illness and appears to be an effective treatment. Valproic acid is often well tolerated, but it can have a range of adverse effects. Sedation and gastrointestinal disturbance with vomiting are common particularly at the start of

treatment. Other more significant adverse effects include thrombocytopenia, pancreatitis, and rarely hepatotoxicity. These more severe adverse effects require monitoring of drug level in the blood, platelet counts, amylase, and liver enzymes.

To date, valproic acid has not been well studied in children or adults with autism spectrum disorders. There are some open case studies suggesting benefit for aggression and agitation; however, these studies have not compared valproic acid to placebo.

See Also

► Mood Stabilizers

References and Readings

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Department of Vocational Rehabilitation

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Synonyms

Employment services; Office of rehabilitation; Vocational counseling

Definition

The Department of Vocational Rehabilitation is a broad marker for an organization that provides services for persons identified with developmental disabilities (Rehabilitation Act of 1973, Public Law 93–112 93rd Congress, H. R. 8070 September 26, 1973). In the act, every state arranges a bureau of vocational rehabilitation services. In NY State, the office is frequently mentioned as VESID (VESID is an acronym for Vocational and Educational Services for Individuals with Disabilities).

In all states, the Department of Vocational Rehabilitation (DVR) delivers occupation services and treatment to those with disabilities who want to work but experience obstacles to work due to physical, sensory, and/or mental disability. A DVR therapist works with every person to develop an individually tailored strategy of services intended to aid them in reaching their employment goal. The aid may contain, but is not limited to, the following:

- Counseling and guidance
- Assessment services
- Independent living services
- Assistive technology services
- Training and education

Vocational and Educational Services for Individuals with Disabilities within the New York State Education Department has accountability criteria for meeting the needs of individuals diagnosed with disabilities from early infancy through old age, plus oversight of special education services for pupils with disabilities aged 3–21. Each year VESID offers thousands of New Yorkers who have a disability a chance to be independent through learning, preparation, and employment. In addition, VESID delivers vocational rehabilitation services to eligible individuals to prepare them for appropriate jobs. These jobs might be in the competitive work force, in private businesses, in supported employment on employer sites, or in sheltered shops. Moreover, VESID aids individuals with disabilities who are having trouble keeping their jobs. Offices of Vocational Services throughout the country provide similar services and oversight.

Offices of Vocational Rehabilitation, or OVR, delivers vocational rehabilitation services to support persons with disabilities to prepare for, obtain, or maintain employment. The office also offers services to qualified persons diagnosed with disabilities, both directly and through a system of

appropriate vendors. Services are provided on a personalized base. The therapist, through face-to-face interviews, helps clienteles in choosing their choice of occupational goals, services, and service providers. An Individualized Plan for Employment (IPE) is established, charting a vocational objective, services, providers, and responsibilities. Some services are subject to a Financial Needs Test (FNT) and could involve fiscal contribution by the client. Counseling and guidance, diagnostic services, assessments, information and referral, job development and placement, and personal services such as readers or sign language interpreters are provided at no cost to the individual. Also, by law, OVR clienteles awarded Social Security benefits for their disability (SSI, SSDI) are relieved from OVR's Financial Needs Test.

Types of Vocational Rehabilitation Services

The OVR runs a variety of services to qualified applicants. Certain services can aid in overcoming or lessening the disability; others can directly support and prepare for a vocation. The services will be organized to meet distinct needs.

The OVR services include:

Diagnostic services: Medical, psychological, and checkups and assessments used to improve understanding of the disability and needs for specific types of services.

Vocational evaluation: Ability, interest, overall ability, academic exams, work tolerance, and "hands-on" job experience used to understand vocational potential.

Counseling: Occupational therapy will help to better understand potential, to rely on abilities, to set accurate vocational goals, to modify them once needed, to advance fruitful work ways, and to initiate a fulfilling career. Counseling is obtainable throughout rehabilitation program.

Training: Education to prepare for a job including, but not limited to, basic academic, vocational/technical, college, on-the-job training, independent living skills, and personal and work adjustment training.

Restoration services: Medical services and gear such as physical and occupational therapy, wheelchairs, and automobile hand controls can be provided to achieve employment.

Placement assistance: Counseling, job-seeking programs, job clubs, and job development used to upturn your skill to acquire a job.

Assistive technology: Assistive technology includes a wide range of devices and services that can empower individuals with disabilities to make the most of employment, independence, and integration into society. The office can help person with a disability in successfully choosing and obtaining appropriate assistive technology. They can arrange for an adviser to assess the situation and to make appropriate recommendations. The office also functions and maintains Center for Assistive and Rehabilitation Technology (CART) at the Hiram G. Andrews Center. There is no charge for evaluation and vocational counseling services through OVR.

Support services: Additional services are provided for eligible persons if they are essential to start and uphold occupation. Such services may include:

- Room, board, and transportation costs during an evaluation or while completing a rehabilitation program
- Occupational tools, licenses, or equipment
- Home modifications, adaptive or special household equipment; van or car modifications, including special driving devices or lifting devices
- Personal care assistance
- Job site modifications, independent living training
- Text telephone (TT), signaling devices, hearing aids, and interpreter services
- Specialized services such as rehabilitation teaching and orientation and mobility training for persons who are blind or visually impaired

See Also

- ▶ Americans with Disabilities Act
- ▶ Individualized Plan for Employment (IPE)
- ▶ Vocational Evaluator
- ▶ Vocational Training

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Depressive Disorder

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Synonyms

Depressive disorders; Dysthymia; Major depressive disorder; Mood disorders

Short Description or Definition

Major depressive disorder
Dysthymia
Depressive disorders
Mood disorders

Categorization

According to the DSM-IV-TR (American Psychiatric Association [APA], 2000), depressive disorders include major depressive disorder, dysthymic disorder, and depressive disorder not otherwise specified. Major depressive disorder includes the presence of a major depressive episode, with specifiers to indicate the severity and duration. Major depressive episodes involve symptoms that are present most of the day, nearly every day consisting of either depressed mood (can be irritability in children) or diminished interest or pleasure in activities, and at least four of the following: significant weight loss or weight gain; insomnia or hypersomnia; psychomotor agitation or retardation; fatigue or loss of energy; feelings of worthlessness or excessive or inappropriate guilt; diminished ability to think or concentrate, or indecisiveness; or recurrent thoughts of death, suicidal ideation without a plan, or a suicide attempt or specific plan for committing suicide. The symptoms must cause clinically significant distress or impairment in social, occupational, or other important areas of functioning, and they must not be due to the direct effects of a general medical condition, a substance, a medication, or other treatment.

Dysthymic disorder includes the presence of depressed mood for most of the day, for more days than not, as indicated either by subjective account or observation by others, for at least 2 years (in children and adolescents, mood can be irritable, and duration must be at least 1 year) and at least two of the following: poor appetite or overeating, insomnia or hypersomnia, low energy or fatigue, low self-esteem, poor concentration or difficulty making decisions, or feelings of hopelessness.

Depressive disorder not otherwise specified includes disorders with depressive features that do not meet the criteria for major depressive disorder but present with subthreshold symptoms that cause clinically significant impairment or distress.

In the ICD-10 (WHO,1992), *depressive disorder* is defined by the presence of at least one depressive episode with the same key characteristics as in the DSM-IV-TR, such as lowering of mood, decrease in activity, decrease in capacity for enjoyment, and difficulty in concentration. Somatic symptoms, such as marked tiredness, sleep, and appetite disturbance are present, and ideas of guilt or worthlessness, and suicidal thoughts are often present. Depressive disorders are also categorized by the severity and duration of symptoms, into mild, moderate, severe, recurrent, or with psychotic symptoms. The ICD-10 differs in the classification from DSM-IV-TR by its lack of a specific number of symptoms required to meet criteria.

Dysthymia in the ICD-10 is defined similarly as in the DSM-IV-TR, with chronic depression of

mood that is not sufficiently severe or prolonged to justify a diagnosis of severe, moderate, or mild recurrent depressive disorder. However, the criteria do not specify a period of 2 years but rather indicates that the symptoms must last at least several years. *Other depressive disorders* include any other disorders that are not of sufficient severity or duration to meet criteria for depressive disorder or dysthymia.

(Note: Major depressive disorder, dysthymia, depressive disorder not otherwise specified, and other depressive disorders will be referred to collectively as "depressive disorders" or "depression" throughout.)

Epidemiology

The occurrence of depressive disorders in individuals with autism spectrum disorders is likely affected by the same complex genetic and environmental interactions seen in typically developing individuals (Ghaziuddin, 2005). However, the impact of these factors is far less understood in ASD due to the lack of systematic epidemiological studies. Family studies suggest a genetic component to the presence of depressive disorders in ASD, with rates of major depression increased in first-degree relatives of individuals with autism and parents of children with ASD exhibiting higher risk for depressive disorders than parents of children with other developmental disabilities (Ghaziuddin & Greden, 1998; Lainhart, 1999). Families of individuals with ASD who present with depression at clinical settings have a history of depression or suicide at a rate of 50–77% (Lainhart, 1999). Stressful life events, including bereavement, peer victimization, and loneliness, could also contribute to the development of depressive symptoms in individuals with ASD (Ghaziuddin, Alessi, & Greden, 1995; Ghaziuddin, 2005).

Despite the recognition that depressive disorders are relatively common in individuals with autism spectrum disorders, true prevalence rates are unknown because most studies have been conducted with psychiatric samples rather than population samples. However, these studies provide initial estimates of the rate of depressive disorders. Reviews of published research on co-occurring depressive disorders in ASD have reported a wide range of prevalence estimates, from 4% to 58% (Lainhart, 1999; Lainhart & Folstein, 1994; Stewart, Barnard, Pearson, Hasan, & O'Brien, 2006). The varied rates of depressive disorders in the literature likely reflect the heterogeneity of the samples and different methods of assessing depressive disorders. For example, the estimates differ depending on whether psychiatric or community samples were used, which ASD subtype was included, the age of participants, and whether psychiatric interviews or questionnaire assessment methods were used. Many researchers posit a higher rate of depressive disorders in ASD than in the general population and suggest that the disorders may be under-diagnosed (e.g., Ghaziuddin, 2005; Lainhart & Folstein, 1994).

In one of the first descriptions of children and adults with Asperger syndrome in a clinical setting, about 1/3 of the adolescents (16 years and above) and young adults presented with clinical levels of depression (Wing, 1981). Other reports describe depression as being the most common psychiatric disorder in Asperger syndrome, with 15% of adults referred to a psychiatric setting presenting with symptoms of depression (Tantum, 1991). Despite the findings of several clinical studies and the recognition of the risk for developing depressive disorders in ASD, no population-based prevalence studies with adolescents and adults appear to have been completed.

There have been some promising studies examining the prevalence of depressive symptoms in children with ASD, with larger, more representative samples. For example, a prevalence study of mood and anxiety symptoms among 9–13-year-old children with Asperger syndrome and high-functioning autism included a community standardization sample of 1,751 typically developing children (Kim, Szatmari, Bryson, Streiner, & Wilson, 2000). On a questionnaire of depression symptoms, 16.9% of the ASD sample scored at least two standard deviations above the population mean, suggesting a significantly higher rate of

depressive symptoms than in the community sample (Kim et al., 2000).

An Australian study examined emotional and behavioral problems in 4–18-year-old children and adolescents diagnosed with ASD and with youngsters diagnosed with intellectual disability (learning disability) and no diagnosis of ASD (Brereton, Tonge, & Einfeld, 2006). The ASD group scored significantly higher on a measure of depression than the non-ASD group. Age and IQ in the ASD group also affected depression scores. Older children (13 years or older) scored significantly higher on the depression measure than the youngest age group (less than 6 years old), and those with higher IQs scored higher than individuals with intellectual disability (learning disability).

Standardized interview methods of assessment have been used infrequently in research on depression in ASD. Only one study was found to examine the prevalence rates of psychiatric disorders in a community-derived sample using a standardized interview measure (Simonoff, Pickles, Charman, Chandler, Loucas, & Baird, 2008). In this sample of children aged 10–14 years, a surprisingly low rate of depressive disorders (1.4%) was found.

When lifetime occurrence of depressive symptoms and a wider age range was included, a higher rate of depressive disorders was found. In a pilot study for the development of an ASD-specific psychiatric comorbidity interview conducted with 5–17-year-olds, 10% of a community sample with higher functioning ASD met criteria for at least one major depressive disorder in their lifetime and 25% met criteria for subsyndromal symptoms of depressive disorders (Leyfer et al., 2006).

The prevalence of depressive disorders in the general population varies by age with more adolescents and adults presenting with depression than children (World Health Organization, 2001). Research on depressive disorders in ASD suggests a similar pattern, with more adolescents and adults with ASD presenting with depression than children (e.g., Brereton et al., 2006; Martin, Patzer, & Volkmar, 2000; Simonoff et al., 2008). It is currently unknown if more women with ASD present with depression than men, as is the case in the general population (Ghaziuddin, 2005).

Natural History, Prognostic Factors, and Outcomes

The presence of depressive symptoms in individuals with autism spectrum disorders was noted in the earliest descriptions of the disorders (Asperger, 1944; Kanner, 1943; Wing, 1981). However, due to the lack of systematic population studies, the course of depressive disorders is not well understood.

Numerous publications have noted that the development of depressive disorders in adolescents and adults with Asperger syndrome and high-functioning autism in particular seems to be related to a developing awareness of "differentness" from their peers and unsuccessful attempts to establish friendships and romantic relationships (e.g., Ghaziuddin, 2005; Howlin, 1997; Wing, 1981). The presence of depressive symptoms in children with Asperger syndrome and high-functioning autism has been found to be associated with higher rates of aggressive and oppositional behavior, along with poorer relationships with teachers, peers, and family members when compared to children with ASD without depressive symptoms (Kim et al., 2000).

In general, the outcomes for adults with autism spectrum disorders, with and without intellectual disability (learning disability), have not been promising, with decreased opportunities for employment, independent living, and access to community services (Howlin, 2005). There is little information on the long-term outcome of persons with ASD and depressive disorders. However, clinicians report that the presence of co-occurring depressive disorders can result in further impairment and disruption in functioning, such as increased morbidity and mortality, and a higher potential for drug interactions due to multiple pharmacotherapy treatment (Ghaziuddin, 2005). Depressive illness can become chronic in some individuals, and a family history

of mood disorders seems to be associated with a poorer treatment outcome (Ghaziuddin, 2005).

Clinical Expression and Pathophysiology

The presentation of depressive symptoms in ASD shares many of the features seen in the general population, such as sadness and lack of interest in formerly pleasurable activities, but individuals with ASD may also present with unique features, due to their restricted range of emotional expression and difficulty in communication. While sad mood and loss of pleasure in activities are defining characteristics of depressive disorders, individuals with ASD are often referred to clinical settings because of changes observed by others, such as facial expressions of sadness or misery, or behavioral expressions, such as increased frequency of crying, irritability, or problem behavior (Stewart et al., 2006). Particular features that must be assessed carefully in individuals with ASD include an increase in social withdrawal, changes in the character of stereotypic and repetitive behavior, and restricted interests, irritability, and regression of skills (Ghaziuddin, 2005).

Other factors that are likely to affect the presentation of depressive disorders in ASD include age, gender, cognitive and verbal ability, other psychiatric disorders, and other medical disorders. Younger children may be more likely to present with irritability than with sad or depressed mood, and this is recognized in the DSM-IV-TR criteria, which allows for substitution of irritability for depressed mood in children (APA, 2000). Research suggests an increase in depressive symptoms with age (e.g., Brereton et al., 2006). The risk of depression and other psychiatric disorders may be higher in individuals with Asperger syndrome and higher functioning individuals with autism because their relatively good cognitive and language skills may lead others to overestimate their abilities and put more pressure on them to "fit in" with peers, while overlooking the severe difficulty they have in understanding social interaction. However, there is not enough evidence at this time to make any conclusions about differential risks of developing depression in these groups (Howlin, 2005).

Individuals with Asperger syndrome and higher functioning autism may present with depressive symptoms differently than individuals with autistic disorder. They may be able to verbally describe feelings of sadness and loneliness, while individuals with more cognitive impairments may not be able to express themselves verbally and may present with more behavioral signs, such as irritability, aggression, and changes in sleep and appetite. However, it is important to recognize that individuals with higher functioning presentations of ASD and intact language abilities may not be able to accurately describe their emotions and may present with atypical signs and symptoms of depressive disorders, such as irritability or bizarre ideation (Howlin, 2005).

The presence of other psychiatric disorders can also affect the presentation of depressive symptoms. The co-occurrence of mood and anxiety disorders is common in the general population, and research suggests that these disorders often co-occur in people with ASD (e.g., Lainhart, 1999). The presence of symptoms associated with anxiety, such as increased stereotypic behaviors, may make it more difficult to assess depressive disorders in individuals with ASD.

Evaluation and Differential Diagnosis

The classification of psychiatric disorders in ASD has involved considerable controversy. Many early researchers adopted a hierarchical approach to diagnosis and argued that psychiatric disorders could not occur in individuals with intellectual disability (learning disability) or autism spectrum disorders. A hierarchical approach conceptualizes symptoms that overlap with other disorders as part of the primary disorder, with little room for the diagnosis of co-occurring psychiatric disorders. An alternative diagnostic approach to the hierarchical approach classifies all symptom constellations that meet criteria for a particular disorder and allows for identification of multiple disorders (Simonoff et al., 2008). Despite the

controversy in the literature, many now agree that the full spectrum of psychiatric disorders can co-occur in ASDs (Ghaziuddin, 2005; Matson & Nebel-Schwalm, 2007; Simonoff et al., 2008).

Despite the recognition that depressive disorders can and do occur in ASD, diagnosing them in individuals with autism spectrum disorders can be particularly difficult due to a variety of factors, including an overlap between symptoms of depressive disorders and features of ASD, such as poor eye contact, restricted affect, and lack of voice inflection. For example, it may be difficult to determine whether the social withdrawal observed in an individual with autism is part of the core social deficits of autism spectrum disorders or is symptomatic of a co-occurring mood disturbance.

An important factor in making an accurate diagnosis of depressive disorders in ASD is having reliable information from multiple sources. If the individual with ASD is able to provide information about symptoms, it is important to assess these carefully. However, given the difficulties that individuals with ASD have in expressing and understanding emotions, it is also important to obtain information from caregivers, teachers, and family members about typical patterns of behavior. Reports by others may also be helpful to interpret self-report of individuals with ASD. The clinician needs to obtain a detailed picture of the individual's baseline levels of social activity, interests, restricted and repetitive behavior, maladaptive behavior, and adaptive skills, in order to detect distinct differences in these areas that may indicate the onset of mood disturbance. Information obtained from parental report concerning developmental and social history, including the presence of significant life events, and the results from prior assessments, such as medical and psychological evaluations, intelligence and adaptive behavior testing, can complete the diagnostic picture. A detailed physical examination is recommended to rule out other possible causes of depressive symptoms such as thyroid disorders (Ghaziuddin, 2005).

Intellectual disability (learning disability) commonly co-occurs in ASD, with estimates of 30–70% of individuals with ASD functioning in the ID (LD) range (Fombonne, 2005). The presence of ID (LD) in this population has important implications for how depression is assessed in this heterogeneous group. The diagnostic manual for intellectual disability (DM-ID) proposed adaptations to the DSM diagnostic criteria for persons with intellectual disabilities based on clinical consensus (Fletcher, Loschen, Stavrakaki, & First, 2007). The DM-ID includes irritable mood as an acceptable substitute for depressed mood for people with ID which the DSM-IV-TR includes in the criteria for children (APA, 2000). The DM-ID reduces the number of symptoms by one for diagnosing major depressive disorder, requiring four symptoms instead of five if the individual has limited expressive language skills. The other important adaptation is that the DM-ID allows observer report for many symptoms (Charlot, Fox, Silka, Hurley, Lowry, & Pary, 2007). This practice is compatible with clinical reports concerning individuals with ASD in which most cases of depression are brought to clinical attention by observations from caregivers rather than by self-report of the individual.

While the alternative diagnostic criteria put forth in the DM-ID represent an important step in the understanding of co-occurring psychiatric disorders in individuals with all types of developmental disabilities, there remains a lack of ASD-specific psychopathology assessment methods. Many studies on depression in ASD have relied on scales or structured interviews designed for the general population or for individuals with intellectual disability. Consequently, it is difficult to determine if these measures are sensitive to the characteristic features of ASD.

A semistructured psychiatric interview was developed to assess psychiatric disorders in children and adolescents with ASD (Leyfer et al., 2006). The Autism Comorbidity Interview – Present and Lifetime Version (ACI-PL) was modified from the Kiddie Schedule for Affective Disorders and Schizophrenia (KSADS, Chambers et al., 1985). This measure aims to distinguish the core symptoms of ASD from symptoms of comorbid psychiatric disorders. It demonstrated good

reliability and validity, although the validation sample was limited to individuals with higher functioning ASD.

The further development of ASD-specific screening measures and structured diagnostic interviews is important to improve the accurate identification of depressive disorders in ASD and to gain access to specific, effective treatment.

Treatment

The treatment of depressive disorders in individuals with ASDs is largely pharmacological in nature, with antidepressant medication being prescribed most often and selective serotonin reuptake inhibitors (SSRIs), such as fluoxetine, sertraline, and fluvoxamine, showing the greatest success in symptom reduction (Lainhart, 1999, Stewart et al., 2006). It is difficult to determine if psychopharmacological treatments are being used in this population specifically to treat depressive disorders because a large percentage (30.5%) of individuals with ASD take one or more psychotropic medications (Aman, Van Bourgondien, Wolford, & Sarphare, 1995). Antidepressants may be prescribed for repetitive or compulsive behavior as well as for depressive symptoms. A naturalistic study, which examined psychotropic drug use among a sample of 109 individuals with high-functioning ASD, reported that about a third of the participants were prescribed an antidepressant with about one fourth taking an SSRI (Martin et al., 2000). Depression was identified as the reason for taking psychotropic medication in about 30% of participants. The response to antidepressants by patients with ASD is reported to be similar to the general population (Ghaziuddin, 2005). Side effects, if they are problematic, tend to be related to other medical issues such as seizures.

There is increasing recognition that cognitive behavior therapy may be an effective treatment for psychiatric disorders in individuals with Asperger syndrome (Anderson & Morris, 2006; Attwood, 2003). Cognitive behavior therapy for depression has been used with individuals with Asperger syndrome with resulting improvement (Hare, 1997). Depending on the individual's level of functioning and communication abilities, CBT may be an appropriate treatment choice. Further study is needed to determine the effectiveness of CBT with individuals with ASD and to identify the active components of the treatment.

Social skills training, environmental modifications, and behavioral interventions may have a role in addressing depressive symptoms in individuals with ASD. Psychosocial interventions are often used in conjunction with medications to treat depressive disorders.

See Also

- ▶ Affective Disorders (Includes Mood and Anxiety Disorders)
- ▶ Antidepressant Medications
- ▶ Anxiety Disorders
- ▶ Cognitive Behavioral Therapy (CBT)
- ▶ Mood Disorders
- ▶ Serotonin Reuptake Inhibitors (SRIs)

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Depressive Disorders

▶ Depressive Disorder

Derailment

▶ Flight of Ideas

Dermamycin® [OTC]

▶ Diphenhydramine

Dermatoglyphic Patterns

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Definition

Dermatoglyphics refers to the study of fingerprints and handprints. Dermatoglyphic patterns are the unique ridges and whorls of the skin of the fingertips and palms. Each individual person (even genetically identical twins) has a slightly different pattern of ridges and whorls on the fingers, especially the tips and palms. There can be unique patterns of the lines that cross the palms and fingers as well. The creases of the palms may be altered in specific genetic syndromes. The dermatoglyphic pattern of the fingerprint is determined prenatally. At this point, the literature on dermatoglyphic patterns in children with ASD is conflicting. The evidence does not indicate that there are differences in the ridges/whorls or palm prints of children with autism spectrum disorders, although there may be differences related to associated or underlying genetic disorders.

See Also

- ▶ Down Syndrome
- ▶ Genetics
- ▶ Physical and Neurological Examination

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Descriptive Research

▶ Qualitative Versus Quantitative Approaches

Desensitization

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Definition

Systematic desensitization refers to the therapeutic technique of gradually exposing an individual to increasingly difficult anxiety-producing conditions in an effort to help an individual reduce anxious responses in those situations by adopting more adaptive ways of coping. The closely related process of counterconditioning consists of coupling opposing, positive responses (e.g., relaxation) to situations known to cause fear or anxiety. By substituting a new, adaptive response to fearful settings, the individual learns to elicit a more appropriate reaction in fearful situations. The development of a hierarchy of fearful conditions (i.e., consists of identifying a range of situations from least to most anxiety provoking) plays a key role in this intervention by serving as a framework for gradual exposure. Anxiety-related situations are introduced in a step-by-step process beginning with the least challenging and progressing to the more difficult. This technique has been used effectively with children and adults with autism.

Historical Background

Systematic desensitization originates from classical conditioning theory. In 1920, John B. Watson demonstrated that fearful responses could be conditioned. Watson conditioned a fear of rats in an infant, referred to as "Little Albert," by pairing the presence of a white rat with a sudden loud noise (Watson & Rayner, 1920). Eventually the presence of the rat by itself elicited a fear response that generalized to all furry objects. Watson postulated that emotional responses could be learned and modified to generalize to a broader category of stimuli. The seminal work by Watson laid forth evidence for the development of phobias.

In response, Mary Carver Jones conducted instrumental research examining the mechanisms in which fearful responses could be reduced and generalization of these new responses achieved (Jones, 1924). She treated a young boy, "Peter," whom she selected partially because of characteristics (i.e., fear of white rats and other furry animals and objects) he shared with "Little Albert." In the experiment, Peter was gradually presented with increasingly difficult fearful situations while he was simultaneously engaged in a pleasant activity. Initially the rabbit was presented a considerable distance away, and over a period of multiple sessions, it was gradually moved closer to Peter. During each of these sessions, Peter received his favorite food that was presented to him by a friendly peer or adult in the presence of the rabbit (Lang, 1966). Peter initially demonstrated fearful responses to the rabbit but gradually exhibited that he was comfortable by holding the rabbit on his lap and he ultimately showed affection towards it. Through the process of gradual exposure, coupled with positive reinforcement (both through tangible rewards and social praise), Jones effectively demonstrated mechanisms through which fear could be reduced.

Building on the findings of Mary Carver Jones, Joseph Wolpe developed and operationalized the method of systematic desensitization to treat clients with anxiety and phobias, especially those connected to situations in which no real danger was present (Wolpe, 1958). He based his method on the principle of reciprocal inhibition, which emphasized that opposite responses to anxiety, such as relaxation, could be utilized to diminish anxiety. Though Wolpe acknowledged that other responses also compete with anxiety (Wolpe, 1990a), he incorporated relaxation as the "reciprocally inhibiting" response in his treatment through gradual exposure. Wolpe's seminal research on systematic desensitization provided a theoretical explanation for the success of gradual approaches through which the therapist determines the degree to which a patient is exposed to anxiety-provoking stimuli (Wolpe, 1961). He also developed the method of imagery construction within systematic desensitization (having the client imagine fearful situations) to gradually expose clients to anxiety-provoking scenarios without confronting them directly to begin with. Systematic desensitization was reportedly successful for treating anxiety of nonpersonal stimuli (enclosed spaces, harmless animals, etc.) as well as interpersonal stimuli (fears of specific people or fear of being criticized). Also, Wolpe's method treated fears that could not be brought into a therapist's office such as complex social situations in a community setting (Lang, 1966). Overall, the method adequately treated abstract fears and anxieties, which separated systematic desensitization from other treatments available at the time.

While Wolpe originally incorporated imagined exposures during treatment, many clinicians now use in vivo exposures when implementing systematic desensitization. These in vivo exposures involve direct exposure to the actual fear-inducing stimuli. Both imagined exposure and in vivo exposure produce diminished anxiety levels in patients. With children, in vivo exposure tends to be used more.

Rationale or Underlying Theory

Wolpe hypothesized that the underlying process at work during systematic desensitization is reciprocal inhibition. If a client can be taught to elicit a response oppositional to anxiety (e.g., relaxation) while in the presence of anxiety-evoking stimuli, then the anxiety response weakens eventually leading to diminished or no

anxiety (Wolpe, 1958). Pairing such a response with systematic presentations of increasingly anxiety-provoking stimuli, fear responses gradually diminish even in response to the most fearful situations.

The theory of habituation provides another explanation for the changes that occur during systematic desensitization (Antony & Stein, 2008; Watts, 1971). The longer and more often a client is exposed to anxiety-producing stimulus, the less effect that stimulus is presumed to have. When a person is exposed to anxiety-producing stimuli without negative consequences (e.g., petting a dog without getting bitten), negative thoughts are challenged and new, more adaptive information is encoded (Antony & Stein, 2008). As a client spends more time exposed to these situations free from negative consequences, the person becomes "habituated" to the stimuli and previously distressing situations no longer cause unmanageable levels of anxiety.

Modern theorists also incorporate cognitive approaches to explain the success of systematic desensitization in treating anxiety symptoms. A retrieval competition theory posits that when clients are exposed to feared stimuli with no negative consequences, they begin to form different mental representations of these situations. Positive aspects of the exposure such as free choice, relative safety, and perceived self-efficacy all contribute to the formation of new mental representations (Brewin, 2006). As exposures are repeatedly completed, these more positive representations are primed for retrieval and activated more quickly than the original negative representations.

Goals and Objectives

The overall goal of systematic desensitization is to reduce anxiety in feared situations. The method aims at addressing fears and anxieties through gradual exposures. Systematic desensitization can be used to treat a range of anxiety symptoms, particularly phobias, from the specific (e.g., fear of snakes) to the abstract (e.g., fear of embarrassment). In this way, phobias such as fear of crowds or fear of public speaking can be remediated in behavioral therapy. While some models of the method utilize only imagined exposure and others incorporate exposure in naturalistic contexts, the objective is to gradually weaken anxious responses to anxiety-evoking stimuli and to minimize the probability of fears returning after being successfully treated (Brewin, 2006). Modern research suggests that the "return of fear" phenomenon is most likely to occur when exposure therapy is conducted only in limited contexts (e.g., clinics), rather than also in the naturalistic settings where fear is experienced in everyday life (Mineka, Mystkowski, Hladek, & Rodriguez, 1999; Mystkowski, Mineka, Vernon, & Zinbarg, 2003).

Treatment Participants

Systematic desensitization is appropriate to treat phobias or anxiety symptoms in both children and adults. Given that phobias and anxiety present themselves in a range of populations, the process has been effective in treating a variety of conditions (Brooks, Gibbs, Jenkins, & Mcleod, 2007; Davis, May & Whiting, 2011; Frank et al., 1988; Morrow, 1986). Research indicates particular effectiveness in treating specific phobias (Gelder et al., 1967), such as with snakes (Lang & Lazovik, 1963) or claustrophobia (Wolpe, 1961). Systematic desensitization has also proven effective to treat fears and anxieties in persons with cognitive limitations (Erfanian & Miltenberger, 1990) and autism spectrum disorders (ASD) (Jackson & King, 1982; Koegel, Openden, & Koegel, 2004; Luiselli, 1978; Luscre & Center, 1996; Wood et al., 2009).

Systematic Desensitization and Autism Spectrum Disorders

Individuals with ASD often experience symptoms of fear and anxiety (Gillot, Furniss, & Walter, 2001; White, Oswald, Ollendick, & Scahill, 2009). Many systematic desensitization interventions among children with autism involve in vivo exposures within the actual setting (Koegel et al., 2004; Luiselli, 1978; Luscre & Center, 1996; Wood et al., 2009). Luiselli (1978) used in vivo

systematic desensitization to successfully treat a child with autism who feared riding the school bus. Additionally, systematic desensitization significantly reduced fear of dental visits in children with autism (Luscre & Center, 1996), and in another study, it was used to successfully eliminate fearful behaviors to common auditory stimuli (e.g., sounds from a vacuum, flushing toilets) in three children with autism (Koegel et al., 2004).

Wood et al. (2009) incorporated systematic desensitization as a component of their cognitive behavioral therapy. Children with autism moved through individually designed fear hierarchies in which they were presented with in vivo exposures and received a variety of reinforcers for their participation. Immediately before and immediately following each exposure, a therapist guided the client through conversations aimed at restructuring negative thoughts with more adaptive cognition. Case studies of this treatment are given in Sze and Wood (2007, 2008), with anxiety targets ranging from intrusive thoughts (worries and obsessions) to separation anxiety, social avoidance at school, and compulsive behaviors.

These studies suggest that systematic desensitization is effective in treating anxious responses in children with ASD.

Treatment Procedures

Joseph Wolpe's original treatment paradigm remains at the foundation of systematic desensitization while some elements have been modified. For example, current systematic desensitization procedures now employ more in vivo exposure rather than imagined exposure when possible. In fact, Wolpe himself utilized in vivo exposures when imagined exposure did not effectively treat a patient's symptoms (Wolpe, 1990a). Similarly, though relaxation is used as a means of reciprocal inhibition (Graziano & Kean, 1968), other methods have been used as well such as positive reinforcement (Koegel et al., 2004; Luiselli, 1978; Wood et al., 2009) and laughter (Jackson & King, 1982). All systematic desensitization treatments continue to function on the principles of reciprocal inhibition and/or habituation.

Before implementing an intervention using systematic desensitization, a hierarchy of fears is established. This hierarchy refers to a list of various situations ordered from mildly to severely anxiety provoking (e.g., Wood & Mcleod, 2008). For example, a mild anxiety-inducing situation in a patient with a fear of snakes would be imagining a snake lying on the ground, while a severe anxiety-provoking situation would be holding a small, defanged, nonpoisonous snake. The hierarchy delineates the full range of conditions that produce fear. The items on the hierarchy can be conceptualized as steps or levels that range from a continuum from least to most anxiety provoking. It is developed before implementing treatment because it serves as a guideline for treatment goals (Lang, 1966). Treatment proceeds in a stepwise progression beginning with mild anxiety-producing situations and gradually addresses more severe anxiety-producing scenarios on the hierarchy. The patient should exhibit and report diminished levels of anxiety before moving to the next step in the hierarchy. Employing a hierarchy during treatment has shown to increase the effects of systematic desensitization (Morrow, 1986) and has been a constant component of systematic desensitization since Wolpe first described the treatment.

Incorporating relaxation into systematic desensitization treatment produces substantial effects (Wolpe, 1958). The presence of a relaxation response inhibits anxiety or fear arousal because it is inherently antagonistic to both (Lomont & Edwards, 1966). However, some research indicates that relaxation training is an unnecessary component to treatment (Agras et al., 1971). While the degree of focus on relaxation may vary, many systematic desensitization treatments continue to include it as a component. Given that it requires intensive focus, relaxation training in children may be challenging (King, Ollendick, Gullone, Cummins, & Josephs, 1990), especially in children with mental retardation or low-functioning autism (Graziano & Kean, 1968). To circumvent these challenges, immediate positive

reinforcement (praise, edibles, toys, etc.) may substitute as an adequate means of attaining reciprocal inhibition and has been successful in treating anxiety in children with ASD (e.g., Wood et al., 2009). This type of treatment paradigm often occurs when employing in vivo exposures rather than imagined exposures. Luiselli (1978) used verbal praise and edible treats for each successive step a child completed in riding the school bus. In a study of hypersensitivity to auditory stimuli in children with autism (Koegel et al., 2004), children's favorite snacks and verbal praise were used to reinforce the children during in vivo exposures. Similarly, Luscre and Center (1996) employed individualized rewards (i.e., music, Play-Doh, fruit, etc.) during and after exposures. Jackson and King (1982) found that laughter could be used as an effective means of inhibiting anxiety in a child with autism suffering from a phobia of the sound from flushing toilets. These studies indicate that the effectiveness of systematic desensitization in children with autism may be enhanced when positive reinforcement or pleasant experiences are coupled with anxiety-provoking situations.

Efficacy Information

The efficacy of systematic desensitization is well documented (Chambless et al., 1998; Choy, Fyer, & Lipsitz, 2007; Wood et al., 2009). Since the treatment requires individualization to the patient, there are numerous single-case studies published (e.g., MacDonald, 1975; Sze & Wood, 2007, 2008). However, studies have also emphasized the effectiveness of systematic desensitization in larger sample sizes (e.g., Frank et al., 1988; Wood et al., 2009). The degree of efficacy varies and is associated with the type of phobia, the severity of symptoms, the length of intervention, as well as individual attributes (e.g., treatment motivation) that is evidenced across typically developing populations (Wolpe, 1990b) and children with ASD (Koegel et al., 2004; Sze & Wood, 2007, 2008). Despite these variations, it seems that systematic desensitization is generally an effective treatment method in treating anxious responses in ASD.

Outcome Measurement

Abstract concepts such as "fear" and "anxiety" can be difficult to measure. As a result, outcome measurement varies across studies. One common method is to measure outcome by the number of steps completed in a fear hierarchy. Many single-case methodological studies utilize this approach as a means of determining the success of treatment in ASD (Koegel et al., 2004; Luscre & Center, 1996). Additionally, the occurrence of anxious behavioral responses (e.g., crying, running away) has been measured using frequency counts or calculated as percentages of occurrence within specific timed intervals using direct observation or review of videotaped sessions (Koegel et al., 2004).

Other measures include parent or patient report of anxiety symptoms (Kendall, 1994; Wood et al., 2009). These self-report measures are subjective ratings (King et al., 1990) and are often used in conjunction with other measures. In order to limit subjectivity, reports may be recorded using standardized anxiety scales such as subjective units of distress scale, which is a 0–100-point scale usually administered with adults to assess their subjective anxiety levels (Choy et al., 2007). When children are the subjects of treatment, measures of parent report are often obtained.

Since changes in physical (somatic) responses such as increased respiration, cardiac rate, blood pressure, or galvanic skin response (GSR) serve as indicators of fear or anxiety, physiological measures may also be recorded as a means of indicating anxiety (Fisher, Granger, & Newman, 2009). All of these outcome measurements are intended to determine the remittance of anxiety behaviors.

Qualifications of Treatment Providers

Trained clinicians familiar with behavioral principles and the treatment population have implemented systematic desensitization. Understanding the rationale of the treatment likely increases the effectiveness of how the treatment is delivered. While therapists typically deliver

the treatment, there are resources available for parents, teachers, and even patients themselves to learn to implement the treatment (Merrell, 2001); however, the efficacy of such implementation has yet to be determined.

See Also

- ▶ Cognitive Behavioral Therapy (CBT)
- ▶ Phobia

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Desipramine

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Synonyms

Norpramin; Pertofrane

Definition

Desipramine is a tricyclic antidepressant. The term tricyclic refers to the three-ring structure of this class of antidepressant medications. These medications are not used as commonly as in the past as they have been largely replaced by the SSRIs. Desipramine has been used to treat depression and attention deficit/hyperactivity disorder. Desipramine has highly selective norepinephrine reuptake inhibitor properties.

The tricyclic antidepressants have several adverse effects in common including dry mouth, urinary retention, constipation, nausea, increased heart rate, dizziness, and, at higher doses, confusion. The tricyclic antidepressants also carry some risk of altering the electrical conduction in the heart. They are well known to be fatal on overdose due to their potential for causing cardiac arrhythmia. Because of their known toxicity at higher doses, treatment with tricyclic antidepressants requires blood-level monitoring and electrocardiogram monitoring as well. Finally, the tricyclic antidepressants are also vulnerable to drug-drug interaction. For example, some medications such as SSRIs or certain antibiotics may interfere with the breakdown of tricyclic antidepressant medications. The interference of metabolism of the tricyclic can cause a sharp increase in the blood levels of the tricyclic antidepressants and increase the vulnerability to toxic effects. The tricyclic medications have not been well studied in children or adults with autism.

See Also

► Antidepressants

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Desyrel

► Trazodone

Detection of Autism by Infant Sociability Interview

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Synonyms

DAISI

Description

DAISI is a semistructured detailed developmental history interview designed to elucidate a child's early sociability and communication. It is for concurrent or retrospective use with parents in clinical and research investigations, particularly those concerning autism. Wimpory, Williams, Nash, and Hobson (2000) provides details of DAISI with an appendix clarifying its schedule and criteria for positive and negative responses, as scored from verbatim parental responses.

The instrument focuses on developmental progression in the manifestation of social engagement in young preschool children with autism through a semistructured interview drawing out retrospective reports of social engagement from their parents. It employs a conversational style masking when the interviewer moves from one to another of DAISI's 19 items. The interview is designed to facilitate the development of a relationship between parent(s) and interviewer so that honest/accurate replies are more likely. To this end, DAISI involves sensitive probing with situational prompts. Questions are ordered to increase the likelihood that parents will be able to give an initial positive response before having to describe any negative responses on further detailed questioning. Rather than focusing merely on discrete communicative skills, there is a focus on the infant's role in any interactive flow of preverbal engagement.

The interview schedule is reproduced below from an appendix within a paper by Wimpory et al. (2000) documenting DAISI's initial published use. DAISI can take up to an hour to administer and requires an understanding of typical and autistic early social communication rather than specific training. Although it was originally designed clinical psychologists' use for clinical and research purposes, it has subsequently been successfully employed by a range of professionals and researchers.

Wimpory et al. (2000) retrospectively used of DAISI with twenty 2–4-year-olds, prior to any autism diagnoses being made, found 15 key items differentiating the children who were subsequently diagnosed with autism from those with nonautistic developmental delay. Distinguishing items include engaging in dyadic social interaction (i.e., sociability in play with or without toys, socially directing feelings of anger and distress, frequency and intensity of eye contact, greeting parents, waving, raising arms to be picked up, enjoying lap games, preverbal turn-taking, and using noises communicatively) as well as "triadic" social behavior, involving an object and another person (i.e., referential eye contact, pointing and following others' points, offering and giving, and showing objects).

The evidence from the study by Wimpory et al. (2000) indicated that infants with autism manifest a range of abnormalities suggestive of profound limitations in social engagement.

These abnormalities were specific to the group with autism and were *not* simply an expression of general developmental delays because they were not characteristic of the infancies of children in the matched control group. Moreover, the abnormalities were *both* in the area of person-to-person nonverbal communication and interpersonal contact *and* in triadic person-person-object interactions. In the former respect, it is notable that the abnormalities extended to socially directed expressions of anger and distress as well as signs of positive engagement. In the latter respect, there were a majority of infants without autism but *no* infants with autism who were reported to offer, give, show, or point to objects in relation to someone else. Finally, nearly all of the infants in the control group, but not a single child with autism, were said to have followed another person's point.

These findings are in keeping with autism theories that focus on impairments in primary intersubjectivity as well as recognize the importance of difficulties with secondary intersubjectivity (Hobson, 1993; Newson, 1984; Rogers & Pennington, 1991; Wimpory et al., 2002). Concurrent use of the 15 key DAISI items that Wimpory et al. (2000) found to be significant also determined significant group differences between the infant siblings of autistic spectrum disordered (ASD) and typically developing children as detailed below (Stone, McMahon, Yoder, & Walden, 2007). Stone et al. (2007) also found significant correlation between total scores from the DAISI and a direct child measure of social-communicative functioning, The Screening Tool for Autism in 2-Year-Olds.

Findings from Wimpory et al.'s use of DAISI, along those from other studies, determined 25 key items for Dereu et al. in screening for ASDs (Dereu et al., 2010). They successfully evaluated the Checklist for Early Signs of Developmental Disorders (CESDD) in a population of almost seven thousand 3–39-month-olds. In summary, DAISI has been used for research retrospectively, with children who have autism or nonautistic developmental delay and concurrently with infant siblings of children with autistic spectrum disorders (ASD) and typical development. It has also been employed for diagnostic purposes in clinical/educational settings for two decades.

Historical Background

DAISI's development was influenced by child clinical training at Nottingham University's Child Development Research Unit, and particularly by Professor Elizabeth Newson's guidelines (1990). The originality of data published on DAISI, by Wimpory et al. (2000) lies in the fact that the interview was carried out before any diagnosis was made; so the parents did not have any a priori assumption when recounting their child's social behavior.

In this respect, the DAISI differs from earlier questionnaires that were used with parents of affected children or adults, such as Dahlgren and Gillberg (1989) and Wing (1969). The latter were completed after the diagnosis of autism had been made and after years of experience of the person with autism, which might have influenced the results. Also, despite the fact that questionnaires are concise and easy to use, they are less sensitive than interviews and provide less accurate answers. These methodological limitations were a feature of almost all previous studies of this kind, even if the period recalled was not so distant. The DAISI interview is designed to give the impression of a natural conversation. There are opportunities for explanation, discussion, and provision of examples as part of the interchange. While previously published diagnostic instruments for young children with autism, such as the Parent Interview for Autism (PIA; Stone & Hogan, 1993) and the revised Autism Diagnostic Interview (ADI-R; Lord, Storoschuk, Rutter, & Pickles, 1993), record impairments in social relatedness, they do not focus exclusively on early social engagement in young preschool children.

The DAISI interview was developed to overcome several of the methodological issues that were a feature of previous research involving retrospective parental accounts. For example, it focuses on aspects of social engagement that are

prominent in the behavior of typically developing infants and thus identify what may be abnormal in the case of autism. In addition, interviewing parents of young children with a specific focus on the first 2 years of life means that recall is required over a relatively short period (e.g., over 6–24 months in Wimpory et al., 2000).

Psychometric Data

The internal consistency of the DAISI was determined using the Kuder-Richardson-20-statistic (for dichotomous data) on retrospective use of DAISI with parents of twenty 2–4-year-olds, prior to any autism diagnoses (Wimpory, 1995). This gave a standardized item alpha coefficient of 0.9. Significant autistic versus developmentally delayed nonautistic group differences emerged from analysis of variance on the total DAISI scores, $F(1,18) = 166.94$, $p < .0001$.

As indicated above, Wimpory et al. (2000) reported 15 key items that differentiated the infancies of children subsequently diagnosed with autism (mean score = 3.6, SD 2.4, range 0–7) from those with nonautistic developmental delay (mean score = 15.7, SD 2.5, range 13–19; Mann–Whitney $U = 0$, $p < .0001$). Distinguishing items, computed on an item by item basis (with Fisher's exact one-tailed test), indicated impairments in frequency/intensity of eye contact ($p < .0001$*) and its referential use ($p < .0001$*); pointing ($p < .0001$*) and following others' points ($p < .0001$*); using noises communicatively ($p < .0001$*); preverbal turn-taking ($p < .0004$*); raising arms to be picked up ($p < .0004$*); offering and giving ($p < .0004$*); greeting ($p < .005$); showing objects ($p < .005$); sociability during play with toys ($p < .005$); socially directing anger/distress ($p < .010$); sociability during play without toys ($p < .016$); waving appropriately ($p < .016$); and enjoying lap games ($p < .043$). Asterisks indicate specific items that individually discriminated between the autistic and developmentally delayed nonautistic groups, following stringent Bonferroni correction for multiple comparisons.

For the above retrospective research, DAISI total scores correlated significantly with Childhood Autism Rating Scales (CARS) scores for the entire group ($-.891$, $p < .0001$; Wimpory, 1995). For the subgroup with developmental delay, DAISI total scores and CARS scores showed a significant negative correlation (Spearman rank correlation $-.86$, $p = .001$); this was not significant for the group with autism (Spearman rank correlation $-.02$, ns; Wimpory et al., 2000). Within each group, there was a relatively small range of DAISI total scores. The significant negative correlation in the case of control (nonautistic developmentally delayed) individuals is of note because here the individuals who were reported to show a number of social deficits on the DAISI (and thus achieved lower scores) were also those who were given relatively high scores for abnormality on the CARS.

Stone et al. (2007) concurrently employed the 15 key DAISI items that the retrospective study by Wimpory et al. had found significant (2000). Stone et al. (2007) reported significant group differences between infant siblings of 64 autistic spectrum disordered and 42 typically developing (TD) children (MD, 1.32; 95% Cl, 0.27–2.37). Autistic siblings' mean scores were 12.8 (SD 3.2, range 0–15), while TD siblings' mean scores were 14.4 (SD 1.2, range 10–15). Stone et al. (2007) also found that DAISI total scores correlated significantly with:

1. CARS total scores (0.74, $p < .01$)
2. Mullen Scales of Early Learning subscores (The Early Learning Composite; Visual Reception, Expressive and Receptive Language; 0.46; 0.28; 0.41; 0.39, respectively, all at $p < .01$)
3. Screening Tool for Autism in 2-Year-Olds total scores (STAT; -0.37, $p < .01$).

This last finding supports face validity for the DAISI as a parental report measure for broadly similar child social-communication constructs that are directly assessed by the STAT.

Clinical Uses

The DAISI interview was designed for both clinical as well as research purposes. It has been employed for multi-agency clinical/educational

diagnostic purposes in some services in England and Wales for over two decades. The expanded clinical form includes items assessing the triad of autistic impairments during both early and current functioning, while the published form focuses exclusively on aspects of sociability and communication in infancy. Parental responses are recorded verbatim, and each item that corresponds to a specific domain of behavior is scored as present or absent as indicated above, the interview relies on the relationship between the interviewer and the parent so that accurate and honest answers are more likely to be provided. DAISI's clinical advantage over standardized diagnostic interviews is that it can be administered much more quickly and affords a more conversational experience, so assisting the clinician in gaining a good rapport with clients within routine diagnostic assessments.

The DAISI Schedule

The following section identifies the specific domains of functioning assessed using the DAISI. Each domain contains a key question (italicized in bold below) and may also have associated questions. These are designed to elicit a comprehensive description of behavior relevant for the domain under consideration. The key questions, identified by corresponding item numbers, are those used to determine DAISI scores, as outlined below. These key questions may be substituted by and/or preceded and/or followed by associated questions. This arrangement is designed to allow the interviewer to assist parents both to gain confidence in answering the key questions and to clarify their answers to those questions. Responses to each key question (either direct or indirect via associated questions) determine the score for its corresponding numbered DAISI item. Examples and criteria for positive and/or negative replies are shown in regular italicized print in the section below.

Questions are arranged below in the order most compatible with the flow of a natural conversation. In this way, responses to more than one domain may be recorded from one segment of conversation. For example, greeting and reaching up to be lifted up from a cot are juxtaposed although these are later analyzed separately as aspects of sociability and gestural communication.

Eye Contact (Item 1)

Did he/she look at you more or less readily as a baby (< 2 years) than he/she does nowadays?

Did his/her readiness to give eye contact change at any stage (< 2 years)?

Key Question for Item 1: Did he/she have difficulties in the frequency and/or intensity of eye contact? *(This item and item 2 below are subject to a special scoring procedure: They are scored as negative when direct observation of the child reveals poor eye contact at the time of diagnosis and where parents report both that their child's readiness to give eye contact has not changed since infancy, and that they do not see eye contact as a problem for their child.)*

Soothability from Crying (Items 4 and 5)

How would you stop him/her crying as a baby?

Key Question for Item 4: Could you stop him/her crying by picking him/her up? *(Positive responses include those where this strategy worked for at least a few months of infancy.)*

Key Question for Item 5: Could you stop him/her crying by just talking to him/her? *(Positive replies include communicative use of "baby talk,"* i.e.*, employing singing, vocalizations, and facial expressions but no physical contact or movement. Negative responses include those for infants described as never interested in social interaction.)*

Greeting, Requesting to Be Picked Up, and Waving (Items 3, 15, and 14, respectively)

What would he/she do when you went to his/her cot after he/she had woken (naturally) from a sleep? Where would he/she be looking?

What would her/his face be like?

Key Question for Item 3: Would he/she greet you? *(Positive responses include manifest pleasure or excitement and/or appropriate facial expression while looking toward parents. Negative responses include a failure to look pleased on most occasions where there was potential for greeting.)*

What would he/she do if he/she wanted to come out of the cot or be lifted from the floor?

Would he/she touch you or the cot while reaching up as if to climb up/out physically?

Did you need to offer your own arms for him/her to lift his/her?

Key Question for Item 15: Would he/she spontaneously lift her arms to be picked up? *(Positive responses cover spontaneous non-tactile gesturing including the support of vocalization, eye contact*, etc.*)*

Would he/she appear to notice if someone he/she knew well was leaving?

What would he/she do?

Would he/she wave if they (or you) waved?

Would he/she need you to tell him/her to wave or to lift his/her hand for her?

Would he/she wave spontaneously?

How did he/she do it? (i.e., to distinguish from arm flapping)

Where would he/she be looking?

Key Question for Item 14: Would he/she spontaneously and appropriately wave goodbye? *(Positive responses cover spontaneous waving with apparently appropriate communicative intent, as indicated by context, looking toward the other's face*, etc. *Negative responses include only brief acquisition of waving and/or waving an arm for social or motoric stimulation without apparent understanding of its gestural significance.)*

Lap Games (Items 7 and 8)

What did he/she tend to do during lap games?

Key Question for Item 7: Did he/she enjoy lap games?, e.g., "Round and round the garden," "Peek a boo." *(Negative responses included a lack of interest in lap games.)*

Would he/she watch you doing the actions?

Would he/she try to join in?

How did he/she show his/her enjoyment?

Key Question for Item 8: Did he/she actively participate? *(Positive replies require use of body actions*, e.g.*, imitative clapping.)*

Social Engagement During Play With and Without Toys (Items 9 and 6, respectively)

Would he/she be happy for you to play with him/her?

How would he/she react if he/she was already occupied with toys?

Key Question for Item 9: Would he/she be happy for you to join in his/her play with toys or would he/she regard that as an intrusion and prefer to play alone? *(Positive responses include descriptions of infants apparently happy for parents to play alongside them without parents feeling excluded.)*

Would you need toys in order to play with him/her?

Key Question for Item 6: Could you amuse him/her without toys (if say, you were together on a bus or in a doctor's waiting room where no toys were available)? *(Positive replies may include chatting and/or singing, play with body parts*, etc.)

Showing, Offering and Giving, Referential Eye Contact, Pointing, and Following Points (Items 11, 10, 2, 12, and 13, respectively)

Did he/she sometimes want to draw your attention to his/her toys?

(Or did he/she seem too interested in them to share them with anyone else?)

Key Question for Item 11: Would he/she show you things? *(Positive replies include either holding an object up to another's field of view or pointing to it and simultaneously looking at the other person. Such referential eye contact also scores positively on item 2, below. Communicative pointing also scores positively on item 12, below.)* (Depending on responses to previous questions. . .)

What would he/she do if he/she wanted you to share his/her experience of a toy?

Would he/she hold it up for you to see? Where would he/she be looking?

Key question for Item 10: Would he/she offer and give objects? *(Positive replies include pausing and looking to the recipient's face before giving.)*

Would he/she give a toy (or other item) to you?

Was this in response to a request or would it be spontaneous?

Have you known babies who like to give something (e.g., a biscuit) to other people . . . babies who give it very carefully, often breathing heavily as they do so, and then they want it back as soon as they have given it?

Did he/she like to play giving and taking games like that or did he/she tend to "post" or place objects on you instead?

Where would he/she be looking before and during the act of giving?

Key Question for Item 2: Would he/she look both to where he/she was pointing and to you? (Referential eye contact)

What would he/she do if he/she wanted something (e.g., a biscuit) out of reach?

(If reaching) How would he/she position his/her fingers?

Where would he/she be looking?

Key Question for Item 12: Would he/she use pointing communicatively? *(Positive replies include eye- or finger-pointing to request and show items of interest accompanied by eye contact. Negative responses include extension of index finger with no apparent communicative intent.)*

What would he/she do if she saw something of interest like a plane, or an animal across the street?

(If reaching) How would he/she position his/her fingers?

Where would he/she be looking?

Did he/she take notice if you pointed at something or did he/she tend to be preoccupied with his/her own interests?

What would he/she do if you pointed (at near and far objects, e.g., an animal across the street, the correct hole for a puzzle piece, etc.)?

Key Question for Item 13: Could she follow your pointing gestures?

Where would he/she look . . . toward your finger or to where you were pointing?

Expressing Directed Anger and Distress (Item 18)

Did he/she have tantrums?

Where would he/she be looking during these?

What would he/she do if he/she was hurt?

Would he/she let you know how he/she was hurt?

Where would he/she be looking?

Key Question for Item 18: Would he/she appear to direct anger and/or distress with apparent communicative intent? *(Negative responses include toddlers who would avoid looking toward other faces during expressions of anger and/or distress. Positive responses include toddlers who directed anger toward parents when feeling physical pain unrelated to parental behavior.)*

Teasing (Item 16)

Did he/she understand "No" even if he/she chose to ignore it?

Have you noticed some toddlers will still do what they have been told not to do (e.g., touch an electric switch) and will be smiling and looking to their parents at the same time as if they are doing it again *because* they have been told not to do it?

Was he/she a toddler who was interested in doing that?

Can you give examples? Where would he/she be looking?

What would his/her face be like as he/she did it?

Key Question for Item 16: Would he/she tease you? *(Negative responses include enjoyment of playful reprimands, such as being chased, rather than manifesting playful provocation/teasing per se.)*

Can you think of other ways in which he/she would tease you?

Preverbal Turn-Taking and Use of Vocalizations (Items 19 and 17, respectively)

Did he/she make baby noises?

(Positive responses enable progression to the following questions.)

Did he/she make these just for him/herself or did he/she seem to be making them for you to listen to him/her?

How did he/she show that they were for you?

Where would he/she be looking?

Key Question for Item 19: Were his/her baby noises communicative? *(Negative responses include an absence of babbling or parental inability to recall communicative use of babbling despite parental expectation that this occurs.)*

Have you noticed how some babies like you to join in with their babbled noises, so that there is a turn-taking pattern between you and them – as if the two of you are speaking another language? *(Positive answers are required before proceeding.)*

Was he/she the kind of baby who did that?

Were you able to have babbling conversations with him/her?

Did he/she use his/her early words for him/herself or for giving messages to you?

Where would he/she be looking when using them?

Key Question for Item 17: Did he/she take turns before he/she could talk, e.g., with babbled noises? *(Positive responses include turn-taking flows established by (a) infants repeating a babbled noise as if with communicative intent apparently in response to an adult's imitations of those noises and (b) active silent participation in a flow of interaction using appropriate facial expressions and communicative body actions during a period of mutism.)*

See Also

- ADI-R
- CARS
- STAT

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Detriment in Skill

- Disability

Developmental Apraxia

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Synonyms

Childhood apraxia of speech (CAS)

Short Description or Definition

A motor speech disorder characterized by difficulty acquiring speech, inconsistent sound errors, and groping behaviors during speech in the absence of weakness or paralysis. Symptoms are similar to verbal apraxia in adults; however, the underlying motor impairment significantly impacts phonological development (Maassen, 2002). Hallmark characteristics consistent with

childhood apraxia of speech include vowel errors or distortions, highly inconsistent speech errors, and inappropriate prosody.

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Developmental Apraxia of Speech (DAS)

► Verbal Apraxia

Developmental Change

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Definition

Developmental change is the process of change that occurs in human beings throughout development.

Gene expression, brain function, cognitive processes, behavior, and environmental factors all involve multiple cross-level interactions, and all are characterized by dynamic developmental change over time. The study of any neurodevelopmental disorder, be it autism spectrum disorders (ASDs) or those of known genetic origin like Down syndrome (DS), Williams syndrome (WS), fragile X syndrome (FXS), or velocardiofacial syndrome (VCFS), must focus on full developmental trajectories from infancy to adulthood, examining how domains interact differently over time.

Developmental Change at the Genetic Level

Many studies map specific genes to specific behaviors, but rare are those which take account of changing gene expression over time. Yet, if a gene is expressed widely initially and becomes increasingly confined to certain brain regions, or if a gene is expressed much more during learning but less during subsequent behavior, then the mapping from gene to behavior will change.

Developmental Change at the Neural Level

The brain is not static; it changes significantly after birth in terms of structure and function. Functionally, one often witnesses the child brain initially processing inputs bilaterally. With development, however, neural networks become increasingly specialized and localized such that, for example, face processing starts out bilaterally and becomes predominantly right lateralized, over developmental time, in a network including the fusiform gyrus. Likewise, the processing of certain aspects of language, for example, the use of, say, articles, starts out bilaterally but becomes increasingly left lateralized. By contrast, in some neurodevelopmental disorders, this progressive fine-tuning of specialization and localization

of function fails to occur, and processing continues to be bilateral, even when the relevant overt behavior is quite proficient.

Developmental Change at the Cognitive Level

In the study of neurodevelopmental disorders, it is critical to differentiate between identical overt behavioral scores and the underlying cognitive processes that sustain them. For example, face processing may be proficient in a disorder, with scores "in the normal range," but the underlying cognitive processes rely on featural analyses, whereas in the typically developing child, processing has moved from featural to configural processing over developmental time.

Developmental Change at the Environmental Level

The environment is not static either. In all neurodevelopmental disorders, parents respond to the subtle differences in their atypical offspring, and thus, the dynamics of parent-child interaction change over time. For example, when learning language, the parents of typically developing children tend to let their children temporarily make overgeneralizations (e.g., "dog" for all animals), whereas parents of atypically developing children tend to correct immediately in the fear, perhaps, that they otherwise may never learn the correct term. However, overgeneralization often helps the development of categories (e.g., "animal"), and subtle differences in the ways in which the environment responds to the atypical child may give rise to the learning of individual exemplars rather than categories.

In conclusion, developmental changes must be taken into account at every level of analysis.

See Also

► Developmental Delay
► Developmental Milestones

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Developmental Continuum (Principles of TEACCH)

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Synonyms

Individual differences in development

Definition

Childhood development is a dynamic process characterized by milestones and challenges that occur at particular ages. The interaction of typical developmental issues with the autism spectrum is complicated. A child with an autism spectrum disorder (ASD) may achieve milestones earlier or later than typical peers, at an atypical rate, and in an atypical order. The child may present a scattered skill profile, which can be confusing to educators and others working with the child, who may have elevated expectations for his overall behavior and skill level based on performance in a domain of strength. Similarly, the challenges that a child with ASD faces may mirror those of his typical peers (e.g.,

entering school, coping with bullying, developing self-image, managing life changes) but may be exaggerated or occur at a different point in development. Awareness of the skill level and current needs of an individual with ASD facilitates the development of specific goals.

Like individuals, families are dynamic and follow a general developmental pathway. This is true of families with typical children as well as those with ASD though, as with individual development, the challenges experienced by the latter are likely to be exacerbated and the changes less linear. The particular needs of a family with a child with ASD tend to correspond to the age of the child. When the child is an infant/toddler, families are recognizing developmental differences and dealing with the impact of these on the family. Early childhood tends to be a time for diagnosis of ASD and dealing with grief. In the middle childhood years, families focus on school concerns, adaptive skills, and issues related to puberty. In adolescence and adulthood, common themes center on collegiate, vocational, and/or residential preparation as well as self-advocacy and interpersonal supports. This pattern of development is not universal, however. Just as professionals must fully assess an individual to ascertain skill level before implementing intervention, they must understand the current family interactions, challenges, needs, and foci so as to have a greater impact on that family.

The developmental continuum is the basis for one of the main principles of TEACCH, which is that of family involvement in service delivery. In working with clients, TEACCH understands that the specific needs of the individual with ASD can be best met by recognizing the family's needs and by working simultaneously with the parents to address them. TEACCH views parents and caregivers as the experts, advocates, and teachers for their children and sees the professional's role as one of facilitator in helping the individual with ASD to maximize their level of independence and in helping family members gain additional tools to be as effective as possible in their roles. The developmental continuum of individuals and of families must be the focus of assessment and intervention in order to most effectively serve in this capacity.

See Also

- ▶ Clinical Assessment
- ▶ Informal Assessment
- ▶ Treatment and Education of Autistic and Related Communication-Handicapped Children

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Developmental Coordination Disorder

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Synonyms

Cerebral palsy; Dyspraxia

Short Description or Definition

Children who present marked difficulties with motor movements have been known since ancient times. Terms like "cerebral palsy" have been used

in the past particularly to refer to situations where these problems appear to relate to some specific process, e.g., birth trauma. Although a medical etiology is sometimes seen, this is less likely in cases that are less severe. The term "developmental coordination disorder" is currently used.

Categorization

In DSM-IV, this condition is defined based on the presence of motor difficulties greater than expected (given age or developmental level) and not due some other condition like autism. Motor difficulties are sometimes seen with other developmental problems, e.g., language or learning disorders. Interestingly some work has been done on the constellation of social-emotional difficulties, motor, and attentional problems (the DAMP syndrome, see Ehlers et al., 1997).

Epidemiology

The condition may be seen in up to 6% of children of school age. Boys are more frequently diagnosed than girls (although various factors may make it less likely that subtle difficulties in girls lead to lower rates of referral).

Natural History, Prognostic Factors, and Outcomes

Various factors determine outcome. Often the ultimate outcome is best when motor difficulties are mild and isolated (i.e., not associated with other developmental problems). Sometimes motor delays can lead to other problems such as social isolation and, in turn, to anxiety and mood problems.

Clinical Expression and Pathophysiology

Motor skill difficulties can arise because of a host of factors. These range from problems during pregnancy in the mother, birth trauma, perinatal difficulties (e.g., hypoxia or severe prematurity). Speech-language issues can be noted reflecting, in some cases, oral motor difficulties. Often a combination of some degree of developmental immaturity and a more specific motor vulnerability is involved.

Evaluation and Differential Diagnosis

Neurological and specialized occupational and physical therapy evaluations are indicated if motor difficulties are severe and/or significant. The presence of unusual movements, problems with hyper- or hypotonia, and of specific neurological symptoms can also prompt referral. Various tests of gross and fine motor skills as well as visual motor integration and of dexterity can be administered. These help to document areas of difficulty and establish baselines for intervention. In some cases, use of auxiliary aids/devices may be helpful, e.g., in children with Asperger's disorder who have problems with cursive handwriting, use of a laptop to teach keyboarding skills can be indicated.

Treatment

Rehabilitative approaches are helpful. Both occupational and physical therapy approaches can be used to address fine and gross motor problems. Within schools, adaptive physical education can also be helpful.

See Also

- ▶ DAMP Syndrome
- ▶ Language Disorder
- ▶ Occupational Therapy (OT)
- ▶ Physical Therapy

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Developmental Delay

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Definition

Developmental delay is a significant lag in reaching the typical childhood milestones in the areas of language; cognition; social, emotional, adaptive functioning; and motor development. Each milestone is reached within a certain number of months based on research of typically developing children. When a child does not reach one or more of the milestones during the expected time frame, then he or she may be suspected of having a developmental delay.

In the context of public education, the IDEA definition of developmental delay is only inclusive of children aged three to nine and lists physical development, cognitive development, communication development, social or emotional development, and adaptive development as the areas to assess for a suspected disability. Children with autism often display delays in several of these areas, which may be the first warning signs that lead to further assessment and evaluation. Assessing developmental delays should be a component of diagnosing autism as the key deficits that characterize the disorder are directly linked to skills typically learned during natural developmental cycles. Skills that may be deficient in early development for individuals with autism include areas such as basic purposeful communication, initiating social interactions, and imitating functional use of objects or toys. Developmental delays may result in gaps in skill acquisition and/or performance and create widely varying strengths and weaknesses in some children.

Evaluations used to assess developmental delays vary among practitioners and typically include a measure of adaptive functioning with assessments such as the Vineland Adaptive Behavior Scales. This rating scale can be used to document delays in social and communicative development in individuals with autism. In addition, there are a number of motor assessments available, tests to measure cognitive levels, and specific communication assessments.

See Also

► Developmental Milestones
► Intellectual Disability

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Developmental Disabilities

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Synonyms

Academic disability; Specific learning disability

Definition

Learning disability is not used here to refer to overall intellectual handicap (i.e., "mental retardation").

- Developmental disability refers to unexpected delay or deficiency apparently healthy young children experience in the acquisition of a learned cognitive/intellectual skill (as opposed to a sensory-motor skill) despite overall intellectual competence, attention and motivation, lack of auditory or visual handicap, and sufficient exposure to appropriate models and educational opportunity in an adequately supportive and nurturing environment.
- Developmental disabilities are extremely prevalent; they are dimensionally defined with fuzzy borders even though they denote atypical development of particular brain circuitries.
- They are both genetically and environmentally influenced.

Major Types

1. *Developmental language disorder (specific language impairment (SLI), dysphasia)* – in affected infants, the disorder presents as variably delayed/impoverished expressive language. There are three main clinical types, each with subtypes:
   a. *Expressive type*: impaired speech production and articulation (phonology) with adequate comprehension. Prognosis generally fairly good, except in the most severe subtype – verbal dyspraxia (not to be confused with oromotor disability, a deficit in motor control of the speech musculature).
   b. *Mixed receptive/expressive type*: comprehension equal to or somewhat better than expression. Phonology, grammar, and vocabulary affected. Prognosis variable, often the harbinger of dyslexia, and poor when phonologic decoding is severely defective.
   c. *Mainly receptive type*: impaired comprehension of discourse. Often overlooked when speech articulation, grammar, and vocabulary are spared. Particularly frequent but not exclusively so in verbal children on the autism spectrum.

   Note: *Language disorders in children on the autism spectrum (ASD)* – Pragmatics, i.e., the communicative/conversational use of language, universally, characteristically, and permanently impaired. The prevalence of types of language disorders in ASD children differs from that of dysphasic children: some have mixed expressive/receptive disorders; very few have expressive disorders with adequate comprehension; most verbal children have receptive disorders with telltale echolalia, use of scripts, incessant questioning, perseveration on self-selected topics, answering questions off topic, and aberrant prosody.
2. *Reading disability (dyslexia)* – difficulty learning the alphabetical code of written language at school age. Dyslexia is often the residual of a developmental language disorder with difficulty making fine auditory discriminations between speech sounds. Most dyslexic

individuals eventually learn to read more or less efficiently, but retain difficulty reading pronounceable non-words and, often, poor spelling (*dysorthographia*). Less frequent causes include visual discrimination difficulties or sequencing problems implicating deficient working memory.

3. *Mathematical disability (dyscalculia)* – difficulty with mental or written arithmetic, geometry, word problems, or other mathematical operations. Identification of its cause requires detailed neuropsychologic investigation. Attention deficit disorder contributes to dyscalculia and complex arithmetical operations. Visuospatial problems impair not only geometry but also written arithmetic.
4. *Dysgraphia* – poor handwriting, associated or not with *dysorthographia*. Either due to an overt or subtle motor deficit or difficulty in learning complex motor skills (*dyspraxia*). A large sloppy handwriting (dyspraxia) with excellent spelling (superior rote memory) often characterizes ASD.
5. *Others* – tone deafness, grossly deficient ability to draw or classify can be considered learning disabilities when they interfere with children's acquisition of required skills.

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Developmental Disabilities – Children's Global Assessment Scale (DD-CGAS)

▶ Children's Global Assessment Scale

Developmental Disability (Ontario)

▶ Mental Retardation

Developmental Dyscalculia

▶ Dyscalculia

Developmental Dysphasia

▶ Childhood Aphasia

Developmental Dyspraxia

▶ Verbal Apraxia

Developmental Intervention Model

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Definition

The developmental approach to intervention draws upon the knowledge of typical

development to design treatment objectives for children with autism. Child development research informs the developmental processes that determine goals, measure change, and select treatment practices. The main pillars of this approach include the selection of developmentally appropriate targets, individualized instruction by focusing on child preferences and interests, and the incorporation of family needs, values, and preferences into intervention objectives. A number of developmental models exist in the early intervention of children with autism including the DIR/Floortime (Greenspan & Weider, 1999), RDI (Gutstein & Sheely, 2002), Hanen Centre programs (Coulter & Gallagher, 2001), JASPER (Kasari, Freeman, & Paparella, 2006), and SCERTS (Prizant, Wetherby, Rubin, Laurent, & Rydell, 2006) models, to name a few. Contemporary behavioral approaches to early intervention for children with autism also emphasize developmental objectives (e.g., PRT, Koegel & Koegel, 2006; Incidental teaching, McGee, Moyer, & Daly, 1999; the Denver Model, Rogers et al., 2000; and Early Start Denver Model (ESDM), Rogers & Dawson, 2010).

Historical Background

This treatment approach has its origins in work with typical children. Teaching during naturalistic and play-based activities has a long history in the typical early childhood literature to ensure motivation and cooperation with instruction.

In recent years, these principles have also been applied to children with developmental disorders, such as autism spectrum disorders. Most developmental interventions for children with autism focus on the core deficit of social communication and include specific emphasis on joint attention, social engagement, and early expressive language (e.g., SCERTS, RDI, JASPER, Hanen). Several comprehensive treatment approaches have also adopted a developmental framework (e.g., Denver model, ESDM, PRT).

Rationale or Underlying Theory

The underlining theory behind developmental treatment approaches is that each child is an individual with corresponding strengths and weaknesses. Not every child has the same profile of development, especially children with a heterogenous disorder such as an autism spectrum disorder. The developmental approach to intervention strives to tailor curriculum to the needs of each child and provide opportunities for learning skills that are appropriate to the child's current level of functioning. A developmental framework for early social-communication intervention pulls from the extensive literature on facilitative teaching. This teaching approach is child-centered and child-directed and involves such strategies as following the child's motivations and interests, offering choices within activities, responding to child initiations, and expanding on a child's verbal and nonverbal communicative bids (Prizant et al., 2006). Unlike typical behavioral approaches that are adult-directed and stick to a strict hierarchy of program objectives, developmental models strive to follow the child's interests in a naturalistic learning environment. The hope is that by embedding learning opportunities within highly motivating and natural contexts, children will be more apt to participate and the total amount of intervention or dosage each day will increase. An underlining goal of developmental approaches is to foster a deeper connection between the child and a social partner that results in meaningful teaching opportunities.

Goals and Objectives

Several common goals exist across early developmental interventions for autism. These goals include the emphasis on individualizing treatment and targeting developmentally appropriate skills and deficits consistent with ASD. Many developmental interventions emphasize the social and communication deficits in children with autism. All developmental models of early intervention place importance on children becoming effective

communicators. Expressive language is a priority as is improving social interactions and promoting engagement between children and their caregivers. Some programs, such as the Walden preschool, also place an emphasis on early interactions with peers. There is also an emphasis on the child's emotion regulation abilities and providing developmentally appropriate supports for student learning. The SCERTS model emphasizes the need to help the child regulate arousal as a foundation to early intervention. Other developmental models also believe that helping the child reach the optimal level of arousal is an early developmental skill necessary for successful learning (e.g., DIR, JASPER, ESDM). Another common theme is to provide learning opportunities within the natural social context of daily activities. This includes embedding intervention objectives within play-based activities and providing support and training for parents to generalize treatment objectives to the home environment.

Treatment Participants

The developmental approach is typically applied in the early intervention of children with autism. The Early Start Denver Model (ESDM) has been applied to infants as young as 12 months of age, and the Denver Model spans into preschool and elementary ages. Other developmental models, such as DIR, also support the development of infants, toddlers, and preschoolers. Children in the Walden preschool program typically enroll between the ages of 15–30 months and stay for about 1 year. Restrictions are not made based upon child developmental characteristics, such as cognitive, language, and adaptive functioning. With the increasing emphasis on early detection and intervention, it follows suit that these models would support the development of the youngest children affected by the disorder.

Some attempts have also been made to apply developmental models of intervention to older children and adults. The JASPER intervention is a modular treatment that is currently being tested for efficacy in a wide range of children from toddlers to older nonverbal and school-aged children. Principles of PRT are used across the lifespan. Clearly, more needs to be done to assure that children and adults across the lifespan can benefit from developmental treatment approaches.

Treatment Procedures

Developmental interventions use naturalistic teaching strategies in a variety of settings. The goal is for treatment to be embedded within natural social experiences; thus, many of the developmental intervention models are play-based. Teaching objectives are embedded within these highly motivating play activities. Research in typical development has shown that children who are engaged in highly preferred activities are more likely to initiate social interactions. Thus, it is believed that children with autism will also benefit from having more autonomy in the choice of activities and more opportunity to lead the interaction.

Developmental interventions incorporate the use of a wide range of treatment settings including clinics, schools, and the home. Many of these treatments are adapted for use across multiple settings. For example, the ESDM can be applied in center-based preschools, inclusive preschools, and the home environment, although data currently exist for home settings only. PRT has been applied and has empirical support for its use across these settings as well.

Instruction is also delivered using a variety of methods. Many developmental models will have a portion of the instruction delivered in a 1:1 teaching model with a trained therapist and the child (e.g., ESDM, PRT, JASPER, SCERTS) and also group settings (e.g., Denver Model, Walden). The Walden preschool uses a zone-based teacher deployment where a lead teacher "conducts" the classroom and several other teachers lead simultaneous centers to ensure that children have choices and teaching is continuous. The JASPER model implements a parent-mediated model where a parent and child are interacting together with a trained clinician serving as a "coach" for these social interactions.

Efficacy Information

Several developmental early intervention programs have been tested for efficacy. While all interventions require greater study with more scientifically rigorous methods, there is some promising evidence of improvement using these models. Perhaps the most studied approach is the Denver Model and ESDM by Rogers and colleagues. To date, they have numerous peer-reviewed papers on the efficacy of this intervention. The early work using this model utilized a within-subject pre-/postdesign, which as a method may not be adequate for determining effective treatments. Later work involved some quasi and true experimental designs including a randomized controlled clinical trial (RCT) of ESDM, which suggests evidence of improvement in the domains of cognition (DQ), language, and adaptive functioning (Dawson, Rogers, Smith, Munson, & Winter, 2010).

Another treatment approach that has gained scientific support is PRT. Utilizing single-subject methodology, PRT has been documented to improve social skills, disruptive behaviors, responsivity, language, and other social behaviors (e.g., Koegel & Frea, 1993; Koegel, Koegel, Hurley, & Frea, 1992; Koegel, Koegel, & Surratt, 1992).

Studies by Kasari and colleagues have shown effectiveness for JASPER, a developmental social-communication intervention for toddlers and preschoolers with autism. In several RCT trials, children randomly assigned to interventions targeting core deficits of autism including joint attention and symbolic play made significant gains in joint attention initiations and symbolic play, respectively (Kasari et al., 2006), and also both made significant gains in expressive language at a follow-up visit 1 year later compared to participants in a control condition (Kasari Paparella, Freeman, & Jahromi, 2008). Similarly, in a wait-list-control design of toddlers with autism and their caregivers using a parent-mediated approach, children improved in their joint attention, play, and joint engagement with their caregivers (Kasari et al., 2010).

Several other developmental approaches, including DIR and SCERTS, have limited research into their efficacy at this time. While SCERTS has almost 30 years of clinical practice, very little research into its efficacy has been conducted. Similarly, DIR has some interesting single-subject work showing improvement on a case-by-case basis. In a review of 200 cases, over 50% of these cases made "significant progress" evidence by gaining age-appropriate academic and social capabilities (Greenspan & Weider, 1997). In addition, a pre-/postdesign was used to evaluate 68 children who received DIR delivered by parents trained in the home (Solomon, Necheles, Ferch, & Bruckman, 2007). Results were promising in that overall children showed improvements in their social and pragmatic development and 45.5% of children made good to very good developmental gains.

Researchers at the Walden preschool used a within-subject pre-/postdesign to examine the efficacy of its program and found that 82% of toddlers with autism were verbalizing upon exiting the program, a gain from 36% at entry. In addition, 71% of children showed improvement in a measure of proximity to peers (McGee et al., 1999).

These studies and others like them illustrate the trend toward efficacious treatment in autism research. Currently, researchers are focused on identifying the active ingredients of interventions and the exploration of which treatments work the best for different populations of children with autism. There is a clear need for more research into this area to establish stricter guidelines for "best practices" in autism intervention. Although there is promising evidence for the efficacy of developmental approaches in early intervention for autism spectrum disorders, these developmental models need to be tested against other approaches of early intervention (e.g., DTT) to better answer the question of which treatments work best for the wide range of children affected with the disorder.

Outcome Measurement

Many of the early developmental interventions target social communication in our youngest children affected with autism. It follows suit that

outcome measures for these interventions would tap into domains of social and communicative functioning. The JASPER intervention has reported on outcome measures specifically tied to the treatment objectives and includes behavioral recordings of joint attention, symbolic play, expressive language, and joint engagement measured from semi-structured interactions with the child (Kasari et al., 2006, 2008, 2010). In addition, standardized measures of expressive and receptive language measured by early language assessments such as the Reynell Developmental Language Scales (Reynell, 1977) and parent report of child language collected by a questionnaire measure such as the MacArthur-Bates Communicative Development Inventory (Fenson et al., 1993) are also utilized. These outcome measures are clearly defined and directly related to the treatment objectives. The Denver and ESDM (Rogers et al., 2010) also use clearly defined and standardized measures of outcome. This comprehensive model targets a wider range of domains and is not limited to the area of social-communication. The outcomes include cognitive IQ measures (Mullen), language, imitation, social initiative, adaptive functioning (Vineland), and diagnostic severity (ADOS).

Other developmental models have less clearly defined treatment outcomes and may consist of a case-by-case compilation of clinical evaluations, progress notes, videotaped interactions, and evaluations by therapists, such as in the DIR model (Greenspan & Weider, 1997).

Qualifications of Treatment Providers

Most developmental interventions require specific training to implement. Trained clinicians carry out the models described above with checks for fidelity to instruction standards occurring at regular intervals for several programs (e.g., PRT, ESDM, JASPER). Hanen requires speech and language therapists to implement the intervention. Many treatments also involve the training of parents to generalize program goals to the home setting. Some models also conduct trainings to extend instruction to general education teachers and peers (e.g., Walden, PRT).

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Developmental Language Delay/Disorder

▶ Expressive Language Disorder

Developmental Language Disorder

▶ Expressive Dysphasia

Developmental Milestones

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Definition

Developmental milestones are a set of behaviors, skills, or abilities that are demonstrated by specified ages during infancy and early childhood in typical development. Developmental milestones are often presented in lists broken down by ages, beginning around 1–3 months of age and progressing through approximately 5 years of age. The Centers for Disease Control and Prevention (CDC) provides easily accessible information through their website (2010). Several categories of skills are often focused on including vision and hearing, social, cognitive, language, motor, and self-help. Parents, day-care providers, teachers, child psychologists, and pediatricians often note emerging concerns regarding development when infants and children fail to reach developmental milestones on time.

While some variation is to be expected among individuals, developmental milestones are used as guidelines to assist in the identification of developmental delays, including autism spectrum disorders. When an infant or child is not reaching developmental milestones or is significantly delayed in meeting them, further assessment and evaluation should be completed. Early diagnosis and early intervention for autism are important for best outcomes. Skills that may be deficient in early development for individuals with autism spectrum disorders include social behavior, joint attention, visual orientation, orienting to noise, response to name, imitation of movement or sounds, and language acquisition including both receptive and expressive language (Watson, Baranek, & DiLavore, 2003).

See Also

▶ Developmental Delay
▶ Early Diagnosis
▶ Early Intervention
▶ Expressive Language
▶ Imitation
▶ Joint Attention
▶ Milestone
▶ Receptive Language

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Developmental Reading Disorder

► Dyslexia

Developmental Right Hemisphere Syndrome

► Nonverbal Learning Disabilities (NLD)

Developmental Right-Hemisphere Syndrome

► Right-Hemisphere Syndrome

Developmental Test of Visual-Motor Integration

► Beery-Buktenica Developmental Test of Visual-Motor Integration

Developmental Verbal Apraxia (or Dyspraxia)

► Verbal Apraxia

Developmental, Individual Difference, Relationship-Based (DIR) Model

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D

Definition

The *D*evelopmental, *I*ndividual Difference, *R*elationship-Based model of intervention (DIR) provides a developmental framework for interdisciplinary assessment and intervention for autism spectrum and related disorders. It is a comprehensive foundation model that utilizes affect-based interactions and experiences tailored to individual needs to promote development. "D" refers to fundamental capacities for joint attention and regulation, engagement across a wide range of emotions, two-way communication, and complex social problem solving which underlie the development of symbol formation, language, and intelligence. Intervention starts with pleasurable interactions between children and parents that are at the heart of building the relationships that support developmental progress. "I" refers to individual differences related to sensory reactivity and regulation, visual-spatial and auditory/language processing, and purposeful movement. Challenges in these neurobiological factors make it difficult to participate in the emotional interactions that enable mastery of the developmental capacities ("D"). "R" refers to relationships with caregivers that are the vehicle for affect-based developmentally appropriate interactions. Parents and families are central to this model because of *their ongoing opportunities to support their child's* everyday functioning to carry out emotionally meaningful goals based on developmental levels. Cultural and environmental influences are also considered. By taking all three areas of DIR into account, the foundation for functioning, learning, and relating to others in meaningful ways is established.

DIR is also commonly known as Floortime, which is the central and initially most intensive component of DIR's approach. Floortime is both a philosophy and a specific technique where caregivers follow the child's natural emotional interests and create states of heightened pleasure in playful interactions tailored to the child's unique motor and sensory-processing profile to strengthen the connection between sensation, affect, and motor action. Connecting words to underlying affects that give them purpose and meaning leads to the formation of symbols, imaginative play, and reflective conversations. In addition, semi-structured problem solving and social activities; play dates, language, sensory-motor, and visual-spatial therapies and activities; educational programs; family support; and augmentative and biomedical interventions make DIR a comprehensive model. The child's evolving DIR profile determines the individualized intervention as he progresses. While DIR emphasizes early identification and early intervention, it is a foundation model that guides developmental intervention across the life span (Greenspan & Wieder, 1998, 2006, 2011; Wieder, 2011; Wieder & Greenspan, 2001).

Historical Background

The components of the DIR Model have long theoretical, clinical, and research traditions. Developmental frameworks go as far back as Freud; were expanded by Erikson, Piaget, Anna Freud, Mahler, Pine, and Bergman; and enhanced by the clinical reports of Spitz, Bowlby, Winnicott, Fraiberg, Lourie, Provence, and others who described the critical impact disrupted and impoverished environments had on early relationships and development. Meanwhile, Escalona, Murphy, Brazelton, and others were identifying biological influences in development. This coincided with the rejection of psychogenic theory which blamed parents for their children's autism implied by Kanner, Asperger, and Bettelheim in prior decades and opened the door to understanding individual differences (Greenspan, DiGangi & Wieder, 2001; Wieder, 2011).

A comprehensive model was needed to integrate theory with the emerging understanding of environmental risks, individual differences, and parent-infant interactions. The initial formulation, the developmental structuralist theory developed during a preventive intervention research study on multirisk families, described the emotional capacities that organize experience at successively higher levels and provide the structure for development (Greenspan et al., 1987; Greenspan & Lourie, 1981). As more children at risk for disorders in relating and communicating were identified, the DIR model evolved and provided the first relationship-based developmental approach to autism that emphasized how emotions and emotional interactions impact cognitive and language abilities, as well as many complex social and self-regulation skills (Greenspan & Wieder, 1998, 2006, 2011).

Interest in a developmental perspective grew as others identified autism-specific deficits and saw autism as a social-emotional-communicative disorder derailed by poor joint attention and intentional communication, recognizing the importance of interactive affective engagement (Kasari, Sigman, Yirmiya, & Mundy, 1994; Rogers & Pennington, 1991). Empirical results also pointed to the importance of natural and spontaneous interests and initiation, and these were highlighted by other behavioral models (Koegel, Koegel, Harrower, & Carter, 1999; Rogers & Dawson, 2010). Simultaneously, neuroscience research found poor connectivity and neural synchronization in different processing areas (Minshew, Goldstein, & Siegel,1997; Mostofsky et al., 2006; Williams & Minshew, 2007). These converging streams of knowledge all relate to elements of the DIR model.

Rationale or Underlying Theory

Autism's deficits relate to the inability to interact with emotional signals, gestures and vocalizations, and difficulty in maintaining these interactions with others. DIR hypothesizes these deficits that stem from a compromised capacity to connect emotions or intent to motor planning/sequencing

and to sensations and later to early forms of symbolic expression of intent or emotions (Greenspan & Shanker, 2004; Greenspan & Wieder 1998, 2006). Usually, an infant connects the sensory system to the motor system through affect, e.g., seeing the caregiver's smiling face or hearing her wooing voice entices the infant to turn and look and listen and smile back. Through many of these interactions, the infant begins to recognize patterns as they share attention, take pleasure in interactions, read each others' cues, and respond to each other over and over again through gaze, vocalizations, and gestures. By the end of the first year, the infant recognizes variations in his caregiver's affect as well as his own feelings related to love, anger, feeling proud, disapproved of, etc. By the second year of life, these patterns lead to a sense of self as purposeful and a differentiated sense of others. By the third year of life, these affect-based interactions enable a child to form and give meaning to symbols leading to higher levels of thinking.

When sensory-motor processing and challenges in language comprehension and visual-spatial knowledge derail this process, affect must be brought into intervention as early as possible strengthening the connection between sensation, affect, and motor action, i.e., simultaneously looking, listening, and moving while engaging in meaningful problem-solving interactions through heightened states of pleasure and other affects. Longer chains of co-regulated affective gesturing will enable the child to recognize the variations in the caregiver's gestures, facial expressions, and tone of voice and become aware of his anxiety and repetitive behavior. The relationship becomes the vehicle for affect transformations that allow the child to negotiate each of the above functional emotional developmental levels. It is affect that transforms labels into meanings leading to symbolic thinking and more complex and abstract reasoning (Greenspan & Shanker, 2004; Greenspan & Wieder, 1998; Wieder & Greenspan, 2003).

DIR theory identifies six fundamental capacities or levels that *emerge* in infancy and *expand* in duration, range, and stability as the child develops. These foundational capacities are necessary for functioning across the life span:

1. *Regulation and Joint Attention (Between Infant and Caregiver)*. From birth to 3 months, an infant's capacity grows for calm, focused interest in the sights and sounds of the outer world while she begins to share her interests with the caregiver.
2. *Forming Attachments and Engaging in Relationships*. During the next first 4 months, infant and parents become more intimate as they interact with warmth, trust, and intimacy. They each use their senses to enjoy each other through looks, hugs, songs, and dancing together. Over time, the infant will need to remain related and engaged across the full range of emotions, even when disappointed, scared, angry, or experiencing other stress.
3. *Intentional Two-Way Affective Communication*. Between 4 and 10 months, purposeful, continuous flow of interactions with gestures and reciprocating emotions gets underway. The infant begins to act purposefully, now that she has matured and is more aware of her body and the functions it can perform. As the infant gains motor control over her body and intent, she is better able to communicate her desires. With emerging abilities to reach;, sit and turn;, crawl and creep;, and give and take or drop objects, the infant's awareness of the interpersonal world is growing, as is her awareness of her body in space and in relation to others who may also be moving.
4. *Complex Social Problem Solving*. Between 9 and 18 months, an infant has learned the back and forth rhythm of interactive emotional signaling and begins to use this ability to think about and solve problems that are emotionally meaningful to get what he wants, such as pulling mommy to the door to go outside and play. All of the child's senses work with his motor system as he interacts with others to solve problems. Difficulties arise when he becomes aware that things are not as they should be based on his memory of prior experiences and encounters new difficulties to solve as his experience expands.
5. *Emotional Ideas*. Between 18 and 36 months, the toddler begins to represent or symbolize intentions, feelings, and ideas in imaginative

play and/or language, using gestures, words, and symbols. The toddler now calls on a toy phone, sets up a picnic or tea party, takes the sick baby to the doctor, or repairs his car before driving somewhere. These first ideas come from experiences in real life that can now be enacted in pretend dramas as the child experiments with different roles and feelings.

6. *Emotional Thinking, Logic, and Sense of Reality*. At about three, the child begins to combine ideas to tell a story as he develops more logic and understanding of himself and others, and of what is real or not real. His stories use imaginative characters and animal figures that talk and may have magic as he discovers he needs more power to encounter the fears and conflicts in life, but reasoning skills click in to elaborate sequences, and stories become increasingly logical and realistic. Over the next few years, the child's emotional and mental abilities move toward abstract thinking, and he develops the ability to distinguish reality from fantasy, self from nonself, and one feeling from another, and make distinctions concerning time and space.

Level six later expands to:

7. *Multicausal and Comparative Thinking*. At this level, the child "deepens the plot" as he can explore multiple motives, get opinions, and compare and contrast ideas. The child can express how she would feel "in your shoes" and predicts what you will do based on your "affect cues" such as deception, fairness, and justice.
8. *Relativistic or Gray-Area Thinking*. Here, the child differentiates more of his thoughts, rather than thinking only in "black and white" terms. The lion may pay a price for killing the zebra or the bear devouring all the honey will disappoint his friend. The child now considers different possibilities and contingencies and is aware of different outcomes and of how he would feel under different circumstances.
9. *Self-Reflection or Thinking Using an Internal Standard*. Now, the child has a sense of herself; she can look at and reflect on her performance and feelings. She can question why she is feeling a certain way and contrast this with how she usually feels or she can compare her current efforts with earlier ones. This kind of thinking allows her to make inferences about herself and others and create new choices and ideas.

Various researchers have confirmed challenges related to these developmental capacities, including difficulties with shared attention, social referencing, and problem solving (Mundy, Sigman, & Kasari, 1990); emotional reciprocity (Dawson & Galpert, 1990); and functional (pragmatic) language (Wetherby, Prizant, & Hutchinson, 1998); empathy (Baron-Cohen, Leslie, & Frith, 1985); and higher-level abstract thinking (Minshew et al., 1997).

Goals and Objectives

The goal of the DIR model is to enable children on the autism spectrum to form a sense of themselves as intentional, interactive individuals, who can develop cognitive, language, and social capacities. This calls for the mastery of six functional developmental levels and comprehensive interventions that treat problems related to gaps in these foundational capacities.

Specific objectives:

- To identify the degree to which each developmental level is mastered fully, partially, or unmastered and how stable or consistent. The critical principle is to engage the child at his or her level and to help the child master that level and subsequent levels. When a child has partial mastery of a higher level, e.g., using ideas, but is not fully engaged or interactive, he still needs work at the earlier levels.
- To identify and treat the bioneurological regulatory, sensory, and motor-processing challenges that effect developmental levels.
- To identify gaps in daily adaptation and expected competencies.
- To identify family's needs for counseling, family functioning, and advocacy.
- To organize comprehensive individualized programs that apply principles of affect-based interactions throughout all interventions.

- To use developmentally appropriate practices which support child initiation, intent, communication, and discovery.
- To keep intervention dynamic and flexible, modifying as needed to support rate of progress.

Treatment Participants

This model provides a road map for the treatment of autism spectrum disorders as well as other developmental, learning, and emotional challenges and diagnoses across the life span. This widespread applicability is possible because it is based on a theory that focuses on capacities fundamental to the development of all children. It is also a comprehensive model with a range of interventions that can be tailored to specific underlying sensory processing, motor, and learning challenges, as well as family and cultural factors. Since autism is so heterogeneous, DIR can guide each family to identify the most appropriate program for the child and family based on their individual profiles and helps set priorities. This theory of development is especially useful for early identification in infancy when capacities for regulation and joint attention, engagement, and communicative intent begin and red flags become evident. The intervention begins as soon as challenges are evident or at risk for occurring during infancy, toddlerhood, and preschool years. The model is also brought in at older ages (children, adolescents, and adults) when gaps in development are identified, rate of progress is less than expected, and core developmental capacities need strengthening in order to benefit from the various other interventions that are in order.

Treatment Procedures

Implementation of an appropriate assessment of all the relevant functional areas requires a number of sessions with the child and family. A senior DIR clinician and/or multidisciplinary team determines which developmental levels have been mastered fully, partially, or not at all and how individual differences in sensory modulation, processing, and motor planning effect each level and underlie particular symptoms, behaviors, and learning challenges. These sessions begin with discussions and observations that include two or more 45-min clinical observations of child-caregiver and/or clinician-child interactions; developmental history and review of current functioning; review of family and caregiver functioning; review of standard diagnostic assessments, current programs, and patterns of interaction; consultation with speech pathologists,; occupational, physical, and arts therapists,; educators,; developmental pediatricians; and optometrists and mental health colleagues, including the use of structured tests (neuropsychological, educational, speech and language, OT, PT, etc.) as needed, rather than routine bases; and biomedical evaluation. These lead to recommendations for an individualized program.

DIR is unique in its comprehensiveness, its developmental focus, the role of the family, its emphasis on emotional and symbolic development, and its long-term developmental perspective. As a dynamic model, it is flexible and changes as the child progresses moving onto typical activities. There is no attempt to fit the child into a program, and the specific interventions and frequency depend on individual needs; for example, some children receive speech or occupational therapy weekly, twice weekly, or not at all. While these therapies are common to other treatments, DIR provides the unifying goals and principles for an integrated approach. The sessions may be individual and/or group based, in schools or therapy offices, and parents participate (Greenspan & Wieder, 2000, 1998, 2006).

DIR interventions include the following:

Floortime, the center of DIR intervention, starts with 6–8 daily spontaneous unstructured "play" sessions of 20–30 min provided by parents and other caregivers, including teachers, therapists, and Floortime players. Key elements are as follows: Observe child's interests, wait for his initiation and response, follow his intentions, and engage in what gives him pleasure using

affect cues to sustain joint attention; expand back and forth interactions by helping child do what he intends, becoming playfully obstructive, and increasing problem solving in gestures or words to get the child to further elaborate his intent and reciprocity. The parent does not change topics or direct but works within the child's interests to deepen engagement and expand ideas at pre-symbolic and symbolic levels where imaginative play focuses on emotions and abstract thinking. These Floortime principles also inform all education and therapies so that children are maximally interested and engaged in learning interactions.

- Semi-structured Problem-Solving Interventions. The child with autism may not benefit just from exposure to experiences and needs mediation and systematic implementation. Natural learning from the environment gets derailed by constricted interests, repetitive behaviors, poor imitation, poor auditory and visual-spatial comprehension, and motor planning difficulties (praxis), as well as hypersensitivity or underreactivity. Opportunities are created daily to get the child to tune into his environment and think when his expectations are challenged, and the change poses a problem for him. These situations are always meaningful and relevant to his emotions such as desires for more or less of something; concern something he is missing or broken, or not finding what he wants in usual places; feeling challenged when needing to open containers, or unwrap books or toys; having to pack his backpack, serve as a messenger, follow multiple directions, getting ready independently for routines, etc. Reasoning is inserted to comprehend the problem and helps the child feels that the new expectations are not arbitrary, with co-regulated interactions to deal with frustration or disappointment, as well as excitement and success. The challenge increases as the child progresses and involves more elaborate sequences of actions and thoughts with the larger goal of helping child develop competencies off of real-life experiences.
- Social Games and Activities. When meaningful and fun, the child chooses or is enticed into typical enjoyable social activities which he may first practice with an adult partner or join peer models. These games may range from ritualized songs and movement such as ring-around-the-rosy to less predictable sequence actions such as red light-green light, red rover, relay races, treasure hunts, or tag. Secondary goals are to help the child learn to negotiate, make deals as to what to do first or second, play structured turn taking games and understand chance games, and resolve conflicts.
- Play dates and social activities with peers to form friendships and spontaneous interactions, sharing ideas, and negotiations. Number per week depends on age of the child.
- Sensory Motor/Visual-Spatial Activities. Four to six 20–30-min daily sessions a day. Many, if not all, children with autism have motor planning, coordination, or executive function challenges and rely on memory to stay oriented in space. Many have reduced muscle tone and movement/discriminative movement difficulties. Ocular motor and other visual-spatial processing challenges contribute to attention and learning difficulties as well as daily adaptation. Therefore, intensive daily practice to strengthen these areas is beneficial. Activities range from specific fun exercise routines, involving running, jumping, climbing, and pulling to solo sports, such as gymnastic, biking, swimming, or track, and to interactive ball sports. While challenges in this area vary in degree, these activities support competence, need to be fun, and are opportunities for interaction and negotiation.
- Individual and group language, occupational, physical, visual-spatial, and creative arts therapies are determined by individual needs of the child, and frequency will vary depending on other activities addressing the child's needs. Therapists working within the DIR model maintain a developmental perspective, include parents in the sessions, and guide home activities between sessions.
- Educational programs range from inclusion in regular education and public and private special education with varying degrees of

inclusion, hybrid programs of school- and home-based intervention, specialized tutoring programs, etc. These programs vary in the level of structure provided and are selected on the basis of which setting will best insure comprehension, social interaction, and learning.
- Augmentative and assistive technologies as indicated.
- Family counseling to help parents implement interventions, support family functioning, and provide advocacy when needed.
- Consideration of nutrition and diet, biomedical interventions, and when indicated, medications addressing regulation and anxiety, possible seizures, concentration, and movement.

Efficacy Information

For a disorder as complex and as heterogeneous as autism, many methods and research from various disciplines, including combined developmental and behavioral approaches, support elements of DIR's complex model. In recent years, research related to these elements has increased signifying the importance of affect-based interactions. For example, responsive parent-child interactions have been found to improve social engagement and communication (Gernsbacher, 2006; Gutstein, 2005; Mahoney & Perales, 2005; Prizant, Wetherby, Rubin & Laurent, 2003; Schreibman & Koegel, 2005; Vismara & Rogers, 2009). Studies on joint attention, emotional attunement, and play reported gains in language and symbolic thought (Kasari, Paparella, & Freeman, 2006; Kasari, Freeman, Paparella, & Jahromi, 2008; Mundi, Sigman, & Kasari, 1990). Following a child's lead improved communication as well as language development over long-term periods (Schreibman & Koegel, 2005; Siller & Sigman, 2002). The strength of relationships and attachment is tied to parent's sensitive responsiveness just as with typical children (Capps, Sigman & Mundy, 1994; Oppenheim, 2009; Rogers, Ozonoff & Maslin-Cole, 1993). Support for co-regulation strategies during distress episodes decreased children's negativity (Gulsrud, Jahromi, & Kasari, 2010). And Rogers and colleagues have long reported on accelerated gains when intervention focused on play, language, cognition, and social relations (Rogers et al., 1986; Rogers, Lewis, & Reis, 1987). Recently, Rogers and Dawson's Early Start Denver model reported affectively rich engaging social interactions to teach social and language skills improved IQ, language, social interaction, initiative, behavior, and adaptive skills and decreased severity of ASD symptoms (Rogers & Dawson, 2010). Zwaigenbaum's et al.'s (2009) summary of studies on children at high risk for autism emphasized the importance of active social learning and parent-child relationships. Similarly, Wallace and Rogers (2010) emphasized four factors important for effective intervention: parental responsivity and sensitivity, individualization, broad learning targets, and early intensive intervention. Sensory integration studies also report improved social responsiveness, sensory processing, and functional motor skills and social-emotional factors and decreased autistic mannerisms (Pfeiffer, Koenig, Kinnealey, Sheppard, & Henderson, 2011), as well as reduced difficulties in sensory modulation disorders common to autism (Miller, Coll, & Schoen, 2007). Lastly, neuroimaging research reports attuned relationships in infancy change brain structure in ways that later affect social and emotional development (Siegel, 2001). Evidence of poor neural connectivity between different brain regions might account for the poor information processing and connectivity contributing to individual differences in sensory-motor processing seen in autism (Mostofsky et al., 2007).

DIR research ranges from clinical reports and chart reviews to surveillance and a within-group pre-post study with randomized control intervention and imaging studies underway or in review. The landmark chart review of 200 children revealed patterns in underlying sensory-processing and modulation difficulties, and 58% of children who started intervention between 22 months and 4 years and treated for a minimum of 2 years between 2 and 8 years improved to no longer met the criteria for autism (Greenspan & Wieder, 1997). Findings revealed capacities for joyful relationships, empathy, affective reciprocity, reality testing, impulse control, creative thinking, and good peer relationships. Some still evidenced auditory or

visual-spatial difficulties, and most had some degree of motor challenges. Contrary to the stereotypes of autism, they seemed eager for emotional contact;, but had trouble figuring out how to achieve it and seemed grateful when their parents helped them express their desire for interaction. The10-to15-year follow-up study of a subset of 16 boys, between 12 and 17, showed a group of empathetic, creative, abstract, and reflective adolescents (Wieder & Greenspan, 2005).

The six functional emotional developmental capacities were used in a norm-referenced surveillance of 1,500 children from birth to 42 months using the Greenspan Social-Emotional Growth Chart and identified infants at risk for autism with a sensitivity of 87% and specificity of 90%. It has become an important screening tool for early identification (Greenspan, 2004). A pre-post study of the P.L.A.Y. project that trains parents of children with autism aged 2–6 to carry out 15 h of Floortime weekly for 8–12 months found 45.5% made significant developmental progress ($p \leq 0.0001$) in the FEAS child subscale scores (Solomon, Necheles, Ferch, & Bruckman, 2007). Based on the strength of this study, a large-scale randomized controlled, community-based clinical trial is underway. A randomized controlled trial of DIR at York University assessing the efficacy of a 12-month DIR/Floortime treatment for children ages 30–51 months compared to the community standard found significant gains in interaction skills, with initiation of joint attention, involvement, and severity of language delay associated with improved language skills, and caregiver skills targeted by the intervention were associated with changes in children's interaction skills (Casenheiser, Shanker, & Stieben, 2011).

While support for developmental models is growing, including DIR, various reviews indicate there is still no definitive evidence on any one method being better than standard of care that any method improves all the symptoms of ASD, and there are no comparative studies between approaches indicating any one method is superior to others (Lord & McGee, 2001; Seida et al., 2009; Spreckley & Boyd, 2009). These reviews suggest the continuing need for clinical approaches based on individual needs, and DIR provides such a model.

Outcome Measurement

DIR studies utilize the standard outcome measures in autism research, including the following instruments and rating scales: Autism Diagnostic Observation Scale (ADOS), Achenbach Child and Adolescent Behavior Checklists, BASC (Behavior Assessment System for Children), Greenspan Social-Emotional Growth Chart, Mahoney Maternal and Child Behavior Rating Scales, Mullen Scales of Early Learning, MacArthur CDI, Reynell Developmental Language Scales, Vineland-II, Parenting Stress Index, CES-D Depression Scale, the FEAS (Functional Emotional Assessment Scale – in revision) (Greenspan et al., 2001), and other various rating scales for symbolic play and joint attention, are developed by autism researchers.

Qualifications of Treatment Providers

Treatment is provided by multidisciplinary licensed/credentialed professionals who complete a multiyear certificate process at different levels to develop competencies within their discipline. They coordinate, consult, and/or oversee the intervention teams and supervise paraprofessional Floortime players and various assistants who implement specified activities in schools, social activity centers, and homes. Professionals include clinical and developmental psychologists, regular and special educators, and speech and language, occupational, physical, movement, and creative arts therapists. Senior professionals coordinate teams. Parents work side by side with the therapists, are coached to provide Floortime, and implement the home programs. Developmental pediatricians, pediatricians, child psychiatrists, neurologists, nutritionists, and other specialists are consulted as needed.

See Also

- Developmental Intervention Model
- Developmental-Pragmatic Approaches/ Strategies
- Early Start Denver Model
- Mutual Regulation
- RJA/IJA (Initiating/Responding to Joint Attention)
- Self and Autism
- Sensory Impairment

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Developmentally Appropriate Practice

▶ Normalization

Developmentally Appropriate Practice (DAP)

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Synonyms

Chronological age appropriateness; Individual appropriates; Intervention targets and strategies that are related to increased quality of life outcomes

Definition

Developmentally appropriate practice (DAP) refers to providing intervention in a manner that is individually appropriate and culturally relevant for the learner. This term was first introduced by Sue Bredekamp and the National Association for the Education of Young Children (NAEYC) in 1987 to warn early educators against the trend of pushing typically developing or gifted children too far too fast, or what some developmental psychologists referred to as "robbing children of their childhood" with deleterious effects that may not show up until adolescence or later. It also has important implications for working with students who have cognitive deficits so that families and interventionists interact with people in a manner that is age appropriate and provide opportunities to people that are both age appropriate and matched with individual strengths and preferences.

This concept of DAP is important when planning and implementing interventions for people with ASD. Developmentally appropriate interventions are those that take the student's chronological as well as developmental age into consideration when identifying targets, materials, places, and strategies for intervention. Interventions that are developmentally appropriate also consider issues of cultural relevance and attempt to insure that the behaviors and skills selected as intervention targets are related to improving the quality of life for the person with ASD and his/her family.

See Also

▶ Curriculum
▶ Early Intervention

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Developmental-Pragmatic Approaches/Strategies

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Definition

Developmental-pragmatic approaches to language intervention have a dual focus: (1) generating treatment goals and procedures based on the child's stage of development as determined by what is known about typical trajectories and (2) generating treatment goals and procedures based on the tenets of social-pragmatic perspectives on language acquisition and use. The child's developmental stage, rather than his or her chronological age, is considered not only in reference to language but also in reference to those areas of development thought to be precursors and cocursors of language, such as symbolic-cognitive (e.g., play abilities) and social-emotional functioning (e.g., interacting with others). Three tenets of social-pragmatic models of language acquisition serve as the foundation for language intervention which is derived from this thinking: (1) language develops within the context of the caregiver-child relationship, with an attuned and loving partner; (2) early developments in engagement, intentionality, and communication set the stage for the ability to comprehend and produce language; and (3) the use of language includes the capacity to know when to say what to whom.

Historical Background

The field of speech-language pathology was dramatically impacted by the introduction of social-pragmatic models of language acquisition in the 1970s and early 1980s (Bates, 1976; Bates, Camaiono, & Volterra, 1975; Bruner, 1975; Bruner, 1977; Dore, 1975; Halliday, 1975; Prutting, 1982). With these models, the world of communication disorders began to reconsider fundamental questions, such as what defines a language user and how does a language disorder compromise these capacities. Interest in constructs such as intentionality, nonlinguistic communication, functions of language, social interaction, contexts of language learning and language use, discourse, and conversational skills represented a departure from earlier thinking in both language acquisition and language intervention. Taxonomies from the world of typical social-pragmatic development began to appear in language assessment protocols and intervention plans for children with autism spectrum disorders. These included taxonomies of prelinguistic development (communicative intentions), speech acts and functions of language (labels, comments, requests, greetings, etc.), and conversational analysis (initiating and maintaining topics, turn-taking, and contingency). These paradigms were immediately of interest to speech-language pathologists (SLPs) working with children with autism spectrum disorders because for the first time, the nature of these children's language and communication challenges was more adequately described and understood.

Once the breadth of pragmatic models of language acquisition and language use were

integrated into the world of communication disorders, the work of speech-language pathologists expanded to include new dimensions of typical language development and language use and greater attention to the contexts of language learning and language use. The earlier "semantic revolution" which brought us from "form" (i.e., the structure of language) to "content" (i.e., the meanings of language) led quite quickly to a "pragmatic revolution" which required professionals to once again rethink the nature and the boundaries of their work as they added a third component to the definition of language, namely, "use." Perhaps as important was the shift in thinking about the role of the SLP, from the teacher of language to the partner in the language acquisition process. Encouraging the child's initiation and intentionality was seen as more important than obtaining responses from the child. Finally, the notion of therapy contexts expanded to potentially include all the contexts of the child's life, from home to school to play, with a variety of partners, both in terms of number and age (from one adult to groups of peers).

The focus on the interpersonal functions of language was particularly attractive to clinicians who were working with children who could talk but did not use language appropriately for the typical range of communicative intentions (commenting, reporting, requesting answers). In fact, the new taxonomies provided ways of understanding the unconventional linguistic patterns used by some children on the autism spectrum. Prizant and Duchan (1981) noted that children with autism were often expressing typical functions of language with echolalic utterances. Obviously, the relationship between form and function was idiosyncratic (e.g., the child says "Do you want a drink?" to indicate that he or she wants a drink), but nonetheless, the utterances were intentional and certainly could not be simply discounted as inappropriate. The "discovery" that echolalic language was intentional led to shifts in intervention procedures from those which suggested ignoring or discouraging echolalia to those that honored it. The primacy of function over form, a direct outgrowth of pragmatic models, was a theme that resonated with SLPs who were working with children who were nonverbal (e.g., standing in the corner to communicate anxiety) and/or using unconventional means of communication (e.g., repetitively asking questions to deal with transitions).

Although the impact of developmental-pragmatic models of language acquisition had a lasting effect on language assessment and intervention with both children and adults with a range of language disorders, many would agree that speech and language intervention with children with autism spectrum disorders was particularly effected by embracing this model. The nature and breadth of pragmatic views of language spoke directly to the nature and breadth of the children's challenges, providing new directions for SLPs working with this group of children.

Rationale or Underlying Theory

A developmental-pragmatic model (DPM) rests on the universals, processes, and facts of typical language acquisition. This information clarifies what is learned by a typically developing child at each point in development, resulting in the child's acquisition of a symbolic language system and his or her success as a social communicator. The speech-language pathologist who embeds his or her thinking in this theory believes that the language acquisition of children on the autism spectrum includes both typical and atypical parameters, all of which are best understood by reference to the universals of speech, language, and communication development.

Developmental-pragmatic models of language intervention pay particular attention to the social underpinnings of language acquisition and use. While encompassing the interest in the form of language (phonology, morphology, and syntax) and the content of language (semantics), pragmatic thinking leads us to consider the broader interpersonal context of language acquisition and the early ability of the communicator to use gestures, facial expressions, and words for social interaction purposes. Thus, the emphasis on context, both of language learning (i.e., caretaker-child interactions) and language use (e.g., how the intent of

our utterances is understood depending on who is being spoken to, what the setting is, and the knowledge of the participants), is considered developmentally from birth to adulthood. The fact that some children on the autism spectrum have strengths in form and content with considerable deficits in pragmatics speaks to the components of language necessary to be a successful and conventional language user.

Regardless of the specific discipline, developmental approaches begin with the assumption that all strategies of intervention, regardless of the target group or desired outcome, can be derived from normative theories of development. That is to say, the general principles of development apply to all children independent of their biological variability or the range of environments in which they live (National Research Council and Institute of Medicine, 2000). We might add to this that goals of intervention can best be derived from normative theories of development as well and that this is particularly compelling when considering children with deficits in social-pragmatic aspects of language.

This overarching understanding of developmental approaches paired with the specifics of pragmatic thinking served as a rich resource for recasting the assessment and intervention of children on the autism spectrum. The emphasis in pragmatic approaches on the intersect between the capacity to interact and the capacity to comprehend and produce language immediately resonated with the challenges and needs of children on the autism spectrum. The models presented in the literature by Bates et al. (1975); Dore (1974, 1975); Halliday (1975); Bloom, Rocissano, and Hood (1976); Snow (1973, 1978); etc., offered the theory and frameworks for reconsidering what and how we were teaching children with autism spectrum disorders to learn and use language. SLPs began to use and adapt the taxonomies which appeared in the research literature on topics such as the speech acts expressed by young children using single words, the early development of conversational skills, and the nature of adult input to language-learning youngsters.

As this movement continued and moved more deeply into the world of joint attention, early relationships, and affective range (Tomasello, 1988; Greenspan & Wieder, 1998; Mundy & Sigman, 2006), speech-language pathologists continued to integrate the expanding theory into their work with children with challenges (Prizant, Wetherby, Rubin, & Rydell, 2006). More and more intervention programs began to address the social engagement issues of children on the autism spectrum, and, in fact, approaches which differed considerably in the strategies and contexts of intervention now share the emphasis on interaction, reciprocity, and shared attention. The fact that typically developing infants can easily participate in attuned, communicative exchanges and that children with autism spectrum disorders find this developmental step so challenging is a universal concern in the educational and therapeutic planning for children on the autism spectrum.

Once again, while many of the pragmatic constructs speak to the process of language acquisition and, thus, are relevant for intervention programs for all children with delays and disorders in speech and language development, the nature of autism spectrum disorders has led to a particular interest in this body of work.

The following list of principles reflect the underlying theory of a developmental-pragmatic model of language intervention (Gerber, 2003) and are thought to serve as the basis for and rationale for intervention goals and procedures:

- Language is learned in the context of spontaneous, natural everyday interactions between the caregiver and the child.
- The child's language acquisition is embedded in his or her cognitive, affective, and social development and life.
- The development of communicative intentionality precedes the development of language.
- Prelinguistic developments in cognitive, social, emotional, and communicative domains precede the comprehension and production of language.
- The child's communicative interactions include many opportunities to play speaker-initiator and listener-responder discourse roles.
- Both typically and many atypically developing children move through the same general

stages of linguistic and communicative development.
- The specifics of language development (e.g., rate, style, strengths) are characterized by individual variation.
- Imitation may play a role in language learning for some children; its role in the development of communication is generally recognized.
- The child plays an active role in his or her language development – meaningful and joyful interactions with the world of objects and the world of people serve as the context for the development of language.

Goals and Objectives

Operationalizing developmental-pragmatic goals and objectives can be thought of in a number of ways, all of which differ from traditional perspectives on how to view the basic components of language intervention. These components include what the goals of intervention are, who the participants are during intervention, what procedures should be used, where the therapy takes place, and what role the adult plays during the interaction. A continuous thread from paradigms of assessment to paradigms of intervention are characteristic of language intervention programs which are based on developmental social-pragmatic theories of language acquisition (Gerber & Prizant, 2000; Prutting & Kirschner, 1987).

One of the most significant impacts of pragmatic models on the world of language disorders was the rethinking of the intervention goals addressed with children who had challenges in the acquisition of speech, language, and communication. The fact that nonverbal communication including gestures, facial expression, body language, and vocalizations were now considered appropriate goals of intervention represented one significant departure from earlier views which focused on the production of words and sentences. For those children who had not yet developed the capacity to communicate through nonlinguistic forms, the importance of that step in the developmental trajectory on the way to language was more fully recognized. In fact, the notion that nonlinguistic communication continues to be a goal of therapy even for children who are verbal was welcomed by clinicians who were working with children on the autism spectrum who could talk but did not use pointing and showing, eye gaze, and intonation to communicate their intentions.

Further, for children who are at very early developmental stages, pragmatic goals address the social-emotional precursors to language. These include increasing engagement in back and forth adult-child interactions; facilitating affective exchanges between the adult and the child using nonlinguistic communicative forms; increasing periods of joint attention with caregivers; communicating a range of intentions using differentiated vocalizations, pointing, eye gaze, and word approximations; and facilitating social referencing. Of course, precursory goals related to the content of language and the form of language would also be a part of every child's intervention plan. At these early stages, goals for the caregivers include increasing their responsiveness to the child's potentially communicative attempts and fostering reciprocal interactions, using the child's current repertoire of behaviors.

Of particular relevance for children with autism spectrum disorders was the notion of intentional communication and functions of language which moved to center stage in language intervention as a result of the understanding of pragmatic models of language development. The fact that this group of children did not use their nonlinguistic or linguistic systems to communicate a range of intentions had been documented in the research and confirmed by clinical experience. Thus, rather than moving on to the development of larger vocabularies and longer sentences, clinicians began to facilitate the use of the children's existing systems for functions beyond requests, such as greetings, comments, and social routines. The idea that children needed to acquire not only the forms of language but also the interpersonal functions led to an expansion of goals and objectives that has had considerable longevity.

For children whose nonlinguistic and linguistic systems are somewhat unconventional, intervention

goals begin with an attempt to analyze the form-function relationship in that child's system. One finding from this type of analysis has been that a child who does not use conventional language may very well be communicating intentions. Unconventional behaviors, echolalia, delayed echolalia, and scripts are often attempts to initiate conversation and/or to communicate particular functions and meanings of language. In terms of a less conventional nonlinguistic system, if a child's tendency to put his or her face close to that of another person is seen as an attempt to start an interaction, the function of the behavior can be acknowledged while more conventional forms are modeled ("let's play"). Responding in this way to a child's behaviors, with an eye toward the function they may serve, came from the focus on function in the pragmatic analysis of language and communication. Similarly, when working with a child who was using a less conventional linguistic system, clinicians began to understand the importance of imbuing the child's echolalic utterances and scripting with communicative intent. This response to the child turns a somewhat ambiguous communicative moment into a productive one and again illustrates how goals informed by pragmatic thinking were drastically different from more traditional ones.

Developmental-pragmatic goals are determined by assessing the child's developmental stage of language acquisition and strengths and challenges in social-pragmatic domains of development. Some examples of typical developmental-pragmatic goals for children functioning at earlier stages of development might include the following, written from the perspective of what the SLP will focus on:

- To facilitate the child's interpersonal engagement and emotional range (e.g., happy, sad, curious, frustrated, angry), with nonlinguistic and/or linguistic forms of communication
- To facilitate the child's participation in joint attention interactions with an adult, with nonlinguistic and/or linguistic forms of communication
- To facilitate the child's range of communicative intentions, with nonlinguistic and/or linguistic forms of communication
- To facilitate the use of spontaneous, self-initiated communication, with nonlinguistic and/or linguistic forms
- To expand the range of forms used to communicate, including both nonlinguistic forms (gestures, signs, visual systems) and linguistic forms (vocalizations, intonation patterns, words, utterances)
- To facilitate the use of social referencing, with nonlinguistic and/or linguistic forms of communication
- To facilitate the child's intention to communicate in a range of naturalistic contexts (at home, on the playground, with adults, with peers)
- To respond to all of the child's attempts to communicate whether they are conventional or unconventional

For children at higher developmental stages of language, typical developmental-pragmatic goals might include:

- To facilitate participation in conversational exchanges, playing both the speaker and the listener roles
- To facilitate the use of contingent responses during conversational exchanges
- To facilitate an understanding of the listener's perspective and the need to modify one's nonlinguistic and linguistic communication for a range of partners
- To facilitate the ability to repair communication breakdowns
- To facilitate peer interactions, first in dyadic interactions and eventually in larger groups
- To facilitate the coordination of conventional nonlinguistic and linguistic systems to communicate intentions

It should be noted that depending on the child's developmental stage of language, simultaneous goals addressing the comprehension and production of language would be included in an integrated plan of language intervention. Similarly, social-emotional, cognitive-symbolic, and regulation goals will necessarily be considered in all intervention plans that are addressing the further development of language and communication.

Treatment Participants

One of the most vivid and lasting effects of the pragmatic revolution on the field of speech and language was the change of thinking about who the treatment participants should be during intervention, Here, again, this notion had particular resonance for children on the autism spectrum because of the nature of their difficulties in interpersonal interactions.

With the early and continuing interest in pragmatic models and social-emotional approaches to working with children with developmental challenges, SLPs have been exposed to a deepened understanding of the nature of the caregiver-child relationship. This relationship sets the stage for the child's healthy development in all areas of functioning, including the development of the comprehension and production of language. SLPs began to think not only of *what* was learned in the prelinguistic period but *who* was propelling the development and why this relationship was key to the process. The notion that more of the "work" in language intervention should be done with the mother or primary caregiver and the child, rather than the therapist and the child, continues to be difficult to realize during intervention and, yet, is a clear implication of pragmatic models of language acquisition. Even in settings where it is easier to work with the caregiver, such as in early intervention conducted in the child's home, practitioners are not necessarily comfortable with the idea of "coaching" a parent during an interaction and, often, prefer to have the parent observe as the therapist interacts with the child. While understandable, this is not in sync with the research now spanning more than 30 years, suggesting that the caregiver-child interaction is where the "action" is relative to setting the stage for development.

Further, because pragmatic models of language acquisition underscore the fact that language use occurs across contexts with different partners, language intervention which has its roots in this model embraces the notion that the child's ability to use language must be addressed in a range of real-life situations, including his or her other interaction with family, teachers, and peers. Remembering that pragmatics refers to the ability to know what to say when to whom, pragmatic interventions go beyond the traditional therapy room and the SLP-child interaction. The child's interactions with typical and atypical peers must be built into the intervention planning. In fact, quite a few programs have been developed where typical peers coach their classmates who are on the autism spectrum to enhance the possibility of more frequent and successful exchanges (Kohler, Strain, & Goldstein, 2005).

Prior to the introduction of developmental-pragmatic models, the fact that a successful language user can communicate effectively with many different partners was not recognized as a potential language intervention goal. This notion led to one of the most significant shifts in the intervention paradigms of speech-language pathologists. Improving the child's ability to communicate with different partners requires the SLP to consider the child's interactions with every person in his or her life and to potentially use these interactions as the contexts for language therapy.

Treatment Procedures

The use of developmental-pragmatic models to generate treatment procedures requires an understanding of the way language acquisition progresses and language use is realized in authentic communicative contexts. As mentioned in the previous section, implications from a developmental-pragmatic model affect decisions about all the components of therapy, not only what the goals of intervention are and who the participants are during intervention but also what procedures will be used during treatment. In this discussion, intervention procedures include intervention strategies, intervention contexts, and the role of the adult during the interaction.

The following list captures the nature of *strategies* generated from developmental-pragmatic models of language use:

- Provide many opportunities to facilitate sustained engagement and reciprocal interactions, both nonlinguistically and linguistically.

- Provide many opportunities to expand shared attention and more consistent responsiveness to the communicative partner.
- Interpret all of the child's behaviors, conventional and unconventional, as intentional and meaningful.
- Maintain a reciprocal flow by treating all of the child's behaviors as communicative as you alternate turns in the interaction.
- Model the use of nonlinguistic and linguistic forms of communication to express the child's meanings, messages, and intentions, not yours.
- Engineer the context so that the child has an opportunity to play both initiator and responder roles in the "conversation."
- Engineer "turn-taking," by expectancy, waiting, and nonverbal communication.
- Teach language within the context of natural interactions and discourse.
- Embed language training in contexts that are familiar to the child relative to meaning and affectively laden.
- Reduce the complexity of your language input while maintaining the "grammar" of language, the melody, and the interactive flow of communication.
- Pair language with the child's actions, interests, agenda; timing and contextual support are critical at early stages of language learning.
- Join in the meaning and affective tone of the child's script.
- Teach language when the cognitive, social, affective, and pre- and/or corequisites are in place.
- Teach the child's parents, teachers, and therapists how best to facilitate language throughout the child's daily life.
- Teach language with words and silence.
- Teach language when the interaction is flowing.
- Teach language by matching and meeting the child and then "up the ante."
- Teach pragmatic skills within the context of natural conversation.
- Engineer natural opportunities for promoting nonverbal pragmatic abilities such as proxemics, body language, gestures, and facial expressions.

In reference to intervention *contexts*, pragmatic views of language suggest that all the contexts of a person's life are of interest when we are studying and supporting language use. Much like the idea of different partners, pragmatic models are rooted in the idea of the range of contexts which make up the person's life and the variations in both nonlinguistic (setting, activity, participants) and linguistic (prior discourse) aspects of each context. As a result, attempts were made to expand the notion of "therapy context" to include those activities that reflected the child's typical day (lunch, recess, soccer, classroom, etc.).

Understanding that every moment is a potential language intervention moment pushed the idea of context in language treatment beyond the previous discrete boundaries. In this view, every interaction offers the child an opportunity to learn about language use and to practice how to be a successful language user. For example, a 10-year-old child on the autism spectrum, M., who the author sees for language intervention, was interested in interacting with a 2-year-old boy, J., who he met each week in the waiting room of the clinic. In his attempt to interact with this toddler, M. often hugged J. a bit too vigorously or spoke to him a bit too loudly. Needless to say, the 2-year-old moved away from M. and backed into his caregiver's lap. In order to help M. express his natural interest in interacting with the young child and to have a more successful experience, the clinician practiced with him how he might approach the boy (i.e., from a distance) and what he might say to him (e.g., show him a toy). In fact, from a pragmatic point of view, the SLP welcomes the opportunity to see how the child functions in different contexts in his or her attempt to make the therapeutic experience representative of the child's typical interactions and to address those missteps that may be interfering with his positive opportunities for interaction.

Finally, in reference to the *role of the adult* during the interaction, pragmatic models of language acquisition and use suggest that the clinician assume more of a partner and less of a teacher role during intervention. The adult is

seen as sharing the communicative interaction with the child, not directing it. Often, the idea of "following the child's lead" is used to help parents and professionals understand that the child's ideas and intentions should take precedence over the adult's. With the goals in mind, the adult will support, scaffold, and facilitate development, always beginning from where the child is and engaging in a dynamic that is more reciprocal and less adult led. The full impact of a developmental-pragmatic approach can be seen as therapy sessions which reflect this thinking, where adults are watching, waiting, observing, and then determining based on the child's actions, behaviors, vocalizations, body movements, and words how the next steps in development can be encouraged.

Efficacy Information

Although many language intervention programs integrate aspects of developmental-pragmatic models of language, two programs in particular reflect the basic tenets of this perspective. The Hanen Program, *More Than Words* (Sussman, 1999), focuses on teaching parents to use responsive strategies that promote social interaction and, ultimately, language development. The fact that the training is designed to support the primary caregivers in their interactions with their children places this program at the heart of pragmatic thinking. Recent studies (McConachie, Randle, & Couteur, 2005; Girolametto, Sussman, & Weitzman, 2007) have shown that parents who participated in the *More Than Words* program used more responsive interaction strategies than the control group of parents. Moreover, gains in vocabulary, frequency of communication, and/or participation in turn-taking routines were noted in the children.

Other studies have also investigated the effects of responsiveness training on the caregivers' interactive style and the resulting effects on their child's social interaction and communication. Specific improvements in joint attention, initiation of communication, periods of engagement, and expressive language have been noted in children whose parents became more responsive (Aldred, Green, & Adams, 2004; Baker, Messinger, Lyons, & Grantz, 2010; Mahoney & Perales, 2003, 2005; Siller & Sigman, 2002).

The SCERTS (Social Communication, Emotional Regulation, and Transactional Support) program developed by Prizant et al. (2006) represents an educational program which embraces the core components of developmental-pragmatic frameworks. This program emphasizes functional, developmentally appropriate goals and objectives which are addressed in meaningful and purposeful activities throughout the child's day. The child's individual differences, including learning style and interests, are embraced; the family, educators, and clinicians are seen as a collaborative team.

The description of social communication in the SCERTS program (Prizant et al., 2006) as the "development of spontaneous, functional communication, emotional expression, and secure and trusting relationships with children and adults" speaks to the priorities of all pragmatically oriented programs. Similar to *More Than Words* (Sussman, 1999), the fact that the family and professionals are taught to respond to the child's needs and interests is derived from the focus in developmental-pragmatic models on the partner's roles in the child's acquisition of language. Prizant, Wetherby, Rubin, and Laurent (2010) provide many references to support the positive outcomes of training in social communication, with approaches that range from those that are more behavioral to those that are more representative of developmental-pragmatic ones (Kaiser, Hancock, & Nietfeld, 2000; Wetherby & Woods, 2006).

Outcome Measurement

Measuring progress in pragmatic goals and objectives has always presented its own set of challenges for SLPs. The very nature of pragmatics speaks to the way language use varies relative to changing aspects of the context such as the participants, the setting, nonlinguistic supports, ongoing discourse, etc., making measurement for this area of language more complicated than

others. Perhaps, the best way to think about the emergence of pragmatic behavior is relative to a continuum of contexts of the child's life, with outcomes measured within specific contexts (e.g., the child's initiation of communication with one particular peer during toy play). From a pragmatic perspective, intervention progress can only be thought of with an understanding of the dimensions of natural contexts and real-life partners.

The outcome measurements of developmental-pragmatic interventions span a wide range of behaviors. Unlike most other approaches, these include both the child's and the partner's behaviors, as the pragmatic approach is anchored in the caregiver's role in creating interactive exchanges. In fact, the responsiveness of the caregiver to the child's behaviors is seen as one of the most important aspects of interaction to measure. Given the underlying theory of typical language learning, clinicians who are working from this framework will want to track the parent's ability to sensitively respond to all of the child's communicative attempts (not just those that involve spoken language). Parent responsiveness provides more opportunities for social interaction and, ultimately, the acquisition of language.

All of the goals and objectives indicated in the previous section are easily translated into outcomes to measure (occasions of intentional communication, use of a range of speech acts, ability to engage in turn-taking exchanges, etc.). Although behavioral principles could be used to conceptualize how to measure a new behavior (e.g., 80% criterion), a developmentalist may be more comfortable with a continuum of criteria, ranging from "emerging" to "achieved." Developmental thinking implies that measures will mirror how typical development proceeds gradually over time rather than thinking in terms of the use of a particular behavior in 8 out of 10 trials.

Developmental-pragmatic models rely heavily on checklists of targeted behaviors, questionnaires, naturalistic observation, language sampling, and semistructured assessment to measure the child's progress in selected goals and objectives. The frequency of assessment will vary with the program and the system, with some measuring outcomes on a daily or weekly basis, and others over a longer span of time. When outcome measurement is being used to determine the success of a particular step in the program, more frequent assessment leads to more frequent modification of the parameters of the treatment plan. Finally, the SLP who is working from a developmental-pragmatic framework will want to periodically measure the child's progress across the contexts of his or her life, as a reflection of the ability to use language in the learning and social interactions that make up his or her day.

Qualifications of Treatment Providers

The majority of treatment providers for developmental-pragmatic approaches to language intervention are speech-language pathologists. Those SLPs who are working directly with parents will need additional training in how to teach strategies and procedures for affecting change in the caregivers' interactive styles (e.g., Hanen programs). Other more broadly based developmentally oriented models, such as the Developmental, Individual Difference, Relationship-Based (DIR) approach (Greenspan & Wieder, 1998), include training components in their certificate process for professionals from a range of disciplines who want to learn how to "coach" parents effectively. Once SLPs begin working with parents closely, they are often aware of the need for further training in counseling in order to deal with the emotional issues typically and understandably raised by the caregivers.

In addition, SLPs working in this model often collaborate with teachers to help them implement a developmental-pragmatic approach in the classroom. The SLP will be called on to help other professionals shift their thinking to implement the goals and strategies in the contexts of the child's academic and social life. Here, again, the developmental-pragmatic approach requires additional programming and planning on the part of the SLP as the work moves beyond the therapy walls and out into the child's everyday world.

See Also

- ▶ Developmental Intervention Model
- ▶ Pragmatic Language Impairment
- ▶ Pragmatic Language Skills Inventory
- ▶ Pragmatic Rating Scale
- ▶ Social Interventions

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Dexedrine

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Synonyms

Adderall; Dextroamphetamine

Definition

Dexedrine is a stimulant medication useful for the treatment of ADHD symptoms and narcolepsy. It is available in tablets or extended-release capsules.

Side effects tend to be mild and include insomnia, loss of appetite, weight loss, headaches, dry mouth, and erectile dysfunction. It can also produce transient increases in blood pressure and may have an effect on seizure threshold and certain heart arrhythmias.

See Also

▶ Dextroamphetamine

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Dextroamphetamine

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See Also

▶ Adderall
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Diagnosis and Classification

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Definition

As used in medicine (including psychiatry), a diagnosis is determined as part of a diagnostic process in the attempt to identify a specific disorder. Diagnoses are used in many ways and for different purposes. As both a term and a process, the issue of diagnosis is very much related to issues of classification. Indeed, the word diagnosis comes through Latin and Greek sources which have to do with understanding/distinguishing things. In clinical medicine, the assignment of a diagnosis often involves various tests, examinations, and so forth; the diagnosis typically guides treatment. In addition, diagnoses have other uses, e.g., in public health, in establishing eligibility for services, and so on. Some special issues arise with respect to psychiatric diagnosis and are discussed subsequently (see also ▶ DSM-IV entry).

Historical Background

Although diagnoses have been used since antiquity, it was only as the causes of various medical illness began to be identified in the 1800s that attempts were made to study the issue more systematically, e.g., in relation to causes of death. This effort took place both in Europe as well as the USA originally focusing on causes of mortality but gradually expanding to include a range of diseases and injuries. This effort results in what is now the International Classification of Diseases (ICD-10). In psychiatry, early efforts to assign diagnoses were limited and classification schemes highly theoretical in nature; this limited their use more generally and with clinicians who did not share similar theoretical orientations. This shifted dramatically with the 3rd edition of the American Psychiatric Association's Diagnostic and Statistical Manual (DSM-III) (American Psychiatric Association, 1980) which adopted an atheoretical approach and which quickly came to dominate psychiatric diagnosis throughout the world.

Current Knowledge

Diagnosis is intimately related to issues of classification. The tendency to engage in the latter activity is an intrinsically human activity that has the potential to facilitate observation and then help generate general principles and hypotheses. When approaches to classification are shared, communication is enhanced. In medicine in particular, the assignment of some specific label to a condition may itself be a source of relief to the patient or family members since it is often (mistakenly) assumed that having a label implies an understanding of etiology and specific treatments. As with any human construction, diagnostic labels can be misused. While official systems like DSM-IV or ICD-10 tend to be organized around categories, other approaches, e.g., using dimensions of function/dysfunction, could also readily be used. Classification systems vary depending on their purpose but to be generally useful that must be amenable to ready and reliable use by a range of individuals. In the past, theoretically based approaches to classification were common but now have given way to more "phenomenologically based" approaches.

A number of misconceptions regarding issues of diagnosis and classification should be noted: (1) by itself, deviant behavior does not need to imply a disorder and (2) diagnoses do

not necessarily have to have a biological base even when symptoms are expressed somatically (e.g., maladaptive personality traits can be a disorder and severe psychological stress can give rise to a range of persistent physical symptoms).

Issues for classification arise from numerous sources. One has to do with the primary goal(s) of classification (e.g., to enhance research or to facilitate clinical work). Also, there are some special issues for classification in relation to difficulties of childhood onset. The two major classification systems for psychiatric and developmental disorders (DSM-IV and ICD-10) adopt approaches that are in some ways similar and in other ways quite different. Although it is often assumed that some ideal classification system must exist in reality, many different factors impact approaches to diagnosis. To complicate things further, different apparent etiologies might result in rather similar clinical pictures, while sometimes the same etiological factor is associated with a wide range of clinical outcomes; often intervention is much more concerned with the expression of the clinical problem rather than its cause. With a few interesting exceptions (e.g., reactive attachment or post-traumatic stress disorders in DSM-IV), etiologies have typically not been specified.

Difficulties of childhood onset present special problems for classification and diagnosis. Developmental factors must be considered, e.g., in relation to the ways they may impact symptom expression or in the ways the symptoms may interfere with development. The use of a multiaxial approach helps in dealing with this problem. In the past, theoretically based approaches to classification were common but now have given way to more "phenomenologically based" approaches.

Contextual factors are of great importance in understanding the clinical expression of conditions in children, i.e., family, school, and ethnic or cultural background may significantly impact the clinical presentation. These issues are often most complicated in very young children where disentangling child-maternal difficulties can sometimes be quite difficult. It should also be noted that disorders not individuals are classified (failure to do this results both in problems of stigmatization and potential adverse effects of labeling).

Having one problem may increase risk for other difficulties (what is termed comorbidity). It has been noted that for individuals with intellectual disability, there has often been a tendency to overlook other problems (what is termed "diagnostic overshadowing"). There are different approaches to the problem of comorbidity, and the problem is a special challenge for childhood-onset disorders since having one problem may contribute to risk for another one.

Future Directions

Particularly in the area of psychiatry, DSM-III marked a watershed event in improving diagnostic reliability and significantly advanced research in the field. In autism and related disorders, similar changes have occurred with diagnostic systems becoming more and more data based and, in turn, more likely to advance research in general. New knowledge in the areas of genetics, biological models, and identification of end phenotypes or intermediate endophenotypes may further advance work on these disorders.

See Also

- ▶ Comorbidity
- ▶ DSM-III
- ▶ DSM-III-R
- ▶ DSM-IV

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Diagnostic Instruments in Autistic Spectrum Disorders

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Definition

Diagnostic measures are designed to capture behaviors in the areas of communication, reciprocal social interactions, and restricted and repetitive behaviors that characterize an autism spectrum disorder. These measures attempt to quantify behaviors associated with an autism spectrum disorder by assigning them numerical scores. These quantitative behavior scores are then translated into summary scores that result in a classification that is typically either consistent with one of the autism spectrum disorders or not. Current diagnostic instruments include parent questionnaires and interviews as well as standardized observational measures. The time and training required to administer and score these instruments varies from minimal for parent questionnaires to more involved for observational measures and semistructured interviews.

Historical Background

One of the first widely used scales for identifying children with autism was *The Rimland Diagnostic Form for Behavior Disturbed Children* (Form E-1; Rimland, 1968). This measure was an important development in the field, as it focused on identifying carefully selected symptoms of autism. Another early diagnostic measure developed at around the same time was the *Behavior Rating Scale for Autistic and Atypical Children* (BRIAAC; Ruttenberg, Dratman, Fraknoi, & Wenar, 1966). This measure is historically significant because it was the first to be based on actual observations of behavior from clinician case notes rather than parent report.

The *Handicaps, Behaviors and Skills Schedule* (HBS; Wing & Gould, 1978) was also an early influential measure because it was the first widely used semistructured parent interview and it contributed to the understanding of the "triad of impairments" that has led to our current understanding of autism. Not technically considered a diagnostic measure, the HBS was a framework for gathering information regarding symptoms and behavior that could be utilized in a clinical evaluation. This measure has been revised and is currently known at the *Diagnostic Interview for Social and Communication Disorders* (DISCO; Wing, Leekam, Libby, Gould, & Larcombe, 2002 – see below).

Another scale of importance in the initial group of diagnostic measures was the *Behavior Autism Rating Scale* (BOS; Freeman, Ritvo, Guthrie, Schroth, & Ball, 1978). This measure was the first instrument that emphasized controlling the environment in which the child was observed, as well as standardizing the behaviors that were observed (Lord & Corsello, 2005).

Most of these measures have been revised, with Rimland's Form E-1 becoming Form E-2, the HBS now the DISCO, and the BOS leading to the development of the Real Life Rating Scale (RLRS; Freeman, Ritvo, Yokota, & Ritvo, 1986).

Diagnostic measures have evolved over time, both because diagnostic criteria have changed with each revision of the Diagnostic and Statistical Manual, Fourth Edition (DSM-IV), and because empirical studies continue to provide information about how well each measure differentiates children with autism from those without autism based on current definitions. The diagnostic measures have changed as we have learned more about the disorder, including the expansion of age range and developmental levels of children included within this diagnostic group.

As the current gold standard in autism diagnostic measures, *the Autism Diagnostic Observation Schedule* (ADOS; Lord et al., 2000) illustrates the change from DSM III to DSM IV criteria to now include Asperger's syndrome and pervasive developmental disorder, not otherwise specified on the spectrum. This measure evolved from its original form developed in the 1980s to its current form which includes five modules for assessing toddlers through adults with module choice dependent on the individual's age and language level. The *Childhood Autism Rating Scale* (CARS: Schloper, Van Bourgondien, Wellman, & Love, 2010) is another example of this evolution, with the addition of a scale for high-functioning autism, as the original version missed many children with better language and cognitive skills.

Current Knowledge

There are currently several measures available for diagnostic purposes, ranging from those that are very quick to administer and require minimal training to those that take more time and training. As with any other psychometric measure, diagnostic measures are evaluated based on reliability and validity data. This section will cover the most widely used and available diagnostic protocols. For more detailed information on these measures, please see the respective individual entries included within this encyclopedia (Table 1).

Parent Questionnaires

The Autism Behavior Checklist (ABC): This questionnaire is one component of the *Autism Screening Instrument for Education Planning* (ASIEP; Krug, Joel, & Almond, 1980), now in its third revision. It builds on several other measures, including Rimland's Form E-2, the BOS, and the BRIAAC. It contains five items across five areas, and ranges are provided to distinguish a high probability of autism, a low probability of autism, or mixed probability. Standard scores are available for children between the ages of 3 and 13 years. It was initially intended to be completed by teachers or other professionals working with a child. This measure requires no special training. It has also been used with parents on a retrospective basis for children with high-functioning autism. One concern regarding this measure, however, is its low sensitivity, as many children on the spectrum appear to be missed using the suggested cutoff score.

Diagnostic Instruments in Autistic Spectrum Disorders, Table 1 Summaryof measures

Measure	Format	Administration time	Age range	Diagnostic criteria used	Training	Suggested use
SRS	Parent/teacher/self-report questionnaire	15 min	Preschool to adulthood	DSM-IV	None	Screening/ response to treatment
SCQ	Parent/caregiver questionnaire	15 min	Preschool to adulthood	DSM-IV	None	Screening
GARS-2	Parent/caregiver questionnaire	15 min	Preschool to adulthood	DSM-IV	None	Screening
CARS-2	Clinician rating based on observation	30 min	Preschool to adulthood	DSM-III-R	Minimal	Diagnostic
BSE-R	Rating based on observation, review of records, and interview	5 min	1½ to 12 years	N/A	Yes	Symptoms for research
ABC	Teacher questionnaire	Not specified	3–13 years	DSM-IV	Minimal	Measure maladaptive behavior
PDDRS	Parent questionnaire	Not specified	Not specified	DSM-III-R	None	Screening
GADS	Parent questionnaire	10 min	3–22 years	DSM-IV	Yes	Assess Asperger's disorder behavior
ASAS	Parent or teacher questionnaire	10 min	3–19 years	Not specified	None	Screening
ADI-R	Semistructured interview	1.5–3 h	Toddler to adulthood	DSM-IV	Yes	Research and clinical diagnosis
DISCO	Semistructured interview	2–3 h	Any age	ICD-10	Yes	Assess individual needs, treatment goals
ASDI	Semistructured interview	Not specified	Not specified	Gillberg's criteria	None	Screening
AOSI	Semistructured observation	20 min	6–18 months	DSM-IV	Yes	Early identification
ADOS	Observation	30–60 min	Toddler to adulthood	DSM-IV	Yes	Research and clinical diagnosis
PEP-III	Caregiver report and clinical observation	45–90 min	1–7 years	DSM-IV	Minimal	Assess development, create treatment goals

The Australian Scale for Asperger's Syndrome (ASAS): This questionnaire includes 19 items covering five areas and is scored on a seven point Likert-type scale. It is designed to be completed by a teacher or parent and covers ages 3–19 years. The authors recommend that the measure be used as a screener rather than a diagnostic measure because of low specificity. There are little published data available on this measure, and the original study had several methodological issues, including raters who were not blind to diagnosis. Though the measure does not result in a classification of Asperger's disorder, as a screener, it provides information on whether a child should receive a diagnostic evaluation.

Behavior Summarized Evaluation – Revised (BSE-R): This rating form is comprised of items from two overlapping instruments, the *Behavioral*

Summarized Evaluation Scale (BSE) and the *Infant Behavioral Summarized Evaluation Scale* (IBSE; Barthelemy et al., 1997). It is primarily designed to document behavioral symptoms associated with autism as they relate to neurophysiological measures. These scales consist of 20 items scored on a five-point Likert scale by trained raters on the basis of direct or videotaped observation, discussion of the child's history, and access to information from multiple sources. It covers the ages of 18 months through 12 years and takes approximately five minutes to administer. Interrater reliability and convergent validity is reported to be strong.

The Childhood Autism Rating Scale – Second Edition (CARS-2): This rating form has been one of the strongest, best documented, and most widely used rating scales for behaviors associated with autism. It consists of 15 items on which children and adults are rated, generally after observation, on a four-point Likert scale and results in classifications of not autistic or mild to severe autism. This measure, most commonly completed by a clinician based on observation, requires minimal training and approximately 15 min to complete. The revision of this measure includes a form to better capture children with high-functioning autism and is recommended for use with individuals whose IQs are above 70 and who are over the age of 6 years. The original CARS form has not changed and is included in the CARS-2 for use with children under the age of 6 years or who have lower IQ scores. The CARS-2 was recently adapted, and there are not yet many research studies evaluating the effectiveness of the rating scale for children with high-functioning autism.

The Gilliam Asperger's Disorder Scale (GADS): This parent questionnaire consists of 32 items and is based on DSM-IV and ICD-10 criteria of Asperger's disorder. It takes approximately 5–10 min to score and also includes a parent interview section that is not scored but provides information on language and cognitive and adaptive behavior which is important in differentiating Asperger's disorder from other autism spectrum diagnoses. Like the Gilliam Autism Rating Scale (GARS), this measure results in an Asperger's quotient of low or high probability of an Asperger's disorder. As with the GARS, the standardization sample diagnosis was reported by parent or professional and not confirmed.

The Gilliam Autism Rating Scale – Second Edition (GARS-2): This questionnaire has recently been revised and is now known as the GARS- 2. It consists of 56 items across four subscales, covers the ages between 3 and 22 years, and takes approximately 5–10 min to administer. The measure is based on DSM-IV and Autism Society of America criteria and results in an autism quotient that indicates whether a child has a "low probability" or a "high probability" of having autism. No training is required. The measure is intended for screening; however, several studies using the original version of the GARS found that it missed up to 52% of the children who met diagnostic criteria for autism clinically and received scores within the autism range on other standardized diagnostic measures (South et al., 2002). The initial normative sample was large, but the diagnoses were reported by the parent and not confirmed. Revisions to the GARS-2 have attempted to address these concerns by lowering the cutoff score and providing a new normative sample. As with the initial normative sample, not much information is available on the group. While the measure is considered to be appropriate for use with adults, scores should be interpreted cautiously because only 9% of normative sample was over 16 years (Montgomery, Newton, & Smith, 2008).

The Pervasive Developmental Disorders Rating Scale (PDDRS): This measure is a revision of an earlier scale (Eaves, 2003). It includes 51 items across three subscales and is based on the DSM-III-R. Each behavior is based on a five-point Likert scale. A child is considered to fall within the range of an autism spectrum disorder if both the total score and arousal score fall one standard deviation below the mean. No standard diagnostic procedure was used to define the sample, and therefore the suggested use of the PDDRS is for screening only.

Social Communication Questionnaire (SCQ): This questionnaire, formerly known as the *Autism Screening Questionnaire*, is based on

a well-validated standardized parent interview, the *Autism Diagnostic Interview – Revised* (ADI-R). It was initially designed as a screening measure and consists of 40 items that cover the areas of communication, reciprocal social interactions, and restricted and repetitive behaviors and interests. It is designed to be filled out by a parent and takes approximately 15 min to complete. No training is required, and scoring instructions are available in the manual.

There are two versions of the measure, a "current" version that is designed for children under the age of 5 years and covers current behavior, and a "lifetime" version that is designed for children over 5 years of age to adulthood and covers early behavior, focusing on the ages between 4 and 5 years. For children under the age of 5 years, several studies have found that a lower cut off score of greater than or equal to 12 results in the greatest diagnostic differentiation. For those older than 5 years of age, scores of greater than or equal to 15 are considered to be significant and suggestive of a possible autism spectrum disorder.

Little information is available on its use with children under the age of 3 years. It works fairly well as a screener for children over the age of 3 years, with the modified cutoff for children under the age of 5 years. It has higher specificity than many screening measures, and its performance has been found to be similar to a standardized diagnostic interview in at least one study (Corsello et al., 2007).

Social Responsiveness Scale (SRS): This questionnaire was initially developed to measure social and communication difficulties along a continuum. It consists of 65 items covering the areas of communication, reciprocal social interactions, and restricted and repetitive behaviors and interests. Gender norms are available, and the measure results in a T-score and a social severity impairment score ranging from typical to severe. Both a teacher version and a caregiver version are currently available, and each takes approximately 15–20 min to complete. The SRS does not require training to administer, and instructions for scoring are included in the manual. The first version of the SRS was designed for children between 4 and 18 years of age. More recently, two additional versions have been developed and are available for research use and are soon to be available for use clinically: an adult version in a self-report and other report form, and a preschool version. Suggested uses include screening and response to treatment.

Semistructured Interviews

The Autism Diagnostic Interview – Revised (ADI-R): The ADI-R is one of the most widely validated diagnostic measures available. Based on DSM-IV criteria, it is administered as a semistructured interview by a clinician to a parent or caregiver, and covers current behavior for all children and historical information for older children and adults. The measure consists of 89 items that are coded on a 0–3 point scale, several of which are transferred to a diagnostic algorithm that results in a diagnostic classification. One of the biggest weaknesses of this measure is administration time, which is between 1.5 and 3 h. The extensive reliability and validity data available for the ADI and the clinically rich information it provides make this measure the gold standard in research despite its lengthy administration time.

The Asperger's Syndrome (and High-Functioning Autism) Diagnostic Interview (ASDI): This measure was designed as a diagnostic tool for verbally fluent individuals with autism and Asperger's disorder. It is a semistructured interview based on Gillberg's criteria and includes 20 items that operationalize six criteria. The interviewer is instructed to obtain descriptions of actual behaviors to accurately code each item. This interview does well in distinguishing Asperger's disorder from psychiatric disorders and normality, but has yet to develop a means of distinguishing Asperger's from autism (Gillberg, Gillberg, Rastam, & Wentz, 2001).

The Diagnostic Interview for Social and Communication Behaviors (DISCO): This measure is a standardized semistructured interview based on the HBS, and it is now in its ninth revision. It was designed to obtain behaviors relevant to the diagnosis of autism for the purpose of assessing individual needs and development across several areas. The DISCO includes items that cover the

areas associated with autism spectrum disorders, as well as developmental items and atypical behaviors. This measure was not originally designed for diagnostic purposes, but rather to assist clinicians in generating recommendations for older individuals with an autism spectrum disorder. Diagnostic algorithms have been developed for research purposes

Observational Measures

The Autism Diagnostic Observation Schedule (ADOS): The ADOS is one of the most widely studied and used diagnostic instruments, and, along with the ADI-R, is considered the gold standard in research studies. It is a semistructured observational measure that consists of several tasks that are administered to a child or adult for diagnostic purposes. The measure includes a number of coded behaviors that allow for assessment in the areas of communication, reciprocal social interactions, and restricted and repetitive behaviors and interests. Scores are transferred to an algorithm and result in a classification of autism, autism spectrum disorder, or non-spectrum.

The ADOS is based on DSM-IV criteria and takes approximately 30–60 min to administer. It is organized into five modules covering children of toddler age who use little or no phrase speech to older children and adults with fluent language. A toddler module has recently been added. Now there are also revised algorithms designed to improve specificity without sacrificing sensitivity, as well as newly developed severity scores for the purpose of measuring change over time. The ADOS requires training and experience with autism spectrum disorders.

The Autism Observation Scale of Infancy (AOSI): The AOSI is a semistructured, standardized observational measure designed for infants between 6 and 18 months of age. It consists of 18 items covering specific behaviors that have been considered to be early indicators of a later autism spectrum disorder diagnosis based on empirical studies and clinical experience. Training on administration and scoring is required. Interrater reliability on a small sample of infants was good to excellent with the exception of a subset of items at the 6 month assessment. Interrater reliability scores on a small sample were fair to good. Reliability was calculated using kappas, and a skewed distribution may affect results. Scores at the ages of 12 and 18 months were considered to be predictive of a later diagnosis of autism. Available data has been on high-risk infant groups, primarily high-risk siblings, and on relatively small samples. The intended use of this measure is to identify children who may be likely to later meet criteria for a diagnosis of autism in a high-risk sample, and it is available for use in research protocols (Bryson, Zwaigenbaum, McDermott, Rombough, & Brian, 2008).

The Psychoeducational Profile Revised (PEP-3): This measure was designed to assess development and diagnostic characteristics of children with an autism spectrum disorder. This measure was designed for children between 12 months and 7 years of age. The PEP-3 consists of a pathology section that is designed to measure the severity of behaviors associated with autism spectrum disorders. There is little information available on the reliability or validity of the pathology section. The PEP-R was primarily designed to assess development and create treatment goals. This measure requires approximately 45–90 min to administer and requires experience with children with autism spectrum disorders. The suggested uses are primarily to create treatment goals and to assess development.

Future Directions

Diagnostic measures continue to be modified and refined as more is learned about their effectiveness, as the diagnostic criteria for autism spectrum disorders changes with new revisions of the diagnostic manual, and as health-care funding changes. There continues to be a need for measures that can be used for research and clinical purposes. Standardized observational measures are generally brief enough to be used as part of a clinical evaluation or research protocol. Several studies suggest that using both a standardized parent interview in conjunction with a standardized diagnostic observational measure and clinical judgment results in the most accurate diagnosis. However, the most

well-validated diagnostic interview, the ADI-R, is long and takes time to administer. As funding changes, there is an increasing need for more efficient diagnostic measures, and consequently, attempts have been made to use more questionnaires and to decrease the length of time required to conduct standardized interviews. Screening measures and questionnaires are also being refined to make them more suitable for diagnostic use in research protocols.

As a field, we have begun to recognize younger children as at risk for autism spectrum disorders, requiring measures that can identify toddlers that may later develop the disorder. Interviews and questionnaires are also being extended, downward to identify the youngest children and upward to better capture older and higher functioning children with autism spectrum disorders. As treatment attempts to address the core deficits of autism spectrum disorders, there have also been requests to develop measures that can capture response to treatment. This has, in part, led to the development of severity scores for the ADOS.

The fifth revision of the DSM is expected within the next few years and will lead to modifications in current measures to match the new diagnostic criteria. Currently there are several very strong diagnostic measures available for use for screening or diagnosis of autism spectrum disorders. The diagnostic measures in the field of autism are dynamic and evolving, with their widespread use in both clinical and research settings leading to modifications for practical application and improved effectiveness.

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Diagnostic Interview for Social and Communication Disorders

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Synonyms

DISCO

Abbreviations

ADI-R	Autism diagnostic interview-revised
PDD	Pervasive developmental disorders

Description

The Diagnostic Interview for Social and Communication Disorders (DISCO) is a semistructured interview schedule used with the parent or carer of an individual to elicit a broad picture of the individual's behaviors and needs. Its primary purpose is to elicit information relevant to the autistic spectrum in order to assist clinicians in their judgment of an individual's level of development, disabilities, and specific needs. It contains sets of algorithms for diagnosis of autism according to the international classification criteria (ICD and DSM) and other sets of diagnostic criteria. Key features of the DISCO are (a) that it can be used at any age, (b) that it collects extensive information not only on the core symptoms of autism but also beyond these symptoms (e.g., sensory symptoms, emotion symptoms, gross and fine motor skills, psychiatric and forensic problems, maladaptive behavior, sleep difficulties, etc.), and (c) that it has a strong developmental focus, including the detailed assessment of current developmental level and developmental delay.

The Diagnostic Interview for Social and Communication Disorders (DISCO) is based on a concept of a spectrum of autistic disorders that predated the earliest ICD and DSM criteria for autism and pervasive developmental disorders (Wing, 1988, 1996; Wing & Gould, 1979). This concept is similar to, but wider than, the concept of pervasive developmental disorders (PDD) described in DSM-IV and ICD-10. Therefore, the use of the DISCO enables diagnosis of specific autism conditions according to DSM-IV and ICD-10, but the DISCO goes beyond this. Information collected is placed in a broad developmental and behavioral context that reflects a dimensional view of a spectrum of autistic disorder and emphasizes its broad-ranging nature. Therefore, an individual's difficulties with reciprocal social interaction, communication, and repetitive behavior can be understood against the pattern of their developmental skills and associated abilities and difficulties. In addition, symptoms of other related disorders (e.g., language, attention, or motor impairments) can be elicited for further investigation. Furthermore, as the DISCO is concerned with the assessment of needs as well as with the diagnosis of ASD, the information it collects is relevant for guiding recommendations relating to management and interventions.

The DISCO interview schedule comprises more than 300 questions that are organized into eight parts. Part 1 provides a factual record of family, medical, and identifying information. Part 2 deals with the first 2 years of life. This infancy section consists of medical questions relevant to the diagnostic criteria for Rett's syndrome and a further set of questions relating to behaviors. Part 3 "Developmental Skills" forms the largest part of the DISCO. This section comprises subsections related to the following domains: (a) gross motor skills, (b) self-care,

(c) domestic skills, (d) independence, (e) verbal and nonverbal communication, (f) social interaction with adults and peers, (g) social play and leisure, (h) imagination, (i) pictures, reading, and writing, (j) visuo-manual skills, and (k) cognitive skills. All the items are rated by the interviewer in terms of three aspects: (a) current level, (b) delay in acquiring relevant skills, and (c) untypical (or unusual) behavior associated with the relevant skills. The untypical behaviors cover both the past and present behaviors.

Other parts of the DISCO also record both the past and present behavior patterns of the individual. Part 4 on repetitive activities includes subsections on stereotypies, atypical sensory responses, and repetitive routines. Part 5 on emotions includes questions on anxiety and mood changes. Part 6 on maladaptive behavior is concerned with behavior that impinges adversely on other people such as aggression and temper tantrums and disturbances of sleep. Part 8 on psychiatric conditions and forensic problems includes considerations of a range of psychiatric conditions relevant for adolescents and adults that may need further investigations such as symptoms of schizophrenia, personality disorders, and eating disorders, and this part also includes specific subsections on catatonic features and sexual problems.

Finally, there is a separate section (Part 7) to help guide clinicians to arrive at a clinical judgment independent of quantitative results. This part includes the interviewer's judgment on the quality of social interaction, social communication, social imagination, and overall pattern of activities. Whereas elsewhere during the interview, the aim is for the interviewer to establish the facts related to specific skills or behavior, in Part 7, the ratings are made on an overview of all the available information. This part of the schedule usually does not involve direct questioning of the informant and elicits judgments by the interviewer.

As mentioned above, the DISCO enables diagnosis of specific autism conditions according to DSM-IV category "pervasive developmental disorders" (American Psychiatric Association [APA], 1994) and the ICD-10 category "pervasive developmental disorders" (World Health Organization [WHO], 1993). Selected items throughout the interview provide the diagnostic criteria not only for these diagnostic systems but also for other diagnostic systems. These diagnostic systems include (a) Kanner's early infantile autism (Kanner & Eisenberg, 1956), (b) Asperger's syndrome based on Gillberg and Gillberg (1989) (Ehlers & Gillberg, 1993; Wing, 1981), (c) autistic spectrum disorder (Wing & Gould, 1979), and (d) Wing and Gould's definition of social impairment.

Completion of the entire interview takes approximately 2–3 h, and this provides a comprehensive picture of the individual's skills and abilities. This is particularly useful for complex cases. However, it is possible to adapt the DISCO for specific purposes. For example, in some cases, some sections may not be needed such as the section on medical/family information, where information may already be recorded, or the section on psychiatric conditions and forensic problems which applies to adolescents and adults. There may also be cases where the clinician needs only to obtain information on the current clinical picture, and therefore questions about delays in development and past behavior can be omitted. It is also possible to complete the interview using only items relevant for the diagnostic algorithms.

The DISCO is distinctively different from other interview schedules, such as the Autism Diagnostic Interview-Revised (ADI-R) (Lord, Rutter, & Le Couteur, 1994), that were designed to be closely related to the ICD-10 research criteria for childhood autism (WHO, 1993) and for DSM-IV autistic disorder (APA, 1994). The DISCO is more detailed in the information it collects and is broader and more developmental in focus. For example, the interviewer collects information on a very large number of separate items each covering specific examples of types of behavior, from the most common to the rare, in order to facilitate the final clinical judgments. The interviewer also records the individual's current developmental level and their developmental delays for all domains of functioning. Finally, the interviewer can then apply a number of

algorithms for different diagnostic systems using the DISCO.

The DISCO can be used both clinically (see section "Clinical Uses" below) and for research. A number of research studies have been published using different data sets to examine its psychometric properties (see section "Psychometric Data" below). Research using the DISCO includes examination of its algorithms for Asperger's syndrome, for Wing and Gould's autistic spectrum disorder, and for ICD-10 childhood autism (Leekam et al., 2002; Leekam, Libby, Wing, Gould, & Gillberg, 2000). Research has also used the DISCO to investigate the role of associated sensory symptoms (Leekam et al., 2007), the adult outcomes of autism (Billstedt, Gillberg., & Gillberg, 2007; Cederlund et al., 2008), ASD symptoms and behavioral profiles in Rett's syndrome (Wulffaert et al., 2009a), Cornelia de Lange syndrome (Wulffaert et al., 2009), mild intellectual disability (Soenen et al., 2009), gender dysphoria (de Vries, Noens, Cohen-Kettenis, van Berckelaer-Onnes, & Doreleijers, 2010), fetal alcohol syndrome (Mukherjee, Layton, Yacoub, & Turk, 2011), and the link between epilepsy and autism symptoms (Danielsson, Gillberg, Billstedt, Gillberg, & Olsson, 2005; Turk et al., 2008). Epidemiological studies have also used the DISCO to study autism in adulthood (Brugha et al., 2011) and in the population of the Faroe Islands (Ellefsen et al., 2006). In addition, items within the DISCO have extracted to form research questionnaires and checklists for research purposes. These research measures have been used in studies of autism and typical populations. For example, a checklist has been used to investigate the empirical clustering of symptoms and cognitive abilities (Prior et al., 1998) and the relation between language delay and diagnosis (Eisenmajer et al., 1996) and a questionnaire used in the study of the development of repetitive behaviors (Leekam et al., 2007).

Training for the DISCO has been developed by Dr. Judith Gould and Dr. Lorna Wing and consists of a 5-day training course in two stages. Training covers the Lorna Wing Centre's method of diagnosis, the complexities of diagnosis and assessment of needs, and the specialist psychological assessment. Stage 1 is for 3 days preceded by pre-course work and followed by evaluated interim coursework. Stage 2 is for 2 days leading to accreditation. A computer program is available for accredited users. Training is available for clinicians involved in diagnosis and assessment of needs and for professionals who use DISCO for research. Information about training is available from the following email address: *elliot.house@nas.org.uk*.

Historical Background

The origins of the DISCO are to be found in a study comparing children with autism with children with other disabilities (Down's syndrome, developmental receptive language disorders, developmental expressive language disorders, partial sight and partial hearing) and a group of children with typical development (Wing, 1969). The "Childhood Behavior Schedule," a questionnaire sent to parents by post, was designed for this study. It elicited information concerning the social, language, imagination, and motor impairments and the odd responses to sensory input and stereotyped behavior found in autism. These behaviors are now covered in much more detail in the DISCO.

The original questionnaire schedule was reorganized and expanded to include items on developmental skills and was named the "Handicaps, Behavior, and Skills (HBS)" schedule. A variety of sources were used when constructing the developmental items, including Cooper, Moodley, and Reynell (1978), Doll (1965), Egan, Illingworth, and MacKeith (1969), Griffiths (1967), Sheridan (1973, 1977), and Williams and Kushlick (1970). The HBS was used for research in an epidemiological study of autism spectrum disorders in children in the former London Borough of Camberwell (Wing & Gould, 1979) and in a follow-up of the children into adult life (Wing, 1988). The original epidemiological study was designed to identify children with any of the features of autism in order to see if any clinical patterns could be discovered. This distinguished it

from previous studies (e.g., Lotter, 1966, 1967) which looked specifically for children showing the narrow criteria originally suggested by Kanner and Eisenberg (1956).

The DISCO interview schedule was developed from the HBS schedules for use in diagnostic work for both clinical work and research purposes. It was designed to include referrals with associated physical or psychiatric conditions or other developmental disorders such as dyslexia and dyspraxia. The schedule was developed to be relevant for all these variations in the clinical pictures. It has been expanded to include past behavior from infancy onward as well as for current state. It is also suitable for use with adults (see section on "Clinical Uses" below).

Reliability and validity studies of the DISCO items were published in 2002 (see section on "Psychometric Data" below), when the ninth version was current (Leekam, Libby, Wing, Gould, & Taylor, 2002; Wing, Leekam, Libby, Gould, & Larcombe, 2002). The schedule has had two subsequent minor revisions and the current version is the eleventh revision and research has been published on both these versions (see "Psychometric Data" section). To date, research has been published using the algorithms of ICD-10 childhood autism, ICD-10 Asperger's syndrome, and ICD-10 atypical autism, Gillberg's Asperger's syndrome, and Wing and Gould's autism spectrum disorder (see Leekam et al., 2000 and Leekam et al., 2002). Research using the other algorithms – DSM-IIIR pervasive developmental disorders (American Psychiatric Association, 1987), Kanner's and Eisenberg's criteria (Kanner & Eisenberg, 1956), and Wing and Gould's definition of social impairment – has not yet been published.

Psychometric Data

The psychometric properties of the DISCO have been examined in studies carried out in UK, in Sweden, and in Holland. The UK studies (Leekam et al., 2002; Wing et al., 2002) used DISCO-9 to carry out inter-rater reliability and validity analyses with data from 82 cases aged 3–11 years. Thirty-six had autistic spectrum disorder, 17 had learning disability, and 14 had language impairments. Inter-rater reliability was analyzed for over 400 items in the interview. Inter-rater reliability was high with kappa coefficient or intra-class correlation at.75 or higher for over 80% of the interview items. Analyses with the same sample examined two algorithms based on the ninth revision of the schedule (DISCO 9). Algorithm diagnoses were applied to interview items in order to analyze the relationship between clinical and algorithm diagnoses and the inter-rater reliability between interviewers for each algorithm output. Results showed that clinical diagnosis was significantly related to the diagnostic outputs for both algorithms and inter-rater reliability was high for both algorithms. The ICD childhood disorder algorithm produced more discrepant diagnoses than the Wing and Gould's autistic spectrum algorithm. Analysis of the ICD-10 algorithm items and combination of items helped to explain the reason for these discrepancies.

The Swedish study (Nygren et al., 2009) used a translation of the tenth version of the DISCO (DISCO-10). Validity analysis compared DISCO-10-algorithm diagnoses with clinical diagnoses and with Autism Diagnostic Interview-Revised (ADI-R) algorithm diagnoses in 57 cases of children and adults. Results showed good to excellent inter-rater reliability in 40 cases. The criterion validity was excellent when compared with clinical diagnoses and the ADI-R. The report concluded that although the DISCO-10 is not as widely used as the ADI-R, the evidence shows that it has the same level of psychometric credibility.

The most recent psychometric research has been carried out by Maljaars, Noens, Scholte, and Berckelaur-Onnes (2011) using the Dutch translation of the DISCO-11. Their study included young children with different levels of intellectual disability (ID) including no ID, borderline, mild, moderate, and severe ID. DISCO algorithms for ICD-10 childhood autism and atypical autism were used in comparison with clinical classification and the Autism Diagnostic Observation Schedule (ADOS; Lord et al., 1999) and Social Communication Questionnaire (SCQ: Rutter et al., 2003) to

examine its criterion and convergent validity. Sensitivity and specificity of the DISCO were.96 and.79, respectively. Strong agreement was found between DISCO-11 and ADOS classification ($k = .69$, $p < .001$), although lower agreement was found with the SCQ ($k = .49$, $p < .001$). Comparisons with clinical diagnosis showed correct classification for the majority of cases with mismatches mainly explained by cases in the moderate and severe ID range. These results confirm that the DISCO has good criterion and convergent validity. This was especially the case for those with average intelligence or mild intellectual disability. However, the specificity was lower for those with moderate and severe levels of intellectual disability ($IQ < 50$), in line with previous findings.

Clinical Uses

The DISCO schedule can be used in clinical practice to fulfill three main purposes – to provide a clinical description, to make a clinical diagnosis, and to provide recommendations. First, it can be used to provide a *clinical description* by assisting the clinician in collecting information needed to compile a developmental history and a description of the present clinical picture. This information, including current level of development in everyday skills and the pattern of behavior, can be used as the basis of a narrative clinical report. Usually, the informant is someone who has known the person concerned from birth. However, when the DISCO is used with an adult and no informant is available to give an early history, the items of the DISCO schedule can be completed for current skills, deficits, and untypical behavior. Second, the DISCO can be used to assist in making a *clinical diagnosis* of autism spectrum disorders as well as of other disorders of development affecting social interaction and communication. Related to this purpose, the schedule can be used to run a number of different diagnostic algorithms according to different classification systems (see "Description" section earlier). In the case of an adult, where no developmental history is available, a diagnosis according to DSM and ICD is not possible, but the information gathered from the DISCO allows the experienced clinician to use their clinical judgment to make a working diagnosis in order to plan a management program. Finally, another important purpose of the DISCO is to provide *information that will guide a clinician's recommendations* concerning programs of education, adult support, and management of behavior.

See Also

- ▶ Asperger, Hans
- ▶ Autism Diagnostic Observation Schedule
- ▶ Diagnostic Instruments in Autistic Spectrum Disorders
- ▶ Epilepsy
- ▶ Fetal Alcohol Syndrome
- ▶ ICD 10 Research Diagnostic Guidelines
- ▶ Intellectual Disability
- ▶ Kanner, Leo
- ▶ Rett's Syndrome
- ▶ Wing, Lorna

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Diagnostic Interviews

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Definition

The diagnostic interview (DI) is a central component of the process (diagnostic process) in which, for a variety of reasons ranging from research to the development of an intervention plan, a decision is made as to whether there is sufficient evidence in an individual's symptoms and signs for a diagnosis of one or more of the "disorder(s)" defined by the criteria of the internationally agreed diagnostic classification systems (► ICD 10 Research Diagnostic Guidelines).

Historical Background

Following the initial descriptions of autism and Asperger syndrome in the 1940s, agreed criteria emerged slowly and a number of checklists were developed which matched a list of symptomatology against the criteria evolving at the time in ICD 9 (1975) and DSM-II (1980) (DSM-III) focusing on accounts of observable behavior, particularly in childhood, notably the E-2 (Rimland diagnostic form for behavior disturbed

children (E-2)) and the Autism Behavior Checklist (ABC).

In the 1960s, in both America and the UK, the search for greater consistency and precision in psychiatric diagnosis led to the development of standardized diagnostic interviews; initially schedules of standard questions, these became elaborated into a more clinical interview that encouraged the interviewer to cross-examine the patient until the nature of the symptom was clear (Wing, Birley, Cooper, Graham, & Isaacs, 1967). A decade later, the same model led to the development of more systematic interviews in making the diagnosis of autism (as the prototypical disorder of the pervasive developmental disorders). Wing and Gould produced the Handicaps, Behavior, and Skills Schedule (HBSS) which they later refined into the DISCO (Diagnostic Interview for Social and Communication Disorder), Schopler and Reichler developed the Childhood Autism Rating Scale (CARS), and Le Couteur, Rutter, and Lord produced the Autism Diagnostic Interview (later revised to become the ADI-R) (Autism Diagnostic Interview-Revised). These standardized diagnostic instruments consist of a semi-structured interview (based on the agreed symptom criteria) with an adult informant and became recognized as the "gold standard" in terms of their comprehensiveness and reliability in obtaining a clinical history.

The identification of a broader spectrum of autism disorders (ASD), going beyond the original narrow definition for autism, led to an extension of the content and form of diagnostic instruments (diagnostic instruments in autistic spectrum disorders). Examples of these are the Asperger Syndrome Diagnostic Interview (ASDI) and the Autism Questionnaire (AQ) (Baron-Cohen, Wheelwright, Skinner, Martin, & Clubley, 2001) for Asperger syndrome, the Pervasive Developmental Disorder in Mental Retardation Scale (PDD-MRS) for people with intellectual disability (Kraijer & de Bildt, 2005), and the Diagnostic Interview Guide for use in general adult psychiatry (Royal College of Psychiatrists, 2011). The recognition of autistic traits (broader autism phenotype – broader spectrum prevalence) in the relatives of people with ASD has led to the development of a variety of interviews to identify these behavioral and personality characteristics.

In many of these, the emphasis was on obtaining material from informants (usually parents) about behavior. At the end of the 1990s, the Autism Diagnostic Observation Schedule (ADOS) was developed as play and activities based assessment with the individual; this assessment is described as a series of tightly defined, detailed observations which systematically elicits autistic symtomatology.

In the last decade, the number of instruments, their use varying from screening to diagnosis, has reflected the mounting interest in ASD while increased public awareness and the Internet have fostered the growth of self-rating scales and the demand for confirmatory diagnostic interviews.

Current Knowledge

The Content of the Interview

There are a variety of models for conducting a diagnostic interview. The structure or framework for the DI is important, but there is no compelling evidence to recommend any particular interview format for any specific situation. For all DIs (irrespective of the interview format), the underlying context is the social engagement and interaction between the interviewer and the interviewee. The interviewing skills and attitudes of the interviewer (clinician or researcher) affect the quality of the interaction which in turn influences the success of the information-gathering process. The responses of the interviewee (also affected by many factors including whether they already know the interviewer; the interviewee is in fact the subject of the interview; his or her intellectual and communicative ability, motivation, emotional state, and so on) and the setting can also influence the outcome and "success" of the diagnostic interview (DI).

For an ASD DI to be successful, it should include:

1. An account of the individual's current concerns – the symptoms that have brought to interview at this particular time, and their development.

2. A systematic survey of the symptomatology associated with ASD, especially that which is directly related to the diagnostic criteria. This review should also include consideration of other behavioral features known to be commonly associated with ASD such as motor coordination, sensory and perceptual symptoms, and feeding and bowel problems. It should include any other behavioral problems recognizing that these can occur in response to a variety of potentially modifiable influences from toothache to a change in school timetable or work colleagues.
3. The wider setting – the individual's everyday life and activities, relationships, and accomplishments.
4. The structure of their family and any history of developmental or psychiatric disorder.
5. An account of the individual's development and their acquisition of skills, not just in infancy and early childhood but subsequently, through school and after, to give a detailed "developmental history."
6. An account of any other anomaly, past or present, including developmental, psychiatric, or medical disorder as well as of any other adversity including deprivation or substance abuse.

The diagnostic interview will usually be complimented by a direct examination of the individual together with the collation of background reports (including direct observation in other settings). All these sources of information will contribute to the accuracy and value of the final, "best estimate," diagnostic conclusions which, in turn, will inform the multiagency needs and skills-based management plan.

While the DI and examination are conceptually distinct, in practice, there is likely to be a substantial overlap. For example, when an individual is being interviewed and asked to provide their own account, the clinician will be considering the way the account is being given, the quality and content of the social interaction, and other individual characteristics (such as their appearance, behavior, and communication). These factors will inevitably affect the interaction between the clinician and the interviewee, thus shaping the course of the DI.

How the DI progresses is at least in part dependent on the skills of the interviewer, their training and expertise, as well as the setting of the interview and the expectations of the interviewees. All these different aspects can foster a "dialogue" between clinician and individual. Instruments may be combined for history-taking and observation although, in the end, the distinction between them is one of emphasis rather than clear-cut. For example, while the framework of observational ratings is central to the ADOS, it is also a semi-structured interview, fostering a "dialogue" between clinician/researcher and individual.

The Format of the Diagnostic Interview

The interview may take a range of formats depending on its purpose:

(a) *Unstructured*. The structure is not immediately apparent, but the interviewer's clinical impression (or equivalent) determines the content, purpose, and conclusions of the interview. Its primary purpose may be a different one with diagnosis as a secondary consideration. Such an assessment depends greatly on the individual clinician's experience and for this reason it is likely to be difficult to understand or replicate.

(b) *Semi-structured/interviewer based*. The interview, usually based on a predetermined diagnostic framework, has well-defined symptoms to be explored. Usually conducted in a conversational style, it takes the form of required questions supplemented by additional, optional, open-ended prompts as necessary until there is sufficient information for the trained interviewer to make the coding judgment for each item and section of the interview. The precision and clarity with which symptoms and their codings are defined contribute to the quality of the instrument.

(c) *Structured/respondent based*. The trained interviewer closely follows a defined format without deviation; the interview may be restricted further by giving the interviewee a limited number of choices. The interviewer is not called upon to make any clinical judgment (and, indeed, may not know very much about ASD and other diagnoses to complete the interview).

The result is a relatively high inter-rater reliability and an interview that lends itself to being turned into a self-completion questionnaire. This can be administered as a preinterview contribution or completed in a computerized format (e.g., the E-2) or Autism Spectrum Quotient (AQ) questionnaires). Increasingly for some individuals, access to this type of questionnaire has been a staging post in their journey to diagnosis.

(d) *A composite*. The interview incorporates the material from a preinterview questionnaire. Not only is this a more effective use of time, substantially shortening the DI, but many individuals are more comfortable (and therefore more open) with the impersonality of a self-completion questionnaire. Examples of DIs that use information-collected preinterview include the Developmental, Dimensional and Diagnostic Interview (3Di) (Skuse et al., 2004) and the Adult Asperger Assessment (AAA) (Baron-Cohen, Wheelwright, Robinson, & Woodbury-Smith, 2005).

It is difficult to define the point at which the self-completion or screening checklist becomes a more formal diagnostic instrument as this will depend on the skill, experience, and intent of those employing it.

The more standardized the format for gathering and organizing the information, the greater the consistency in the data collected and the diagnoses arrived at by clinicians and researchers of varied experience and views and from different centers. However, validity is lost with increasing rigidity that limits the clinician's skills. Using agreed diagnostic systems permits prospective research as well as making clinical material available for retrospective review for service and academic analysis. The whole process is more transparent and can be taught to trainees.

The style of interview has to be appropriate to the task in hand: a structured interview, with its very narrow, specific remit, will be used for screening or surveys and as such can be administered by a technician. The semi-structured interview provides the framework for a more in-depth assessment when a definitive research or clinical diagnosis is required, and usually includes one or more summary algorithms to identify ASD using prespecified thresholds. However, the protean presentations of ASD and the demands of clinical work mean that, in the end, even the best of these instruments does not remove the need for knowledge and experience of ASD in coming to a clinical diagnosis which will inform the diagnostic formulation and intervention planning. There are cases, notably in adulthood, of individuals with less clear-cut presentations where it is difficult to discern the pattern of symptoms. It is here that the experience of working with a wide variety of people across the variations of age, ability, gender, ethnicity, and comorbidity makes it possible to appreciate the characteristic impairments of ASD. In addition, within the assessment team, there needs to be sufficient knowledge and experience to recognize the developmental and psychiatric disorders that are associated with ASD (notably attention deficit hyperactivity disorder (ADHD) (▶ Attention Deficit/Hyperactivity Disorder) and developmental coordination disorder (▶ Developmental Coordination Disorder)).

The choice to use a particular diagnostic instrument will be informed by both the purpose of the interview and the features of the instrument. For example, the ADI-R (▶ Autism Diagnostic Interview-Revised) provides a summary lifetime diagnosis, using information about early childhood and the current state for key aspects of behavior and development and a record of the particular unusual behaviors (such as restricted, repetitive mannerisms and stereotyped behaviors) relevant to the decision as to whether a pervasive developmental disorder is present or not. The frequency and intensity of each symptom is carefully graded to give a detailed quantified picture of key components. The DISCO (▶ Diagnostic Interview for Social and Communication Disorders) takes a rather broader approach to arrive at a systematic description that allows the identification of other developmental disorders. The 3Di is a computer-based interview designed to focus on current functioning to assess autistic traits, social impairments, and comorbidities in children of normal ability. The content of the interview generates a structured report with summary algorithms of symptom profiles for autism and common

non-autistic comorbidities. By contrast, the CARS (▶ Childhood Autism Rating Scale) draws on observation as well as interview. The format is much less structured, guiding the interviewer through the relevant domains rather than individual symptoms, requiring the researcher/clinician to reach the coding decisions through the integration of information from subject and informants

Most structured instruments (▶ Diagnostic Instruments in Autistic Spectrum Disorders) have been designed for a specific group, often defined by age (e.g., childhood) or ability. This means that the phrasing or materials might not be suitable for a different "client" group when adaptation of materials and further reliability and validity studies would be required.

As adults come forward for diagnosis, including, for example, those with a severe intellectual disability, women of normal ability, and individuals with preexisting psychiatric and personality disorder diagnoses, the challenge will be how best to tailor the format and content of the DI appropriately. A particular issue is the necessity of a developmental history to confirm that the evidence of delayed or deviant development dates back to early childhood. This becomes particularly important in adulthood should there be a need to differentiate ASD from other disorders (such as schizophrenia (▶ Schizophrenia) or dissocial or obsessive-compulsive personality disorders (▶ Obsessive-Compulsive Disorder (OCD))). However, it is this client group who may experience real difficulty finding an informant with accurate knowledge about their early development.

Whatever the format of the DI, training in its use is required. This applies especially to standardized instruments where the more structured the interview, the more straightforward the training. While it may be obtained by attending a specific training course, receiving in-house individual tuition or by using a self-taught program, it should include a check that the clinician/researcher has reached an acceptable standard of accuracy and reliability. This should be followed by regular opportunities to maintain consistency and reliability over time. Undertaking the rating of standardized videos or attending joint sessions with colleagues can help to maintain best practice in administration of the procedure as well as reliability between colleagues and different centers. However, because this is time consuming and may be seen as additional pressure on scarce resources, it is all too easily overlooked.

Implementing the Interview

A DI may take place as a single event in one setting or be spread across several sessions and settings. The venue (clinic, specialist center, home, school, or other setting) will depend on the needs of individual, their family/carers, clinicians, and services. For example, a very anxious individual or a disabled relative may only be accessible in the home; a clinic may be the only place to get the opinion of a busy clinician or be the best place to provide the structured, calm setting needed to see someone at their best. It may be necessary to go to a school, nursery, or workplace to see the context and thereby understand what is happening there. Observation in different settings may allow some distinction to be made between what behavior is pervasive and what is situational and in response to a particular environment or set of circumstances.

The DI must provide sufficient information for the interviewer to decide whether the symptoms and signs are:

(a) *Sufficiently pronounced in their intensity or frequency* to cross the threshold that separates so-called normal variation for developmental progress and personal characteristics from disorder: threshold that may well vary according to the problems experienced by the individual, the context and situation, and the "demands" and expectations placed upon them. For example, a young child who has managed well in their home with a supportive family may find it much more difficult to settle into an educational setting such as preschool if they do not have sufficiently flexible communication, social, and play skills to join in with other young children or cope with new and unexpected changes in routine in an otherwise familiar environment. Similarly, an adult who may have learnt to manage effectively in a particular workplace may still find that he/she is less able to succeed

in social and more personal relationships. For the diagnostic interview to be successful, the interviewer needs to understand the importance of gathering information about the development of the individual's behavior in different settings and contexts over time. This may well require (especially for children and young people but often also for adults) information from other informants who know the subject well in different settings.

(b) *Sufficiently close to the currently agreed criteria* (▶ ICD 10 Research Diagnostic Guidelines) for a diagnosis of ASD or might be explained better by some other disorder. ASD is a neurodevelopmental disorder defined by its onset in early childhood, something that may be difficult to confirm in later adulthood.

The interview therefore has to enable the clinician to distinguish the signals of ASD against the background noise of other complicating disorders, particularly other developmental and psychiatric disorders such as intellectual disability, specific speech and language disorders, attention deficit hyperactivity disorder (ADHD), epilepsy, and/or mental health problems such as anxiety or obsessive-compulsive disorder.

The interview must also be appropriate *to its immediate purpose*: for example, the requirements for inclusion in a research study might be more stringent than those needed as the basis for clinical or administrative planning.

A diagnosis may be sought for many reasons, ranging from inclusion in a research study, accessing specific treatments and interventions, eligibility for particular education provision, achieving financial benefits, and gaining family understanding, through to assisting a court to understand the needs of the individual. Most importantly, it can give the individual a more complete understanding of their profile of strengths and impairments. The diagnostic interview also provides a benchmark against which subsequent progress can be measured. It has to be tuned accordingly to meet these specific requirements.

The results of the interview should be valid (i.e., that others would agree with the diagnostic conclusions) and reliable (they would be the same if repeated, whether by the same clinician or others). The process needs to be acceptable to all, sufficiently transparent to be understood, and sufficiently valued for the results to be useful.

Most instruments require the interviewer to make judgments and ascribe a numerical score to each item in the assessment. These scores may be collated to symptom and/or domain scores which can be summarized within one or more instrument-specific diagnostic algorithms. For a number of instruments, usually those that have been developed for research, the reliability and validity of the algorithm scores and instrument-specific diagnostic thresholds have been tested and refined in different populations. However, it is important to recognize that a diagnostic algorithm score derived from a particular instrument may contribute to, but is not equivalent to, a clinical diagnosis. This is something broader, using an internationally agreed diagnostic classification system, based on information gathered from several sources, and often involving professionals working in different agencies to provide a multidisciplinary assessment. This information, in turn, will contribute to, but is not sufficient for, the development of a (needs and skills based) management plan. The DI, which may include the use of a structured instrument, is an opportunity for the development of a dialogue between the interviewer, the individual, and the family/carer and, as such, can also provide the context for sharing the outcome of the multiagency assessment.

One of the great values of using an agreed diagnostic classification system is that it facilitates the possibility of successful research collaborations between clinical academic centers as well as making clinical material available for service review and analysis. With greater transparency between services and centers, there is an increase in research capacity, the ability to share new knowledge and significant developments, and opportunities for trainees to learn from the experiences of their colleagues.

Future Directions

A number of standardized instruments are now in routine use for the DI providing both a valuable

framework for the history as well as being the basis for the start of a therapeutic relationship with individuals and families. Many are time consuming and resource intense, and this has to be balanced against the benefits of the therapeutic alliance and detailed descriptions of behavior. While the use of a detailed DI may well be appropriate for a behavioral syndrome that has such a variety of presentations and underlying disorders, there is great pressure to develop briefer processes and ever greater consistency while maintaining validity.

The value of increasingly sophisticated online questionnaires as an adjunct to the DI needs to be investigated. New measures will also be required as further understanding of the complexity of the autism spectrum across the lifespan become available. However, the development of new instruments is a complex and expensive task. An equally important challenge is to investigate the best ways of getting reliable information from different sources to complement the DI and enable the clinician/researcher, referred individual, and family achieve a valid diagnostic formulation that in turn leads to an accurate needs- and skills-based management plan.

The recognition of autistic traits in the families of people with autism has led to the development of instruments to identify these which, once sufficiently validated and standardized, will be published.

In spite of many claims and much research, there is still no reliable laboratory test for ASD. However, even if such a test were ever developed, its results would complement the diagnostic interview rather than replace it, a model seen in other medical conditions as, for example, the use of genetic testing in the clinical diagnosis of Down or Rett syndrome.

With increasing awareness and understanding of ASD, there is likely to be greater emphasis on the identification of the strengths, skills, needs, and impairments of the individual and their family, as well as on diagnosis, to inform a dimensional diagnosis and profile across different domains of functioning. Although separate assessments may be needed to measure different aspects of an individual's functioning (e.g., social responsiveness, language and flexibility, anomalies in sensory sensitivity and motor coordination), this information will always need to collated alongside the findings of a DI to achieve a diagnostic formulation. At least for the foreseeable future, classification systems used in clinical and research practice, together with other social and resource pressures, will continue to require a categorical diagnosis of ASD.

See Also

- ▶ Anecdotal Observation
- ▶ Asperger Syndrome Diagnostic Interview
- ▶ Autism Behavior Checklist
- ▶ Autism Diagnostic Interview-Revised
- ▶ Autism Diagnostic Observation Schedule
- ▶ Broader Autism Phenotype
- ▶ Childhood Autism Rating Scale
- ▶ Developmental Coordination Disorder
- ▶ Diagnostic Interview for Social and Communication Disorders
- ▶ Diagnostic Process
- ▶ Dimensional Versus Categorical Classification
- ▶ DISCO
- ▶ DSM-III
- ▶ Dyspraxia
- ▶ Evaluation of Sensory Processing
- ▶ ICD 10 Research Diagnostic Guidelines
- ▶ Informal Assessment
- ▶ Obsessive-Compulsive Disorder (OCD)
- ▶ Psychotic Disorder
- ▶ Schizophrenia
- ▶ Sensory Impairment in Autism
- ▶ Theory of Mind

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Diagnostic Overshadowing

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Definition

Diagnostic overshadowing refers to the negative bias impacting a clinician's judgment regarding co-occurring disorders in individuals who have intellectual disabilities or other mental illness. Symptoms or behaviors that may be due to a specific mental illness are attributed to another disorder, historically Mental Retardation, without considering alternative etiology.

Historical Background

Reiss, Levtan, and Szyszko first coined the term "diagnostic overshadowing" to describe the tendency to assess individuals with intellectual disability less accurately (Reiss, Levitan, & McNally, 1982; Reiss, Levitan, & Szyszko, 1982; Reiss & Szyszko, 1983). Subsequent research has consistently demonstrated that the cognitive deficits displayed by an individual negatively impacted the ability of clinicians to make accurate judgments with regard to other co-occurring disorders (c.f., Jopp & Keys, 2001; White et al., 1995).

Jopp and Keys provide a review of the concept of diagnostic overshadowing in addition to possible moderators (Jopp & Keys, 2001). Their review indicated that most clinician based variables, such as nature of clinical position (e.g., school, clinical and counseling psychologists, social workers), educational level (e.g., graduate student vs. Ph.D.), and years of experience, were not associated with the strength of the bias. Moreover, though the presence of multiple disabilities would presumably be more inherently difficult to disentangle for a diagnosing clinician, the research clearly indicated that the clinician's perception of the cognitive deficits present in the individual being assessed was the most salient feature reducing diagnostic accuracy.

Diagnostic overshadowing causes clinicians to overlook a range of comorbid mental illness in individuals with intellectual disability, including phobias, schizophrenia, avoidant personality disorder, and depression (Jopp & Keys, 2001). As Jopp and Keys note, the bias potentially serves to reduce both sensitivity and specificity – two important components of accurate diagnosis. Sensitivity refers to the ability to accurately diagnose individuals who have a disorder, while specificity refers to the ability to accurately rule out individuals who do not have a particular disorder. Diagnostic overshadowing may reduce sensitivity by creating more false negatives, such as when a child with a cognitive deficit is not diagnosed with an anxiety disorder that they truly have. It may also reduce specificity by increasing the number of false positives, such as when a child is diagnosed with an intellectual disability when they really have another disorder that has caused the cognitive deficit.

Only one factor has been found to moderate the impact of diagnostic overshadowing, which is how clinicians process information, termed cognitive complexity (Jopp & Keys, 2001). That is, when a clinician is able to view a patient's behaviors in a multidimensional fashion, incorporating a wide range of thoughts, feelings, and behaviors, which in turn leads to generating multiple hypotheses, the impact of the patient's cognitive deficits and the resulting diagnostic overshadowing can be reduced.

The concept of diagnostic overshadowing has direct epidemiological implications. If diagnostic accuracy is impacted and individuals are missed with regard to a diagnosis, or misdiagnosed, then prevalence data may be misleading or incorrect. Moreover, epidemiological studies not only inform prevalence and incidence of a disorder and its associated characteristics, but can also help guide etiological understanding. For example, this was especially the case in autism wherein the initial report of the prevalence of co-occurring epilepsy in autism led to scientists to examine biological mechanisms in contrast to the nonbiological theories promulgated at the time (Bryson & Smith, 1998; Lotter, 1974). If diagnostic overshadowing causes clinicians to overlook important co-occurring disorders, advancements in etiological understanding may also be impacted.

Current Knowledge

More recently, clinicians and researchers have extended the notion of diagnostic overshadowing beyond individuals with cognitive deficits to those with other disorders such as autism. In addition, diagnostic overshadowing has been extended beyond the diagnostic process to discussions regarding how it may impact treatment. For example, some researchers have found that diagnostic overshadowing has direct treatment implications. How an individual is diagnosed affects what treatments are recommended by their treating providers. If the treating provider is affected by diagnostic overshadowing and thus does not recognize other disorders, those other difficulties will not be appropriately treated. Minnes and Steiner found that parents of children with Down syndrome, for example, reported more problems receiving treatment for the co-occurring illnesses, such as cataracts, thyroid problems, and possible dementia (Minnes & Steiner, 2009).

Researchers have proposed that the same mechanism biasing clinicians who work with individuals with cognitive deficits may also apply to clinicians who work with individuals with autism. More specifically, given the wide range of cognitive abilities in addition to the other symptoms of autism, such as communication problems and other challenging behaviors, clinicians may be underdiagnosing comorbid disorders in individuals with autism, despite the accumulation of evidence that demonstrates a high prevalence of co-occurring disorders in autism such as mood disorders, attentional disorders, and behavioral disorders (Simonoff, Pickles, Charman, Chandler, & Baird, 2008).

Others have demonstrated how diagnostic overshadowing has impacted epidemiological research results. For example, Charman and colleagues, using the Special Needs and Autism Project sample (i.e., total population cohort of 56, 946 children in the UK ages 9–10), compared the concordance of their research-based diagnosis to the diagnoses derived from local services in children with IQs above and below 70. They found that the amount of children diagnosed with an autism spectrum disorder from local services who had cognitive impairment was less than those in that group that had been diagnosed through their epidemiological research design, 25% compared to 45% (Charman et al., 2009). These results demonstrate the potential diagnostic overshadowing bias and its impact on prevalence rates of autism depending on method of ascertainment.

Future Directions

In their 2001 review, Jopp and Keys noted four areas in need of research with regard to diagnostic overshadowing which remain relevant despite the broadening of diagnostic overshadowing beyond intellectual disability: (1) improve specification of clinical decisions that make up diagnostic overshadowing, (2) note the processes whereby diagnostic overshadowing occurs, (3) increase the appreciation of other variables such as the environment as they impact overshadowing, and (4) explore overshadowing more fully using qualitative and other methodologies (Jopp & Keys, 2001). How much overshadowing actually takes place in local and "real world" clinics, as opposed to the vignettes used in the research that explore its presence, needs to be more fully explored, as well as a better

delineation of how diagnostic overshadowing is impacting other diagnoses, such as autism, in addition to cognitive deficits alone.

See Also

- ▶ Autism
- ▶ Epidemiology

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Diagnostic Process

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Definition

Autism spectrum disorders (ASDs) are a group of heterogeneous disorders that share overlapping diagnostic criteria. These include deficits in communication and socialization, and restricted interests and repetitive behaviors. Deficits in socialization are the hallmark of all ASDs, and deficits in this area are diagnostically required to meet criteria for all of the ASDs. Important to note is that even with these three core domains of impairment, heterogeneity across these symptoms exists on an individual basis. As such, the classification systems used to categorize the core impairments in ASD have been amended over time. Even still, the diagnostic process of ASD is complicated by numerous factors including the differential diagnosis within ASDs, a push to identify symptoms of ASD at very young ages, and the stability of ASD diagnoses over time. Thus, this entry will review these factors in regard to the diagnostic process of ASD.

Historical Background

Autism spectrum disorders were first introduced into the diagnostic nomenclature in 1980 (i.e., *Diagnostic and Statistical Manual of Mental Disorders, Third Edition* [*DSM-III*]; American Psychiatric Association [APA], 1980) under the category of pervasive developmental disorders. However, two of the currently recognized diagnoses, pervasive developmental disorder not otherwise specified and Asperger's disorder, were not introduced as diagnostic disorders until 1987 and 1994, respectively. Although the diagnostic categories have changed throughout the different editions of the *DSM*, the main areas of impairment (i.e., symptom domains) have remained largely consistent. For example, deficits in interpersonal relationships,

impairment in communication, and bizarre responses to the environment were the three main symptom domains in the *DSM-III*. Currently, the three main symptom domains include impairment in social interaction, impairment in communication, and restricted interests and repetitive behaviors (APA, 2000).

Current Knowledge

ASD is an umbrella term used to encompass five disorders: autistic disorder (AD), Asperger's disorder (AS), pervasive developmental disorder not otherwise specified (PDD-NOS), Rett's disorder, and childhood disintegrative disorder. Given the very low incidence of these latter two conditions, the focus of this overview is related to AD, AS, and PDD-NOS. A child is referred for an assessment of ASD if developmental milestones are not met or after observations of behaviors related to diagnoses on the autism spectrum. Initial observations of symptoms or concerns regarding developmental milestones are most often made by teachers, day-care providers, pediatricians, and parents. As with other psychiatric disorders, best practices in regard to the assessment of ASD is to incorporate multiple informants and multiple methods. Informants come in the form of teachers, day-care providers, parents, grandparents, guardians, and other therapists familiar with the child (e.g., physical therapist, speech therapist). The assessment for a diagnosis of ASD should include an interview, an observation, and the administration of at least one assessment measure that has been psychometrically investigated to screen/diagnose ASD. It is also common practice to utilize measures of cognitive functioning and adaptive function to assess for a comorbid diagnosis of intellectual disability. During the entirety of the assessment sessions, clinicians assess for the triad of impairments indicative of an ASD diagnosis: deficits in communication, impairments in socialization, and the presence of repetitive motor movements (e.g., hand flapping) or intense and restricted interests (e.g., will only play with cars). Clinicians should also be mindful of the high rates of comorbid psychopathology and challenging behaviors, and should use ASD measures that also address these issues.

More recently, there has been a move to diagnose ASD at very young ages. Fortunately, assessments designed to screen for symptoms of ASD in young populations have been developed. The measures with the best research to support them for this purpose are the *Modified Checklist for Autism in Toddlers* (*M-CHAT*; Robins, Fein, Barton, & Green, 2001) and the *Baby and Infant Screen for Children with aUtIstic Traits-Part1* (*BISCUIT-Part1*; Matson, Boisjoli, Wilkins, 2007). Both measures are rating scales that can be administered in 30 min or less, have determined cutoff scores, and present with sound psychometric properties. Given the push to identify symptomatology indicative of ASD at younger ages, researchers have explored the diagnostic stability of symptoms using samples of toddlers. Outcomes of such investigations have provided support for the diagnostic stability for ASD for children under age three (Worley, Matson, Mahan, Kozlowski, & Neal, 2011). If diagnostic status changes, it is often from one ASD to another (e.g., PDD-NOS to AD; Cox et al., 1999; Eaves & Ho, 2004; Kleinman et al., 2008). Thus, at this time, research supports the need and the ability to reliably diagnose ASD during the toddler years. Diagnosing ASD at very young ages is important, as early intervention is key for long-term success.

Another factor to consider when choosing an assessment tool is the ability of the measure to differentiate between the various ASDs, given the blurred boundaries of the various disorders comprising the spectrum. The reader will note that with the appearance of the *DSM-V*, all ASDs will be collapsed together into one diagnostic category. However, for the purpose of service planning, evaluating the severity and symptom profiles will remain very important.

Although ASD can be reliably differentiated from other developmental disorders, differential diagnosis between AD, AS, and PDD-NOS remains difficult. This phenomenon is largely due to the overlapping diagnostic criteria used to define these disorders in the diagnostic nomenclature. More specifically, the diagnostic criteria for PDD-NOS are ill defined with no specific number of criteria

established to obtain this diagnosis. In addition, the diagnostic symptoms for AD and AS overlap exactly in the area of socialization and repetitive behavior and restricted interests. As a result, many researchers have examined differences between disorders comprising the spectrum. However, findings are largely inconsistent. Nonetheless, it is still important to assess for the different ASDs as a means of conforming with the current diagnostic classification system. Two measures that assist in the differential diagnosis between the various ASDs are *Autism Spectrum Disorders Diagnostic for Child* (*ASD-DC*; Matson & González, 2007) and the *Pervasive Developmental Disorders Behavior Inventory* (*PDDBI*; Cohen & Sudhalter, 1999). Both tests are rating scales that can be completed in 20 min or less.

In addition to the need to differentially diagnose between different psychiatric disorders, medical conditions also need to be ruled out as symptoms of certain medical conditions may simulate symptoms of certain psychiatric disorders. As such, a medical assessment should be conducted prior to making an ASD diagnosis. The most important factors to assess during the medical evaluation would be the child's hearing, vision, and oral functioning. Ruling out any problems with the aforementioned is vital to ensure that symptoms of ASD are not better accounted for by medical conditions. For example, individuals with ASD present with delays in communication and socialization. If a child is having trouble hearing or having oral motor problems, these challenges would affect their ability to speak and, subsequently, their ability to socialize with others. In addition, visual impairments could account for other symptoms such as failure to initiate and sustain eye contact and joint attention.

Lastly, intellectual disability (ID) is a highly comorbid condition with ASD. As such, the assessment process should incorporate evaluations of both adaptive skills and intellectual functioning to assess for deficits specific to these areas. Deficits in cognition and adaptive behavior are required to meet criteria for a diagnosis of ID. The assessment of intellectual functioning also assists with the differential diagnosis of ASDs, specifically between AS and AD. For instance, individuals diagnosed with AS typically fall within the average range of cognitive functioning whereas those diagnosed with AD often have a comorbid diagnosis of ID. However, these boundaries become blurred when examining those with AS and "high-functioning autism" (HFA), most of whom have intelligence quotients (IQ) in the average range. Conversely, individuals diagnosed with AS tend to have higher verbal than performance IQs, and those diagnosed with HFA tend to have higher performance than verbal IQs.

In sum, the assessment process is conducted to arrive at a diagnosis of either AD, AS, or PDD-NOS or to rule out these diagnoses. First, AD is characterized by impairments in all three core domain areas. Children with AD are often referred for an assessment at very young ages since parents' first concerns typically arise during the first year of life. In contrast, individuals meeting diagnostic criteria for AS are often not identified until later in childhood. Likely, this is due to deficits in socialization which are the most impairing symptom associated with a diagnosis of AS. As social demands increase with age, these deficits become more pronounced and more obvious. Thus, deficits in this area become more apparent to the outside observer as the child develops and has more social interactions with others. In addition, unlike children diagnosed with AD, language development is not delayed for children meeting diagnostic criteria for AS. Instead, individuals diagnosed with AS tend to have exceptional vocabularies. Therefore, as toddlers, there is no obvious cause for concern for children eventually meeting criteria for an AS diagnosis. Lastly, a diagnosis of PDD-NOS is given when symptoms of ASD are present, but the individual does not meet the criteria for another disorder on the spectrum. Therefore, the diagnostic category of PDD-NOS is a subthreshold category. Children comprising this diagnostic category have less severe deficits in socialization and may have minimal deficits in communication or less presentation of restricted interests or repetitive behaviors when compared to a child meeting criteria for AD. In addition, it may be that these

children present with the same symptoms of a child meeting criteria for AD, but the age of onset occurs after 36 months of age.

Future Directions

The current classification system for ASD is categorical. However, this approach is problematic due to the poorly defined boundaries of the disorders comprising the autism spectrum. Due to these poorly defined boundaries, there has been a failure to find consistent differences between AD, AS, and PDD-NOS in regard to diagnostic criteria. As such, a dimensional approach to diagnosing has been proposed. This approach to diagnosing ASD is supported in the literature by researchers who have examined the underlying latent structure of symptoms of ASDs utilizing cluster analytic techniques or taxometric analyses. Although results often contradict each other, it has been suggested that the underlying taxon of ASD is dimensional (Boisjoli, 2010; Verté et al., 2006).

As a result of the overlap in the behavioral phenotype of ASDs, the APA (2010) has proposed revisions for ASD to be included in the DSM-V, set to be published in 2013. The revisions include utilizing a dimensional approach to diagnosing ASD. As such, there will be no subcategories of ASD, but instead one diagnostic entity referred to as autism spectrum disorder. In regard to diagnostic criteria, impairment related to socialization and communication would be amalgamated into one domain. The second domain refers to symptoms of restricted interests and repetitive behaviors. The third domain would indicate that symptoms need to be present in early childhood; however, early childhood is not further defined. Lastly, the symptoms must cause impairment in everyday functioning (APA, 2010).

These changes will bring about further modifications to the diagnostic process. For instance, parceling out differences between the various ASDs would no longer be necessary, since PDD-NOS, AS, and AD would no longer represent discrete diagnostic entities. However, given what will be even greater heterogeneity within the ASD diagnostic category, being able to identify symptom severity will still be critical. Even more important, existing measures that assess for symptoms of ASD would need to be renormed to follow the new diagnostic criteria and continuing emerging research.

See Also

- ▶ Asperger Syndrome
- ▶ Autistic Disorder
- ▶ Diagnostic Interviews
- ▶ Pervasive Developmental Disorder Not Otherwise Specified

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Diagnostic Substitution

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Definition

Diagnostic substitution has been hypothesized as one possible explanation for why growing numbers of children have been classified with a label of autism in publicly funded service systems such as special education and state systems of care for people with developmental disabilities. The term has been used in two related ways. One refers to a historical shift in the probability of being labeled with autism, whereby some proportion of children labeled with autism in recent years would have been classified with a different label had they been served by the same organization at a previous point in time. The other refers to individual children initially being labeled with one diagnosis and then being reclassified with autism at a later age. In each case, the hypothesis predicts that as enrollment tallies in the autism category increased, there would be some corresponding decrease in the number of children being enrolled and labeled in other administrative categories (e.g., ▶ Intellectual Disability).

Evidence testing the diagnostic substitution hypothesis has been mixed. One study of data from California's service system for people with developmental disabilities from 1987 to 1994 found little change in the administrative prevalence of intellectual disability, whereas autism rates increased nearly fivefold (Croen, Grether, Hoogstrate, & Selvin, 2002, 2003). Another study examined special education enrollment data from Minnesota for the years 1991–2001 and found no substantial decrease in administrative prevalence for other disabilities while autism enrollment counts were increasing (Gurney et al., 2003).

A study using state-level special education data for the whole United States found that the growing administrative prevalence of autism from 1994 to 2003 was strongly associated with decreasing prevalence in other disability categories, though not in every state (Shattuck, 2006). A study of special education enrollment in British Columbia from 1996 to 2004 found that nearly one third of growing autism prevalence was explained by children who had initially been classified with some other type of disability being relabeled with autism (Coo, 2007).

See Also

▶ Intellectual Disability

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Diastat

► Diazepam

Diazepam

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Synonyms

Diastat; Valium

Definition

A long-acting anxiolytic medication in the benzodiazepine class. Diazepam is commonly used in the treatment of anxiety disorders, agitation, and spasticity. Diazepam and other medicines of this class bind to benzodiazepine receptors, enhancing the inhibitory effects of γ-aminobutyric acid (GABA). Side effects of benzodiazepines can include sedation, dizziness, fatigue, and confusion. Additionally, prolonged use of diazepam or other benzodiazepines may lead to tolerance and physical dependence.

See Also

► Anxiety

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Dichotic Listening

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Description

Dichotic listening is the auditory process that involves listening with both ears. Dichotic listening can be broken into two different processes: binaural integration and binaural separation. Binaural integration is the ability to perceive different acoustic messages presented to the left and right ears at the same time. Binaural separation is the ability to perceive an acoustic message in one ear while ignoring a different acoustic message in the other ear. In order to perceive the acoustic messages in both ears, the outer, middle, and inner ears must be working properly, but more importantly, the auditory brainstem nuclei, auditory cortical neurons, as well as neurons in the corpus callosum must be functioning properly. Individuals with dichotic listening deficits often have difficulty hearing in the presence of background noise.

Historical Background

Dichotic speech testing was first introduced by Broadbent in 1954. It requires the simultaneous presentation of different speech stimuli to each of the ears; the listener must repeat back everything that is heard (binaural integration) or what is heard in one ear only (binaural separation). In 1961, Kimura first used these tests to demonstrate hemispheric asymmetry and cortical dysfunction. She demonstrated contralateral auditory deficits

following temporal lobe lesions. These findings indicate that if a lesion is located in the left temporal lobe, the auditory signal presented to the right ear will not be perceived. In typical individuals (those with normal hearing and no known lesions in the central auditory nervous system), a right ear advantage has consistently been reported (Berlin, Lowe-Bell, Cullen, Thompson, & Loovis, 1973; Dirks, 1964; Kimura, 1961a, b). Right ear advantage refers to the ability to better perceive the auditory signal presented to the right ear than the speech signal in the left ear. The right ear advantage exists because the hemisphere in the brain responsible for processing the speech signal is in the left hemisphere. Since the contralateral pathways are stronger, the speech signal presented to the right ear travels directly to the left hemisphere for processing; however, the speech signal presented to the left ear must travel to the right hemisphere and across the corpus callosum to the left hemisphere to be processed (creating a slight time delay).

Currently, a variety of dichotic listening tests are available for clinical use. Common dichotic speech tests, specifically binaural integration tests, are the Dichotic Digits Test (Musiek, 1983; Musiek & Wilson, 1979; Musiek, Wilson, & Pinheiro, 1979); the Staggered Spondaic Word Test (SSW; Katz, 1962), and Dichotic Consonant-Vowels (Dichotic CVs; Berlin et al., 1973). Some common binaural separation tests are Competing Sentences (Willeford, 1977) and the Synthetic Sentence Identification with Contralateral Competing Message (SSI-CCM; Jerger, 1970).

Psychometric Data

Dichotic listening tests, such as the Dichotic Digits, Dichotic CVs, SSW, Competing Sentences, and SSI-CCM, have been shown to be sensitive and specific to central auditory nervous system lesions, including interhemispheric lesions (for review, see Musiek & Pinheiro, 1985). Peripheral hearing sensitivity should be symmetrical and normal when using dichotic listening tests since any hearing differences between ears can influence test results.

Clinical Uses

Dichotic listening tests are used in clinical audiology to evaluate the central auditory processes of binaural integration and separation. These tests may be used in the assessment of children or adults with possible central auditory nervous system dysfunction. Since dichotic listening tests (tests of binaural integration and separation) evaluate two critical auditory processes, it is important for these tests to be included in a central auditory processing test battery. Clinically, the person administering dichotic listening tests should take into consideration the cognitive, hearing, speech, and language abilities of the individual being tested as these factors may affect performance. Thus, dichotic listening tests are not typically administered to children with autism, and performance on these tests should be interpreted with caution in this population.

See also

- ▶ Central Auditory Processing Disorder
- ▶ Corpus Callosum
- ▶ Temporal Lobes

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Didactic Approaches

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Synonyms

ABA; Adult/clinician/teacher-directed approaches; Behavioral approaches; Direct instruction

Definition

A *didactic approach* to teaching refers to a manner of instruction in which information is presented directly from the teacher to the pupil, in which the teacher selects the topic of instruction, controls instructional stimuli, obligates a response from the child, evaluates child responses, and provides reinforcement for correct responses and feedback for incorrect ones. Intervention methods for early communication in children with autism spectrum disorders (ASD) are often divided into three categories: didactic, naturalistic, and pragmatic or developmental.

Didactic approaches utilize a variety of concepts from behavioral theory, including massed trials, operant conditioning, shaping, prompting, chaining, and reinforcement. Difficulty with the generalization and maintenance of behaviors learned through this method along with the passive communication acquired by many children (i.e., waiting on adults' lead during interactions) are some of the drawbacks associated with this approach. Still, the effectiveness of this approach in initiating and expanding expressive language and developing attention to language and comprehension in preverbal children with ASD is supported by research from numerous case studies and several group studies.

As this approach requires a notable amount of adult direction, a passive role as responder by the child, repetitive drills and practice, and specific events that should occur before and after a child's response, this method is ideally effective if the instructor consistently monitors the student's interest level, readiness for the information being conveyed, and the motivational value of reinforcers. The passivity and prompt-dependence that can result from these methods led to the development of more naturalistic instructional techniques (e.g., contemporary applied behaviors analysis).

See Also

- ▶ Applied Behavior Analysis
- ▶ Teach Me Language

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Differential Ability Scales

► Differential Ability Scales (DAS and DAS-II)

Differential Ability Scales (DAS and DAS-II)

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Synonyms

Cognitive measures; DAS; DAS-II; Differential ability scales

Description

The Differential Ability Scales, Second Edition (DAS-II; Elliott, 2007) is an individually administered test designed to measure distinct cognitive abilities for children and adolescents ages 2 years, 6 months to 17 years, 11 months. The DAS-II is comprised of individual subtests that evaluate strengths and weaknesses of a broad range of learning processes. A General Conceptual Ability (GCA) composite score is generated that reflects conceptual and reasoning abilities. Three cluster scores of the DAS-II measure more specific learning processes: verbal, nonverbal reasoning, and spatial abilities. There is also a Special Nonverbal Composite that can be derived for an individual of any age where the verbal demands are too taxing to obtain standardized results. The core subtests of the DAS-II tap into specific cognitive processes that are used to estimate the cluster and GCA scores, and the abilities they assess are directly related to educational needs at each age range. There are also Diagnostic subtests that measure memory, processing speed, and early school learning abilities. These scores do not contribute to the overall cluster or GCA scores; however, they are still important foundational skills that address a child's profile of cognitive strengths and weaknesses, as well as educational needs.

Core Batteries of the DAS-II

There are two batteries of the DAS-II: Early Years and School Age. Within Early Years, there are two levels. The first level is for children ages 2 years, 6 months through 3 years, 5 months. This lower level consists of 4 core subtests (*Verbal Comprehension* [VCom], *Naming Vocabulary* [NVoc], *Picture Similarities* [PSim], and *Pattern Construction* [PCon]) and yields a Verbal Ability (VCom + NVoc) and Nonverbal Ability (PSim + PCon) cluster score, as well as the GCA. The upper level is for children ages 3 years, 6 months to 6 years, 11 months and has 6 core subtests (VCom, NVoc, PSim, *Matrices* [Mat], PCon, and *Copying* [Copy]) that yield three cluster scores: Verbal Ability (VCom + NVoc), Nonverbal Ability (PSim + Mat), and Spatial Ability (PCon + Copy), as well as the GCA.

The School-Age battery of the DAS-II can be administered on children ages 7 years, 0 months to 17 years, 11 months, and it is comprised of six core subtests (*Word Definitions* [WDef], *Verbal Similarities* [VSim], Mat, *Sequential and Quantitative Reasoning* [SQR], *Recall of Designs* [RDes], and PCon) that yield three cluster scores: Verbal Ability, Nonverbal Reasoning Ability, and Spatial Ability, as well as the GCA.

Both the Early Years and School-Age batteries of the DAS-II are normed on children between the ages of 5 years, 0 months and 8 years, 11 months. This allows the School-Age subtests to be administered for brighter young children and, in contrast, the Early Years subtests to be administered for older, less cognitively able children.

Diagnostic Subtests of the DAS-II

The Early Years battery of the DAS-II consists of the following ten Diagnostic subtests: *Early Number Concepts* [ENS], *Matching Letter-like Forms* [MLLF], *Phonological Processing* [PhP], *Recall of Sequential Order* [SeqO], *Recall of Digits Forward* [DigF], *Recall of Digits, Backward* [DigB], *Speed of Information Processing* [SIP], *Rapid Naming* [RNam], *Recall of Objects – Immediate and Delayed* [RObI, RObD], and *Recognition of Pictures* [RPic]. Seven of these subtests contribute to three cluster scores: School Readiness (ENC + MLLF + PhP), Working Memory (SeqO + DigB), and Processing Speed (SIP + RNam).

The School-Age battery of the DAS-II only consists of seven Diagnostic subtests that yield two cluster scores: Working Memory (SeqO + DigB) and Processing Speed (SIP + RNam). The School Readiness subtests from the Early Years battery are not included in the School-Age norms, with the exception of PhP, which has norms up to age 12 years, 11 months.

Historical Background

The original Differential Ability Scales (DAS; Elliott, 1990) was modeled after the British Ability Scales (BAS; Elliott, Murray, & Pearson, 1979). Both instruments were unique in the field of intelligence tests in that their focus was on distinct subtest scores that could be used to flush out cognitive profiles of strengths and weaknesses rather than on an overall intelligence quotient or estimation of IQ. This conceptualization of cognitive assessment sets the DAS and subsequent second edition (DAS-II; Elliott, 2007) aside from other commonly used measures, such as the Wechsler Intelligence Scale for Children, Fourth Edition (WISC-IV; Wechsler, 2003) or Stanford-Binet Intelligence Scales, Fifth Edition (SB5; Roid, 2003), where the theoretical models tend to focus more on generalized intelligence than on distinct cognitive abilities. Nevertheless, the DAS and DAS-II have an overall composite score that reflects general cognitive functioning (i.e., General Conceptual Ability score) and that is derived from those subtests which load highest on the factor of general intelligence, or *g*. This results in the GCA being a more refined score than other measures of global intelligence that are derived from a broader collection of subtests. However, examiners are cautioned against interpreting the GCA as a global measure of functioning, as many children have a variable cognitive profile that one general score cannot appropriately encapsulate. This is particularly the case for children with autism spectrum disorders (ASD), where scatter within a cognitive profile is the norm rather than the exception (e.g., Klin, Saulnier, Tsatsanis, & Volkmar, 2005).

Although the theoretical development of the BAS, DAS, BAS-II (Elliott, 1996), and DAS-II predated theoretical work on the Cattell-Horn-Carroll theory of intelligence (CHC; McGrew, 2005), the structure of the DAS-II fits well into the seven-factor CHC model. For instance, the DAS-II Verbal Ability cluster measures crystallized intelligence (*Gc*), the Nonverbal Reasoning cluster measures fluid intelligence (*Gf*), the Spatial Ability cluster measures visual-spatial processing (*Gv*), the Working Memory diagnostic cluster measures short-term memory (*Gsm*), the Recall of Objects subtest measures long-term storage and retrieval (*Glr*), the Processing Speed cluster measures cognitive processing speed (*Gs*), and the Phonological Processing subtest measures auditory processing (*Ga*).

Psychometric Data

The DAS-II has been standardized on a normative sample of 3,480 children ages 2 years, 6 months to 17 years, 11 months that is representative of the general population. Data are also available for a range of clinical samples,

including developmental risk, learning disabilities, attention deficit/hyperactivity disorder, mild to moderate intellectual disability, and the gifted and talented.

On the DAS and DAS-II, Verbal, Nonverbal, Spatial, and Special Nonverbal cluster scores, as well as the GCA score, are reported in standard scores that have a mean of 100 and standard deviation of 15 and that range from 30 to 170. Individual subtest scores are reported as T scores that have a mean of 50 and a standard deviation of 10 and that range from 10 to 90. T scores are derived from ability scores, which are based on the number of correct responses (i.e., the raw scores) and on the difficulty of administered items, following the Rasch Model of item response theory. The administration and scoring system of the DAS and DAS-II is also different from other common measures in that raw scores are computed based on the number of items administered within a response set, rather than calculating this number in addition to items below the basal. In this way, children are administered only those set of items that are appropriate in difficulty to their ability level. Subtest scores can be presented as age equivalents that represent the median ability score for each child's performance, and descriptive categories are provided for standard scores that range from "Very High" (70 and above) to "Very Low" (69 and below).

The DAS-II has strong internal reliability, with average reliability coefficients for the Early Years subtests ranging from .79 to .94 and for the School-Age subtests ranging from .74 to .96. The average reliability for the DAS-II GCA is .95 for Early Years and .96 for School Age. Confirmatory factor analyses were conducted to assess the internal validity of the DAS-II, and general results confirmed the existing clusters; for instance, the structure of cognitive abilities varies with age, with fewer models emerging for the youngest children (e.g., Verbal and Nonverbal clusters) and additional models emerging with age (e.g., Spatial, Short-term Memory, and Cognitive Speed clusters).

Correlations between the DAS and DAS-II are strong, with .88 for the GCA and .85 for the SNC. The correlation between the DAS-II GCA and the Wechsler Preschool and Primary Scale of Intelligence, Third Edition (WPPSI-III; Wechsler, 2002) Full Scale IQ is .87; however, WPPSI-III Index and FSIQ scores range from 1.7 to 5.1 points higher than DAS-II cluster scores. WISC-IV Index and FSIQ scores also range from 1.2 to 6.6 points higher than DAS-II cluster scores, with a correlation coefficient of .84 between the two measures.

In nonclinical samples, the correlation between the DAS-II GCA and measures of academic achievement is as follows: .82 with the total score of the Wechsler Individual Achievement Test, Second Edition (WIAT-II; Harcourt Assessment, 2005); .81 with the Comprehensive Achievement Composite of the Kaufman Test of Educational Achievement, Second Edition (KTEA-II; Kaufman & Kaufman, 2004); and .80 with the Total Achievement score of the Woodcock-Johnson III Tests of Cognitive Abilities (WJ-III; Woodcock, McGrew, & Mather, 2001).

Clinical Uses

There are several clinical benefits to using the DAS-II when assessing individuals with autism spectrum disorders (ASD; Klin et al., 2005; Saulnier, Quirmbach, & Klin, 2011). These advantages include the following:

1. The teaching items that are provided within each DAS-II domain are extraordinarily useful when complex instructions impede a child's ability to comprehend a given verbal request. When the examiner is allowed to model or demonstrate the correct response, the child is better able to comprehend the nature of the task and successfully complete a subtest on which they otherwise might have failed to obtain a basal level of performance.
2. The extended norms on the DAS-II Early Years battery allow for obtaining standard scores for older, more impaired individuals through age 8 years, 11 months – an option not available in other measures (Elliott, 2007).
3. The extended norms of the School-Age battery down to age 5 allow for adequately testing younger children with ASD with more advanced cognitive skills.

4. The Special Nonverbal Composite makes it particularly appealing for individuals on the autism spectrum with significant language vulnerabilities for whom the language demands on the verbal tasks are too taxing. The SNC is also useful for other unique samples, such as children with speech, language, and/or hearing impairments or children who are not fluent in English.
5. The results can generate recommendations for educational and treatment programming that are clinically relevant to each child.

The DAS-II is also extremely useful for clinical research in ASD. First, the extensive age range makes it possible to conduct scientific studies on both cohort and longitudinal studies of children between the ages of 2 and 17. Second, the extended norms allow for utilizing the same battery for varying levels of functioning. Finally, the core subtests can be administered quickly while generating a more comprehensive measure of cognitive functioning than an abbreviated measure of intelligence.

There have been several studies using the DAS that highlight its utility in detecting learning disabilities and cognitive delays. For instance, in one study comparing composite scores between the DAS and WISC-III, children with learning disabilities evidenced a specific weakness in the Nonverbal Reasoning cluster of the DAS that was not demonstrated on the Perceptual Reasoning Index of the WISC-III (Dumont et al., 1996). The majority of research on cognitive profiles in autism spectrum disorders (ASD) has been conducted using the Wechsler Scales. Less research has investigated DAS and DAS-II profiles in ASD, despite the fact that many researchers have used both measures as part of the characterization process for research paradigms. A study conducted by Joseph, Tager-Flusberg, and Lord (2002) used the DAS on a longitudinal sample of children with and without ASD. They found that the majority of preschool-aged children exhibited lower verbal than nonverbal cluster scores and that greater discrepancies between verbal and nonverbal abilities were detected in ASD vs. the normative sample, with this gap widening with age. Furthermore, children with larger gaps between their verbal and nonverbal skills had greater social impairments, and impaired social functioning was independent of their verbal skills.

See Also

- ▶ Achievement Testing
- ▶ Cognitive Skills
- ▶ Educational Testing
- ▶ Intelligence Quotient
- ▶ Psychological Assessment
- ▶ Standardization
- ▶ Standardized Tests
- ▶ Wechsler Intelligence Scale for Children
- ▶ Wechsler Preschool and Primary Scale of Intelligence
- ▶ Wechsler Scales of Intelligence
- ▶ Woodcock-Johnson Cognitive and Achievement Batteries

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Differential Reinforcement

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Definition

Differential reinforcement is the process of reinforcing a specific response in a particular context and not reinforcing (i.e., extinguishing) other responses. More specifically, differential reinforcement involves providing either positive or negative reinforcement for a targeted response (or targeted member of a response class) and withholding reinforcement from all other responses (or members of a response class). The withholding of reinforcement is defined as "extinction." Thus, differential reinforcement is a two-part process – reinforcing the desired response(s) and extinguishing all other responses. For example, a parent might reinforce with praise a young child calling out the mother's name and ignoring (and thus not reinforcing) the child's behavior of hitting the parent. Another example would be a teacher reinforcing (with praise and attention) a child raising her hand before being called upon to answer a question and ignoring that child if she were to shout out the answer without raising her hand. The goal of differential reinforcement is to increase the strength of the response being reinforced, while weakening the strength of the other responses not being reinforced.

Current Knowledge

A basic principle in understanding differential reinforcement and how people learn in most situations is the concept of discrimination. Basically, discrimination is a process for behaving one way in one situation or context, and behaving in a completely different way in a different situation or context. Thus, discrimination is the ability to tell the difference between environmental events (or contexts or cues) and behaving accordingly. Discrimination typically develops as a result of differential reinforcement.

Almost all learning occurs due to the concept of discrimination and differential reinforcement. For example, consider learning the letters of the alphabet. When the letter "B" is shown and the learner asked to identify the letter, indicating "B" will be reinforced and naming any other letter will not be. This process of differentially reinforcing the learner's responses (as correct and incorrect) results in learning of the alphabet. Consider learning to speak. When an infant says "mama" in the presence of the mother, that response will be reinforced with smiles, hugs, and positive attention. If the infant says "mama" in the presence of the father, there will be no reinforcement. Differentially reinforcing a response in one context (i.e., in presence of the mother) and not in another (i.e., in the presence of the father) results in the baby learning what to say in the presence of each parent. Consider the acquisition of social behaviors. Some young children refuse to share their toys. When this occurs, the adult rarely reinforces such selfishness. However, when a child does in fact share her toys, adults provide positive attention and reinforcement. In this case, the adult responds differently to two different behaviors – sharing and not

sharing. Through this process, the child learns that sharing is preferred and hoarding toys is not. Thus, virtually all learning is accomplished through the process of learning discriminations via differential reinforcement.

The procedure of differential reinforcement has been used to both increase and decrease the strength (future rate) of specific behaviors. However, even though the goals are different (when considering increasing or decreasing future rates of behaviors), the procedure of differential reinforcement is the same. The basic procedural components of all differential reinforcement programs are these. First, the interventionist must operationally define the target behavior to be changed. That could be an appropriate behavior that must be increased in rate, a behavior deemed inappropriate that must be decreased in rate, or both. The behavior must be operationally defined to allow for both correct recording of its occurrence (so the interventionist can objectively determine if the differential reinforcement procedure is having the desired effect) as well as for accurate implementation of the procedure (i.e., so that the interventionist(s) reinforce (or not reinforce) the correct response).

The second step in using differential reinforcement is to determine the actual reinforcement that will be made contingent upon the required response. This, by necessity, will vary across the individual due to the fact that what constitutes a motivating reinforcer is so personalized across individuals. However, most of the time, the interventionist will use some form of positive reinforcement, such as praise, smiles, good grades, tokens, or other forms of tangible reinforcement found desirable by the individual. On occasion, the interventionist might use a form of negative reinforcement, such as allowing the individual to escape a work demand contingent upon displaying the targeted response. For example, in the case where an individual tantrums in order to escape or avoid work, the caregiver might allow that person to take a break from work if the individual asks for a break instead of tantruming. Allowing the individual to briefly escape an unpleasant work demand negatively reinforces asking for a break. However, if the individual continues to tantrum and does not ask appropriately for a break, the caregiver would continue to keep the person in the demand situation by requiring work. The use of formal reinforcement preference assessments is considered best practice to determine the most motivating reward items available.

The last step in the procedure is to determine if and how reinforcement can be withheld from the individual when she/he displays a behavior other than the targeted one. In the case of using differential reinforcement to increase the strength of an appropriate behavior, the interventionist must only reinforce the targeted appropriate behavior. In the example of a child shouting out answers instead of raising a hand, the teacher will reinforce hand raising but will have to decide exactly how to respond to the shouting out of answers. The interventionist will need to ensure that no positive reinforcement follows any behavior other than the targeted one. An important question is whether the inappropriate behavior can be ignored. In the case of shouting out an answer, it is probably the case that planned ignoring can be used effectively. However, in other situations, with other behaviors such as self-injury or aggression, planned ignoring may be difficult.

There are many variations of differential reinforcement procedures that have been used. The most common ones are differential reinforcement of alternative behaviors (DRA), differential reinforcement of incompatible behaviors (DRI), differential reinforcement of other behaviors (DRO), and differential reinforcement of low rate behaviors (DRL; see "See Also" section, below).

Differential reinforcement is one of the most widely used procedures to change behavior. The treatment of problem behaviors has evolved to the point that there is a common assumption that reinforcement-based procedures are considered to be best practice and the most ethical strategies to implement. The procedure is a natural one to most interventionists, in which desired behaviors are rewarded and all other behaviors not rewarded. The research has shown that differential reinforcement procedures can be very effective in changing behaviors, and – since they are

based on the use of reinforcement (most of the time, positive, as opposed to negative) – many caregivers are comfortable with using such interventions. An advantage of differential reinforcement procedures is that caregivers have a systematic way to implement a technique that focuses on appropriate (positive) behaviors. Another advantage is that such procedures maintain a positive learning atmosphere and allow the instructional (or work activities) to continue in the context in which these procedures are used. A third advantage is that differential reinforcement can be effective without the addition of aversive or unpleasant procedures, such as punishment. Differential reinforcement is also a good procedure to implement when targeting problem behaviors due to the fact that this procedure can be used before and after the administration of functional assessment strategies to determine the function of that behavior. In these cases, differential reinforcement can possibly establish appropriate replacement behaviors, by orienting staff to notice and reinforce desired behaviors. This is important because differential reinforcement procedures do not address the function of challenging behaviors. That is, these procedures are used in an attempt to "override" the reinforcing function of problem behaviors.

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Differential Reinforcement Procedures of Alternative Behavior (DRA/DRAlt) of Incompatible Behavior (DRI)

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Definition

Differential reinforcement of alternative behaviors (DRA) and differential reinforcement of incompatible behaviors (DRI) are both procedures designed to decrease the rate of targeted unwanted behaviors. Targeted behaviors decrease due to two mechanisms – reinforcement of appropriate behaviors that will replace the unwanted behavior and the withholding of reinforcement that historically followed the unwanted behavior. DRI is often considered a type of DRA procedure.

With both of these procedures, reinforcement is contingent upon specific behaviors that will replace the unwanted behavior. The nature of the replacement behaviors marks the difference

between DRA and DRI. In DRI, the replacement behaviors are physically incompatible with the unwanted behavior. They both cannot be done at the same time. For example, if the unwanted behavior were out of seat, a physically incompatible behavior would be staying in seat. If the unwanted behavior were putting fingers in the mouth, a physically incompatible behavior would be putting hands in pants pockets. Thus, with a DRI procedure, the replacement behavior is both an appropriate one, as well as physically incompatible with the unwanted behavior. In DRA, there is no concern about the replacement behaviors being physically incompatible; it is simply an appropriate behavior that could fulfill the same function as the unwanted behavior. For example, if the unwanted behavior were screaming (to indicate a need to escape a work demand), an interventionist might use a DRA procedure and select an appropriate replacement behavior such as pointing to a card to signal a need to break from work. Another example would be that if the unwanted behavior were a child inappropriately calling out answers in class (without waiting for the teacher to call on her), an appropriate replacement behavior would be to raise her hand to be called on. Note that in both of these examples, the appropriate replacement behavior is *not* physically incompatible with the targeted unwanted behavior; both the unwanted behavior and the replacement behavior could be displayed simultaneously. In both procedures, reinforcement is delivered for the alternative or incompatible behavior, and reinforcement is withheld (extinguished) from the targeted unwanted behavior. Both procedures result in a decrease in rate of the unwanted behavior. The strength of these procedures lies in the discrimination between the two – the alternative or incompatible behaviors are reinforced, while the unwanted behaviors are not.

Historical Background

The three general areas of concern for persons with autism are social, behavior, and language. Many persons with this diagnosis display behaviors that are deemed inappropriate, such as aggression, self-stimulation, or self-injury and that greatly interfere with the person learning positive adaptive skills and increasing their independence in life. Psychologists and educators have long investigated the best treatment for these types of concerns. One approach that has been studied extensively has been the use of restrictive or punitive procedures. These involve either presenting a stimulus that is aversive or unpleasant to the individual following the occurrence of the unwanted behavior or by removing a desirable stimulus following the display of the unwanted behavior. Although these procedures have been shown to be effective in eliminating a wide variety of unwanted behaviors, they have been associated with a number of negative side effects, as well as potential ethical problems, including misuse and abuse.

Alternatives to punishment have been pursued vigorously in the research over the past few decades. One development has been that of functional assessment procedures, which allow the practitioner to determine the reinforcement maintaining the unwanted behaviors. Research has shown that if the reinforcement maintaining an unwanted behavior can be prevented from occurring, then the unwanted behavior will reduce in strength. Similarly, if an appropriate behavior that will earn the same reinforcement (function) as the unwanted behavior can be taught, then the individual will likely shift to the appropriate replacement behavior and reduce the occurrence of the unwanted behavior.

Along with functional assessment, researchers have developed a set of procedures that emphasize the use of positive reinforcement to reduce unwanted behaviors. Among these are the DRA and DRI procedures that focus on simultaneously reinforcing behaviors that can replace the unwanted behavior and removing the reinforcement that has maintained the targeted unwanted behavior. Findings of dozens of studies show that using reinforcement in particular ways can have the same results as punishment in stopping targeted behaviors.

Current Knowledge

Differential reinforcement procedures have been found to be some of the most frequently used

procedures to reduce and eliminate unwanted behaviors, across educational, social, and vocational contexts. DRA is useful for behaviors that may occur at high or low rates, as this procedure involves teaching the individual to engage in a more appropriate behavior than the behavior targeted for reduction. Often, DRA is combined with DRI. DRI is preferable, as the student cannot engage in the targeted behavior for reduction since the reinforced response is physically incompatible with the unwanted behavior.

The procedural steps for both DRA and DRI are similar. First, the implementer must operationally define the targeted unwanted behavior to be reduced or eliminated so that the implementer (s) will not deliver reinforcement after its occurrence and that there will be increased accuracy in data collection, to confirm (or not) if the differential reinforcement procedure is having the desired effect. With both of these procedures, the implementer must track the occurrence of both the targeted unwanted behaviors, as well as the alternative and incompatible ones.

Second, the interventionist should determine the function of the unwanted behavior. This information is helpful when deciding the procedures to use to prevent the reinforcement of the unwanted behavior (see below), as well as in guiding the selection of the appropriate replacement behaviors, which is the third step. The implementer must operationally define one or more behaviors that will be (a) desirable alternatives to the unwanted behaviors, (b) fulfill the same function as the unwanted behaviors, and (c) preferably be physically incompatible or compete with the unwanted behaviors. For example, if the unwanted behavior is swearing when frustrated, then an alternative behavior to strengthen could be having the individual write down what is frustrating. When planning on using a DRI procedure, the implementer must define an appropriate behavior that is physically incompatible with the targeted inappropriate one. In the example of an individual swearing, an incompatible behavior to reinforce could be saying, "oh, I am so frustrated, I need help!" instead of swearing. Note that expressing frustrating using that phrase is physically incompatible with swearing.

The fourth step in using DRA or DRI is to determine the actual reinforcement that will be made contingent upon the required alternative or incompatible response. The implementer will be guided by two considerations here – the function of the unwanted behavior (determined through a functional assessment) and the preferences of the individual. Reinforcement needs to be determined based upon the particular individual with whom the implementer is working, since reinforcement is so individualized. Most of the time, the implementer will use some form of positive reinforcement, such as praise, smiles, good grades, tokens, or other forms of tangible reinforcement desired by the person. On occasion, the implementer might use a form of negative reinforcement, such as allowing the individual to escape a work demand contingent upon displaying the targeted response. These procedures are referred to as differential negative reinforcement of alternative behaviors (DNRA) and differential negative reinforcement of incompatible behaviors (DNRI). For example, in the case where a person tantrums in order to escape or avoid work, the caregiver might allow the individual to take a break from work if she/he asks for a break instead of tantruming. Thus, in this procedure, asking for a break is negatively reinforced by allowing the person to briefly escape an unpleasant work demand. However, if the individual continues to tantrum and does not ask appropriately for a break, the caregiver would keep the individual in the demand situation and continue to present work demands. The use of formal reinforcement preference assessments is considered best practice to determine the most motivating reward items available.

The last step in the procedure is to identify the extinction procedures to implement contingent upon the occurrence of the targeted unwanted behavior. The results of the functional assessment are critically important here. Once the reinforcement for the unwanted behavior has been determined, the interventionist must plan on how to prevent that reinforcement from occurring when the unwanted behavior is emitted. In the case of using DRA and DRI, the implementer will need to ensure that no reinforcement follows the unwanted behavior. For example, when an individual swears, how will the implementer react?

In DRA and DRI, the implementer must ignore the swearing and not comment or react to it and focus on reinforcing the occurrence of the alternative or incompatible behavior.

There are several advantages to DRA procedures. Of particular importance is the focus on appropriate behavior. These procedures require specification of appropriate and positive behaviors to strengthen in the individual, which will contribute to the individuals' overall level of reinforcement. They learn what to do, not just what *not* to do. A second advantage of this group of procedures is that they are associated with few or no negative side effects, unlike more restrictive procedures, such as time-out, overcorrection, and other forms of punishment. Since DRA/DRI is associated with reinforcement for appropriate responding, the individual receiving the reinforcement will likely show positive affect, demonstrate generalized responding, and develop a positive relationship with the interventionist.

A third and equally important advantage is that practitioners view these procedures quite positively, much more so than punitive or restrictive ones. Caregivers, thus, are more likely to carry out these procedures with greater willingness and fidelity. A final advantage is that DRA procedures are associated with long-term positive change. As the unwanted behavior decreases in strength, and the appropriate behaviors increase, there should be continued suppression and elimination of the unwanted behavior.

When considering the use of this group of procedures, it has been shown that the effect on the targeted replacement behavior may take some time. Reinforcement does result in behavior change, but the change may not be that rapid. To increase the speed of behavior change, it is recommended selecting powerful reinforcers. Another way to further increase the speed of further progress, one should select alternative or incompatible behaviors that already exist in the individual's repertoire. These appropriate behaviors should already be occurring at some level so that the implementer has opportunities to reinforce them when they occur. Although interventionists could teach a new skill or behavior as the replacement behavior, this simply complicates the effort involved. As with most behaviors that are targeted for increase, it would be important to select these appropriate behaviors that will likely be naturally reinforced in the individual's daily environment. It is also good practice to select these alternative and incompatible behaviors that will be less effort to emit than the targeted unwanted one. As noted earlier, of equal importance is to select replacement behaviors that are incompatible with the unwanted behavior.

In addition, there is a potential danger of a DRA procedure that focuses on a limited group of replacement behaviors of reducing the strength of other, equally appropriate replacement behaviors. For example, consider an unwanted behavior of screaming to escape or avoid a work situation. If the interventionist selected one appropriate replacement behavior, that of pointing to a break card, the individual may learn to use that card when a break is desired but at the same time, no longer asks for a break using words or a communication device. To avoid this potential result, the interventionist should select all replacement behaviors that could serve the same function as the targeted unwanted behavior.

Lastly, the implementer must *consistently* reinforce the alternative and incompatible behaviors and *consistently* extinguish the unwanted behavior. The procedures are less effective when some instances of the alternative or incompatible behaviors are not reinforced and some instances of the unwanted behavior continue to achieve reinforcement. Extinction of the unwanted behavior seems to be important in the success of DRA/DRI. Research has shown that these procedures will be less effective if the unwanted behavior continues to result in reinforcement.

Future Directions

Differential reinforcement of alternative/incompatible behaviors should be seriously considered when planning on addressing unwanted behaviors. To use these procedures effectively, the practitioner must carefully determine the reinforcement for the unwanted behavior, plan powerful reinforcement to strengthen the appropriate

behavior, and develop procedures for preventing the unwanted behavior from being rewarded. When working with individuals who display unwanted behaviors in which it may be difficult to prevent the reinforcement for those behaviors, caregivers will need to determine how to manipulate the reinforcement for the replacement behaviors in a way to promote their increase, regardless of the reinforcement for the unwanted behaviors. For example, the use of intermittent reinforcement, increased duration of reinforcement, or a greater magnitude of reinforcement for the appropriate replacement behaviors could be considered.

See Also

- ▶ Differential Reinforcement
- ▶ Functional Assessment

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Differential Reinforcement Procedures of Low Rates of Responding (DRL)

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Definition

Differential Reinforcement of Low Rates of responding (DRL) is a procedure in which the implementer can lower the rate of a response by reinforcing fewer incidents of that response or by reinforcing longer time intervals between incidents of the response. For example, if an individual rocks back and forth an average of 10 times per half hour, an interventionist could provide a positive reinforcer contingent upon that individual rocking 8 or fewer times per half hour. Alternatively, the interventionist could provide a reinforcer following a rocking incident if there had been a minimum amount of time (e.g., 5 min) since the previous rocking episode.

A related term is Differential Reinforcement of Diminishing rates (DRD). The technical difference between DRL and DRD is that in DRD, reinforcement follows a response that has been preceded by a minimum amount of time since the last response. DRL technically refers to providing reinforcement for fewer and fewer responses exhibited by the individual. However, DRL is the most common term and often refers to both of these procedures.

Historical Background

The three general areas of concern for persons with autism are social, behavior and language. Many persons with this diagnosis display behaviors that are deemed inappropriate, such as aggression, self-stimulation, or self-injury that, if left untreated, can greatly interfere with the individual acquiring positive adaptive skills and becoming more independent. Psychologists and educators have long investigated the best treatment for these types of concerns. One approach that has been studied extensively has been the use of restrictive or punitive procedures. These involve either presenting a stimulus that is aversive or unpleasant to the individual following the occurrence of the unwanted behavior or by removing a desirable stimulus following the display of the unwanted behavior. Although these procedures have been shown to be effective in eliminating a wide variety of unwanted behaviors, they have been associated with a number of negative side effects, as well as potential ethical problems, including misuse and abuse.

Alternatives to punishment have been pursued vigorously in the research over the past few decades. One development has been that of functional assessment procedures, which allow the practitioner to determine the reinforcement maintaining the unwanted behaviors. Research has shown that if the reinforcement maintaining an unwanted behavior can be prevented from occurring, then the unwanted behavior will reduce in strength. Similarly, if an appropriate behavior that will earn the same reinforcement (function) as the unwanted behavior can be taught, then the individual will likely shift to the appropriate replacement behavior and reduce the occurrence of the unwanted behavior.

Along with functional assessment, researchers have developed a set of procedures that emphasize the use of positive reinforcement to reduce unwanted behaviors. Among these is the DRL procedure that focuses on reinforcing less occurrences of the unwanted behavior and not reinforcing higher occurrences of the unwanted behavior. Findings of dozens of studies show that using reinforcement in particular ways can have the same results as punishment in stopping targeted behaviors.

Current Knowledge

Even though the DRL procedure is used to reduce rates of a problem behavior, the reinforcement is delivered after the occurrence of that behavior, which may seem counterintuitive. This is in contrast to the Differential Reinforcement Alternative behavior (DRA), which reinforces appropriate replacement behaviors; Differential Reinforcement of Incompatible behavior (DRI), which provides reinforcement for appropriate replacement behaviors that are physically incompatible with the targeted unwanted behaviors; or Differential Reinforcement of Other behavior (DRO) procedure, in which the reinforcement is delivered in the absence of the target behavior. When using DRL, reinforcement occurs following an unwanted response that remains below a certain criterion or following an unwanted response that was preceded by progressively longer intervals of time from the previous response.

It is important to point out that the goal of a DRL procedure is to simply reduce the rate of the targeted behavior but not to eliminate it entirely. Some behaviors that might be considered undesirable at higher rates may be acceptably tolerated at lower rates, without needing to reduce them to zero. For example, perhaps one could find as acceptable a child who gets out of seat in school a few times a week, but the exact same behavior considered intolerable if it were to occur several times an hour. A child with autism who spontaneously verbalizes movie scripts only a few times per week could be considered more tolerable than engaging in this behavior several times per half-hour period. Thus, the DRL procedure is typically used when considering reducing a behavior that is considered acceptable at lower rates but not higher levels.

There are several variations of the basic DRL procedure. In "full session DRL," the implementer provides reinforcement at the end of a session or a predetermined amount of time if the number of incidents of the undesired behavior falls at or below a predetermined criterion level. For example, a teacher divides the school day into 12-, 30-min sessions or time periods. Each half hour consists of one "session." A child engages in

tantrums on an average of 6 per half-hour period. The initial rule for delivering reinforcement in this "full session DRL" program would be that the child engages in five or fewer tantrums in a session. As the rate drops to consistently at five or fewer, a new rule would be implemented, whereby reinforcement would be made contingent upon four or fewer occurrences in the session. Over time, by gradually reducing the criterion level, the DRL program will eventually bring the rate of behavior to an acceptable level. Note also that in full session DRL, the individual has an opportunity to earn reinforcement numerous times, across the multiple sessions, since each new session signals a new opportunity.

Another type of DRL is the "interval DRL," which is a procedure for implementing DRL in which the total session is divided into equal intervals and reinforcement is provided at the end of each interval in which number of responses during the interval is equal to or below a criterion limit. Similar to the full session DRL, this would involve taking the full session and breaking it down into smaller intervals and reinforcement could be delivered during each of those intervals. For example, a teacher divides a 30-min lunch period into 3, 10-min intervals. A child, on average, 21 times during the lunch period. The rule for delivering reinforcement in this "interval DRL" would be that if the child swore seven or fewer times in each 10-min period, reinforcement would be provided. A potential advantage of an interval DRL program is that the individual has multiple opportunities within a session to earn reinforcement, as opposed to just one opportunity (at the end of the session).

A third variation of the basic DRL procedure is the "space-responding DRL" (sometimes called DRD). This is a procedure for implementing DRL in which reinforcement follows each occurrence of the target behavior that is separated from the previous response by a minimum inter-response time (IRT). For example, a child correctly answers questions asked by the teacher but answers so quickly that other students have no opportunity to be called on. The teacher makes a rule with this student that to be called on to answer a question, 3 min have elapsed since the child last answered of a question. Thus, the rule for reinforcement is that only responses that have been preceded by a minimum of 3 min from the previous response will receive reinforcement.

The basic procedural components of all DRL procedures are these. First, the interventionist must operationally define the targeted unwanted behavior to be changed. This must be done to allow for both correct recording of its occurrence (so the interventionist can objectively determine if the differential reinforcement procedure is having the desired weakening effect) as well as for accurate implementation of the procedure (i.e., so that the interventionist(s) implement the DRL plan consistently).

The second step in using DRL is to determine the current "operant level" of the response. That is, the interventionist must have data showing the current rate of the behavior before implementing DRL. Depending upon the type of DRL procedure to use, data might be needed showing the total number of responses during a day, the total number of responses (on average) during individual sessions, and/or the average amount of time between occurrences of the targeted undesired behavior.

The third step in using DRL procedures is to determine the actual reinforcement that will be made contingent upon the response meeting the rule for earning reinforcement. This, by necessity, will vary across individuals due to the fact that what constitutes a motivating reinforcer is personalized. However, most of the time, the interventionist will use some form of positive reinforcement, such as praise, smiles, good grades, tokens, or other forms of tangible reinforcement desired by the learner. On occasion, the interventionist might use a form of negative reinforcement, such as allowing the individual to escape a work demand contingent upon displaying the targeted response. For example, in the case where a person tantrums in order to escape or avoid work, the caregiver might allow the individual to take a break from work if s/he asks for a break instead of tantruming. In this procedure, asking for a break is negatively reinforced by allowing the individual to briefly escape an unpleasant work demand. However, if the person continues to tantrum and does not ask appropriately for

a break, the caregiver would continue to keep the individual in the demand situation and constantly require work. The use of formal reinforcement preference assessments is considered best practice to determine the most motivating reward items available.

The last step in the procedure is to determine the actual rule for providing reinforcement. Three rules or criteria must be planned. First, the rule for what level of behavior will be required as the initial new criterion must be established. To determine this, the interventionist would set the initial criterion at or a little below the operant level. For example, if the operant level was 10 occurrences per session or interval, the initial DRL criterion could be anywhere from eight to ten. The second rule that must be determined is the criterion for changing from the current criterion to a new, lower one. This criterion would specify the number of sessions that must be at the criterion level before changing to new one. The final rule that must be established is the ultimate, terminal criterion at which point the interventionist would consider an acceptable level of the behavior and at which point the DRL plan would be discontinued.

For example, for the full session DRL, the interventionist must determine the size of the reduction (from the pre-DRL level) within the session that will result in reinforcement. For example, if the pre-DRL level of the response was an average of 25 responses within each session, the interventionist will need to determine what lower number of responses will result in reinforcement. Generally speaking, a gradual reduction from baseline levels will likely lead to more success than a large reduction. Thus, if the baseline level was an average of 25 responses per session, one should select as the criterion for reinforcement 23 or 24 responses per session. Although there is no definitive rule for how to select the lower criterion for reinforcement, one should plan on a gradual reduction, with that level of reduction occurring over a set number of sessions. For example, if the baseline level average was 25 per session, the interventionist could set 23 responses per session, over 3 consecutive sessions, as the first lower criterion for reinforcement.

An excellent example of DRL that has been shown to be effective is called the "Good Behavior Game." This procedure involves dividing a group of individuals (such as students in a classroom) into two or more teams. The goal is to be the team with fewest occurrences of undesired behaviors. Generally, the interventionist would periodically observe each team and note whether or not undesired behaviors are occurring. After a set period of time (e.g., end of the day, before lunch, etc.), the team with the fewest occurrences of the targeted undesired behavior will earn some type of positive reinforcer.

DRL is a positive procedure in that it utilizes only reinforcement to reduce undesired behaviors. It is also advantageous in that it is more easily tolerated than a behavior-reduction procedure that only provides reinforcement for the *absence* of the targeted behavior (i.e., DRO). The goal of that procedure is the cessation of the unwanted behavior. A complete elimination would generally be considered more difficult to achieve than allowing some (but lower) level of the target behavior. The individual exhibiting the target behavior may more easily tolerate being allowed some amount of the unwanted behavior, than attempting to eliminate it altogether. That is why DRL is often successful; it results in a targeted behavior that is inappropriate at higher levels becoming appropriate and tolerated at lower levels. Lastly, DRL procedures have been shown in the literature to be effective procedures with a wide variety of individuals and target problems; thus, it has good generalization evidence.

There are several considerations for using DRL most effectively. Firstly, the practioner must recognize that the DRL procedure does not produce rapid behavior change; rather, it produces slow and gradual changes. So, one must use DRL to change behaviors that are amenable to gradual change. Secondly, practitioners should not use DRL when targeting behaviors that could be physically harmful to the individual or others (such as self-injury, aggression, etc.). For those categories of behaviors, the interventionist should use procedures that have more of an

immediate impact or combine DRL with such strategies. Lastly, DRL does, by its nature, focus on the undesired behavior, rather than reinforcing appropriate replacement behaviors. This suggests that the implementer combines DRL with procedures that target and reinforce appropriate replacement behaviors.

Future Directions

When developing programs for children with autism, often part of that programming focuses on attempting to reduce problem behaviors. The set of DRL programs could be useful in that regard, depending upon the characteristics of the undesired behavior. Future directions could include clarifying the specific behavioral or contextual variables that would suggest a particular DRL program be used over another type of program, such as DRA, DRI, DRO, or more restrictive techniques. In addition, rules for determining the combination of DRL with other programs to specifically teach, model, and reinforce appropriate incompatible behaviors (to the undesired ones) would be useful for practitioners.

See Also

► Differential Reinforcement

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Differential Reinforcement Procedures of Other Behavior (DRO)

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Definition

Differential reinforcement of other behaviors (DRO) is a reinforcement procedure in which reinforcement is delivered for any response *other than* a specific target behavior. This procedure results in a decrease in that specific target behavior because that behavior is never followed by reinforcement; thus, it weakens in future rate. For example, if a child with autism displays self-stimulatory behavior in the form of waving both hands in front of his face, a DRO procedure

would be to provide a positive reinforcement for a 10-s period during which his hands were *not* waving in front of his face. Other names for this procedure include differential reinforcement of zero occurrences or omission training.

Historical Background

When considering interventions for undesirable behaviors, interventionists initially found punishment procedures to be effective. Although such procedures as overcorrection, time-out, and response cost do indeed reduce unwanted behavior, there are often negative side effects for the individual being exposed to those procedures, and historically, there have been abuses using aversive techniques.

As more research was conducted on dealing with unwanted behaviors, professionals learned that using positive procedures could be effective tools in obtaining reductions in these behaviors. Generally speaking, differential reinforcement has been shown to both increase appropriate behaviors as well as reducing the strength of unwanted responses. One form of differential reinforcement that has been shown in the research to be quite effective in weakening problem behaviors is DRO. This technique has been shown to be effectively across a wide variety of unwanted behaviors exhibited by a variety of individuals.

Current Knowledge

Differential reinforcement of other behaviors (DRO) is a procedure for decreasing problem behavior in which reinforcement is contingent on the absence of the problem behavior during or at specific times. DRO is perhaps the simplest of all behavior reduction procedures as it involves the simple rule of providing reinforcement whenever the specific undesirable behavior is *not* displayed. DRO differs from differential reinforcement of alternative behaviors (DRA) and differential reinforcement of incompatible behaviors (DRI) in that with those two procedures, reinforcement follows specific appropriate responses. In DRO, reinforcement is provided contingent upon a passage of time in which the targeted undesired behavior does not occur. Note that reinforcement does not follow any specific response; it can follow any response as long as that response is not the targeted undesirable behavior. Because the "other" behaviors are not defined, no one behavior is reinforced so much that it is likely to increase in strength. But what does happen is that the targeted undesirable behavior is never reinforced, so over time, it reduces in rate.

There are basically two types of DRO, whole-interval and momentary-interval. The whole-interval DRO is a procedure in which reinforcement is available at the end of a fixed interval of duration if the targeted unwanted behavior did not occur at any time throughout that interval. For example, a child with autism is often out of her seat during independent work time. A whole-interval DRO procedure could involve dividing the independent work time period into 6, 5-min periods. During each 5-min period, the teacher observes the child, and if the child does not get out of seat at all during a 5-min period, the teacher delivers reinforcement. However, if the child did get out of seat during a 5-min period, no reinforcement will be provided; the child will have another opportunity at the beginning of the next 5-min interval. Because the out of seat behavior is not reinforced by the teacher, and other behaviors are, the out of seat behavior should begin to diminish in rate.

This procedure requires constant vigilance and observation on the part of the interventionist throughout the interval, so as to observe any occurrence of the target behavior. This DRO is appropriate for high or low rates of challenging behaviors, as the interval can be set according to the rates of challenging behaviors. Typically, one sets the interval just below the pre-intervention IRT duration of the problem behavior (see below).

The momentary DRO is a DRO procedure whereby reinforcement is available at specific moments of time and delivered contingent on the problem behavior not occurring at that those precise moments. For example, a child with autism often whines while playing at home.

A caregiver could make a rule that every 2 min (and exactly at the 2-min mark), the child will be provided a reinforcer if *at that very moment of observation*, there is no whining being emitted. Thus, reinforcement is delivered at the moment of observation if the individual is doing anything other than whining. Note that this DRO procedure does not demand constant vigilance and attention on the part of the interventionist as does the whole-interval DRO. Using a momentary DRO allows the interventionist to be attentive to the individual only at the precise moment specified by the DRO schedule. Whether reinforcement is delivered is not dependent upon whether the targeted behavior was present or absent before or after the moment of observation; reinforcement is entirely dependent upon whether it is occurring at the precise observational moment.

There are two variations of the whole- and momentary-interval DRO procedures. The intervals can be a fixed or variable duration. Thus, a fixed-whole-interval DRO consists of the interval size be standard across all intervals. However, a variable-whole-interval DRO consists of the interval duration varying per interval. For example, the intervals could range from 5, 10, 35, 3, and so forth but varying around a set mean. Momentary-interval DRO programs can be either fixed or variable, too. A fixed-momentary-interval DRO consists of the interval size being standard across all intervals; a variable-momentary-interval DRO plan allows each interval to vary around some average duration. The advantage of the variable DRO is that individuals cannot predict when the interval will end and reinforcement is available.

All DRO procedures target the reduction of targeted inappropriate behavior. The research in which DRO procedure to use shows mixed results; both types of DRO plans can be effective in reducing the targeted undesired behavior.

The basic procedural components of all DRO procedures are these. First, the interventionist must operationally define the target behavior to be changed. That requires carefully specifying the targeted unwanted behavior to allow for both correct recording of its occurrence (so the interventionist can objectively determine if the differential reinforcement procedure is having the desired weakening effect) as well as for accurate implementation of the procedure (i.e., so that the interventionist(s) know exactly when reinforcement should or should not be provided).

The second step in using DRO is to determine the actual reinforcement that will be made contingent upon the absence of the unwanted response and how it will be delivered. This, by necessity, will vary across individuals due to the fact that what constitutes a motivating reinforcer is so personalized. However, most of the time, the interventionist will use some form of positive reinforcement, such as praise, smiles, good grades, tokens, or other forms of tangible reinforcement desired by the learner. On occasion, the interventionist might use a form of negative reinforcement, (termed differential negative reinforcement of other behavior, or DNRO) such as allowing the learner to escape a work demand contingent upon displaying the targeted response. For example, in the case where an individual tantrums in order to escape or avoid work, the caregiver might allow the person to take a break from work if she/he asks for a break instead of tantruming. In this procedure, asking for a break is negatively reinforced by allowing the person to briefly escape an unpleasant work demand. However, if the individual continues to tantrum and does not ask appropriately for a break, the caregiver would continue to keep the person in the demand situation and constantly requiring work. The use of formal reinforcement preference assessments is considered best practice to determine the most motivating reward items available.

The third step in implementing a DRO procedure is to determine which type of DRO will be used, interval or momentary, and the criteria for establishing the initial interval size and increasing the interval size as the behavior begins to weaken. Once the type of DRO program is decided, the interventionist must determine the interval size to use to begin the procedure. Research has shown the most success is seen when the initial interval size is set small and gradually lengthened over time, as the targeted behavior reduces in rate. This should be based upon pre-intervention levels of the problem

behavior and the average "inter-response time" (IRT) duration historically observed. IRT refers to the duration between two occurrences of the target behavior. The formula for calculating IRT is to divide the total number of responses observed during a certain time interval by the total amount of time of that interval. For example, if during pre-intervention conditions, the individual exhibits the target behavior, on average, 10 times every hour, the mean interval between occurrences is 6 min (10 occurrences of the behavior divided by 60 min). That information can then be used to establish the initial interval size for the DRO procedure. Next, the interventionist must develop a criterion for increasing the interval duration as the DRO program demonstrates success. For example, if the practitioner begins with an interval size of 6 min, and over 90% of the intervals show no targeted problem behavior over 3 consecutive days, then the interval size could be increased to 7 min. Such a mastery criterion if developed, in advance, will result in both increased progress in decreasing the problem behavior and a procedure gradually easier to implement.

The last step in the procedure is to determine exactly how to respond to the display of the targeted undesired behavior. The rule in DRO is to not provide any reinforcement for its occurrence. So, the interventionist must be careful not to react in any way that could possibly provide any source of reinforcement for its occurrence. An important question is whether the inappropriate behavior can be ignored or if it is such a serious behavior that some sort of intervention must apply. In the case of shouting out an answer, it is probably the case that ignoring it can be done effectively. However, in other situations, with other behaviors such as self-injury or aggression, not reacting may be difficult, due to potential safety issues. In those cases, DRO may not be the method of choice.

There are several advantages of DRO. The procedure is positive, easy to implement, and focuses solely on the use of reinforcement to decrease undesired behaviors. Reinforcers are not removed from the individual, and few to no negative side effects are reported. Interventionists appreciate and are more willing to use positive procedures as opposed to more aversive or unpleasant interventions. Since these procedures are generally effective and positive, they are more ethically appropriate as a treatment choice. DRO is easy for teachers to use in most classrooms and school settings and have been shown to work across a wide variety of populations and contexts. The effect of such procedures is more rapid than simply extinguishing the targeted undesired behavior; although extinction can work, the application of DRO produces quicker change. Additionally, the effects of DRO have been shown to be long lasting, producing durable response suppression. A particular advantage of a momentary DRO is that it does not require such continuous attention, and for a busy teacher or parent, that can be a useful feature. With this procedure, at the moment of observation, the interventionist can interrupt what she/he is doing, observe whether or not the targeted undesirable behavior is occurring, and deliver (or not deliver) the reinforcement based upon that immediate observation.

However, there are several potential disadvantages to DRO procedures. One is that such procedures are not designed to teach and/or increase any particular appropriate behavior. Its inherent characteristic is to focus on the *absence* of the targeted behavior, and there is no attempt to operationally define and strengthen an appropriate replacement behavior. Another potential limitation of this procedure is that it focuses the attention of the interventionist on the negative or undesired behavior. Since its occurrence triggers whether or not reinforcement is delivered, the interventionist is paying attention primarily to whether or not the problem behavior occurs. This may result in the individual inadvertently getting attention for the problem behavior. Thus, caregivers need to be aware of any potential reaction being given to the individual following the occurrence of the targeted unwanted behavior. Another potential disadvantage of the DRO procedures is that since reinforcement is delivered for any response *other than* the targeted undesired behavior, there is a risk that other behaviors equally undesirable may inadvertently be reinforced and thus strengthened. For example, consider a DRO procedure used to reduce

a self-stimulatory behavior of jumping up and down repeatedly. With DRO, reinforcement is given whenever jumping is not occurring. However, if the individual is not jumping but instead waving fingers in front of the face, reinforcement would be allowed (since the rule is to provide reinforcement for any response other than jumping). This potential disadvantage is possible when working with an individual who displays a large number of undesired behaviors. If this potential exists, a recommendation would be to provide the reinforcement only when none of the undesired behaviors are occurring or to use a procedure other than DRO (such as DRA or DRI).

Future Directions

DRO procedures are effective, show long-lasting results, are relatively easy to implement, and preferred by interventionists due to their positive nature. Further clarification of the behavioral characteristics of when to use which type of DRO would enhance its use and effectiveness. Guidelines for establishing initial interval size and criterion for increasing the interval duration would be helpful as well.

See Also

► Differential Reinforcement

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Diffusion Tensor Magnetic Resonance Imaging

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Definition

Diffusion tensor imaging (DTI) is a magnetic resonance imaging (MRI) modality used in brain imaging which measures characteristics of water diffusion in vivo to make inferences on the underlying neuroanatomy, such as the structural integrity of white matter. White matter structures probed include major neuronal fiber tracts such as association (e.g., superior longitudinal fasciculus), commissure (e.g., corpus callosum), and projection (e.g., corticospinal tract) fibers. Water diffusion

can be characterized at each anatomical location by the diffusion tensor, a second-order model which provides the direction and the degree of anisotropy (i.e., directionality). The diffusion tensor can be visualized as an ellipsoid and generally aligns with the underlying white matter fibers. Diffusion properties in tissue can then be captured using various numeric metrics computed from the tensor and commonly include fractional anisotropy (FA), radial diffusivity (RD), axial diffusivity (AD), mean diffusivity (MD), and apparent diffusion coefficient (ADC), with FA being the most widely utilized in neuropsychiatric research.

There are some general relationships between the aforementioned metrics and biological features of tissue. Thus, knowledge of these inferences can guide the interpretation of research findings using DTI. Each of these measures aims to characterize the restriction of water diffusion due to physical barriers such as membranes and myelin; therefore, they are used as surrogates for white matter structural integrity in DTI studies. RD is a measure of the inhibited water diffusion occurring across or perpendicular to nerve fibers. Causes of increased restriction perpendicular to the fiber (a low RD) include thicker myelin, a more water-impermeable myelin, denser packing of fibers, and/or smaller fiber diameters. Less restriction (a high RD) could be due to delayed myelination, loss of myelin, more water-permeable myelin, loss of axonal membrane integrity, looser fiber packing, disorganized fiber packing, and/or larger-diameter fibers. On the other hand, AD is a measure of water diffusion occurring along or parallel to nerve fibers. A higher AD value indicates less hindrance to water movement along axons and could be due to axonal loss and/or less-dense fiber packing. MD and ADC measure average water diffusion in all directions. Finally, FA ranges from zero to one and describes the degree to which water diffusion is directionally dependent. A value of zero means that water diffusion is isotropic; it is equally restricted in all directions such that the pattern of diffusion resembles a sphere. A value of one means that water diffusion is completely restricted to a single direction. FA is most frequently used to characterize white matter integrity. Regardless of the specific measure, however, each of these parameters provides different information about the underlying white matter architecture. Because of this, considering multiple measures has become a common approach in DTI studies.

Moreover, DTI can also be used to reconstruct the 3D structure of white matter fiber tracts using a technique called tractography or "fiber tracking." Algorithms are used to determine 3D curves which trace fibers by following the orientation of maximum water diffusion. These fibers can then be visualized resulting in spectacular images of multiple fiber pathways. Tractography is now being used regularly in the study of neuropsychiatric disorders such as autism. Previously, such white matter anatomy could only be studied by postmortem dissection or invasive tracing studies in nonhuman animals. Because of this, tractography has been referred to as "virtual dissection."

DTI has revolutionized the study of structural brain connectivity in humans and is extensively used in the field of autism research to study alterations in neural connectivity. In the past 5 years, there has been a surge in the number of DTI studies published in autism research with the overall consensus being that some level of impairment exists in structural brain connectivity likely in the direction of underconnectivity. The focus of this chapter is the application of DTI in the study of the neurobiology of autism spectrum disorders (ASD). While a brief description of the technical aspects of DTI has been provided, the reader is referred to other reading which covers the technical details of DTI in much greater detail (Mori, 2007; Mori & Zhang, 2006).

Historical Background

Interestingly, diffusion MRI had been known for many decades as a source of obtaining tissue contrast. Early work in the 1950s by Hahn (Hahn, 1950), Carr and Purcell (Carr & Purcell, 1954), and Torrey (Torrey, 1956) laid the groundwork for diffusion measurements from magnetic resonance, providing an understanding of the change in the magnetic resonance signal in the

presence of water diffusion. Stejskal and Tanner (Stejskal & Tanner, 1965) advanced this formulation and incorporated the diffusion tensor. Finally, Basser and colleagues (Basser, Mattiello, & LeBihan, 1994) developed the acquisition strategy that allowed computation of the diffusion tensor. Using multiple acquisitions, each sensitive to diffusion in a specified direction, the diffusion tensor can be reconstructed at each location in the brain image.

Current Knowledge

At the time of this writing, there are over 30 studies using diffusion imaging, investigating the neurobiology of ASD since the first study was published in 2004 (Barnea-Goraly et al., 2004). In recent years, the number of studies has increased sharply: one study in 2004, five studies in 2007, eight studies in 2009, and 13 studies in 2010 (all reviewed below). The methods implemented in these studies are diverse, ranging from voxel-wise comparisons to tractography-based studies. Some studies use a combination of methods or other MRI modalities such as structural and/or functional MRI. The DTI studies reviewed in this chapter are presented according to their methodology which will include voxel-wise, region of interest (ROI), tractography, combination DTI, and multimodal MRI studies. White matter properties vary with age through development. Thus, in order to better appreciate the developmental aspects of ASD, these DTI studies are further subdivided into child (age <13 years), adolescent (13–20 years), and adult (age $\geq$ 21 years) categories based mainly on the average age of ASD participants.

Voxel-Wise

The first DTI study published in the autism research literature was a voxel-wise study. Thus, it comes as no surprise that voxel-wise studies are the most common of the DTI studies in ASD. In general, image volumes are warped to a common space, and then, groups are compared on a voxel-by-voxel basis within the white matter. A variety of statistical procedures are used to identify significant differences and control for false positives which can result from the large numbers of comparisons made (each brain contains thousands of voxels). At the time of this writing, there are 10 DTI studies which utilize a voxel-wise approach in the study of ASD. Overall, these studies demonstrate diffuse abnormalities in white matter using the previously mentioned metrics, though the most commonly reported abnormality is a reduction in FA.

There are four studies which implement a voxel-wise analysis studying children with ASD. Cheung and colleagues (Cheung et al., 2009) reported on a comparison of 13 children with autism (9.3 ± 2.6 years) and 14 controls (9.9 ± 2.5 years) where FA in the autism group was significantly lower than controls in bilateral prefrontal and temporal regions, particularly in the right ventral temporal lobe adjacent to the fusiform gyrus. Additionally, FA was greater in the right inferior frontal gyrus and left occipital lobe. Barnea-Goraly and colleagues (Barnea-Goraly, Lotspeich, & Reiss, 2010) reported on a comparison of 13 children with autism (10.5 ± 2.0 years), 13 of their unaffected siblings (8.9 ± 1.9 years), and 11 controls (9.6 ± 2.1 years). Both the autism and unaffected sibling groups had widespread FA reductions in the frontal, parietal, and temporal lobes, including regions known to be important for social cognition. Within regions of reduced FA, reductions in AD with preserved RD were observed. There were no differences in white matter structure between autism and unaffected sibling groups. Sahyoun and colleagues (Sahyoun, Belliveau, & Mody, 2010) reported on a comparison of nine children with autism (12.8 ± 1.5 years) and 12 controls (13.3 ± 2.45 years). Controls showed increased FA within frontal white matter and the superior longitudinal fasciculus. The autism group showed increased FA within peripheral white matter, including the ventral temporal lobe. Shukla and colleagues (Shukla, Keehn, & Muller, 2011) reported on a comparison of 26 children with ASD (12.8 ± 0.6 years) and 24 controls (13.0 ± 0.6 years). The ASD group demonstrated decreased FA and increased MD and RD in numerous white matter structures: corpus callosum, anterior and posterior limbs of the internal capsule,

inferior longitudinal fasciculus, inferior fronto-occipital fasciculus, superior longitudinal fasciculus, cingulum, anterior thalamic radiation, and corticospinal tract. There were no areas of increased FA, reduced MD, or RD in the ASD group.

There are four studies which implement a voxel-wise analysis studying adolescents with ASD. In the first published DTI study in ASD, Barnea-Goraly and colleagues (Barnea-Goraly, et al., 2004) reported on a comparison of seven adolescents with autism (14.6 ± 3.4 years) and nine controls (13.4 ± 2.8 years). The autism group demonstrated reduced FA in white matter adjacent to the ventromedial prefrontal cortices, anterior cingulate gyri, and temporoparietal junctions. FA reductions were also seen adjacent to the superior temporal sulcus bilaterally, temporal lobes approaching the amygdala bilaterally, occipitotemporal tracts, and corpus callosum. Cheng and colleagues (Cheng et al., 2010) compared 25 adolescents with ASD (13.71 ± 2.54 years) and 25 controls (13.51 ± 2.20 years), reporting reduced FA in the right posterior limb of internal capsule with increased RD distally and reduced AD centrally. ASD adolescents also demonstrated greater FA with reduced RD in the frontal lobe, greater FA with reduced RD in the right cingulate gyrus, greater FA with reduced RA with increased AD in the bilateral insula, greater FA with reduced RD in the right superior temporal gyrus, and greater FA with reduced RD in the bilateral middle cerebellar peduncle. Noriuchi and colleagues (Noriuchi et al., 2010) reported on a comparison of seven adolescents with ASD (13.96 ± 2.68 years) and seven controls (13.36 ± 2.74 years). For the ASD group, FA and AD were lower in the white matter around left dorsolateral prefrontal cortex, posterior superior temporal sulcus/temporoparietal junction, right temporal pole, amygdala, superior longitudinal fasciculus, occipitofrontal fasciculus, mid- and left anterior corpus callosum, and mid- and right anterior cingulate cortex. Higher AD values were observed in the cerebellar vermis lobules in the ASD group. Groen and colleagues (Groen, Buitelaar, van der Gaag, & Zwiers, 2011) reported on a comparison of 17 adolescents with autism (14.4 ± 1.6 years) and 25 controls (15.5 ± 1.8 years). Participants with autism had lower FA in the left and right superior and inferior longitudinal fasciculi which lost significance after controlling for age and IQ. MD levels were markedly increased in the autism group throughout the brain.

In the two remaining voxel-wise studies, one examined adults only, and the other included subjects from the entire age range from children to adults. Bloemen and colleagues (Bloemen et al., 2010) reported on a comparison of 13 adults with Asperger syndrome (39.0 ± 9.8 years) and 13 controls (37.0 ± 9.6 years). Adults with Asperger syndrome had lower FA than controls in 13 clusters which were largely bilateral and included white matter in the internal capsule; frontal, temporal, parietal, and occipital lobes; cingulum; and corpus callosum. Keller and colleagues (Keller, Kana, & Just, 2007) reported on a comparison of 34 children, adolescents, and adults with ASD (18.9 ± 7.3 years) and 31 controls (18.9 ± 6.2 years). Participants with ASD had lower FA in areas within and near the corpus callosum and in the right retrolenticular portion of the internal capsule.

Region of Interest (ROI)

In using the ROI method, anatomical area(s) which are to be studied are traced for each individual participant, usually by hand and without knowledge of group membership, in order to obtain averaged measures (e.g., FA, RD) within the ROI that characterize the selected region for a particular participant. Comparisons can then be made testing for significant group differences. ROI studies are particularly useful when particular brain structures, which can be readily defined, are suspected to be abnormal. By focusing on hypothesized regions, the problem of multiple comparisons is greatly reduced. At the time of this writing, there are seven DTI studies which use an ROI approach in the study of ASD. Overall, these studies demonstrate various diffusion abnormalities in most areas studied with the most common abnormality being a reduction in FA.

There are four studies which implement an ROI approach studying children with ASD. Ben Bashat and colleagues (Ben Bashat et al., 2007)

reported on a comparison of seven toddlers with autism with ages ranging from 1.8 to 3.3 years. ROI measurements in different anatomical regions revealed an increase in FA with dominance in the left hemisphere and frontal lobe. Sivaswamy and colleagues (Sivaswamy et al., 2010) reported on a comparison of 27 children with ASD (mean age 5.0 years) and 16 controls (mean age 5.9 years) where ROIs were placed in the cerebellar peduncles. In the ASD group, there was an increase in the MD of bilateral superior cerebellar peduncles and reversal of asymmetry in FA of the middle cerebellar peduncle and inferior cerebellar peduncle. Brito and colleagues (Brito et al., 2009) compared eight children with ASD (9.53 ± 1.83 years) and eight controls (9.57 ± 1.36 years). In the ASD group, they reported reduced FA in ROIs corresponding to the anterior corpus callosum, right corticospinal tract, posterior limb of right and left internal capsules, left superior cerebellar peduncle, and right and left middle cerebellar peduncles. Shukla and colleagues (Shukla, Keehn, Lincoln, & Muller, 2010) reported on a comparison of 26 children with ASD (12.7 ± 0.6 years) and 24 controls (13.0 ± 0.6 years). ASD children demonstrated reduced FA and increased RD for whole-brain white matter and ROIs corresponding to the corpus callosum and internal capsule. Additionally, there was increased MD for whole-brain white matter and ROIs corresponding to the anterior and posterior limbs of the internal capsule. Finally, reduced AD was reported for the ROI of the body of the corpus callosum, and reduced FA was also found for the ROI of the middle cerebellar peduncle.

In the three remaining studies, analyses included subjects across the entire age range including children, adolescents, and adults. Lee and colleagues (Lee et al., 2007) reported on a comparison of 43 individuals with ASD (16.2 ± 6.7 years) and 34 controls (16.4 ± 6.0 years) with ROIs capturing the superior temporal gyrus and temporal stem. In all examined regions, the ASD group demonstrated decreased FA and increased MD and RD. Lange and colleagues (Lange et al., 2010) reported on a comparison of 30 individuals with autism (15.78 ± 5.6 years) and 30 controls (15.79 ± 5.5 years) with ROIs including superior temporal gyrus and temporal stem. Tensor skew, a measure of tensor shape, was used in addition to the more common metrics. In the superior temporal gyrus, reversed hemispheric asymmetry was reported for the autism group: tensor skew was greater on the right, and FA was decreased on the left. Moreover, there was also increased AD bilaterally. In the right temporal stem (but not the left), increases in MD, AD, and RD were exhibited in the autism group. Alexander and colleagues (Alexander et al., 2007) reported on a comparison of 43 individuals with ASD (16.23 ± 6.70 years) and 34 controls (16.44 ± 5.97 years) using a corpus callosum ROI. There were significant group differences in white matter volume, FA, MD, and RD which appeared to be driven by an autism subgroup with small corpus callosum volumes, high MD, low FA, and increased RD. Compared to other individuals with autism or the controls, this subgroup had lower performance IQ measures.

Tractography

Tractography studies have similarities to ROI studies, except the area of interest is defined using tractography. The results of tractography are very sensitive to the method and parameters used in creating these tract volumes; thus, great care must be taken to ensure reliability and blindness. In a manner analogous to ROI studies, diffusion metrics captured within the tract volume are analyzed. In addition, geometric properties of the tracts can also be obtained (e.g., lengths, volumes). Comparisons can be made by averaging these measures and comparing means between groups. At the time of this writing, there are six DTI studies which utilize a tractography approach in the study of the neurobiology of ASD. Overall, studies using tractography demonstrate diffusion abnormalities in many fiber tracts, again with the most common abnormality being a reduction in FA.

There are two studies which implement the tractography approach studying children and adolescents with ASD. Sundaram and colleagues (Sundaram et al., 2008) reported on a comparison

of 50 children with ASD (4.79 ± 2.43 years) and 16 controls (6.84 ± 3.45 years). Tractography was performed on frontal lobe long- and short-range pathways. The ADC was significantly higher for whole frontal lobe, long- and short-range association fibers in the ASD group. FA was significantly lower in the ASD group for short-range fibers but not for long-range fibers. There was no between-group difference in the number of frontal lobe fibers (short and long); however, the long-range association fibers of frontal lobe were significantly longer in ASD group. Fletcher and colleagues (Fletcher et al., 2010) reported on a comparison of 10 adolescents with autism (14.25 ± 1.92 years) and 10 controls (13.36 ± 1.34 years), performing tractography of the arcuate fasciculus (superior longitudinal fasciculus). The results showed an increase in MD in the autism group, due mostly to an increase in the RD. Both MD and FA were less lateralized in the autism group.

The remaining four tractography studies include adults with one study including participants across the entire age range. Catani and colleagues (Catani et al., 2008) reported on a comparison of 15 adults with Asperger syndrome (31 ± 9 years) and 16 controls (35 ± 11 years). Tractography was performed on short intracerebellar connections, long-range afferent (i.e., corticopontocerebellar and spinocerebellar tracts) and efferent (i.e., superior cerebellar tracts) connections. The Asperger group had significantly lower FA in the short intracerebellar fibers and right superior cerebellar peduncles, but no difference in the afferent tracts. Conturo and colleagues (Conturo et al., 2008) reported on a comparison of 17 adults with autism (26.46 ± 2.73 years) and 17 controls (26.08 ± 2.69 years), performing tractography of hippocampo-fusiform and amygdalo-fusiform pathways. While these pathways had normal size and shape, the right hippocampo-fusiform had reduced RD compared with controls, opposite to the whole-brain effect of increased RD. In contrast, left hippocampo-fusiform, right arcuate fasciculus, and left arcuate fasciculus had increased RD and increased AD in autism. There was a general loss of lateralization compared with controls. Thomas and colleagues (Thomas, Humphreys, Jung, Minshew, & Behrmann, 2011) reported on a comparison of 12 adults with autism (28.5 ± 9.7 years) and 18 controls (22.4 ± 4.1 years), performing tractography on callosal and visual-association pathways. Compared with the control group, the autism group demonstrated an increase in the volume of the intra-hemispheric fibers, particularly in the left hemisphere, and a reduction in the volume of the forceps minor and the body of the corpus callosum. Finally, Pugliese and colleagues (Pugliese et al., 2009) compared 24 children, adolescents, and adults with Asperger syndrome (23.3 ± 12.4 years) and 42 controls (25.3 ± 10.3 years), performing tractography on the following limbic pathways: inferior longitudinal fasciculus, inferior frontal occipital fasciculus, uncinate, cingulum, and fornix. There were no significant between-group differences in FA and MD. However, the Asperger group had a significantly higher number of streamlines in the right and left cingulum and in the right and left inferior longitudinal fasciculus. In contrast, the group with Asperger syndrome had a significantly lower number of streamlines in the right uncinate.

Combination DTI

While each of the DTI methods described above has limitations when used alone, these can be overcome by using the methods in combination with one another, ideally in a synergistic manner. Kumar and colleagues (Kumar et al., 2010) reported on a comparison of 32 children with ASD (mean age 5.0 years), 12 developmentally impaired children without ASD (mean age 4.6 years), and 16 controls (mean age 5.5 years). They essentially performed two separate analyses on the same group of participants: voxel-wise and tractography study. In the voxel-wise portion of the study, when the ASD and developmentally impaired children were compared with controls, FA was lower in the right uncinate fasciculus, right cingulum, and corpus callosum in both affected groups. There was also reduced FA in right arcuate fasciculus when ASD children were compared with controls and reduced FA in the bilateral inferior fronto-occipital fasciculus when developmentally impaired children were compared with controls. ADC was increased in right arcuate fasciculus in both ASD and developmentally

impaired children. In the tractography portion of the study, the ASD group showed shorter length of the left uncinate fasciculus and increased length, volume, and density of the right uncinate fasciculus; increased length and density of the corpus callosum; and higher density of the left cingulum compared with the control group. Compared with the developmentally impaired group, the ASD group had increased length, volume, and density of the right uncinate fasciculus; higher volume of the left uncinate fasciculus; and increased length of the right arcuate fasciculus and corpus callosum. Jou and colleagues (Jou et al., 2011) reported on a comparison of 10 ASD adolescents (13.06 ± 3.85 years) and 10 controls (13.94 ± 4.23 years). DTI data was analyzed in a synergistic manner by performing a voxel-wise comparison with follow-up tractography to identify underlying affected white matter structures. The regions of lower FA, as confirmed by tractography, involved the inferior longitudinal fasciculus/inferior fronto-occipital fasciculus, superior longitudinal fasciculus, and corpus callosum/cingulum. Notably, some volumes of interest were adjacent to the fusiform face area, bilaterally, corresponding to involvement of the inferior longitudinal fasciculus. The largest effect sizes were noted for volumes of interest in the right anterior radiation of the corpus callosum/cingulum and the right fusiform face area (inferior longitudinal fasciculus). Finally, Pardini and colleagues (Pardini et al., 2009) reported on a comparison of 10 adults with autism (19.7 ± 2.83 years) and 10 controls (19.9 ± 2.64 years). They compared FA within orbitofrontal cortex volumes defined by tractography in addition to voxel-wise comparison of FA. The low-functioning group with autism demonstrated reduced tract volume and lower mean FA values in the left orbitofrontal cortex network compared with controls.

Multimodal MRI

While an extremely powerful technology, DTI remains an indirect probe of white matter integrity based on measuring properties of restricted water diffusion. One strategy to augment this data is to use multiple modalities in search for converging evidence supporting a particular neurobiological hypothesis. At the time of this writing, there are a total of five published studies taking a multimodal MRI approach: two combining with structural MRI, two combining with functional MRI, and one combining with both structural and functional MRI.

Ke and colleagues (Ke et al., 2009) reported on a comparison of 12 children with autism (8.75 ± 2.26 years) and 10 controls (9.40 ± 2.07 years) using voxel-wise comparison of both white matter density (structural MRI) and FA (DTI). In the autism group, there was a decrease of the white matter density in the right frontal lobe, left parietal lobe, and right anterior cingulate. Moreover, there was an increase of the white matter density in the right frontal lobe, left parietal lobe, and left cingulate gyrus. The autism group also exhibited reductions of FA in the frontal lobe and left temporal lobe. Mengotti and colleagues (Mengotti et al., 2011) reported on a comparison of 20 children with autism (7.00 ± 2.75 years) and 22 controls (7.68 ± 2.03 years) using a combination of voxel-wise comparison in gray/white matter and ROIs (corpus callosum, frontal, temporal, parietal, and occipital lobes) comparing ADC. Compared to controls, the autism group exhibited increased white matter volumes in the right inferior frontal gyrus, right fusiform gyrus, left precentral and supplementary motor areas, and left hippocampus. Moreover, there were increased gray matter volumes in the inferior temporal gyri bilaterally, right inferior parietal cortex, right superior occipital lobe, and left superior parietal lobule. Additionally, there were decreased gray matter volumes in the right inferior frontal gyrus and left supplementary motor area. Finally, the autism group exhibited abnormally increased ADC in the bilateral frontal cortex and left genu of the corpus callosum.

Using a combination of DTI and functional MRI, Sahyoun and colleagues (Sahyoun, Belliveau, Soulieres, Schwartz, & Mody, 2010) reported on a comparison of 12 adolescents with autism (13.3 ± 2.1 years) and 12 controls (13.3 ± 2.5 years). DTI analysis included a tractography approach in which fiber tracking was aided by functional MRI. FA was captured within these tracts, and mean FA was compared between groups. The functional MRI included response time on pictorial

problem-solving task. Autism and control groups showed similar networks: linguistic processing activated inferior frontal, superior and middle temporal, ventral visual, and temporoparietal areas, whereas visuospatial processing activated occipital and inferior parietal areas. However, the autism group activated occipitoparietal and ventral temporal areas, whereas controls activated frontal and temporal language regions. The autism group relied more heavily on visuospatial abilities as evidenced by intact connections between the inferior parietal and ventral temporal ROIs. There was impaired activation of frontal language areas in the autism group as evidenced by reduced connectivity of the inferior frontal region to the ventral temporal/middle temporal regions.

In another combination DTI and functional MRI study, Thakkar and colleagues (Thakkar et al., 2008) reported on a comparison of 12 ASD adults (30 ± 11 years) and 14 controls (27 ± 8 years). DTI analysis included a comparison of FA performed 2 mm below the white/gray matter boundary. Functional MRI included a saccadic paradigm where activation was compared in error versus correct antisaccades, and in both correct and error antisaccades versus fixation, both within and between groups using a random effects model. Relative to controls, the ASD group made more antisaccade errors and responded more quickly on correct trials. The ASD group also showed reduced discrimination between error and correct responses in rostral anterior cingulate cortex and reduced FA in white matter underlying anterior cingulate cortex. Finally, in the ASD group, there was increased activation on correct trials and reduced FA in rostral anterior cingulate, both of which were related to repetitive behavior.

Using a combination of DTI and structural and functional MRI, Knaus and colleagues (Knaus et al., 2010) reported on a comparison of 14 ASD adolescents (age range 11–19 years) and 20 controls (age range 11–19 years). Structural MRI analysis included volumetric measurements of language areas. DTI analysis included tractography to delineate a pathway between temporal and frontal language areas to compare mean FA. Functional MRI was used to divide participants into typical (leftward) and atypical (rightward) language laterality groups. Participants with typical left-lateralized language activation had smaller frontal language region volume and higher FA of the arcuate fasciculus compared to the group with atypical language laterality, across both ASD and controls. The group with typical language asymmetry included the most right-handed controls and fewest left-handers with ASD. Atypical language laterality was more prevalent in the ASD than in controls.

Future Directions

Future directions include further refinement of DTI techniques, sophistication in the integration of multiple imaging modalities, and multidimensional longitudinal designs. Improvements in technology include higher scan resolution, improving signal-to-noise ratio while maintaining tolerability, and developing novel metrics with higher pathological specificity. Other improvements go beyond the tensor model to examine the directional variation of diffusion in more detail (Lo et al., 2011). Tractography faces challenges in its ability to resolve multiple fiber populations in a single voxel (e.g., crossing and kissing fibers), growing usage as a more quantitative measure, and lack of standardized technique supported by gold-standard postmortem studies. While several multimodal studies have been published, there could be tighter integration of more modalities (MRI and beyond) to create novel study designs with higher synergy. The studies reviewed in this chapter are all cross-sectional; thus, longitudinal studies would be optimal to fill in the gaps in current knowledge. In addition to longitudinal imaging across the life span, there should be longitudinal clinical assessments designed to give further meaning to imaging data.

See Also

▶ Functional Connectivity
▶ Magnetic Resonance Imaging

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DiGeorge Syndrome

▶ CATCH 22 (Chromosome 22q11 Deletion Syndrome)

Digitigrade Gait

▶ Toe Walking

Dimensional Versus Categorical Classification

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Synonyms

Class versus variable; Discrete versus continuous

Definition

Is autism a distinct and discrete abnormality or is it simply the upper end of some dimension of normal human variability? Such a contrast of categorical and dimensional conceptualizations of mental health has a long history, especially relevant to the discussion about an autism spectrum and "the autisms." It should be noted that the question conflates at least two issues: one is the contrast between discrete and continuous but the other is the implicit value judgment that is associated with abnormal and normal. The choice has broad consequences for almost all aspects of measurement, explanation, and much of treatment and policy formulation. It is also the basis of much unproductive and confused debate.

Essentially, all our clinical measurement of autism starts with sets of categorical symptoms or items, though implicit judgments about dimensional severity may be implicit in the scoring of each item.

From these, the international diagnostic systems such as DSM (American Psychiatric Association [APA], 1994) spent decades refining rules for combining these items into categorical diagnostic categories. Screening questionnaires (e.g., Charman et al., 2007) commonly start with a similar item set and form total scores that might be considered a dimension. However, the items chosen commonly identify clear abnormality (high threshold or difficult items in the terminology of psychometrics), generate strongly nonnormal item-total distributions when applied to a general population, and, through use of cut points, are intended to increase the proportion or probability of caseness rather than to provide a metric. They are not intended to differentiate among the majority who fall within the normal range. By contrast, questionnaires such as the Autism Quotient (e.g., Wheelright, Auyeung, Allison, & Baron-Cohen, 2010) have items with a range of difficulties and are quite explicitly orientated toward measurement of an autism-related dimension. Questions then arise as to whether the variation that is being differentiated among the normal and supernormal is the same dimension as the variation being differentiated among the abnormal or whether instead we have a mixture of normal and abnormal populations. Some formal tests have been proposed (e.g., Meehl, 1995).

The use of a categorical diagnostic tool and a separate dimensional severity has the potential to lead to inconsistencies, a problem that can be resolved if both are derived from the same instrument, for example, the Autism Diagnostic Observation Schedule (Gotham, Pickles, & Lord, 2009). It is however crucial to distinguish a dimensional severity measure that relates to symptom abnormality from one that relates to level of impairment. While these are correlated, they are not the same.

So should autism be treated as a category or as a high score on a dimension? The arguments of Pickles and Angold (2003) imply that while a dimensional perspective may be more appropriate when considering some aspects of autism, such as when assessing treatment outcome effects, a categorical perspective may be better, even necessary, when considering another, notably treatment eligibility. Whether that dimension should be severity or impairment will depend on the circumstance.

See Also

- ▶ Atypical Autism
- ▶ Autism
- ▶ Autism Diagnostic Observation Schedule
- ▶ Broader Autism Phenotype
- ▶ DSM-IV
- ▶ Factor Analysis
- ▶ Latent Variable Modeling
- ▶ Screening Measures

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Dimethylglycine

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Synonyms

DMG

Definition

Dimethylglycine (DMG) is a natural substance thought to inhibit the buildup of certain amino acids in the body and enhance the immune response in children with ASD. It is a derivative of the amino acid, glycine. It is found in foods, such as beans, grains, and liver.

DMG supplementation has been proposed as a treatment for autism. Anecdotal reports have suggested that use of DMG improved social behavior, frustration tolerance, speech, and reduced aggressive behavior in individuals with autism. However, two randomized clinical trials revealed no significant differences in behavior in individuals with autism after taking DMG (Bolman & Richmond, 1999; Kern, Miller, Cauller, Kendall, Mehta, & Dodd, 2001).

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Diminished Capacity

► Diminished Responsibility

Diminished Responsibility

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Synonyms

Diminished capacity

Definition

In criminal law, the defense of diminished responsibility reduces a person's liability in connection with the killing of another if it can be argued that they were suffering from an "abnormality of mind (whether arising from a condition of arrested or retarded development of mind or any inherent causes or induced by disease or injury) as substantially impaired his mental responsibility for his acts and omissions in doing or being a party to the killing" (Homicide Act (England & Wales) 1957). As this definition from English law indicates, this defense can only be used in connection with charges of murder and, if successful, reduces a person's culpability such that they are found guilty of the lesser charge of manslaughter rather than murder. It is particularly useful in this context as there are many "disposal" options available to the court for a charge of manslaughter, whereas murder carries the mandatory life sentence.

The defense itself was first recognized under the common law in Scotland and is recognized in several jurisdictions across the globe, including several states in the USA; certain territories in Australia, Hong Kong, and Singapore; and several Caribbean countries. Moreover, in certain jurisdictions without this defense, there have been a number of cases described where a defense of "lack of intent" has been advanced on the grounds of a mental disorder not amounting to insanity, essentially amounting to the same thing as a diminished defense.

It is important to contrast diminished responsibility with defense of insanity, which states that if a person, at the time of the act or omission, was, due to a severe mental disease or defect, unable to appreciate the nature or quality of their act, then they cannot be held criminally responsible for their behavior. As a result, and in contrast to the defense of criminal responsibility, they are deemed to be "not guilty." Both diminished responsibility and insanity are therefore interpreted at the level of a person's mens rea (i.e., their ability to form a "guilty mind").

The relevance of this defense to individuals with ASDs will therefore only really arise in connection with allegations of murder. Such an

occurrence will be extremely uncommon, and at the time of writing, no case law on the use of this defense for an individual with ASDs is available.

See Also

▶ Violent/Criminal Behavior in Autism

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Diphen [OTC]

▶ Diphenhydramine

Diphenhist® [OTC]

▶ Diphenhydramine

Diphenhydramine

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Synonyms

Aler-Cap [OTC]; Aler-Dryl [OTC]; Aler-Tab [OTC]; AllerMax® [OTC]; Altaryl [OTC]; Anti-Hist [OTC]; Banophen™ [OTC]; Banophen™ anti-itch [OTC]; Benadryl® allergy [OTC]; Benadryl® allergy quick dissolve [OTC]; Benadryl® children's allergy [OTC]; Benadryl® Children's Allergy Fastmelt® [OTC]; Benadryl® Children's Allergy Perfect Measure™; Benadryl® children's allergy quick dissolve [OTC] [DSC]; Benadryl® children's dye-free allergy [OTC]; Benadryl® dye-free allergy [OTC]; Benadryl® itch relief extra strength [OTC]; Benadryl® itch stopping [OTC]; Benadryl® itch stopping extra strength [OTC]; Compoz® nighttime sleep aid [OTC]; Dermamycin® [OTC]; Diphen [OTC]; Diphenhist® [OTC]; Dytan™; Genahist™ [OTC]; Histaprin [OTC]; Hydramine [OTC] [DSC]; Nytol® quick caps [OTC]; Nytol® quick gels [OTC]; PediaCare® children's allergy [OTC]; PediaCare® children's NightTime cough [OTC]; Siladryl allergy [OTC]; Silphen cough [OTC]; Simply Sleep™ [OTC]; Sleep-ettes D [OTC]; Sleepinal® [OTC]; Sleep-tabs [OTC]; Sominex® [OTC]; Sominex® maximum strength [OTC]; Theraflu® Thin Strips® multi symptom [OTC]; Triaminic Thin Strips® children's cough and runny nose [OTC]; Twilite® [OTC]; Unisom® SleepGels® maximum strength [OTC]; Unisom® SleepMelts™ [OTC]

Definition

Diphenhydramine (generic name) is also known as Benadryl®. Diphenhydramine acts by blocking the effect of histamine on the H1 receptor site. Diphenhydramine inhibits most responses of smooth muscle to histamine. It acts as a vasoconstrictor by inhibiting the vasodilator effects of histamine.

Diphenhydramine is used to provide relief to allergic symptoms caused by histamine release, for sedation, as prevention of motion sickness, as an antitussive, as treatment of phenothiazine-induced dystonic reactions, as adjunct to epinephrine in the treatment of anaphylaxis, and topically for relief of pain and itching.

Diphenhydramine is often used to control agitation or aggression in children; however, it does not have an FDA indication for this use.

Pharmacodynamics/Kinetics:
Onset of action: Maximum sedative effect: 1–3 h
Duration: 4–7 h

Distribution: V_d: 3–22 L/kg
Protein binding: 78%
Metabolism: Extensively hepatic n-demethylation via CYP2D6; minor demethylation via CYP1A2, 2C9, and 2C19; smaller degrees in pulmonary and renal systems; significant first-pass effect
Bioavailability: Oral: ~40–70%
Half-life elimination: 2–10 h; elderly: 13.5 h
Time to peak, serum: 2–4 h
Excretion: Urine (as unchanged drug)

Side Effects

Since diphenhydramine acts by blocking the effect of histamine on the H1 receptor site, it can cause significant anticholinergic side effects such as ataxia; loss of coordination; decreased mucus production; consequent dry, sore throat; xerostomia or dry mouth with possible acceleration of dental caries; cessation of perspiration; consequent decreased epidermal thermal dissipation leading to warm, blotchy, or red skin; increased body temperature; pupil dilation (mydriasis); consequent sensitivity to bright light (photophobia); loss of accommodation (loss of focusing ability, blurred vision (cycloplegia)); double vision (diplopia); increased heart rate (tachycardia); tendency to be easily startled; urinary retention; diminished bowel movement, sometimes ileus; increased intraocular pressure; and shaking.

In high enough doses, diphenhydramine can cause a cholinergic delirium (children and elderly are more prone), and may include confusion, disorientation, agitation, euphoria, or dysphoria; respiratory depression; memory problems; inability to concentrate; wandering thoughts; inability to sustain a train of thought; incoherent speech; wakeful myoclonic jerking; unusual sensitivity to sudden sounds; illogical thinking; visual disturbances (periodic flashes of light, periodic changes in visual field, restricted vision); visual, auditory, or other sensory hallucinations (warping or waving of surfaces and edges, textured surfaces, "dancing" lines, "spiders," insects); and, rarely, seizures, coma, and death.

Diphenhydramine may cause paradoxical excitation in young children.

Its chemical name is 2-(Diphenylmethoxy)-N, N-dimethylethylamine hydrochloride, and it has a molecular weight of 291.82. The molecular formula is $C_{17}H_{21}NO \bullet HCl$.

See Also

- ▶ Anxiolytics
- ▶ Benzodiazepines
- ▶ Diazepam
- ▶ Gabapentin
- ▶ Oxazepam

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Direct Instruction

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Definition

Direct instruction is a general term used to describe the explicit teaching of a skill set and was developed by Siegfried Engelmann, Wesley Becker, and colleagues. It is a teaching model that focuses on systematically planned lessons

and clearly defined teaching procedures. It often involves breaking down instructional targets into smaller components and using a scaffolding approach to teach material. Direct instruction emphasizes the explicit teaching of skills and requires that students consistently demonstrate mastery before moving on to new material. Direct instruction requires that students actively participate in learning and necessarily involves meaningful teacher-student interaction.

See Also

► Didactic Approaches

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Direct Observation

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Definition

Direct observation, also known as observational study, is a method of collecting evaluative information in which the evaluator watches the subject in his or her usual environment without altering that environment. Direct observation is used when other data collection procedures, such as surveys, questionnaires, etc., are not effective; when the goal is to evaluate an ongoing behavior process, event, or situation; or when there are physical outcomes that can be readily seen.

Direct observation can be overt, when the subject and individuals in the environment know the purpose of the observation, or covert, when the subject and individuals in the environment are unaware of the purpose of the observation.

Structured direct observations are most appropriate when standardized information needs to be gathered, and result in quantitative data. Unstructured direct observation looks at natural occurrence and provides qualitative data, such as that used when administering the Childhood Autism Rating Scale (CARS), the Checklist for Autism in Toddlers (CHAT), and the American Psychiatric Association's Diagnostic and Statistical Manual, 4th Edition (DSM-IV).

Data recording for direct observation includes narrative notes, video or photographs, recording checklist (yes/no), observation guidelines (printed forms with space to write notes), and combinations of the above. Direct observation provides the highest degree of ecological validity but lowest degree of experimental control. The value of direct observation is directly related to the evaluator's ability to capture detail, determine what is important, and interpret what has been observed. Because autism is a disorder that is diagnosed and individuals are evaluated through behavioral observation, direct observation is a critical evaluative tool that affords an objective perspective of the individual's profile.

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Direct Observation Scales

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Definition

Direct observation scales are structured instruments used to collect first-hand information regarding observable behaviors. They contrast to scales that provide indirect accounts, such as rating scales, report forms, or interviews with parents, caregivers, or teachers regarding behaviors of an individual, although both provide important information. Direct observation scales are critical in both diagnosis and intervention with children with autism spectrum disorders. While these scales can vary in format, they share common characteristics, including having a structure as to what is attended to in the observation and what is coded. Thus, they are not simply a description of what an individual is doing. For autism spectrum disorders, the behaviors central to the diagnosis are most often the target of direct observation scales (e.g., eye contact, social initiations, conversational turn-taking) and behaviors that interfere with functioning and are the targets of intervention (e.g., aggression or bolting). Direct observation scales can be more or less structured in how the observation situation is set up and how the data is collected. Some direct observation scales provide a set of semi-structured activities and record and code observed target behavior within those activities, while others provide a structured means to record and code direct observations in the natural environment. A number of direct observation scales have been developed for diagnostic purposes including those that provide semi-structured activities in which to record and code observations, such as the widely used Autism Diagnostic Observational Schedule (ADOS; Lord, Rutter, DiLavore, & Risi, 2001) and the Autism Observation Scale for Infants (AOSI; Bryson, McDermott, Rombough, Brian, & Zwaigenbaum, 2000). For assessment of interfering behaviors for the purpose of treatment planning, direct observation scales are often used during a functional behavioral assessment (FBA). These direct observations are most often conducted in the natural environment and data is collected with a very systematic methodology. Different types of data can be collected during an FBA including interval, frequency, duration, latency, and antecedent-behavior-consequence (ABC) data.

See Also

- ▶ Autism Diagnostic Observation Schedule
- ▶ Direct Observation
- ▶ Functional Behavior Assessment

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Directive Play Therapy

- ▶ Play Therapy

Disability

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Synonyms

Affliction; Detriment in skill; Exceptionality; Incapacity; Relative weakness in an area of functioning

Definition

In common terms, it is the condition of being unable to perform a skill as a consequence of physical or mental incapacity. It may suggest impairments, limitations, or restrictions on performing certain activities. Autism is one category of disability under special education regulations (IDEA, 2004). Other categories of disability include mental retardation, a hearing impairment (including deafness), a speech or language impairment, a visual impairment (including blindness), a serious emotional disturbance (referred to in this part as emotional disturbance), an orthopedic impairment, traumatic brain injury, other health impairments, a specific learning disability, deaf-blindness, or multiple disabilities. A child with a disability under IDEA (2004) needs special education and related services. Additionally the law provides for services for children with a disability aged 3 through 9, to include a child experiencing developmental delays as measured by appropriate diagnostic instruments and procedures, in one or more of the following areas: physical development; cognitive development; communication development; social or emotional development; or adaptive development; and by reason thereof, needs special education and related services. In some situations, children with a disability may be said to present a developmental delay if members of the IEP team are not certain that the individual meets the criteria for autism.

See Also

- ▶ Exceptionality
- ▶ Psychotic Disorder

References and Readings

Assistance to States for the Education of Children with Disabilities and Preschool Grants for Children with Disabilities; Final Rule, 2004, 4000-01-U Department of Education 34 CFR Parts 300 and 301, Part II.
Individuals with Disabilities Education Act of 2004, 20 U. S.C., et. seq.

DISCO

▶ Diagnostic Interview for Social and Communication Disorders

Discourse Management

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Synonyms

Conversational discourse; Pragmatic language; Topic management; Turn-taking

Definition

Discourse management refers to the ability to organize topics and turns and to repair any communication breakdowns during conversation. Carrying on a conversation involves the appropriate use and coordination of a variety of skills including, initiating and maintaining topics, using eye contact, taking turns, being polite,

and observing and responding appropriately to nonverbal behaviors. During discourse, individuals must monitor their own contributions while taking into account the explicit and implicit responses, intentions, and knowledge of their conversational partner(s). The existing literature on language use and conversational skills in individuals with ASD indicates that the ability to contribute new information to topics introduced by others, shift topics appropriately, provide turns for others within conversation, take turns appropriately, and provide repairs for conversational breakdowns frequently present challenges to this group.

See Also

- ▶ Conversational Manner
- ▶ Pragmatics

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Discrete Versus Continuous

▶ Dimensional Versus Categorical Classification

Discretionary Trust

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Discretionary Trust

A discretionary trust is a common method of estate planning whereby the creator of the trust (the *settlor*) transfers the assets to another (the *trustee*), who then has a duty to hold and manage the assets for the benefit of a third party (the *beneficiary*). If the trust is established by a living settlor, rather than through a will, the trust acts as a will substitute and the transferred estate avoids probate and some estate taxes.

The terms of a discretionary trust delegate power to the trustee to decide the "time, purpose and amount of all distributions" to one or more beneficiaries (POMS SI §01120.200.B.10). The trustee may be given complete authority over distributions that the trustee considers advisable. For example, a settlor might delegate absolute discretion upon a trustee in order to protect the long-term interests of a financially irresponsible beneficiary, or to establish a supplemental needs trust for lifetime support of an orphaned or disabled child. The purpose of such trusts may be to protect a spendthrift beneficiary from poor financial decisions; provide funds that "supplement, but not supplant, sources of income including SSI or other government benefits" (POMS SI §01120.200B.13); and shield the trust against invasion by the beneficiary, or the beneficiary's general creditors. The trustee may only be compelled to distribute money from the trust under very restricted circumstances.

Alternatively, the settlor may limit the trustee's discretion by directing that distributions be used for specific purposes. Often, such an arrangement is made to provide for the long-term care and support of an incompetent beneficiary. For instance, a trustee's discretion is

limited to distributing money for the "comfortable support, education, health and maintenance" of the beneficiary (Leslie & Sterk, 2006). Support trusts are often used to provide care for a surviving spouse, or an incompetent or elderly adult.

Depending on the intent and objectives of the trust, creating a discretionary trust is an effective estate planning tool that may extend the life and availability of estate assets, while offering flexibility for the trustee to deal with unanticipated events. However, problems may arise such as a trustee's breach of duty to manage the trust in "good faith," or "in accordance with its terms and purposes," or in the "interests of the beneficiaries" (Uniform Trust Code §801 *et. seq*., 2005). This may be demonstrated when the trustee abuses the assigned discretionary power, and the beneficiary is not competent to address the breach. Therefore, one must carefully evaluate the goals of the settlor, the competence and trustworthiness of the trustee, and the long-term needs of the beneficiary in order to determine if a discretionary trust is the best estate planning option.

See Also

- ▶ Beneficiary
- ▶ Trust

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Social Security Act (SSA), §42 U.S.C. §1396p
Uniform Trust Code §801 (2005) *et. seq*.

Disfluency

- ▶ Fluency and Fluency Disorders
- ▶ Stuttering

Disinhibited Attachment Disorder

- ▶ Attachment Disorder

Disinhibited Social Engagement Disorder

- ▶ Attachment Disorder

Disintegrative Disorder

- ▶ Acquired Autism
- ▶ Childhood Disintegrative Disorder (Heller's Syndrome)

Disintegrative Psychosis

- ▶ Childhood Disintegrative Disorder (Heller's Syndrome)

Disorder of Executive Dysfunction

- ▶ Frontal Lobe Syndrome

Disordered Attachment

- ▶ Reactive Attachment Disorder

Dispute Resolution Procedures

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Definition

A dispute resolution procedure is a method of resolving a conflict between parties. Historically, dispute resolution was judicial in nature; however, in recent years the number of disputes resulting in trial has decreased significantly due in part to the advent of alternative dispute resolution (ADR) procedures such as arbitration, mediation, and negotiation. Today, most references to a dispute resolution procedure are to these alternatives to litigation (Yarn, 1999, p. 154). These methods of dispute resolution along with other types of ADR may be utilized by parties trying to minimize costs and avoid the adversarial nature of litigation.

Types of Alternative Dispute Resolution Procedures

Modern alternative dispute resolution procedures were developed primarily as a response to the rising levels of litigation in the United States throughout the twentieth century. In the mid-1970s, Harvard Professor Frank Sander articulated his vision of a system where, instead of leading directly to litigation, disputes could be directed to various alternative methods to resolve the dispute without resorting to a trial. He described this multifaceted system of the judiciary working alongside other forms of conflict resolution as the "multidoor" courthouse. (Menkel-Meadow, 2005, p. 19). The implementation of such alternatives to litigation has greatly reduced the number of cases going to trial even as the number of complaints filed in courthouses has greatly increased (Stipnowich, 2004, p. 844).

Arbitration

Arbitration is a dispute resolution process in which the disputing parties present their cases to a third party intermediary who makes what is usually a binding decision for the parties. Arbitration is generally not as formal as in-court adjudication, and the procedural rules can be structured to meet the necessities of the particular situation. As in court-based adjudication, the outcome of an arbitration proceeding will typically result in a clear winner and loser. Although the arbitrator may recommend a solution that clearly benefits both parties, arbitrators are not expected to develop ideas for meeting the interests of both sides or to help the parties see areas of agreement and reconciliation.

Mediation

Mediation is a process in which the parties attempt to resolve a conflict with the assistance of a neutral third party (mediator) (Yarn, 1999, p. 272). Mediation is similar to negotiation in that the parties to the dispute are in control. However, to assist the process of negotiation, the mediator is present to help reach a mutually agreeable solution to their differences. Although ultimate control and decision-making authority remain with the parties, the mediator has significant power throughout the process to direct the negotiations, identify areas of agreement, and encourage the parties to accept concessions (Goldberg, Sander, Rogers, & Cole, 2007, p. 107).

Negotiation

Negotiation is a process where the parties, with the aid of a mediator, attempt to come to a mutually acceptable agreement about issues on which they disagree (Nieuwmeijer, 1988, p. 9). The parties use bargaining and open communication to reach a consensus over their outstanding issues. Negotiation works best in situations where all parties involved in the process have a mutual interest in resolving their dispute and are willing to each make concessions in order to reach an acceptable resolution.

See Also

► Eligibility (for Services Under IDEA/ADA, etc.)

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Disruptive Behavior

► Conduct Disorder

Dissocial Behavior

► Conduct Disorder

Distributed Practice

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Definition

Distributed practice is a technique commonly used with students who are learning material or studying for a test. It involves the student creating a schedule of study sessions that are short in duration. Distributed practice can be contrasted to massed practice or cramming, where the student spends fewer studying sessions but for longer periods of time. This technique has proven to be beneficial for maintaining newly learned skills. Distributed practice aids students in prioritizing learning material.

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Distribution-Free Statistics

► Nonparametric Statistics

Divalproex

► Depakene

Dizygotic (DZ) Twins

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Synonyms

Fraternal twins

Definition

Twins are two individuals who are the result of the same pregnancy. Dizygotic twins are

nonidentical or fraternal twins. This is in contrast to identical or monozygotic twins. Unlike the case in monozygotic twins, the genetic information or deoxyribonucleic acid (DNA) carried by each of the individual twins in a pair of dizygotic twins is different. This genetic information in the form of DNA is the material inherited from each of the parents that contains all the instructions for the creation and subsequent operation of an individual. Errors in this genetic information can lead directly to disease or make individuals more susceptible to disease.

In singleton pregnancies, a sperm from the father fuses with an egg from the mother, and together, they form a single cell called a zygote, the earliest stage of an embryo. In the case of dizygotic twins, two separate eggs in the mother are released at one time. Each of these is then fertilized by a separate sperm from the father and forms a distinct zygote and embryo. Since each sperm and egg carry distinct genetic material, each of the two embryos will, thus, carry distinct genetic material. On average, dizygotic twins' genetic material is only about 50% identical, as compared to 100% for monozygotic twins. Since each dizygotic twin carries distinct genetic material, his or her physical appearance will be distinct. Dizygotic twins may be of the same sex. However, they might also be of different sexes.

Monozygotic twins, in contrast, form as follows. A sperm from the father fuses with an egg from the mother and initially forms a single zygote. Further cell divisions occur during embryonic development. At an early point in this development, the embryo in the case of monozygotic twins splits into two separate embryos, the cells of each having originated from the initial zygote. Each of these embryos goes on to develop into a separate and complete individual. Since each originated from the same initial cell, each individual is identical in his or her genetic composition. Barring rare occurrences (see Monozygotic Twins), since monozygotic twins share the same genetic material, their physical appearance will be identical, and they will be of the same sex.

Dizygotic twinning is more common than monozygotic twinning. Dizygotic twins comprise approximately two thirds of all twins. Monozygotic twins comprise one third. While the rate of monozygotic twinning in pregnancies that are unassisted by fertility treatments is relatively stable across world populations at a rate of approximately 4 in every 1,000 live births, there is evidence that the rate of dizygotic twinning in the absence of fertility treatments varies from population to population. Studies estimate that dizygotic twinning rates are the lowest in East Asian countries fewer than 8 per 1,000 live births. Dizygotic twinning rates are intermediate in Europe, the United States, and India with a rate of approximately 9–16 per 1,000 births. They are highest in some African countries where they can be 18 or greater per 1,000 births.

The rate of both monozygotic and dizygotic twins has increased worldwide since the 1970s. It is thought that the majority of the increase has resulted from the increase in dizygotic twins born as a result of fertility treatments. Twin pregnancies of either type increase pregnancy risk and especially the risk of preterm delivery and low birth weight. Approximately 51% of twins are born preterm compared to 9.4% of singletons.

See Also

- ▶ Genetics
- ▶ Twin Studies in Autism

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DMG

▶ Dimethylglycine

DNA

▶ Deoxyribonucleic Acid

Dominance, Cerebral

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Synonyms

Hemispheric dominance; Hemispheric lateralization; Hemispheric specialization

Definition

Cerebral dominance refers to the dominance of one cerebral hemisphere (commonly referred to as the left or right side of the brain) over the other in the control of particular cerebral functions. After decades of study in the fields of behavioral neurology, systems neuroscience, neuroimaging, and neuropsychology, it is clear that each hemisphere of the brain is dominant for specific behavioral and cognitive functions. For example, in most right-handed individuals, portions of the right hemisphere temporal lobe are specialized for processing faces, and similar regions of the left hemisphere temporal lobe are specialized for processing letters. Similarly, in approximately 95% of right-handers and 65% of left-handers, the left side of the brain is dominant for language.

See Also

▶ Cerebral Cortex
▶ Neuroscience

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Dopamine

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Definition

Dopamine is a neurotransmitter that is implicated in the pathophysiology of many psychiatric and neurologic disorders. Its most notable psychiatric role is in the pathophysiology of psychosis and schizophrenia, particularly the presence of hallucinations and delusions. However, among a complicated network of neural pathways, dopamine is also believed to influence mood states, anxiety, cognition, and the presence of repetitive symptoms experienced in conditions like autism spectrum disorders (ASD), Tourette's disorder, and obsessive-compulsive disorder. For these reasons, dopamine is the target of research attempting to uncover etiologies and treatments for such diseases. Understanding dopamine's relationship to ASD may offer much insight into the pathophysiology of its symptoms.

Dopamine is synthesized in specialized neurons using the amino acid precursor tyrosine (Stahl, 2008). Tyrosine is first pumped from the

extracellular space into dopaminergic neurons by a tyrosine transporter. Within the neuron, tyrosine then passes through the rate-limiting enzyme tyrosine hydroxylase, followed by the enzyme dopa decarboxylase, to become dopamine. (Dopamine can also be converted to the neurotransmitter norepinephrine via the enzyme dopamine beta-hydroxylase.) Dopamine is packaged into vesicles by a vesicular monoamine transporter (VMAT2) for storage until later use. When a neuron receives the appropriate signal, dopamine is released from synaptic vesicles to travel across the cleft between the presynaptic and postsynaptic axon terminals. Once in the cleft, dopamine is free to attach to dopamine receptors on the postsynaptic axon terminal. It can also be taken up by dopamine transporters in the presynaptic axon terminal to be repackaged for later use or degraded. One of the most notable receptors is the dopamine-2 (D_2) receptor, which is located on postsynaptic axon terminals, presynaptic axon terminals, and somatodendritic areas. When dopamine attaches to D_2 receptors on the presynaptic axon terminal or somatodendritic areas, D_2 receptors provide negative feedback that slows or further prevents the release of dopamine from the presynaptic terminal. Excess dopamine is degraded within the neuron by the enzymes monoamine oxidase (MAO)-A or MAO-B and outside the neuron by the enzyme catechol-O-methyltransferase (COMT). In some areas in the brain, such as the frontal cortex, there are fewer dopamine transporters to take up excess dopamine remaining in the cleft, so these alternative routes of degradation function to regulate dopamine concentration.

There are five key dopamine pathways in the brain. The first is the mesolimbic pathway, which projects from the dopaminergic cell bodies of the ventral tegmental area of the brainstem to the nucleus accumbens in the ventral striatum. Increased dopamine activity in this pathway is thought to generate psychosis, also known as the "positive symptoms" of schizophrenia, which include hallucinations and delusions. Stimulant drugs, like amphetamine and cocaine, produce increased dopaminergic activity and subsequent psychotic symptoms, whereas first- and second-generation antipsychotic medications, which antagonize dopamine in this pathway, cause reduced psychotic symptoms. The mesolimbic pathway is also known to regulate emotions, motivation, pleasure, and reward. Dysfunction in this area may result in symptoms such as avolition and anhedonia, accounting for some of the "negative symptoms" of schizophrenia. The second pathway is the mesocortical pathway, which projects from the dopaminergic cell bodies of the ventral tegmental area to the prefrontal cortex. Branches from this pathway are believed to regulate cognition and executive function, as well as emotion and affect. Unlike the mesolimbic pathway, where an excess of dopamine is hypothesized to produce symptoms of psychosis, a deficit of dopamine in the mesocortical pathway is thought to cause more negative symptoms observed in schizophrenia, such as flat affect, reduced cognition, and impaired executive function. The model of increased or decreased dopaminergic activity in different pathways is hypothetical and is likely an oversimplification of a more complex system yet to be understood. The third pathway is the nigrostriatal pathway, which projects from the dopaminergic cell bodies in the brainstem substantia nigra to the basal ganglia or striatum. This area regulates motor movements and is part of the extrapyramidal nervous system. Hypoactivity of dopamine in this pathway produces parkinsonian symptoms of rigidity, akinesia or bradykinesia, and tremor. Hypoactivity in the basal ganglia specifically can result in dystonia or akathisia. Hyperactivity of dopamine in this pathway results in hyperkinetic movements, such as tics, chorea, and dyskinesia. Longer term blockade of the D_2 receptors via antipsychotics can produce a hyperkinetic disorder known as tardive dyskinesia. The fourth pathway is the tuberoinfundibular pathway, which projects from the hypothalamus to the anterior pituitary. Dopamine typically inhibits prolactin, a hormone that results in lactation. When dopaminergic activity is blocked in this pathway, prolactin levels rise as it is no longer inhibited. Elevated prolactin can cause galactorrhea (breast secretions), amenorrhea (loss of ovulation and menstruation), and possibly sexual side effects. This can occur with the use of antipsychotic medication, which blocks D_2 receptors. The fifth pathway is the lesser-known thalamic dopamine pathway, which innervates the thalamus. It is thought to originate in multiple sites, including the periaqueductal gray

matter, ventral mesencephalon, hypothalamic nuclei, and lateral parabrachial nucleus. The function of this pathway may involve regulation of sleep and arousal.

Historical Background

In the late 1950s, a Swedish pharmacologist named Arvid Carlsson was the first person to discover dopamine as a distinct neurotransmitter, and in the year 2000, he won the shared Nobel Prize in Physiology and Medicine for this very significant contribution. As outlined in Abbott's article in *Nature* (2007), this monumental discovery occurred while experimenting with reserpine, the first antipsychotic to be used in the treatment of schizophrenia. Treatment with reserpine was observed to cause a catatonic state in experimental rabbits, but the mechanism by which this happened was unknown. Using a spectrophotofluorimeter, a machine used to measure the amount of neurotransmitter synthesized from fluorescently tagged precursors, Dr. Carlsson determined that reserpine somehow drained stores of brain neurotransmitters. Because the known neurotransmitters serotonin and norepinephrine were not able to cross the blood-brain barrier, Dr. Carlsson hypothesized that their precursors could be injected and cross over the blood-brain barrier to be converted to the needed neurotransmitters, hopefully restoring movement. He extracted serotonin and norepinephrine precursors, one of which was L-dopa (levodopa), and injected them into the catatonic rabbits. L-dopa restored movement in the animals, and Dr. Carlsson determined dopamine to be a separate neurotransmitter while examining the rabbits' postmortem brains.

With the help of his graduate students, Dr. Carlsson went on to discover dopamine concentrated in areas of the brain associated with movement, like the basal ganglia. Given the similarities between reserpine's side effects and Parkinson's disease, he hypothesized that the disease must be caused by a deficiency of dopamine. He brought these ideas to various symposia but received a mixed reception; the favored thinking at that time was that nerve conduction in the brain occurred via electrical impulses, with little emphasis on chemical transmission. Slowly, others began uncovering similar results, publishing studies showing an absence of dopamine in the basal ganglia in patients with Parkinson's disease (Ehringer & Hornykiewicz, 1960) and that healthy basal ganglia neurons contain high levels of dopamine (Birkmayer & Hornykiewicz, 1961; Dahlstrom & Fuxe, 1964). The drug is not without imperfection, and unwanted side effects such as nausea and emesis can occur. At times, the drug can lose its therapeutic effect in some patients. Nonetheless, L-dopa continues to be the first-line treatment for Parkinson's disease. It also likely garnered increased public awareness after being featured in the 1973 book *Awakenings* by British neurologist Oliver Sacks. This memoir recounts Dr. Sacks' use of L-dopa in 1969 to treat patients with catatonia who survived the 1917–1928 outbreak of *encephalitis lethargica*, otherwise known as sleeping sickness. The book was transformed into a 1990 film with the same name starring American actors Robin Williams and Robert De Niro. In 1961, L-dopa was injected into the first Parkinson's patients with dramatic effect, providing relief for their rigidity and immobility.

Not long after the discovery of dopamine's relationship to Parkinson's disease, neurologists observed that treatment with L-dopa resulted in psychosis, leading to the discovery that the pathophysiology of schizophrenia may be related to dopamine. The observation that antipsychotic drugs caused movement disorders similar to that observed in Parkinson's disease leads Dr. Carlsson to reason that antipsychotics blocked dopamine receptors, resulting in a feedback mechanism by which neurons released more compensatory dopamine. These conclusions have led Dr. Carlsson to become a pivotal figure in the discovery of dopamine as a distinct neurotransmitter, as well as someone who uncovered fundamental mechanisms in neurotransmission that continue to be employed today.

With time, neural pathways controlling dopamine were thought to influence motivation and reward, exemplified by the tendency of patients treated with L-dopa to gamble excessively. Research into addiction and drugs of abuse has

also implicated brain regions and neural pathways primarily governed by dopamine. Dopamine's widespread effect in the brain has led autism researchers to investigate it in the pathophysiology of ASD. The relationship between dopamine and ASD is explored in the "Current Knowledge" section.

Current Knowledge

Due to its extensive innervation of the brain, dopamine has been hypothesized to be involved in the pathophysiology of ASD. According to Baskerville and Douglas (2010), neurologic behavioral disorders caused by profound disruption of the key dopaminergic pathways in the brain are known to adversely affect prosocial behavior. These pathways likely involve complex interactions with multiple other neurotransmitters and neuropeptides, and it is hypothesized that dysfunctional interactions result in the aberrant social behavior observed in ASD. One of the proposed interactions is between dopamine and oxytocin, a neuropeptide with physiologic and behavioral influences. Oxytocin is an endocrine hormone that regulates parturition and milk ejection, but is also involved in regulating social behaviors such as social bonding, parental behavior, and sexual behavior (Lee et al., 2009). It is also thought to regulate nonsocial behaviors such as stress, anxiety, and aggression, which all appear in ASD, and has been thought to be influenced by dopamine pathways. Given their shared roles, dopamine and oxytocin are hypothesized to jointly contribute to aberrant social behaviors, anxiety, and aggression in ASD. The results of studies linking oxytocin to the pathophysiology of ASD have been mixed, however, but treatments involving intranasal oxytocin have resulted in improvements in communication and secure relationship attachment (Heinrichs et al., 2009; Kosfeld et al., 2005). Unfortunately, revealing a definitive, symbiotic relationship between oxytocin and dopamine has yet to occur, but research in this area continues. There has been stronger evidence linking dopamine dysfunction with autism-like disorders, particularly involving the dopamine transporter and D_4 receptor genes (Baskerville & Douglas, 2010). Nakamura et al. (2010) used positron emission tomography (PET) to study the binding of dopamine and serotonin transporters in the brains of autistic male adults compared to age- and IQ-matched controls. They found that dopamine transporter binding was significantly higher in the orbitofrontal cortex of the autistic individuals and that this was inversely correlated with serotonin binding, which was lower throughout the brain of autistic individuals. They concluded that dysfunction in dopamine and serotonin systems likely contributes to the pathophysiology of autism.

Research has attempted to link symptoms of ASD to specific genetic polymorphisms and neuroanatomical regions of the brain. For example, the presence of repetitive, stereotyped behaviors in ASD has been associated with the basal ganglia and frontal lobe circuitry (Langen et al., 2011), which is believed to be regulated by the dopamine system. Housed in the basal ganglia is the caudate nucleus, a brain region associated with behavioral rigidity. The caudate nucleus has been found to be enlarged in ASD, representing one of the best replicated neuroimaging findings in ASD research (Langen et al., 2009). The basal ganglia, particularly the caudate nucleus, exhibit high expression of the dopamine-3 receptor gene (DRD3), a gene that appears to be associated with ASD. Genetic studies have revealed an association between the SNP (single nucleotide polymorphism) rs16777 on DRD3 and ASD (de Krom et al., 2009). This polymorphism is also related to risperidone-induced extrapyramidal symptoms (Gasso et al., 2009), which is significant because risperidone and aripiprazole (a partial agonist at the D_2 receptor) are the only FDA-approved drugs for the treatment of symptoms associated with ASD (Staal, de Krom, & de Jonge, 2011). The DRD3 receptor site is also an action site for atypical antipsychotic drugs, and another of its polymorphisms is a predictor for improvement with risperidone therapy (Correia et al., 2010). All of this data supports a positive association between the presence of the DRD3 gene and ASD; however, a small study performed by Staal et al. (2011) revealed that the presence of SNP rs16777 on DRD3 paradoxically decreased the risk for "insistence on sameness," a form of stereotyped behavior observed in ASD. Given the breadth of findings,

some which are conflicting, there is a need for continued research into DRD3 and its relationship to symptoms of ASD.

Other genetic biomarkers of interest include dopamine transporter gene (DAT1) and dopamine D4 receptor gene (DRD4). In a study by Gadow et al. (2010), the DAT1 and DRD4 genotypes approached significance for teachers' ratings of oppositional behavior and mothers' ratings of tics. The researchers proposed that variation in the alleles for DRD4 may serve as biomarkers predicting challenging behaviors in children with ASD, but the study was small and would require replication with larger samples.

Despite these attempts at localizing specific genes implicated in the pathophysiology of autism, some research indicates that it may not be so simple. A study genotyping 28 SNPs of 14 prominent dopamine pathway candidate genes concluded that the evidence was not strong in favor of linkage or association to any specific gene or combination of genes within the pathway (Anderson et al., 2008). The role of genes within the dopamine pathway, if any, was considered mild to moderate in the pathogenesis of autism.

Inattention and hyperactivity, symptoms that commonly occur in autism, also appear to result from dysfunction of the dopamine system. Gadow et al. (2008) found that a variable number tandem repeat (VNTR) in a region of the dopamine transporter gene (DAT1, SLC6A3) was associated with the severity of ADHD, anxiety, and tics in children with ASD.

The association between dopamine and autism is also evident via the observed effects of antipsychotics medication on the treatment of irritability in ASD. Approximately 30% of children and adolescents with ASD suffer from moderate-to-severe irritability (Lecavalier, 2006). Irritability can include aggressive acts towards the self (self-injurious behavior) or others and severe tantrums. Currently, the most effective drugs used to treat symptoms of irritability are the antipsychotics, which are believed to antagonize postsynaptic D_2 receptors in the brain, although some may also have serotonin receptor antagonism. At present, there are only two atypical antipsychotics that are FDA-approved for the treatment of irritability in autistic disorder: risperidone (Risperdal) and aripiprazole (Abilify). Risperidone is FDA-approved for the treatment of irritability in patients with autistic disorder aged 5–16 years, whereas aripiprazole is approved for the treatment of patients with autistic disorder aged 6–17 years. Risperidone is a potent D_2 antagonist, whereas aripiprazole has partial D_2 receptor agonists, meaning it detaches from the D_2 receptor more readily than risperidone and typical antipsychotics. These traits may contribute to these drugs' relative success in managing symptoms observed in ASD. Other antipsychotics that have been studied include the "typicals," such as haloperidol, pimozide, chlorpromazine, trifluoperazine, thiothixene, trifluperidol, fluphenazine, and molindone. Other atypical antipsychotics include clozapine, olanzapine, quetiapine, and ziprasidone. In addition to irritability, some studies have noted reductions in other symptom domains such as repetitive behavior and inattention, hyperactivity, and impulsivity. However, the direct relationship between dopamine and these symptom outcomes is not always apparent, so future research is needed to explicate this.

Future Directions

Future directions for research into the relationship between dopamine and autism will likely involve genetic studies, neuroendocrine research, neuroimaging, and pharmacologic treatment development. Genetic research has focused on identifying polymorphisms that may or may not be associated with symptoms of ASD. This type of research has yielded mixed results but will likely continue to examine the association between ASD and dopamine receptor genes like DRD3 and DRD4. Attempting to link dopamine and oxytocin has also not yielded strong results, but their shared roles with regard to social behavior, stress, anxiety, and aggression will likely spur continued research attempting to find an association. Given the consistent finding of an enlarged caudate nucleus in patients with ASD, a dopamine-rich area of the brain, neuroimaging may continue to yield useful information about other brain regions

that utilize dopamine and how they relate to symptoms of ASD. It may also reveal more about dopamine binding in such areas. Lastly, new pharmacological treatments for symptoms of ASD should be investigated via randomized, double-blind, placebo-controlled studies to ensure a variety of safe and efficacious treatments are available to patients. The atypical antipsychotic paliperidone, which is the active metabolite of risperidone, is an evident choice since risperidone has shown efficacy in treating children and adolescents with autistic disorder (Stigler et al., 2010).

See Also

- ▶ Antipsychotics: Drugs
- ▶ Aripiprazole
- ▶ Atypical Antipsychotics
- ▶ Caudate Nucleus
- ▶ Clozapine
- ▶ Obsessive-Compulsive Disorder (OCD)
- ▶ Olanzapine
- ▶ Pimozide
- ▶ Psychosis
- ▶ Quetiapine
- ▶ Risperidone
- ▶ Tourette Syndrome
- ▶ Ziprasidone

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Double-Blind Study

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Definition

DOUBLE-BLIND TRIAL. The double-blind trial is a research method that attempts to reduce the bias in research studies. In the classic double-blind trial, subjects are randomly assigned to receive an active medication or a placebo. The placebo is formulated to look and perhaps even taste like the active medication – but the placebo contains no active ingredients. We use the term "double-blind" to indicate that investigators and patients (and parents) do not know whether the patient is getting the active medication or the placebo. The treatment mask is intended to reduce bias and expectation.

When a new medication is being introduced, there may be a lot of interest and hope for the new medication. In the absence of placebo control, this interest and hope could lead to false impressions about the benefits of the medication. Indeed, high expectations can also contribute to the so-called "placebo effect." In several recent studies in children with autism spectrum disorders, as many as one third of the subjects on placebo were classified as much improved or very much improved. For example, in the citalopram study (▶ Citalopram), 34% of the subjects randomly assigned to placebo showed a positive response rated by clinician who was blind to treatment assignment.

Several elements are essential in the conduct of a double-blind, placebo-controlled trial. First and perhaps most important is random assignment. Random assignment is essential to ensure that the two treatment groups are similar. Second, there should be a match between the entry criteria and the study treatment. For example, in the risperidone trial conducted by the RUPP Autism Network (▶ Citalopram), subjects were required to have serious behavioral problems. This ensures that there is room for improvement on the target clinical symptoms. This is important for ethical and statistical reasons. It is fair to compare a new medication to placebo when it is unknown whether the new treatment is effective. In most situations, however, it seems unfair to enroll subjects into a medication study if it was known that the active treatment has a low chance of conferring benefit. In statistics, investigators are interested in finding out if the new treatment is superior to placebo. Subjects who have low severity on the clinical target have little room for improvement, which will make it difficult to detect change. Finally, there is the issue of sample size. A trial that is too small cannot answer the question whether the new medication is superior to placebo. This could be unfortunate if a beneficial treatment is abandoned too soon because it failed to show efficacy in a small trial. On the other hand, treatment trials are expensive.

Moreover, we are asking subjects and families to consider randomization to placebo. A trial should only be as large as needed to test whether the new treatment is superior to placebo. Investigators have to determine the minimum magnitude of benefit that would be considered clinically meaningful and then calculate the sample size needed. The "minimum clinically meaningful benefit" depends on the treatment target. For example, self-injurious behavior is a serious problem. Even a modest level of benefit might be considered meaningful. Repetitive behavior such as rocking or watching the same video over and over can be problematic – but not

a severe as self-injury. For a less severe behavior, a higher level of benefit might be demanded of a new treatment. In general, the smaller the difference between medication and placebo, the larger the trial has to be.

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Douglass Development Disabilities Center

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Major Areas or Mission Statement

The Douglass Developmental Disabilities Center (DDDC) is a unit of the Graduate School of Applied and Professional Psychology at Rutgers, the State University of New Jersey, and is located in New Brunswick, New Jersey, on the Rutgers campus. The DDDC opened in 1972 to serve children with autism. Because of the university affiliation, the Rutgers Board of Governors had to officially approve its establishment. In the beginning, there were nine children, two teachers, and several graduate students as well as a small cohort of undergraduates from the university.

Landmark Contributions

In the decades since its modest start, the DDDC has steadily expanded its services and refined its mission. The current tripart functions of the DDDC are to (1) serve people on the autism spectrum and their families, (2) educate undergraduate and doctoral students in the latest methods of treating people with autism spectrum disorders (ASD), and (3) do research on questions of importance in the treatment of people with autism and on meeting the needs of their families. From its inception, the DDDC has relied on the principles of applied behavior analysis (ABA) to guide services. As the teaching strategies derived from ABA have grown more elegant and precise, so too have the teaching methods at the Center. Methods that were once at the heart of practice in the 1970s have evolved steady into the more effective and extensively studied techniques in use in the twenty-first century.

Major Activities

Direct Service to People with Autism

Two units at the DDDC are devoted to center-based direct instruction of people with autism. These are the Douglass School and Adult Services.

The Douglass School is approved by the New Jersey Department of Education as a "college-operated program" to serve children and adolescents from 3 to 21 years of age with autism spectrum disorders (ASD) who need a specialized setting to address their educational needs and behavior intervention services to address inappropriate behaviors. Because of a very intense staff to student ratio, the Douglass School has sufficient staff members to address the unique needs of each learner. Both skill acquisition and behavior reduction programs for all learners regardless of age are based on the science of applied behavior analysis. Specific strategies vary based on the needs of the learner and the most current empirically validated and least intrusive strategies that meet the needs of each individual. Families are urged to be active in the education of their children and are provided with training in ABA teaching methods as well as being invited to do regular observations at the Center. In addition to work in the classroom and at home, every effort is made to bring students into the community so they can use their skills in the settings where they will be most appropriate.

The DDDC's Small Wonders Preschool is an integrated classroom that has both children on the autism spectrum and typically developing peers who serve as role models for age appropriate behavior. This classroom model, which was opened in the early 1980s, has been adopted by other programs in the public and private sector. Over the years, approximately half of the target children served in this classroom have left the Center for a regular education classroom in a public or private school.

The adult services program serves adults with autistic disorder and intellectual disability who are 21 years of age or older. These adults either continue to need a very intense adult to client ratio and/or have other significant challenges that make it difficult for them to be in a less specialized adult program. The Center's objective for every person in the adult program is to integrate them as fully as possible into the community. As of 2011, a little under a quarter of the adults spend 5 days a week in community vocational settings, the majority of the other adults spend 3–4 days a week in a community vocational setting, and it is a rare for an adult client to have no vocational activities outside of the Center. These vocational placements include janitorial work at local restaurants, yard work both on and off of campus, house cleaning, and doing basic clerical work in offices including filing, copying, and other support tasks. In addition, among those adults who are not engaged in vocational tasks 5 days a week, all of them take part in community-based recreational activities. The parent of one adult at the center created a private entity called "Men with Mops" that bills private individuals and companies for the services the adults provide and issues paychecks to the workers.

Consultation to Schools and Families

In addition to direct service to people with autism, the Center also provides extensive consultation services to public and private schools in the New Jersey, New York, and Pennsylvania area. These services are provided by staff members working for the DDDC's Outreach Services. Schools sign contracts with Outreach Services to provide in-class consultation to teachers who have children with ASD in their classrooms or for support in establishing an in-district applied behavior analysis program. These consultations vary from once or twice a month to several days a week depending on the needs and request of the school district. Some districts contract for a brief period and others draw on these consultation services for many years to ensure that their teachers continue using state-of-the-art ABA techniques as those methods evolve.

Outreach Services also provide two kinds of home-based services. One of these is early intervention for children under the age of 3 years and the other is home-based services on a full-day basis or after the child's school day has ended.

The early intervention program (EI) serves infants and toddlers younger than 3 years of age in their own homes. In addition to direct services to the child by the home consultant, parents are also taught the ABA intervention techniques so they can use them in their daily interactions with their child. Among the older children who receive home-based services about 30% have full day/4 or 5 days a week intervention. The rest of the families receive services after school or on a part-time basis during the day. Again, these services are based on the principles of ABA and typically involve direct instruction to the child as well as helping parents master the techniques so they can apply the ABA methods on their own.

Other Services to Families

In addition to educational/treatment services through Douglass Outreach, the DDDC provides assessment and diagnostic services for families and schools. This includes diagnostic assessments, intelligence testing, speech and language assessments, and learning evaluations. The Center has a group of full-time staff and part-time consultants who do these evaluations and make treatment recommendations. Douglass Outreach Services have an NJ Department of Education–approved child study team for providing second opinions at the request of families and/or schools. Outreach Services staff members also do functional assessments of problematic

behaviors for schools and families and make detailed treatment recommendations based on these assessments.

Educating Undergraduate and Graduate Students

Educating undergraduate students about autism and behavioral intervention strategies has been at the core of the DDDC's mission since its inception. Junior and senior undergraduate students at Rutgers University can enroll in fieldwork in psychology. Through the field work course, 40–50 undergraduates per semester participate in one day per week of clinical work in a classroom for students or adults with autism. Their hands-on clinical training is supplemented by didactic training and lectures by the DDDC's teachers, graduate teaching assistants, and faculty. Fieldwork training covers topics such as behavioral intervention, applied behavior analysis teaching strategies, assessment, curriculum, and characteristics of autism. Undergraduates are able to take a second semester of fieldwork and participate in an advanced seminar while continuing their clinical experience.

Undergraduates are also able to enroll in a research methods class focusing on single-case design and applied behavior analysis research methodology. A small number of students enrolled in the research course each semester spend 10 h per week participating in ongoing DDDC research projects and activities such as running experimental sessions, integrity and reliability data collection, literature review and critique, and data coding and compilation. Students are also active in a weekly seminar led by a senior graduate student.

Graduate training at the DDDC takes place in one of three ways. Primary graduate training experiences are available to the full-time doctoral program in clinical psychology through the Graduate School in New Brunswick and the Graduate School of Applied and Professional Psychology at Rutgers, the State University of New Jersey. Graduate students are offered practicum positions or graduate assistantships at the DDDC. Graduate students serve as behavioral consultation staff and support in the assessment and treatment of challenging behavior, while also supporting case management and behavior analytic research. Advanced doctoral students also support the DDDC's research mission while conducting independent theses and dissertations. Graduate students gain experience in teaching by coordinating the undergraduate courses in fieldwork and research.

Other graduate training at the DDDC takes place through the University's Center for Applied Psychology and Continuing Education program. Graduate students from other university departments and professionals from the general community can enroll in a series of graduate courses taught by DDDC faculty. These courses are designed to fulfill the academic requirements for becoming board-certified behavior analysts.

The Research Mission of the DDDC

The research mission of the DDDC is to explore best practice behavior analytic treatments for autism and contribute to the dissemination of research to support their use. Research activity at the DDDC is driven by the clinical needs of clients at the Center and the needs of the general and scientific communities to which we belong. As such, the focus of the DDDC's clinical research shifts according to the presenting needs of the students and the status of the science in the field of behavioral autism treatment.

The DDDC also works collaboratively with researchers across different disciplines at the University and at other University settings, by supporting recruitment, methodology consultation, and providing autism expertise to projects by multidisciplinary research teams.

Current and ongoing research themes in the DDDC research plan are the evaluation of behavior analytic teaching strategies, methods for assessing and intervening with challenging behavior, impact of autism on families, and methods for assessing and predicting treatment outcome and progress in behavioral treatment.

See Also

- ▶ Applied Behavior Analysis
- ▶ Early Intensive Behavioral Intervention (EIBI)

Down Syndrome

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Synonyms

Down's syndrome; Trisomy 21

Definition

This condition, first described by Langdon Down in the 1860s, is caused by the presence of three copies of chromosome 21 (trisomy 21). The trisomy can reflect an entire extra copy of chromosome 21 or a partial one (the latter due to translocation). At one time, a very common genetically caused form of intellectual disability, the frequency has decreased given the potential for diagnosis early in the pregnancy. Both cognitive difficulties and characteristic features and medical problems are present.

Overall, cognitive level is typically in the mild to moderate range of impairment (average IQ 50). Individuals with mosaic Downs (where only some cell lines exhibit the trisomy 21) may have higher IQs. Physical problems include slow physical growth and characteristic features such as unusual facial appearance (due to a round face, epicanthal folds, and small chin, and large tongue). Cardiac defects are frequent. Other medical problems can include seizures, ear infections, thyroid problems, as well as leukemia and higher rates of Alzheimer's disorder. Educational interventions focus on fostering overall development and adaptive skills to achieve the highest possible functional outcomes in adults.

Interest in Down syndrome relative to autism arises for several reasons. It has frequently been the case that individuals with Down syndrome have been used as control or comparison groups in studies of autism. There has also been an impression that Down syndrome individuals are typically more social than might otherwise be expected given their cognitive level although several case reports suggest that Down syndrome and autism co-occur. Howlin, Wing, and Gould (1995) described four such cases and emphasized the importance of correct diagnosis of both condition to be able to provide appropriate services.

See Also

► Intellectual Disability

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Down's Syndrome

► Down Syndrome

Doxepin

► Sinequan

Draw-a-Person Intellectual Ability Test for Children, Adolescents, and Adults

► Human Figure Drawing Tests

DSM-III

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Definition

The 3rd edition of the American Psychiatric Association's Diagnostic and Statistical Manual (DSM-III) appeared in 1980 and proved to be a landmark in the development of psychiatric taxonomy.

Historical Background

Beginning in the 1800s, attempts had begun to be made in categorizing and studying rates of various disorders (including psychiatric disorders) in the USA and other countries. For psychiatry, an attempt was made to codify a specific approach in the early 1900s and was subsequently revised. These early attempts included only a small of categories. However, following World War II, a concern for providing mental health services in a more systematic fashion (and including to the many returning veterans) provided a stimulus for the first edition of DSM. This effort reflected both a growing awareness of the mental health issues in the military in the USA as well as the stimulus provided by a revision (the 6th edition) of the International Statistical Classification of Diseases (ICD) which recognized mental disorders for the first time. A second edition was undertaken in the 1960s, and DSM-II recognized over 180 disorders. Both the first and second editions of DSM adopted a specific theoretical (e.g., psychodynamic) framework. Developments more broadly in the field (particularly at Washington University in St. Louis and subsequently at Columbia University) led to a focus on less theoretical and more descriptive definitions useful for research. This research diagnostic criteria approach (Spitzer, Endicott, & Robins, 1978) proved particularly helpful, and the decision was made for the 3rd edition of DSM to move toward such an approach as well as greater convergence with the ICD (Spitzer, Endicott, & Robins, 1978).

Current Knowledge

Changes were made in DSM-III based on a series of consideration including issues of reliability and results of "field trials." By the time it was published in 1980, DSM-III included over 260 categories and quickly proved invaluable in transforming research in psychiatry. Although not without controversy (e.g., around use of terms like neurosis and the approach to diagnosis of sexual orientation problems) for childhood-onset disorders, DSM-III had several important advantages. It recognized disorders like autism for the first time (previously the term childhood schizophrenia was the only "official" diagnosis available) based on a series of papers in the 1970s demonstrating the unique diagnostic features and course of children with autism (Kolvin, 1971; Rutter, 1972). Autism was included along with several other disorders in a newly class of conditions – the pervasive developmental disorders (PDD). Disorders recognized within this class included infantile autism, residual infantile autism (for individuals who once met full criteria for the infantile form of the disorder), childhood-onset pervasive developmental disorder (COPDD) (to encompass the rare individuals who developed autism or something very like it after several years of normal development), and a residual COPDD category along with a new subthreshold condition atypical PDD. The class name *pervasive developmental disorder* was used to refer to what today might more usually be termed autism spectrum disorders. The PDD term was meant to convey that a range of functions were impacted,

although the term itself was widely debated (e.g., see Gillberg, 1991; Volkmar & Cohen, 1991b).

Apart from the explicit recognition of autism as a specific and valid diagnostic category, the DSM-III had several important advantages for childhood disorders in general including the use of multiple axes of diagnosis (psychiatric, developmental, medical, and psychosocial stressors and overall adaptive functioning). This multiple axial approach proved especially helpful for child psychiatry (Rutter, Shaffer, & Shepherd, 1975). The use of more detailed and specific definitions without a specific theoretical bias also enhanced reliability. The *DSM-III* system also had some disadvantages for autism. The proposed was based largely on Rutter's modification (Rutter, 1978) of Kanner's (1943) original description, but in the attempt to make this more operational, the monothetic definition adopted focused on what might now be thought of as more prototypical ("classical") autism, i.e., more "infantile" autism (consistent with the name chosen). For example, the social criterion emphasized a pervasive lack of social responsiveness. This effectively meant that for many children who developed (to varying degrees) greater social skills, the clinician was technically forced to use the "residual" autism category. A problem with this lack of developmental orientation was the implicit implication that somehow their problems were less severe. Similarly, the rationale for COPDD as a category was to account for the small number of children who had developed an autistic-like disorder at a somewhat later point in early childhood (Kolvin, 1971); COPDD was not, however, meant to be simply with Heller's syndrome (disintegrative psychosis) (Heller, 1908, 1930) as it was assumed, probably incorrectly, that the latter was invariably a result of a general medical/neurological process (see Volkmar & Rutter, 1995). Similarly, the term *atypical PDD* was used as a placeholder for the subthreshold condition ("autistic like" or now "autism spectrum disorder") for difficulties that appeared to be best thought of as occurring within the overarching PDD class but meeting criteria for infantile autism or COPDD. Unfortunately, this term had its own prior history in that it was suggestive of Rank's earlier concept of atypical personality (Rank, 1949; Rank & MacNaughton, 1949). Another problem arose because of the recognition that autism was NOT a kind of schizophrenia and the adoption of an exclusionary rule for autism and schizophrenia; on the other hand, one might reasonably argue that adolescents and adults with autism are not necessarily protected from this condition in later life – at rates presumably at least comparable to those of the general population (Volkmar & Cohen, 1991b). Finally the multiaxial placement of autism and related disorders was somewhat controversial. Autism and mental retardation (intellectual disabilities) were by convention made axis I diagnosis, while the specific developmental disorders were placed on axis II of the multiaxial system. The problems with *DSM-III* were widely recognized, and a major revision was undertaken for *DSM-III-R* (American Psychiatric Association, 1980, 1987).

See Also

- ▶ DSM-III-R
- ▶ DSM-IV
- ▶ DSM-IV Field Trial
- ▶ ICD 10 Research Diagnostic Guidelines

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DSM-III-R

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Definition

The successor to DSM-III (appearing in 1987) work on this edition began shortly after DSM-III (1980) had appeared. Originally viewed as a small-scale revision, major changes were made in several categories including autism and related conditions (see Waterhouse, Wing, Spitzer, & Siegel, 1993). The definition of autistic disorder (name changed from infantile autism in DSM-III) was more consistent with the views of Lorna Wing and her colleagues (e.g., see Wing, 1981) who adopted a somewhat broader diagnostic view of the concept. This revision also put much greater weight on developmental changes discarding the earlier concept of "residual" infantile autism and replacing it with a single category with criteria applicable to the entire range of functioning over age and developmental level. Consistent with the previous definition, the three major domains of dysfunction (social, communicative, and restricted interests/behaviors) were included, although early age of onset was no longer required. Final scoring rules were developed based on a field trial (Spitzer & Siegel, 1990) with 16 criteria; a diagnosis of autism required that an individual exhibited at least 8 of these features (with a specified distribution over the three areas). The problematic earlier concept of childhood-onset pervasive developmental disorder (COPDD) was dropped, and throughout the manual, the earlier term "atypical" was replaced with "not otherwise specified" (in large part because of the potential confusion with an earlier diagnostic concept – atypical personality development; see (Volkmar & Klin, 2005)).

The greater developmental orientation of the approach was welcomed but also appeared to come at a price. Several reports suggested high rates of false positives – particularly relative to more intellectually disabled individuals; this led to an apparent overdiagnosis of autism in more intellectually handicapped individuals while also diverting attention from more cognitively able persons. Additional problems included a complex and detailed criteria set with inclusion of examples within criteria (thus tending to "reify" the examples as features that should be present). The changes introduced complicated interpretation of previous research and were particularly acute relative to pending changes in the ICD (see Volkmar & Klin, 2005; Volkmar, Cicchetti, Bregman, & Cohen, 1992).

See Also

▶ DSM-III
▶ False Positive
▶ ICD 10 Research Diagnostic Guidelines

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DSM-IV

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Definition

The fourth edition of the American Psychiatric Association's Diagnostic and Statistical Manual was published in 1994 with a subsequent text revision published in 2000. The publication of DSM-IV followed several years of preparation. For autism and related disorders, the definitions proposed were, for the first time, convergent with the International Classification of Diseases 10th edition (CD-10). The fourth edition marked some important changes from its predecessors while maintaining much in the way of historical continuity.

Historical Background

Preparations for the fourth edition of DSM began shortly after DSM-III-R (APA, 1987) due, in part, to the pending revision of ICD-10, and this edition appeared partly due to the pending changes in the ICD-10. The intention was to base the revision on research and with consideration of relevant issues such as clinical utility, reliability, and descriptive validity of categories and the issue of coordination with ICD-10 (WHO, 1994). As part of this process, a series of literature reviews were conducted with emphasis on categories "new" to DSM. On balance, these reviews suggested the potential usefulness of including categories in addition to autism within the overarching pervasive developmental disorder (PDD) group (see Volkmar and Klin (2005)) and also supported the desire for compatibility with ICD-10. As part of this process, a series of data reanalyses that were undertaken focused on autism, and these suggested the DSM-III-R definition to be overly broad (Volkmar, Cicchetti, Cohen, & Bregman, 1992). Other issues identified included the inclusion (or not) of early age of onset as an essential feature and the variability of sensitivity/specificity in relation to IQ and other variables, and to address these concerns, a large, international field trial was undertaken in conjunction with ICD-10.

Current Knowledge

The DSM-IV Field Trial

The final DSM-IV definition was based on the results of the DSM-IV field trial which included 21 sites from around the world, over 100 raters, and nearly 1,000 cases (Volkmar et al., 1994). Cases were sometimes rated more than once (for reliability) and other issues (e.g., rater experience) were addressed. In general, cases were rated as seen over the course of a year but with some supplementation of previously seen cases for certain issues (e.g., children with "late-onset" autism). Cases could be included if the clinician believed autism to reasonably be part of the differential diagnosis. Multiple sources of information (assessment, history) were available to the raters who judged the quality of data available to them good or excellent about 75%

DSM-IV, Table 1 ICD-10 criteria for autism and related pervasive developmental disorders

Childhood autism (F84.0)	
A. Abnormal or impaired development is evident before the age of 3 years in at least one of the following areas:	(1) Receptive or expressive language as used in social communication
	(2) The development of selective social attachments or of reciprocal social interaction
	(3) Functional or symbolic play
B. A total of at least six symptoms from (1), (2), and (3) must be present, with at least two from (1) and at least one from each of (2) and (3)	(1) Qualitative impairments in social interaction are manifest in at least two of the following areas:
	(a) Failure adequately to use eye-to-eye gaze, facial expression, body postures, and gestures to regulate social interaction
	(b) Failure to develop (in a manner appropriate to mental age, and despite ample opportunities) peer relationships that involve a mutual sharing of interests, activities, and emotions
	(c) Lack of socio-emotional reciprocity as shown by an impaired or deviant response to other people's emotions; or lack of modulation of behavior according to social context; or a weak integration of social, emotional, and communicative behaviors
	(d) Lack of spontaneous seeking to share enjoyment, interests, or achievements with other people (e.g., a lack of showing, bringing, or pointing out to other people objects of interest to the individual)
	(2) Qualitative abnormalities communication as manifest in at least one of the following areas:
	(a) Delay in or total lack of development of spoken language that is not accompanied by an attempt to compensate through the use of gestures or mime as an alternative mode of communication (often preceded by a lack of communicative babbling)
	(b) Relative failure to initiate or sustain conversational interchange (at whatever level of language skill is present), in which there is reciprocal responsiveness to the communications of the other person
	(c) Stereotyped and repetitive use of language or idiosyncratic use of words or phrases
	(d) Lack of varied spontaneous make-believe play or (when young) social imitative play
	(3) Restricted, repetitive, and stereotyped patterns of behavior, interests, and activities are manifested in at least one of the following:
	(a) An encompassing preoccupation with one or more stereotyped and restricted patterns of interest that are abnormal in content or focus, or one or more interests that are abnormal in their intensity and circumscribed nature though not in their content or focus
	(b) Apparently compulsive adherence to specific, nonfunctional routines or rituals
	(c) Stereotyped and repetitive motor mannerisms that involve either hand or finger flapping or twisting or complex whole-body movements
	(d) Preoccupations with part objects or nonfunctional elements of play materials (such as their odor, the feel of their surface, or the noise or vibration they generate)

(*continued*)

DSM-IV, Table 1 (continued)

Childhood autism (F84.0)	
C. The clinical picture is not attributable to the other varieties of pervasive developmental disorders; specific development disorder of receptive language (F80.2) with secondary socio-emotional problems' reactive attachment disorder (F94.1) or disinhibited attachment disorder (F94.2); mental retardation (F70-F72) with some associated emotional or behavioral disorders; schizophrenia (F20) of unusually early onset; and Rett's syndrome (F84.12)	
F84.1 Atypical autism	
A pervasive developmental disorder that differs from autism in terms *either* of age of onset *or* of failure to fulfill all three sets of diagnostic criteria. Thus, abnormal and/or impaired development becomes manifest for the first time only after age 3 years and/or there are insufficient demonstrable abnormalities in one or two of the three areas of psychopathology required for the diagnosis of autism (namely, reciprocal social interactions, communication, and restrictive, stereotyped, repetitive behavior) in spite of characteristic abnormalities in the other area(s). Atypical autism arises most often in profoundly retarded individuals whose very low level of functioning provides little scope for exhibition of the specific deviant behaviors required for the diagnosis of autism; it also occurs in individuals with a severe specific developmental disorder of receptive language. Atypical autism thus constitutes a meaningfully separate condition from autism and includes: • Atypical childhood psychosis • Mental retardation with autistic features	
F84.1 Atypical autism	A. Abnormal or impaired development is evident at or after the age of 3 years (criteria as for autism except for age of manifestation)
	B. There are qualitative abnormalities in reciprocal social interaction or in communication, or restricted, repetitive, and stereotyped patterns of behavior, interests, and activities. (Criteria as for autism except that it is unnecessary to meet the criteria for number of areas of abnormality)
	C. The disorder does not meet the diagnostic criteria for autism (F84.0). Autism may be atypical in either age of onset (F84.10) or symptomatology (F84.11); the two types are differentiated with a fifth character for research purposes. Syndromes that are typical in both respects should be coded F84.12
F84.10 Atypicality in age of onset	A. The disorder does not meet criterion A for autism (F84.0); that is, abnormal or impaired development is evident only at or after age 3 years
	B. The disorder meets criteria B and C for autism (F84.0)
F84.11 Atypicality in symptomatology	A. The disorder meets criterion A for autism (F84.0); that is, abnormal or impaired development is evident before age 3 years
	B. There are qualitative abnormalities in reciprocal social interactions or in communication, or restricted, repetitive, and stereotyped patterns of behavior, interests, and activities. (Criteria as for autism except that it is unnecessary to meet the criteria for number of areas of abnormality.)

(*continued*)

DSM-IV, Table 1 (continued)

Childhood autism (F84.0)	
	C. The disorder meets criterion C for autism (F84.0) D. The disorder does not fully meet criterion B for autism (F84.0)
F84.12 Atypicality in both age of onset and symptomatology	A. The disorder does not meet criterion A for autism (F84.0); that is, abnormal or impaired development is evident only at or after age 3 years
	B. There are qualitative abnormalities in reciprocal social interactions or in communication, or restricted, repetitive, and stereotyped patterns of behavior, interests, and activities. (Criteria as for autism except that it is unnecessary to meet the criteria for number of areas of abnormality)
	C. The disorder meets criterion C for autism (F84.0)
	D. The disorder does not fully meet criterion B for autism (F84.0)

Source: World Health Organization (2003). *Diagnostic Descriptions and Criteria for Autism and Related Pervasive Developmental Disorders from International Classification of Diseases, 10th Edition*. Geneva, Switzerland: WHO

of the time. A standard coding system was used with information on the case and rater as well as ratings of various diagnostic criteria. The DSM-III approach was noted to be developmentally less sensitive than DSM-III-R, although that system appeared to overdiagnose autism in individuals with more severe intellectual handicap (i.e., relative to clinician judgment). The ICD-10 draft approach appeared more reasonable although overly detailed. Reliability of criteria was generally good with clinical diagnosis also noted to have excellent reliability for more experienced clinicians (Klin, Lang, Cicchetti, & Volkmar, 2000). A series of analyses suggested that a modification of the draft ICD-10 approach could be adopted with reasonable sensitivity and specificity and good coverage over the IQ range.

Although not primarily focused on disorders other than autism, the field trial also provided data regarding the inclusion and definition of Asperger's disorder, Rett's disorder, and childhood disintegrative disorder. The final DSM-IV definition had good sensitivity and specificity over the IQ range. Diagnostic criteria adopted were essentially the same as in ICD-10 (see Table 1). At least six criteria had to be rated positive for a diagnosis of autism with at least two of these from the "social" category (this was consistent with Kenner's original view of autism and also with a series of data analyses that confirmed the importance of social features). At least one feature must be present from the other two groups (impaired communication/play and restricted interests). Onset before age 3 was also specified.

The inclusion of various condition as well as autism and "subthreshold autism" was a major change from DSM-III-R. Although the substantive work on these other conditions was less advanced than that for autism, there appeared to be sufficient data for their inclusion; this further enhanced compatibility with ICD-10. Convergence of the final ICD-10 and DSM-IV definitions of autism represented a major shift (i.e., with the same system being used around the world) and facilitated subsequent research and clinical work as reflected, in part, in the explosion of work in the area over the subsequent decade. These criteria are provided in Table 1.

Future Directions

At the time of this writing, preparation for DSM-V was underway with the two major preliminary proposals suggesting a change of the class of disorder to autism spectrum disorder and collapsing the various disorders currently listed in DSM-IV within one overarching disorder type.

See Also

- ▶ DSM-III
- ▶ DSM-III-R
- ▶ ICD 10 Research Diagnostic Guidelines

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DSM-IV Field Trial

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Definition

The DSM-IV field trial for autism (Volkmar et al., 1994) was an international effort with the goal of establishing a definition with a reasonable balance of sensitivity and specificity that could be used to facilitate both clinical work and research. In contrast to previous DSM definitions of autism, this effort was done in conjunction with the ICD-10 revision 21 sites and 125 raters participated from around the world.

Historical Background

The DSM-IV field trial arose as a result of concerns about the definition of autism adopted in DSM-III and DSM-III-R. For the latter definition, a small field trial had been conducted but suffered from some deficiencies. Several published papers suggested that while the DSM-III-R definition was more developmental in nature, it also appeared to be more likely to give an autism diagnosis to individuals with greater levels of intellectual disability.

Current Knowledge

This field trial followed a period of considerable work including targeted literature reviews and data reanalyses (e.g., Frances, Davis, Kline, Pincus, First & Widiger, 1991; Mayes, Volkmar, Hooks, & Cicchetti, 1993; Szatmari, 1991, 1992a, b; Tsai, 1992; Volkmar, 1991, 1992; Volkmar, Cicchetti, Bregman, & Cohen, 1992; Volkmar, Cicchetti, Cohen, & Bregman, 1992).

As part of the field trial, 21 sites and 125 raters participated. Each site had some clinical program for individuals with autism and raters with a range of experience and professional backgrounds; about half the rates report relatively extensive experience allowing for comparison of issues of reliability and clinical utility in both more and less experienced clinicians. Over the course of a year, nearly 1,000 cases were submitted (with about 10% of cases rated by more than one evaluator). In general, the preference was that bases currently being seen be provided (i.e., rather than ratings based on past experience), and by design, five of the participating sites contributed about 100 consecutive cases. To be included, the case had to exhibit difficulties in which autism was a reasonable part of the differential diagnosis. Smaller groups of cases were

specifically solicited to identify potential gaps relative to much less frequent conditions (e.g., Rett's and childhood disintegrative disorders). However, consecutive cases constituted the bulk of the sample. Typically multiple sources of information were available (e.g., parents, past records, as well as current assessment) and raters indicated that in the majority (75%) of cases, the information available was good or excellent.

A standard system of coding was created for each deidentified case rating including information on the individual being examined (age, IQ, communicative ability, educational placement), basic information on the evaluator(s), and explicit ratings of diagnostic criteria both from previous (DSM-III, III-R) and potential new criteria. The evaluator was also asked to provide his/her best judgment of clinical diagnosis – the latter serving as the "gold standard" against which comparisons would then be made. The rating form also provided possible criteria for Asperger's syndrome, Rett's syndrome, and childhood disintegrative disorder, based on the draft ICD-10 definitions.

Sample information is presented in Table 1. Clinicians' primary diagnosis of the "nonautistic" PDD cases included Rett's syndrome (13 cases), childhood disintegrative disorder (16 cases), Asperger's syndrome (48 cases), and PDD-NOS (116 cases) or atypical autism (47 cases) (the latter group was included as possible clinical diagnosis given the ICD-10 draft inclusion of such a category which, essentially, referred to "subthreshold" autism or autism that was atypical in somewhat – cases that in US terminology would have been said to have PDD-NOS). In comparison (nomad), cases with primary clinical diagnoses included mental retardation ($N = 132$), language disorder ($N = 88$ cases), schizophrenia of childhood onset ($N = 9$), and other or mixed developmental disorders ($N = 54$).

A series of cases were addressed in a range of different analyses, and in addition to the main report of the field trial (Volkmar et al., 1994), many of these analyses were published in their own right. Consistent with previous reports, it appeared that the DSM-III approach was insufficiently developmental and overly stringent, whereas the DSM-III-R erred on the site of overdiagnosis of autism associated with more severe intellectual deficiency. An explicit goal for the development of a final criteria set was that the final criteria for autistic disorder should work reasonably well over the entire range of IQ. A result more consistent with the much more detailed ICD-10 (research) draft definition. These results are presented in Table 2.

DSM-IV Field Trial, Table 1 DSM-IV autistic disorder field trial group characteristics*

	Clinically autistic ($N = 454$)	Other PDDs ($N = 240$)	Non-PDD ($N = 283$)
Sex ratio (M:F)	4.49:1	3.71:1	2.29:1
% Mute	54%	35%	33%
Age	8.99	9.68	9.72
IQ	58.1	77.2	66.9

Note: Cases grouped by clinical diagnosis
Diagnoses of the "other PDD"cases included: Rett syndrome (13 cases), childhood disintegrative disorder (16 cases), Asperger syndrome (48 cases), PDD-NOS (116 cases) and atypical autism (47 cases).
Diagnoses of the non-PDD cases included mental retardation (132 cases), language disorder (88 cases), childhood schizophrenia (9 cases), other disorders (54 cases).
Adapted from Volkmar et al. (1994). Reprinted from Volkmar et al. Issues in classification, Chapter in F. Volkmar, A. Klin, R. Paul, & D. Cohen (Eds.), *Handbook of autism and pervasive developmental disorders*, Vol I, page.

In looking at other sources of diagnostic disagreement, it appeared that DSM-III-R's failure to include age of onset as an essential feature contributed to its difficulties, while, on the other hand, its great developmental orientation and flexibility appeared to be a plus. Indeed, if onset of the condition by age 3 years was included as an essential feature, the sensitivity of that system was increased.

The available data also allowed for examination of clinician agreement on diagnosis based on various factors including clinician experience. Using chance-corrected statistics, the inter-rater reliability of individual diagnostic criteria was examined and in the good to excellent range. Typically more detailed criteria had greater reliability. More experienced raters also had

DSM-IV Field Trial, Table 2 Sensitivity/Specificity by IQ Level – a comparison of DSM-III[a] DSM-III-R ICD-10[b]

Overall		Se	Sp	Se	Sp	Se	Sp
		0.82	0.8	0.86	83	0.79	89
By IQ Level	N	Se	Sp	Se	Sp	Se	Sp
<25	64	.90	.76	.84	.39	.74	.88
25–39	148	.88	.76	.90	.60	.88	.92
40–54	191	.79	.76	.93	.74	.84	.83
55–69	167	.86	.78	.84	.77	.78	.89
70–85	152	.79	.81	.88	.81	.74	.96
>85	218	.78	.83	.78	.78	.78	.91

Table adapted, with permission, from Volkmar et al. (1994) Field Trial for Autistic Disorder in DSM-IV. *American Journal of Psychiatry*, *151*, 1361–1367. Reprinted from Volkmar et al. Issues in classification, Chapter. In F. Volkmar, A. Klin, R. Paul, & D. Cohen (Eds.), *Handbook of autism and pervasive developmental disorders*. Vol I, page.

[a]"Lifetime" diagnosis (current IA or "residual" IA)

[b]Original ICD-10 criteria and scoring

excellent reliability both on the broader autism spectrum and narrower autistic disorder diagnoses; this was much less true for inexperienced raters (see Klin, Lang, Cicchetti, & Volkmar, 2000). In addition to inter-rater reliability, temporal stability was examined in a small number of cases and generally high; diagnosis stability was more problematic for very young children, those with lower IQ, and with the DSM-III-R system.

Before a final decision could be made about the definition of autistic disorder in DSM-IV, it was important to decide whether other disorders would be included in the PDD class (see Szatmari, 1992a, b; Tsai, 1992; Volkmar, 1992; Volkmar, Cicchetti, Bregman, & Cohen, 1992). While these disorders were not a primary focus of the field trial, some data relevant to their inclusion had been collected. Data from the field trial supported the inclusion of these conditions (Asperger's disorder, Rett's disorder, and childhood disintegrative disorder), and their inclusion had some advantages relative to compatibility with ICD-10 and for deriving a better diagnostic approach for autistic disorder. One area of difference between ICD-10 and DSM-IV was left unresolved; this had to do with the concept of atypical autism vs. PDD-NOS. ICD-10 allowed for more detailed coding of the "atypicality" of the presentation, e.g., failing to meet age or specific criteria cutoffs, while DSM-IV adopted a broader view of this as a "subthreshold" category that, today, would be equated with autism spectrum disorder.

The field trial data suggested that age of onset as an additional feature would have strengthened the DSM-III-R definition. A series of alternatives were considered, and in the end, a final definition was developed in coordination with IDD-10 (see Appendix). This definition balanced clinical and research needs, was reasonably concise, user friendly, and had good coverage over both age and developmental level.

Several changes in proposal for other categories (notably Asperger's disorder and PDD-NOS) were made in the final stages of the DSM process; these have raised other issues of concern to the field (e.g., see Buitelaar, Van der Gaag, Klin, & Volkmar, 1999; Miller & Ozonoff, 1997). Some of these concerns were addressed in the DSM-IV text revision, which appeared in 2000; for Asperger's disorder, the text was very extensively revised, although no changes in the formal criteria were made.

Appendix

ICD-10 Research Criteria*. Source: Diagnostic descriptions and criteria for autism and related pervasive developmental disorders from international classification of diseases, 10th Edition (World Health Organization, Geneva, Switzerland, 2003).

	Pervasive developmental disorders
	A group of disorders characterized by qualitative abnormalities in reciprocal social interactions and in patterns of communication, and by a restricted, stereotyped, repetitive repertoire of interests and activities. These qualitative abnormalities are a pervasive feature of the individual's functioning in all situations.
	Use additional code, if desired, to identify any associated medical condition and mental retardation.
F84.0	*Childhood autism*

(*continued*)

A type of pervasive developmental disorder that is defined by: (a) the presence of abnormal or impaired development that is manifest before the age of 3 years, and (b) the characteristic type of abnormal functioning in all the three areas of psychopathology: reciprocal social interaction, communication, and restricted, stereotyped, repetitive behavior. In addition to these specific diagnostic features, a range of other nonspecific problems are common, such as phobias, sleeping and eating disturbances, temper tantrums, and (self-directed) aggression.

Autistic disorder

Infantile:

Autism

Psychosis

Kanner's syndrome

Excludes: Autistic psychopathy (*F84.5*)

F84.1 Atypical autism

A type of pervasive developmental disorder that differs from childhood autism either in age of onset or in failing to fulfil all three sets of diagnostic criteria. This subcategory should be used when there is abnormal and impaired development that is present only after age 3 years, and a lack of sufficient demonstrable abnormalities in one or two of the three areas of psychopathology required for the diagnosis of autism (namely, reciprocal social interactions, communication, and restricted, stereotyped, repetitive behavior) in spite of characteristic abnormalities in the other area(s). Atypical autism arises most often in profoundly retarded individuals and in individuals with a severe specific developmental disorder of receptive language.

Atypical childhood psychosis

Mental retardation with autistic features

Use additional code (F70-F79), if desired, to identify mental retardation.

F84.2 Rett's syndrome

A condition, so far found only in girls, in which apparently normal early development is followed by partial or complete loss of speech and of skills in locomotion and use of hands, together with deceleration in head growth, usually with an onset between seven and 24 months of age. Loss of purposive hand movements, hand-wringing stereotypies, and hyperventilation are characteristic. Social and play development are arrested but social interest tends to be maintained. Trunk ataxia and apraxia start to develop by age 4 years and choreoathetoid movements frequently follow. Severe mental retardation almost invariably results.

F84.3 Other childhood disintegrative disorder

A type of pervasive developmental disorder that is defined by a period of entirely normal development before the onset of the disorder, followed by a definite loss of previously acquired skills in several areas of development over the course of a few months. Typically, this is accompanied by a general loss of interest in the environment, by stereotyped, repetitive motor mannerisms, and by autistic-like abnormalities in social interaction and communication. In some cases the disorder can be shown to be due to some associated encephalopathy but the diagnosis should be made on the behavioral features.

Dementia infantilis

Disintegrative psychosis

Heller's syndrome

Symbiotic psychosis

Use additional code, if desired, to identify any associated neurological condition.

Excludes: Rett's syndrome (*F84.2*)

F84.4 Overactive disorder associated with mental retardation and stereotyped movements

An ill-defined disorder of uncertain nosological validity. The category is designed to include a group of children with severe mental retardation (IQ below 35) who show major problems in hyperactivity and in attention, as well as stereotyped behaviors. They tend not to benefit from stimulant drugs (unlike those with an IQ in the normal range) and may exhibit a severe dysphoric reaction (sometimes with psychomotor retardation) when given stimulants. In adolescence, the overactivity tends to be replaced by underactivity (a pattern that is not usual in hyperkinetic children with normal intelligence). This syndrome is also often associated with a variety of developmental delays, either specific or global. The extent to which the behavioral pattern is a function of low IQ or of organic brain damage is not known.

F84.5 Asperger's syndrome

A disorder of uncertain nosological validity, characterized by the same type of qualitative abnormalities of reciprocal social interaction that typify autism, together with a restricted, stereotyped, repetitive repertoire of interests and activities. It differs from autism primarily in the fact that there is no general delay or retardation in language or in cognitive development. This disorder is often associated with marked clumsiness. There is a strong tendency for the abnormalities to persist into adolescence and adult life. Psychotic episodes occasionally occur in early adult life.

Autistic psychopathy

Schizoid disorder of childhood

F84.8 Other pervasive developmental disorders

F84.9 Pervasive developmental disorder, unspecified

(*continued*)

See Also

- Asperger's disorder
- Autistic Disorder
- Childhood Disintegrative Disorder
- DSM-IV
- Rett's Disorder

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Due Process

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Definition

The due process hearing and other procedural safeguards provide a system of checks and balances for schools and parents. The due process principle essentially aims to ensure that schools and parents are held accountable to each other for carrying out the student's rights as outlined in the Individuals with Disabilities Education Act (IDEA). A due process hearing may be requested by the parents or the school district if they are in disagreement about any of the following: identification, evaluation, placement, the IEP document, or the provision of a free and appropriate education (FAPE) to a child.

A due process complaint must be filed in written form and must contain the following specific information: the name of the child, the address of the residence of the child, the name of the school the child is attending, a description of the nature of the child's problem related to the proposed action, a statement of how requirements of part B of IDEA or its implementing regulations have been violated, the facts upon which the statement is based, and a proposed resolution of the problem. A copy of the due process complaint must be provided to the other party, and a copy must be forwarded to the state educational agency.

A due process hearing is like a mini-trial before an impartial, third-party, hearing officer and is similar to a regular courtroom trial. The

hearing officer is responsible for listening to both sides of the dispute, examining all related issues, and settling the dispute. Parents have the right to be accompanied or advised by counsel, present evidence, cross-examine witnesses, and see the evidence presented by the school district 5 days prior to the hearing. Parents also have the right to have the child present at the due process hearing, but it is not required. Only a small number of disagreements between parents and schools result in parents filing a due process petition. Even fewer cases actually proceed to a hearing. If either the parent or the school district is dissatisfied with the outcome of the hearing, they have the right to appeal the decision to state or federal courts.

The school district is responsible for scheduling a resolution or mediation meeting with the parents within 15 days of receiving a due process complaint. Under the IDEA provisions, the school district and parents have 30 days from the date that the due process complaint was filed to reach an agreement through the process of resolution or mediation. If the parties are not able to reach an agreement by the end of these 30 days, then a due process hearing must be held and final decision issued within the next 45 calendar days. In some cases, the parents or the school district may choose to expedite the due process hearing. If this is the case, then a due process hearing must be conducted within 20 school days after receiving the due process complaint and the decision must be issued within 10 school days after the hearing.

Historical Background

The due process provision has been a part of IDEA since its inception. Under the procedural safeguards provision in IDEA, parents and school districts have the right to a due process hearing and the rights that go along with those hearings. Procedural safeguards are the protections in IDEA that ensure that students with disabilities and their parents or guardians are meaningfully involved in all decisions related to the student's special education and that they have the right to seek a review of any decisions they think are appropriate. The procedural safeguards are grounded in the 5th and the 14th Amendments of the US Constitution, which guarantee that no person shall be deprived of life, liberty, or property without due process of the law.

Current Knowledge

The recent 2004 amendments to IDEA emphasized the importance for parents and school districts to resolve disputes collaboratively and quickly. IDEA encourages parents and schools to utilize alternative methods for resolving their dispute prior to proceeding to a due process hearing. First, the IDEA recommends resolution and then mediation as methods for resolving agreements prior to proceeding to a due process hearing.

Under the current 2004 amendments to IDEA, parents and school districts have up to 2 years to file a due process complaint. Exceptions to the 2-year timeline may apply if the parent was prevented from filing the due process complaint due to misrepresentations by the school district or if the school district withheld information that was required to be provided to the parent under the statutes and regulations of IDEA. States do have the right to change the 2-year timeline as they desire. If a state decides to shorten or lengthen the timeline, this information must be included and explained in the procedural safeguards notice that the school district is required to provide to parents so that parents are fully informed of the timeline limitations within their individual state.

Key changes implemented under the amendments to the IDEA 2004 statutes and regulations include the following:

1. *Notification*: Parents and/or school districts filing a due process complaint must provide notice to the other party as well as the state educational agency. Further, school districts are required to provide parents with notice of their procedural safeguards and information about free or low-cost legal services in the area.
2. *Specific timelines for responding to a due process complaint*: If the school district has

not already provided parents with written notice regarding their actions relating to the issue addressed in the due process complaint, the school district must now respond within 10 days of receiving the due process complaint. The response must include an explanation of why the school district has proposed or refused to take the action addressed in the complaint. The response must include a description of (a) options that the IEP team considered and why those reasons were rejected; (b) the evaluation procedure, assessments administered, and reports reviewed by the IEP team; and (c) any additional factors related to the case.

3. *Specific timelines for conducting a resolution meeting*: The school district must convene a meeting with the parent within 15 days of receiving the due process complaint. The purpose of the meeting is to resolve the dispute if possible. This meeting may be waived if the parents and school district agree in writing to waive the meeting or if the parent and school district agree to use the mediation process as opposed to a resolution meeting. If the school district fails to respond to the due process complaint or fails to participate in a resolution meeting within 15 days of receipt of the complaint, the parent may contact the hearing officer to begin the due process hearing timeline.
4. *Request by the school district to dismiss the case*: If a school district has made reasonable, documented efforts to schedule a resolution meeting with the parent and the parent has been nonresponsive, the school district may request that the hearing officer dismiss the case after 30 days.
5. *Requirements for resolution meeting agreements*: In the case that the parents and school district are able to resolve the dispute during a resolution meeting, both parties are required to sign a legally binding document stating the agreement. This document may be voided by either party within 3 business days but otherwise if enforceable in any state of district court.
6. *Timelines for conducting the hearing and issuing a final decision*: After the 30-day resolution period, the due process hearing and final decision must be conducted within 45 days. By the end of the 45-day period, not only must the hearing be conducted but also a final decision issued by the hearing officer, and a copy of the decision must be mailed to the parents and the school district. The IDEA amendments also allow states the opportunity to review the decision of the hearing officer. The state has 30 days to review the decision and provide a written copy of their review decision to the parents and school district.
7. *Hearing officer requirements and decisions*: The hearing officer cannot be an employee of the state or school district where the child attends school. The hearing officer must not only have knowledge of the provisions of the IDEA as well as federal and state regulations related to the IDEA statutes but also the ability to conduct hearings and document decisions according to standard legal practice. The decision of the hearing officer in the due process hearing must be based on substantive grounds. A hearing officer may determine that a child did not receive a free and appropriate education (FAPE) if the procedural inadequacies of the school district obstructed the parent's opportunity to participate in the identification, evaluation, and IEP development process; interfered with the child's right to a FAPE; or caused a deprivation of educational benefit.

See Also

▶ Procedural Safeguards

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Durability of Treatment Effects

► Maintenance of Treatment Effects

Dynamic Assessment

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Synonyms

DA; Learning potential assessment; Mediated learning experience

Description

Dynamic assessment (DA) is an assessment methodology that measures an individual's performance with the assistance of an experienced peer or adult. As such, DA provides the examiner with information regarding the individual's learning *process* (Lidz, 2003). During DA, the assessor manipulates the interaction (e.g., contextual and/or linguistic prompts and cues) for the specific purpose of optimizing the child's performance. As such, DA provides information regarding the child's ability to benefit from these contextual and linguistic manipulations, including the level and type of support that is needed to facilitate performance (Peña, 1996).

Dynamic assessment contrasts with traditional or static assessment (SA), which measures an individual's independent, unaided performance at a specific point in time (Lidz, 2003). During SA, the examiner acts as a neutral observer; the examiner does not provide the individual with feedback regarding performance or assistance to complete the assessment. As such, SA provides the examiner with information regarding the individual's learning *products* (Lidz, 2003). Dynamic assessment, when used in conjunction with static assessment, can provide the examiner with an understanding of an individual's *developing* and *developed* skills (Jeltova et al., 2007).

Historical Background

Dynamic assessment is based on the work of Russian psychologist, Lev Vygotsky, who advocated studying how children's social interactions with others shape their individual development. Vygotsky proposed that the organizational properties of the individual's mental processes reflect those of his/her social life. As such, Vygotsky (1978) suggested that static measures of assessment could not fully describe an individual's understanding, as static assessment only measures what the individual can perform independently. This independent performance is known as the individual's level of actual development.

In contrast to the individual's level of actual development (as measured by static assessment), the individual's level of potential development is measured by his/her performance within a social interaction framework that provides the assistance of a more experienced peer or adult (i.e., dynamic assessment). The distance between the individual's level of actual development and level of potential development defines the

individual's zone of proximal development (ZPD; Vygotsky, 1986/1934).

An individual's ZPD may be narrow, which indicates that the individual is not yet ready to participate in the activity at a more advanced level than his/her unaided performance. Conversely, an individual's ZPD may be wide, which indicates that, when given appropriate supports, the individual may demonstrate more advanced skills than revealed by his/her unaided performance (Campione, Brown, Ferrara, Jones, & Steinberg, 1985).

Dynamic assessment has been utilized with a variety of populations in a number of ways. Feuerstein developed a dynamic assessment battery, the Learning Potential Assessment Device (LAPD; Feuerstein, 1979), to assess the cognitive skills of children from diverse cultures entering a new country (e.g., immigrants) and children with developmental disabilities. The "dynamic goal" of his approach was to measure the degree of modifiability, or learning potential, of the individual during a focused learning experience. In this training-assessment model, a test item is presented and the individual's performance is carefully observed to provide information regarding how to proceed with training (the focused learning experience, also known as mediated learning experience (MLE)). During MLE, Feuerstein follows the learner's responses, offering verbal, tactile, and visual instructions with the intent of developing a particular skill. The expectation of this type of approach would be that the individual will demonstrate improved performance following training, as compared to his/her initial performance.

Another type of DA is known as the test-teach-retest approach. Budoff (1987) followed this format to determine an individual's learning potential. One major difference between Budoff's approach and that of Feuerstein was that Budoff's intervention was standardized to allow for consistent comparison across groups, whereas Feuerstein's approach has been viewed as more of a clinical evaluation whereby the examiner follows a scripted procedure, but may vary in how support is offered to the individual (Brown, Campione, Webber, & McGilly, 1992). Budoff's intent was to improve diagnoses of children who may have been mislabeled as developmentally disabled due to differing background experiences (i.e., children whose upbringing did not expose them to information assessed by standard psychometric measures). As such, this approach to DA is often used with individuals from culturally and linguistically diverse backgrounds (Peña, 2000).

Use of graduated prompting is another form of DA. Campione and Brown's (1987) approach utilizes a graduated prompt procedure that focuses on the individual's ability to learn a specific skill through provision of increasing specific prompts and his/her ability to transfer learning to novel situations. In this pretest-posttest format, the purpose of assessment is to determine the level of support necessary for the individual to achieve optimum performance (Brown et al., 1992).

Testing the limits is a DA approach intended to address a possible mismatch between the individual and the assessment measure. Carlson and Wiedl (1992) discussed two factors that may result in poor performance on ability tests, these include (1) the individual's personal characteristics (e.g., test anxiety, personality traits) and (2) the individual's difficulty understanding the tasks required by the assessment measure (i.e., the test directions). Given these factors, testing the limits approach requires analysis of the fit between the individual and the measure; when a mismatch occurs, manipulation of the testing situation is indicated. That is, the examiner may use feedback and extended explanations to determine the individual's understanding of the task and the nature of his/her response.

Finally, the aforementioned DA methods have been used to assess an individual's performance related to his/her school curriculum. Lidz (2003) developed a curriculum-based approach to DA during which tasks are taken from an individual's classroom, pretest/posttest measures are developed based on the specific task, and intervention following the MLE model and best teaching practices is provided to the individual. According to

Lidz (2003), this approach focuses on generating quantitative and qualitative information regarding the individual's performance and learning to be used in intervention planning.

Psychometric Data

Given the objective of DA, to determine an individual's learning process or potential given assistance, DA measures utilize interrater reliability (agreement between examiners/coders) with regard to the individual's performance and the use of examiner supports.

The predictive validity of DA with regard to future achievement has been investigated across DA methods. DA has been found to predict further achievement more accurately than SA under the following conditions: when the examiner's feedback is noncontingent (standard response to an individual's failure vs. an individualized response); when the individuals tested are students with disabilities, rather than at-risk or typically developing students; and when the measure of achievement includes DA posttests and criterion-referenced tests versus norm-referenced measures and teacher report (Caffrey, Fuchs, & Fuchs, 2008).

Clinical Uses

Given dynamic assessment's focus on an individual's potential to learn, it has been used to increase equity, accuracy, and fairness in assessment of individuals with special needs as well as individuals from linguistically and culturally diverse backgrounds (Peña, 1996; Tzuriel & Feurstein, 1992).

As noted above, DA and its application can come in several forms. Regardless of the specific DA orientation, the environment is manipulated in an effort to improve the child's performance. These environmental variables typically include contextual and linguistic manipulations. Overall, because DA allows for the manipulation of contextual and linguistic variables that may influence performance, it provides an appropriate framework for examining the learning potential (and learning process) of at-risk learners, individuals with disabilities, and individuals from linguistically and culturally diverse backgrounds.

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Dysarthria

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Definition

Dysarthria is a motor speech disorder caused by generalized weakness to the oral musculature that occurs as a result of damage to the central and/or peripheral nervous system (Duffy, 1995; Freed, 2000; Vinson, 2007; Zemlin, 1998). This damage may occur as a result of stroke, head injury, cerebral palsy, muscular dystrophy, or other brain injury (American Speech-Language-Hearing Association, n.d.; Freed, 2000). As a consequence of oral musculature weakness, the speech of individuals with dysarthria is slow and labored, and their articulation is imprecise (Freed, 2000; Zemlin, 1998). Other areas of speech may also be affected including respiration, voicing, and prosody (Duffy, 1995).

See Also

▶ Articulation Disorders
▶ Speech

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Dyscalculia

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Synonyms

Developmental dyscalculia; Mathematics disability

Definition

Dyscalculia is a learning disability characterized by an inability to acquire the mathematical skills that would be expected for a given chronological age, cognitive ability, and educational level. Mathematics skills are typically broken down into mathematics calculation (i.e., computation) and mathematics reasoning (i.e., problem solving). Given the cumulative nature of mathematics, initial difficulty in learning and becoming fluent in basic numerical concepts impedes the later development of more complex arithmetic concepts (Butterworth, 2008). For example, proficiency with whole numbers and fractions (including decimals, percent, and negative fractions) as well as measurement and geometry has been identified as being foundational for later academic success (National Mathematics Advisory Panel, 2008).

Specific characteristics of dyscalculia vary among individuals but commonly include one or more of the following: poor automatic recall of basic facts, such as multiplication tables; poor knowledge of or poor fluency in procedures for multidigit calculation, such as addition with regrouping; visuospatial weaknesses that result in place errors in written calculations and in difficulty with geometry; language deficits in areas requiring higherorder thinking, thus interfering with carrying out word problems; and insufficient attention, impairing short-term memory necessary for mental arithmetic (e.g., Rapin, 2010). Furthermore, those with dyscalculia not only struggle with mathematics in school but even have difficulty with numbers in everyday tasks, such as telling time and remembering phone numbers (Butterworth, 2008). However, some individuals with dyscalculia often perform without difficulty in other academic areas, although there are individuals who struggle with reading and spelling, as well as mathematics.

Possible causes of dyscalculia are numerous; these include but are not necessarily limited to poor instruction, low intelligence, anxiety about numbers, behavioral and/or attentional problems, poor working memory, language-based learning disabilities, impaired visuospatial abilities, and motor skill deficits (e.g., Butterworth, 2008; Zager & Donaldson, 2010). Apart from environmental causes (e.g., poor teaching or behavioral issues), developmental dyscalculia may be brain-based, for example, associated with a familial-genetic predisposition (Shalev & Gross-Tsur, 2001). Developmental dyscalculia also frequently occurs in neurologic disorders such as attention-deficit/hyperactivity disorder, developmental language disorder, and fragile X syndrome (Shalev & Gross-Tsur). Dyscalculia is also often associated with either a nonverbal learning disability, that is, performance is poor only in mathematics (but also reading and spelling), or a comorbid condition of reading/spelling and mathematics disabilities.

Particular to autism spectrum disorder (ASD), studies have found that on mathematics assessments, approximately 25% of those students with high-functioning ASD perform at least one standard deviation below their vocabulary

scores, thereby presenting with a mathematics disability (e.g., Mayes & Calhoun, 2008; Zager & Donaldson, 2010). The fact that nearly one-quarter of this population has a developmental dyscalculia contradicts the commonly held belief that persons with ASD have high mathematical ability levels (Williams, Goldstein, Kojkowski, & Minshew, 2008).

Interventions for students with dyscalculia must address specific areas of difficulty using explicit and systematic teaching of skills. Practice and cumulative review are especially important. Often the use of visuals and/or manipulatives is of benefit in teaching and practicing mathematics concepts.

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Dyschezia

▶ Constipation

Dysexecutive Syndrome

▶ Frontal Lobe Syndrome

Dysfluency

▶ Fluency and Fluency Disorders

Dysgenesis (Malformation)

▶ Agenesis of Corpus Callosum

Dysgraphia

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Synonyms

Handwriting difficulty

Definition

Dysgraphia is a specific learning disability in which writing letters by hand is impaired, thereby affecting the acquisition and use of written language. Spelling difficulties may also be present in dysgraphia. Thus, an individual with dysgraphia may have problems with handwriting or spelling or both.

Importantly, handwriting (i.e., letter production) is not a simple motor act. Letter production requires visuospatial integration and motor planning for controlling the size of strokes and alignment of letters on paper, motor control and memory for hand movements involved in writing letters, and working memory for holding letters

while motor acts are being planned and carried out (Berninger, 2004). Similarly, spelling is not simply a visual skill. It requires both orthographic (i.e., letter-sound associations) and phonological processes (i.e., short-term memory for spoken information) (Berninger, 2004).

The defining characteristic of dysgraphia is poor or slow handwriting, though additional characteristics are possible; thus, clinical subtypes of dysgraphia have been suggested: language-based or dyslexic dysgraphia, motor-executive dysgraphia, and visuospatial dysgraphia (e.g., O'Hare, 1999). In dyslexic dysgraphia, writing difficulties arise from impairments in phonological processing (e.g., phonological awareness), semantics (e.g., word knowledge), and/or syntax (e.g., grammar). Writing is characterized by both poor legibility and weak spelling, though copying is typically relatively intact. Differently, a motor-executive dysgraphia is associated with a motor-planning weakness, that is, difficulty remembering the sequence of kinesthetic movements necessary to form letters correctly. As in dyslexic dysgraphia, handwriting is illegible; however, spelling is not affected and copying is impaired. Visuospatial dysgraphia results from impairment in understanding space. Characteristics are similar to motor-executive dysgraphia; however, in addition to letter formation, weaknesses also occur in margin consistency and spacing of letters. Further, along with handwriting difficulty, visuospatial dysgraphia also includes difficulty with drawing and motor-free visuospatial tasks (e.g., visually perceive [recognize] letters in the correct direction). Regardless of the clinical subtype, because those with dysgraphia focus more energy on handwriting, in order to shorten the handwriting process, they use as few words as possible in written communication.

The high prevalence of writing disabilities in individuals with autism spectrum disorders (ASD) has been well documented (e.g., Miyahara et al., 1997). Impairments in any or several domains that contribute to handwriting account for the frequency of dysgraphia in the population. These include but are not limited to problems with fine and gross motor functions that make precise manipulations of writing difficult; with proprioception, thus making it difficult to accurately develop fluid, automatic handwriting; and with vision that affects how letters are perceived and reproduced (Fuentes, Mostofsky, & Bastian, 2009). Research has found that some children with ASD have problems forming letters, but not sizing, spacing, or aligning them (Fuentes et al., 2009).

It is important to address dysgraphia with appropriate treatment. Mechanics of writing, especially handwriting fluency, are predictive of both the fluency (rate) and quality of written compositions. Difficulties with the mechanics of writing (i.e., constructing letters and spelling) interfere with the same attentional resources necessary to generate meaningful composition (Berninger et al., 1997).

See Also

▶ Agraphia

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Dyslexia

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Synonyms

Developmental reading disorder; Specific reading disability

Short Description or Definition

The National Institute of Neurological Disorders and Stroke defines dyslexia as "a brain-based type of learning disability that specifically impairs a person's ability to read. These individuals typically read at levels significantly lower than expected despite having normal intelligence. Although the disorder varies from person to person, common characteristics among people with dyslexia are difficulty with spelling, phonological processing (the manipulation of sounds), and/or rapid visual-verbal responding. In adults, dyslexia usually occurs after a brain injury or in the context of dementia. It can also be inherited in some families and so on, and recent studies have identified a number of genes that may predispose an individual to developing dyslexia."

Categorization

Learning disability
Neurological disorder

Epidemiology

Dyslexia is known as a neurological disorder in that there appear to be differences in brain functioning associated with language, learning, and reading in this population. Dyslexia is typically not acquired but related to congenital factors and frequently occurs in related family members. Current genetic research suggests that a number of genes exist that may predispose a child to developing dyslexia. Dyslexia is usually detected and diagnosed in early elementary years, when affected children demonstrate difficulties with classroom demands related to alphabet learning, word recognition, reading comprehension, spelling, and writing. It is thought to affect between 5% and 10% of the population although there have been no studies to indicate an accurate percentage. In adults, symptoms associated with dyslexia can occur following a brain injury/stroke, or as a result of developing dementia.

Natural History, Prognostic Factors, and Outcomes

Although typically not diagnosed until middle elementary grades, dyslexia is frequently associated with delayed language development during the preschool period. Although the language delay often appears to resolve in primary grades, learning to read and write is often slow and laborious. Children with dyslexia demonstrate difficulties in phonological awareness during primary school years; they have trouble identifying rhymes, recognizing words that start or end with the same letter, and breaking words down into component sounds (hit = /h/ + /I/ + /t/). Although in multisensory interventions children "experience" letters and words in various tactile modalities (such as feeling sandpaper letters or making letters in finger paint), the approach with the best evidence base is prolonged, intensified exposure to phonological awareness training, letter-sound correspondence, sound analysis (what sounds are in the word *cat*?), and sound-word synthesis (What word do these sounds make s-u-n?). With intensive instruction, many children with dyslexia learn to read and write, although both may remain slow and labored. For students with severe dyslexia, educational practice requires alternative access to curricular texts by means of material to be read to the student, or recorded for listening. Computer applications that translate text to speech are also used. With appropriate compensations, individuals with dyslexia can

achieve high levels of independence and achievement. However, many suffer from poor self-esteem if compensations and support are not provided.

Clinical Expression and Pathophysiology

The symptoms of dyslexia may vary, depending on the age of the individual and the severity of their difficulties. In young children, delayed language, trouble identifying and segmenting sounds, rhyming, and letter-sound matching are often seen. Children with dyslexia are commonly thought to simply "reverse" letters in their reading and writing; however, many typical children reverse letters when learning to read and write. In fact, a person with dyslexia may show no pattern of letter reversal at all. Although children and adults with dyslexia tend to have average to above-average cognitive skills, they may demonstrate associated difficulties with reading comprehension, writing, as well as math, as these areas also require connection and understanding of letters/graphics.

Evaluation and Differential Diagnosis

Thorough measures of neuropsychological assessment exist in order to detect and treat dyslexia in children from an early age. Assessment for a child showing delayed or impaired reading acquisition may include cognitive and academic achievement testing, as well as an evaluation of the critical underlying language skills closely linked to dyslexia (phonological awareness, letter naming, fluency). Developmental history, family history of dyslexia, and early development of speech and language should also be investigated. The presence of vision, auditory, and attention impairments are unrelated to the reading and comprehension signs of dyslexia and should be ruled out and treated as separate disorders.

There are a number of underlying skills that comprise a person's ability to read, including phonological awareness, alphabet decoding, automatic word recognition, and short-term memory. In young children learning to read, these skills develop along a continuum and work together for successful reading acquisition. For a child suspected of dyslexia, these skills should be carefully assessed in order to detect what areas are underdeveloped and/or causing the most difficulty. As typical children acquire these skills, their reading becomes more fluent and with a quicker pace. Pacing and fluency does not tend to come as naturally for children with dyslexia and remains a chronic difficulty for many adults with dyslexia.

Symptoms associated with dyslexia can also occur in children with other language and learning disabilities; therefore, a comprehensive assessment is necessary to evaluate areas of reading, writing, comprehension, and verbal expression. Many children with reading problems also have spoken language deficits.

Treatment

Depending on the varying degrees of difficulty and the areas most impaired in an individual with dyslexia (i.e., letter/word recognition, reading fluency, comprehension), treatment methods and intensity of approach will vary. For children, strategies and supports in developing phonological skills (e.g., letter-sound recognition, sound separation, segmentation, rhyming) will ultimately assist with reading and writing deficits. For school-aged children who have acquired reading but continue to struggle, teaching strategies should address pacing, processing, and comprehension. Regardless of student age, a team of professionals should consult and collaborate to develop an educational plan with specific teaching methods and accommodations to meet the needs of the child.

School professionals and clinicians, particularly reading specialists, special educators, and speech-language pathologists, are trained to develop interventions and treat dyslexia. Multisensory approaches that target auditory, visual, and tactile areas associated with reading and comprehension offer thorough methods to address difficulties caused by dyslexia. A thorough assessment and

teacher report can also offer information related to individual learning styles. For example, individuals who benefit from visual versus purely auditory teaching methods.

Assessment can also reveal the specific reading skills that require remediation for a child or adult, including:

- Phonemic awareness: recognition of the letter sounds in words
- Phonological awareness: understanding that words can be broken down into phonemes and those phonemes can be manipulated, such as segmenting sounds in words, blending sounds, and rhyming (sounds are distinct from meaning)
- Reading fluency: spelling, speed, accuracy, and ease
- Oral reading: proper expression and fluency
- Reading comprehension: includes vocabulary knowledge and understanding the meaning of passages

For adults, individualized tutoring can provide both structured and tailored teaching to address problem areas and monitor progress. Counseling sessions with a trained clinician familiar with dyslexia can provide a supportive arena to develop and discuss strategies for home and career settings where reading is involved. Counseling is also beneficial for individuals with dyslexia who demonstrate fear or anxiety surrounding their reading difficulties.

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Dysphasia

▶ Aphasia
▶ Global Aphasia

Dysphoria

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Definition

A negative emotional state characterized by dissatisfaction, restlessness, anxiousness, irritableness, and depression. Dysphoria is a symptom of various psychiatric disorders such as major depressive disorder, dysthymia, generalized anxiety disorder, body dysmorphic disorder, bipolar disorder, and premenstrual dysphoric disorder. Dysphoria is usually experienced during states of depression, but people with bipolar disorder may also experience dysphoria during manic or hypomanic episodes. Dysphoria is the opposite of euphoria.

See Also

▶ Depressive Disorder
▶ Mood Disorders

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Dyspraxia

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Synonyms

Apraxia

Definition

The term "dyspraxia" is often used to describe less severe forms of apraxia. Apraxia is the disruption in the ability to plan and execute volitional (purposeful) movements despite intact muscle strength and coordination. Involuntary movements remain intact. Importantly, apraxia is not associated with weakness, slowness, or incoordination. Apraxia is a motor disorder resulting from neurological damage. There are three types of apraxia: limb, oral, and verbal. In a limb apraxia, the volitional movements of the extremities are affected. In an oral apraxia, nonspeech movements of the oral mechanism are affected. Verbal apraxia (or Apraxia of Speech) is a disorder in which an individual has difficulty positioning and sequencing muscles for the volitional production of speech.

See Also

- ▶ Apraxia
- ▶ Developmental Coordination Disorder
- ▶ Developmental Dyspraxia
- ▶ Oral-Motor Apraxia
- ▶ Verbal Apraxia
- ▶ Verbal Dyspraxia

References and Readings

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Dystaxia

- ▶ Ataxia

Dysthymia

- ▶ Depressive Disorder

Dystonia

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Definition

A movement disorder characterized by involuntary movements and prolonged muscle contraction, resulting in twisting body motions, repetitive

movements, or abnormal posture (Fahn, Bressman, & Marsden, 1998; Geyer & Bressman, 2006). These movements may involve the entire body or only an isolated area. Dystonia can be hereditary or occur sporadically without any genetic pattern; it can occur as a result of birth related or other trauma or may be associated with medications, particularly neuroleptics, or diseases. The gene responsible for at least one form of dystonia has recently been identified. Some types of dystonia respond to dopamine or can be controlled with sedative-type medications or surgery. Dystonias may be classified by the age of onset, by the part(s) of the body affected, or by the cause (primary or secondary dystonia).

Primary dystonia presents with signs only related to the dystonia and is thought to be caused by pathology in parts of the brain that are concerned with movement (basal ganglia) and the GABA (gamma-aminobutyric acid) producing neurons. This dystonia occurs without additional neurologic, laboratory, or imaging abnormalities. The precise cause of primary dystonia is unknown. In many cases, it may involve some genetic predisposition towards the disorder combined with environmental conditions.

Secondary dystonia refers to dystonia associated with a known cause or additional neurologic findings. It usually arises as the result of a specific underlying condition such as insufficient oxygen at birth and exposure to medications that block dopamine receptors (Friedman & Standaert, 2001).

Treatment of dystonias is based upon the symptomatology. There are no curative therapies, although in the case of medication-induced dystonia, discontinuation of the medication may result in a resolution of some dystonic symptoms. Management of dystonia includes medications such as levodopa, anticholinergics, tetrabenazine, clonazepam, and baclofen. Botulinum toxin injections and deep brain stimulation are also recognized treatments.

See Also

- ▶ Anticholinergic
- ▶ Dopamine

References and Readings

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Friedman, J., & Standaert, D. G. (2001). Dystonia and its disorders. *Neurologic Clinics, 19*(3), 681–705. vii.

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Dytan™

- ▶ Diphenhydramine