19 Fluency and Fluency Disorders

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19.1 Introduction

We begin this chapter with some information on just how prevalent stuttering is within the world. There have been many studies that examine the prevalence of stuttering and, with few exceptions, prevalence numbers remain within a range of about 1% (see Bloodstein & Bernstein Ratner, 2008 for a review). Although that number may seem small, clinicians within the United States, for example, must realize that this number is equal to about 3 million people who stutter (PWS), or about 600,000 in the UK. The number of people in the world that stutter is certainly significant in number and character.

Throughout this chapter, we will use the terms "stutterer" and person who stutters ("PWS") interchangeably. The term stutterer (also analogous to "stammerer") appears in research papers and texts prior to the mid- to late 1990s, and is slowly being replaced with the more consumer-friendly term, PWS, and child who stutters (CWS).

19.1.1 Background, Philosophy, and Definition

Although the study of stuttering has existed since the onset of the field of speech-language pathology, its existence has been documented to very early times, including descriptions of Moses who was described as being "slow of speech and tongue" (Exodus 4 : 10). Despite its long history, it is still not totally understood.

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Within the realm of stuttering disorders, there appears to be a key philosophical division that drives both research and clinical interests. This issue is the cause of opposing points of view in establishing validity for both research agendas and clinical applications. This key issue has caused strong debate and several points of view when considering therapy approaches, evidence-based practice issues and outcome measures, assessment tool use and development, and even general theories relating to definition, onset, progression, and cause. This issue that drives current thought, theory, and research in fluency and fluency disorders is the dilemma regarding the impact of behaviorism versus social constructivism. With regard to stuttering, behaviorism relates to aspects of stuttering that can be clearly observed, that is, behaviors that can be seen and heard by the human sensory system. From this philosophy, stuttering is viewed as the motor movements that produce the stuttered speech. The stuttering may be a result of a person's genetic composition, neurological makeup, or motor speech patterns, but the purveyors of this approach are most interested in the observable aspects of speech, that is, the stuttering itself. From this standpoint, these observable characteristics are what define stuttering.

The opposing view looks at the issues related to stuttering from a social constructivist view, that is, "how does stuttering affect an individual as they operate within a social system?" Consistent with this philosophy would be how stuttering affects a person's ability to communicate, or *inability* to communicate in a functional setting. The supporters of this philosophy are interested in the outward speech symptoms of stuttering, but are equally interested in the inner emotions and anxieties associated with stuttering and how the stuttering impacts a person's ability to live and communicate with others in real-life scenarios. The stuttering itself can be easily observed and documented, but the internal fears, avoidances, frustration, or reluctance to speak with others as a result of the stuttering and how they impact a social interaction are the real interest of the social constructivist.

This debate has also impacted the intervention strategies for those who stutter. As noted in the first chapter of this collection, intervention (from a medical model) can encompass a view to "get rid of" or "eliminate" the disorder. However, a social view of intervention means adapting to the stuttering and educating the community to understand the stuttering and make accommodations for those that do stutter. Each philosophy has its merits and detractions, and they will be pointed out whenever possible. Using this controversy as a backdrop, this chapter will review information relating to the definition, onset, development, treatment, and theory surrounding fluency and fluency disorders. Currently, there is a trend toward a broader view of stuttering. Many organizations, such as the World Health Organization (WHO) and the American Speech-Language-Hearing Association take this broader view that views stuttering from a functional perspective. In this realm, stuttering refers to more than just stuttering. It refers to a speaker's experience of stuttering and can involve affective, behavioral, and cognitive reactions (both from the speaker and the environment). Some of these may be negative and can limit a speaker's ability to participate in activities of daily living and have a negative impact on the speaker's quality of life (QoL).

19.1.2 *Definition of Stuttering (Behavioral)*

From a behavioral standpoint, a definition of stuttering is based upon clearly defined and measurable symptoms. For example, one of the most widely used definitions of stuttering comes from the 1964 work of Marcel Wingate, who defined stuttering as ". . .(a) Disruption in the fluency of verbal expression, which is (b) characterized by involuntary, audible or silent, repetitions or prolongations in the utterance of short speech elements, namely: sounds, syllables, and words of one syllable. These disruptions (c) usually occur frequently or are marked in character and (d) are not readily controllable" (p. 488). In this definition, all of the behaviors are observable, except for the final point that relates to the "readily controllable" aspects of stuttering. From this viewpoint, stuttering is a speech disorder that can be observed and documented by a listener. Wingate's definition does note the issue of "readily controllable," and this warrants explanation. Although there are many techniques that can quickly eliminate or reduce stuttering (see Andrews et al., 1983; see Table 19.1 for examples), the long-term efficacy of treatments that eliminate stuttering is unclear and poorly defined, especially in older children and adults (Cordes, 1998). A later follow-up meta-analysis showed some positive trends, particularly in young children, but these reports were mostly limited to behaviorally based interventions (Bothe, Davidow, Bramlett, & Ingham, 2006; Herder, Howard, Nye, & Vanryckeghem, 2006). Clinically, we have heard many parents ask (or tell) their children to stop stuttering, or to control their speech. This is to insinuate that they could stop stuttering if they wished, and contrary to the "not readily controllable" portion of Wingate's definition. Further testimonials from people who stutter include stories of how they had practiced their fluency for an important event and were highly successful in practicing, only to fail when the actual situation arose (St. Louis, 2001). This is indicative that PWS may not stutter on the same words in all conditions, and their stuttering may vary from day to day and situation to situation. If there is one thing that is certain about stuttering, it is that there is significant variance in the way that the observable symptoms present themselves.

Table 19.1 Examples of Fluency Inducing Strategies.

Delayed auditory feedback	Goldiamond (1965)
Fluency altered feedback	Kalinowski, Armson, Roland-Mieszkowski, Stuart, and Gracco, (1993)
Operant techniques	Martin and Siegel (1966)
Reduced rate	Adams, Lewis, and Besozzi (1973)
Rhythmic speech	Brady (1969)
Singing	Johnson and Rosen (1937)
White noise masking	Shane (1955)
Whispering	Johnson and Rosen (1937)

Also within this genre of behavioral/observable symptoms, there have been numerous attempts to quantify exactly what is stuttering and what is not stuttering. One of the first attempts at defining and describing these speech behaviors came from the work of Wendel Johnson and his associates (1959), later modified by Williams, Silverman, and Kools (1968), and appearing in Darley and Spriestersbach (1978). Their works defined all of the types of speech breakdowns that were reported in the speech of American speakers. They then classified which speech behaviors were considered to be stuttering and which ones were considered to be "other types of disfluency" (see Table 19.2). Throughout this chapter, we will use the term *nonfluency* to define any breakdown in fluency, whether stuttering or not. We will use the terms *stuttering*, or stuttering-like disfluency, to define the breakdowns in fluency that would be defined as stuttering. And finally, we will use the term *disfluency* to define the breakdowns in fluency that would not be considered stuttering. This terminology is consistent with studies that must differentiate between stuttering and other types of nonfluencies that occur in a variety of speech and language disorders (Van Borsel & Tetnowski, 2007). In this classification system, stuttering and disfluency are both subsets of nonfluency. Also, most stuttering occurs at the beginning of words, phrases and sentences, and is considered

Table 19.2 All Types of Nonfluencies.

Nonfluency type	*Example*	*Stuttering or disfluency*
Interjections	My ***um*** dog's name is Sherry.	Disfluency[a]
Part-word repetition	My ***d-d-d-d***-dog is a poodle.	Stuttering
Word repetition	***She-she-she*** is silver.	Stuttering[b]
	She is ***silver-silver-silver***.	Disfluency[b]
Phrase repetition	***She likes-she likes*** to play.	Disfluency[a]
Revision	***I like-I love*** my dog.	Disfluency[a]
Incomplete phrase	***She is***-oh I forgot how old.	Disfluency[a]
Broken word	The dog is ***ru(pause)-nning*** fast.	Disfluency
Prolonged sounds	***Sssssssss***ilver is a pretty color.	Stuttering
Tense pause[c]	***. . .. . .(pause with tension)*** I'm done.	Stuttering
Word-final disfluency	Please put-***ut-ut*** the book here	Atypical disfluency
Mid-word insertion	Can you spea—***n***—k about that?	Atypical disfluency

Note: The nonfluency in each case is shown in ***bold italics***.

[a] Often seen in excess in cluttering.

[b] In further studies, it has been determined that word repetitions of one syllable are generally considered as stuttering and word repetitions of multisyllable words are disfluencies (Ham, 1989).

[c] Also referred to as blocks, stoppages, or fixations.

typical. The *atypical stuttering* listed in Table 19.2 is indicative of fluency breakdowns that occur in certain conditions, and is not considered *typical stuttering*. It should further be noted that stuttering is but one type of fluency disorder. The other fluency disorders will be defined later in this chapter.

Based on the work of Ham (1989), we might infer that any nonfluency that takes the form of a part-word repetition, single-syllable word repetition, prolongation, or block is considered to be stuttering. All other types of nonfluency, including interjections, multisyllable word repetitions, phrase repetitions, revisions, incomplete phrases, and broken words are considered to be a disfluency, that is, *not stuttering*. More recently, this concept was renewed in the epidemiological research of Yairi and Ambrose (2005) who coined the term "stuttering-like disfluencies" (SLD) that separated those behaviors that were likely to occur with a higher degree of frequency and consistency in children who stutter. These SLDs include part-word repetitions, monosyllabic word repetitions, and dysrhythmic phonations, which consist of prolongations and blocks. These behaviors are consistent with research carried out on expert judges (Ham, 1989), and the criteria set forth by the American Speech-Language-Hearing Association (n.d.). The key factor from a behavioral point of view is that these behaviors can be readily observed, counted, and documented.

19.1.3 Other Fluency Disorders

Gaining more attention in recent years are fluency disorders that reflect nonfluent speech different to and less understood than stuttering. These include the fluency disorders that are not stuttering and include "neurogenic stuttering," "psychogenic stuttering," and cluttering. The International Classification of Functioning, Disability and Health (ICF) classification system complements the World Health Organization's (WHO) *International Classification of Diseases-10th Revision* (ICD-CM), and lists four different categories for the term "fluency disorder." These are summarized with their codes in Table 19.3.

Neurogenic stuttering and psychogenic stuttering are *acquired* disorders following a severe neurological trauma (e.g., stroke), or a severe emotional trauma, emotional, or psychological stress (Cruz, Amorim, Beca, & Nunes, 2018). Stuttering may have its onset following a stroke or other cerebrovascular event (I69), in a

Table 19.3 ICF Classification of Fluency Disorders.

ICF code	*Terminology*
F80.81	Childhood onset fluency disorder
F98.5	Adult onset fluency disorder
I69	Fluency disorder following cerebrovascular accident
R47.82	Fluency disorder in conditions classified elsewhere

condition that arises after development, such as Parkinson's (R47.82) or as a result of a traumatic event, such as a severe emotional trauma (R47.82). Thus, childhood onset fluency disorder (F80.81) refers to childhood onset "stuttering" and another fluency disorder referred to as cluttering. Cluttering is a fluency disorder characterized by a rapid-sounding rate resulting in a breakdown in intelligibility of message. This breakdown can be due to a lack of efficiency in message transmission due to excessive disfluencies (i.e., interjections, revisions, phrase repetitions), a lack of clarity due to failure to pronounce all sounds and/or syllables in words (i.e., over-coarticulation), and/or pauses in places not expected grammatically, resulting in a "jerky" sounding speech (St. Louis & Schulte, 2011). Atypical disfluencies occur at the ends of words (i.e., word-final disfluencies) or result in audible sound insertion in the middle of words (e.g., ple–n–ease). Although the research for both cluttering and atypical disfluency remains sparse, the database of studies examining these disorders is building. Atypical disfluencies present differently than stuttering in that there is not typically tension and/or struggle, and/or attempts to avoid their production (Sutkowski, 2016). Cluttering, on the other hand, can at times be accompanied by a tension and/or struggle. Both cluttering and atypical disfluency result in disfluent speech, and therefore fit currently under the umbrella of nonfluent speech.

Awareness of atypical disfluencies is variable for all individuals. In general, small studies have shown awareness in some but not all clients with these types of disfluencies. A proposed reason for lack of awareness is lack of tension surrounding the moment of disfluency. Awareness of one's cluttering is more common. However, often awareness in the moment of cluttering is lacking (van Zaalen, Wijnen, & Dejonckere, 2011).

19.1.4 Definition of Stuttering (Constructivist)

Alternately, a definition of stuttering is based on the WHO's *International Classification of Functioning, Disability and Health* (ICF; World Health Organization [WHO], 2020). Within this definition of functionality (and thus how it is related to stuttering), Yaruss and Quesal (2004) have defined stuttering by its impact on how stuttering affects the ability of a person to function in their everyday environment. In this definition, stuttering is defined by how much it may "handicap" an individual from meeting their ability to function in their everyday environment. That is, a person may stutter overtly in their speech, but may meet all of their daily duties and expectations without any impact on their day-to day function, whereas another person may stutter mildly, yet never leave home, have a relationship, or hold a job due to their stuttering. In a similar fashion, some individuals may be greatly handicapped by back pain and may not seek employment, travel or social outings, and become greatly "handicapped" and "less functional" as a result of their back pain, while other individuals simply cope with the pain and function normally in all settings, with adaptations as needed. In the same way, the range of "functional limitations" due to stuttering may vary greatly. This limitation to functionality is "reality" to the social constructivist, but can only be defined through

measures other than the outward blocks, prolongations, and repetitions. Within a constructivist point of view, stuttering symptoms would include far more than just overt stuttering and would include constraints that stuttering would place on the functional and social activities carried out by the PWS. If this were true of stuttering, a valid definition of stuttering would include the observable speech symptoms, but also must include the social activities that the PWS would not or could not carry out. It might include an assessment of fears, avoidances, feelings, attitudes, and other cognitive and emotional issues that cannot be readily observed. For example, when asked his name in a casual, social setting, the first author of this chapter might answer, "They call me Dr Tetnowski," when "John" would be the preferred answer. The shift from "John" to "Dr Tetnowski" is an adjustment to the fear of saying his first name (a common fear among PWS). Other examples of social limitations might include being underemployed due to stuttering, avoidance of social relationships due to stuttering, and other choices made to not communicate, fear communication, alter communication, and any other adjustments made as a reaction to stuttering. These behaviors may be difficult to observe and document in a behavioral paradigm, but are highly valid in a constructivist point of view and require different types of research designs and data collection strategies (Tetnowski & Damico, 2001). Thus, the constructivist view would say that a valid definition of stuttering must include the internal fears, avoidances, word substitutions, functional limitations, temperament, and social anxieties that are present in many PWS.

A common critique of this philosophy is that these behaviors cannot be easily observed (Ingham, 2005). Alternately, others feel that the documentation of stuttering can only be accomplished by the PWS themselves. Some researchers have gone as far as to say that the only person who can identify stuttering is the PWS themselves and only within a short period of time after the stuttering (and emotional reaction) has occurred. Research has shown that the PWS can be accurate judges of their own stuttering (Moore & Perkins, 1990; Tetnowski & Schagen, 2001). Based on these findings, Perkins, Kent, and Curlee (1991) believe that stuttering is a response to internal time pressures, which is certainly difficult to observe in behavioral paradigms. Others have claimed that the most valid assessment of stuttering is only made in authentic, social settings where communication breakdowns can be studied in their true contexts (Tetnowski & Damico, 2001). Within this paradigm of the social constructivist, stuttering is far more than just the behavioral observations of stuttered speech. This can also hold true in cases of cluttering.

From this discussion, clinicians and researchers should understand that there are at least two distinct paradigms on how stuttering should be labeled, evaluated, and treated. In summary, these two opposing views of stuttering present the case that stuttering is either (a) an outward manifestation of speech that can be reliably judged by observers or precise physical measurement tools, or (b) the opinion, inner feelings, attitudes, and reactions of the PWS and how it affects their daily life in authentic communication settings. Stuttering, therefore, must be evaluated differently by people who hold these opposing points of view.

19.2 Stuttering Evaluation and Assessment

The method by which speech-language pathologists evaluate stuttering is defined by the paradigm of stuttering to which they subscribe. Behaviorists will evaluate stuttering within observable paradigms, whereas social constructivists will evaluate stuttering on its overall impact on communication in authentic settings.

19.2.1 Behavioral Assessment of Stuttering

Stuttering has traditionally been evaluated by how many observed instances of stuttering have been observed within a given time-frame, or as a percentage of total words or syllables spoken. The most common means of identifying stuttering is simply counting the number of instances of stuttering and dividing that by the total number of syllables spoken, then multiplying that number by 100 in order to calculate a percentage of stuttered syllables (% SS). Thus, six instances of stuttering in a sample of 100 total syllables spoken would yield a total of 6% SS. These types of calculations have been consistently used by clinicians and researchers for many years and serve as the basis for most stuttering assessment batteries including the highly popular Stuttering Severity Instrument-4 (Riley & Bakker, 2009). In this assessment tool, a stuttering severity score is calculated by combining the totals of three subscores. The three subscores are (a) the % SS (calculated from a monologue task in younger children and a combination of monologue and reading tasks by adults and older children), (b) the length of stuttering events (calculated by averaging the three longest stuttering events within the sample), and (c) physical concomitants, that is, the documentation of physical movements that may accompany stuttering, such as eye blinks, foot tapping, facial grimaces, distracting sounds, or other observable behaviors (based on a total of four 0–5 subscore ratings relating to distracting sounds, facial grimaces, head movements and movements of the extremities). The stuttering frequency, duration, and physical concomitants scores are totaled to determine an overall score that is transposed to provide a severity rating and percentile score. Most observation-type stuttering evaluation scales and protocols are based upon similar models to the Stuttering Severity Instrument-4, that is, they evaluate stuttering on the basis of observable behaviors of speech and other movements.

During evaluation, the behavioral symptoms of stuttering must be differentiated from the disfluencies in cluttering, which are not SLDs and result in an inefficient message. Perceived rapid rate would also help differentiate cluttering from stuttering. Any symptoms of over-coarticulation should be considered unique to cluttering. It is important to note that at times people who stutter covertly may speed up to avoid moments of disfluency. If this increased speed does not result in a communication effectiveness breakdown as observed in cluttering, the client likely does not clutter. On the other hand, if increased speed results in excessive disfluencies and/or atypical pausing, cluttering should be considered in addition to stuttering. Atypical disfluencies can also be differentiated from stuttering and

cluttering in that typically they are exhibited at the ends of words or as a mid-word insertion (Scaler Scott, 2018).

The value of behaviorally based stuttering evaluation tools has been invaluable to researchers and practicing clinicians; however, their reliability has been called into question by several researchers (Ingham, Cordes, & Gow, 1993; Lewis, 1995). The biggest point of concern for this type of scoring method is whether judges, even expert judges, could reliably indicate the precise point where stuttering actually occurred. In response to this argument, Ingham, Cordes, and colleagues (Ingham, Cordes, & Finn, 1993; Ingham et al., 1993) have developed an alternate method for determining the occurrence of stuttering. Rather than using % SS as the dependent measure for stuttering, they used time intervals as the basis for counting the occurrence of stuttering. That is, judges listened to a short period of speech and simply made a binary decision as to whether stuttering occurred or not within a given time period. In a series of very clever experiments, Ingham, Cordes, and colleagues determined the shortest interval of time by which stuttering could be reliably identified. The results of their experiments determined that time intervals of 4 s were the shortest durations which a listener could reliably judge the occurrence of stuttering. Therefore, they subscribe to the theory that accurate observation of stuttering should take place with judges listening to four-second intervals of speech and then determine whether stuttering has occurred or not. This method has been shown to bring about reliable judgments of stuttering across types of stuttering (Cordes & Ingham, 1994), using individuals with different backgrounds and from different training programs (Ingham & Cordes, 1992), and individuals with various levels of expertise and experience (Cordes & Ingham, 1995). In spite of the high levels of reliability provided by this method, its widespread use has not universally caught on due to questions of practicality, clinical importance, and validity. For most observable assessments of stuttering, most speech-language pathologists continue to use the % SS method.

19.2.2 *Alternate Methods for Assessing Stuttering Behaviors*

As an outcry to the reliability issues brought up by behaviorists, a separate group of clinicians and researchers have taken a totally different route when assessing stuttering. These researchers believe that stuttering is not a condition that can be reliably observed and that the most salient features of stuttering are internal, such as emotions and feelings. Thus, another set of diagnostic tools have been developed that challenge the validity of behavioral assessments of stuttering as the sole diagnostic criteria by which stuttering is evaluated. These measures have been used for a number of years and include tools such as the Modified Erickson, S-24 Scale (Andrews & Cutler, 1974), the Perceptions of Stuttering Inventory (PSI; Woolf, 1967), the Communication Attitude Test-Revised (CAT-R; De Nil & Brutten, 1991), the Profile of Stutterers' and Nonstutterers' Affective, Cognitive, and Behavioral Communication Attitudes (Watson, 1987) and other similar protocols. The common link between these assessment tools are that they are paper and pencil tests where the PWS, with the help of the clinician, indicates how they

feel about their stuttering. These tools assess the feelings, attitudes, and emotions of stuttering and how it affects their life. The behaviorists have often questioned both the reliability and validity of these tests, and in response, a new wave of more carefully designed tools have been designed in recent years. These tests include the Wright and Ayre Stuttering Self-Assessment Profile (WASSP; Wright & Ayre, 2000) and the Overall Assessment of the Speaker's Experience of Stuttering (OASES; Yaruss & Quesal, 2006). These tools, especially the OASES, have been put through more stringent evaluations and have been shown to be considerably more valid and reliable than their predecessors.

A myth that has been dispelled over time is that those who clutter are immune to a negative life impact due to their communication disorder. More recent research has shown that even if people with cluttering are unaware of their communication disorder as it is occurring, many are often aware in general of negative feedback from others regarding their communication skills (Scaler Scott & St. Louis, 2011). Knowing that those who clutter may also have negative life impact, tools to assess the feelings and attitudes of those who clutter are in progress. Little has been reported, and more needs to be studied, regarding any negative feelings or attitudes regarding atypical disfluencies. To date, only one study reports cognitive distortions related to the origins of disfluencies in a school-age child (Healey, Nelson, & Scaler Scott, 2015). Ongoing research is needed; however, considering that any communication disorder can have a negative impact upon a person's QoL is the most inclusive assumption.

In conclusion, there are a large number of tests, profiles and protocols for the assessment of stuttering and other fluency disorders. Most clinicians and researchers employ a combination of these tools to evaluate both the observable, as well as the emotional and cognitive aspects of stuttering and other fluency disorders.

19.3 Epidemiological Issues Related to Stuttering Based on Longitudinal Studies

In most cases, adults who stutter can readily identify themselves as such. However, diagnosis of stuttering in early childhood is not as straightforward. Since most children go through periods of disfluency (remember, these are nonfluencies that would not be identified as stuttering by experts) as they learn to use language, it may appear to the casual observer that they are really stuttering. Unfortunately, research has shown that the nonfluent behaviors observed in young children who stutter are also observed in children that do not stutter (Ambrose & Yairi, 1999). Since it is well known that the prevalence of stuttering in children is 5%, while the prevalence in adults is only 1%, it would be valuable to know why and how this change takes place. Either many children who stuttered are getting better spontaneously or with therapy before adulthood, or there is a dramatic miscounting of school-age children that truly stutter. It would be advantageous to know which speech behaviors and what frequency of these speech behaviors differentiate

chronic stuttering from developmental episodes of disfluency. If this distinction could be made readily in young children, it would be possible to get young children into stuttering therapy at an early age before emotional scars of stuttering can develop. Again, the importance of accurately predicting which children are likely to recover and which children are likely to continue stuttering cannot be overestimated.

In order to answer these and similar questions, a group of researchers at the University of Illinois, under the direction of Ehud Yairi, have set out to track stuttering from a very early age to determine its course and accurately describe its symptoms. In a series of longitudinal studies, Yairi and his associates have tracked at least 89 young children who were reported to stutter. They tracked the PWS across many years, beginning at the time when stuttering was most likely to have its onset. Prior studies have placed the mean age of onset at around 3 years of age, with a majority of cases having their onset before the age of 6 (2.7 years old, Bernstein Ratner & Silverman, 2000; 3.0 years old, Milesen & Johnson, 1936; 2.7 years old, Yairi & Ambrose, 1992). In the vast majority of these types of studies, date of onset was reported by parent interviews and was not directly observed. The purpose of the longitudinal studies by Yairi and colleagues was to plot the course of stuttering (or its recovery/remission) from near the time of onset. Monitoring the symptoms from this early time would allow clinicians to make informed decisions about which children are likely to continue to stutter (and thus need intervention) and which children are likely to recover. The results of the data are very compelling and should be used as a metric for determining the early course and intervention strategies for those children who may develop into chronic people who stutter, that is, those who are unlikely to recover without intervention.

In this series of studies, participants were considered to be "recovered" if they were free of clinical symptoms of stuttering and were judged to be free of stuttering by parental interview. These criteria had to be met and maintained for a period of over 12 months in order to be labeled "recovered." In addition, they had to maintain this label of "recovered" for 4 years in order to be classified as such (Yairi & Ambrose, 2005). Thus, those labeled as "recovered" very likely were truly recovered.

19.3.1 Early Childhood Stuttering: Persistence and Recovery

Among the factors that were considered in the series of studies by Yairi and his colleagues were: (a) age at onset of stuttering and (b) age of remission of symptoms. Once these factors could be determined, they also considered these important variables: (a) types of stuttering behaviors observed; (b) gender of recovered and persistent children who stutter; (c) change in stuttering behaviors over time; (d) characteristics of stuttering symptoms observed; and (e) types of physical behaviors observed.

A great deal of investigation of the development of stuttering has led to increased understanding of the development of stuttering and possible factors related to its persistence and remission. Whereas we once considered linear tracks along which

stuttering progressed, we now realize that stuttering can begin at any level of severity. The majority of cases, however, do follow some pattern of progression, beginning with little tension and/or avoidances and increasing along all of these dimensions. It is clear, however, that this is still not a linear or universal pattern. Yairi suggested this in 1990 when he called for subtyping of CWS for the purposes of research. Due in large part to the work of Yairi and his workers, we have now pinpointed several specific prognostic indicators that help us to make potential predictions about recovery and therefore to plan intervention.

Prognostic parameters serve as a guideline to professionals for determining whether or not stuttering intervention is warranted. Because there is an overlap between types of nonfluency in those who will become chronic stutterers and those who will spontaneously recover, and because some studies indicate that as many as 80% of preschoolers who stutter will achieve spontaneous recovery (Yairi & Ambrose, 2005), knowing what risk factors are more associated with those who do not stutter becomes critical for timing of intervention. Thanks to ongoing epidemiological work, we now know that children who have a family history of stuttering (particularly those family members who did not recover), children who have concomitant speech and/or language disorders (in particular, phonological disorders), children who have been stuttering at a stable level for at least a year prior to referral, and boys are more at risk to continue to stutter (Yairi & Ambrose, 2005). This information becomes even more valuable when we consider the fact that Yairi and Ambrose were among the first to correct mistakes in previous studies of early childhood stuttering. That is, the 89 children in these researchers' studies were selected closer to the onset of stuttering (i.e., within 12 months of onset), were followed for longer periods of time (i.e., at least 4 years, many for longer) and did not receive any speech-language intervention that might serve as a confounding variable. These 89 children were followed for 4–12 years after stuttering onset to obtain the recovery and persistence data we currently have available to us today.

Researchers have become more accurate in measurement of disfluency and have developed some measurement markers that enable them to begin to differentiate between typical disfluency and stuttering. Although there is more than one approach to counting disfluencies adopted for research and/or evaluation purposes, one of the most commonly adopted systems is that of Yairi and Ambrose (2005), in which childhood disfluency is divided into the categories of "stuttering-like disfluencies" and "other disfluencies." Such a classification system recognizes the fact that children who do not stutter (CWNS) may in fact exhibit stuttering that is more typical of children who do stutter. Yairi and Ambrose argue that their classification system is based upon the idea that those disfluencies classified as "stuttering-like disfluencies" are ones that are more frequently a part of the disfluencies of those who stutter, and that "other disfluencies" are those that more frequently occur in those who do not stutter, while taking into account that both groups can exhibit both types of nonfluency. In other words, the difference is not so much in the types of nonfluency exhibited, but rather in the degree to which each type is exhibited. This involves a more qualitative analysis of the nonfluencies once they are identified. For example, Yairi and Ambrose argue that

children who stutter tend to have a greater number of iterations of a sound repetition than CWNS, who might experience only one iteration.

Most researchers follow a cutoff point to determine when a child can be classified as stuttering, that is, a child must exhibit at least 3% of syllables or words stuttered. Although there are slight variations in the cutoff points for those moments defined as stuttering and those defined as normal disfluency, this 3% is most accepted among researchers as one criterion for differentiating CWS from CWNS. Other criteria include parental concern and diagnosis by a speech-language pathologist. A slight distinction exists between Conture's (2001) and Yairi and Ambrose's (2005) definitions, in that Conture includes within-word disfluencies, whereas Yairi and Ambrose include SLD; however, the rest of their definitions are the same (i.e., parental concern and 3 disfluencies per 100 syllables for Yairi and Ambrose and per 100 words for Conture). Within the past 10 years in the *Journal of Speech, Language and Hearing Research*, the definitions researchers most based their own definitions upon were upon these criteria of Yairi and Ambrose, and Conture. Thus, our procedures for clearly defining stuttering in order to conduct research studies have been slowly tightening.

Within this context, Yairi and his colleagues have looked to indicators that show recovery from stuttering, in contrast to persistent stuttering. Through their studies, they have found that recovery is more likely in females than males (1.8 : 1.0 ratio for females; 4.5 : 1.0 ratio for males; Yairi & Ambrose, 2005), and that if recovery does occur, it happens faster in females than in males (12–30 months in females; 24–36 months in males; Yairi & Ambrose, 2005). However, a major point of their research was to identify the specific speech behaviors that are most commonly seen in young children who truly stutter. These behaviors are specifically labeled by Yairi and colleagues as "stuttering-like disfluencies" and specifically include part-word repetitions (bu-bu-bu-bu-butter tastes really good), single-syllable word repetitions (I-I-I-I-I love butter) and dysrhythmic phonations that include prolongations (I lllllllllllllllllllllllove to eat butter; the word love is stretched out over an abnormal period) and blocks (. . . . . .butter tastes really good; the speech mechanism becomes rigid and no phonation occurs). The important part of this definition is that they have served to become a predictor of recovery or persistency of stuttering. Specifically, the concept of the SLD has progressed to a concept called weighted SLD and the weighted SLD has been shown to be a powerful predictor of recovery from stuttering in young children, as noted in Figure 19.1. As indicated in Figure 19.1, the recovered stutterers showed dramatic changes in stuttering behaviors, that is, weighted SLD within a relatively short time after onset. It should also be noted that the route to recovery from stuttering can take as long as 4 years or longer. Just as importantly, the persistent stutterers showed a lesser decrease in weighted SLD, a leveling off of weighted SLD and in some cases, an increase in weighted SLD was noted. In summary, Yairi and his colleagues have provided parents and clinicians with valuable information regarding the likelihood of stuttering spontaneously resolving itself.

In addition to the information on recovery, Yairi and colleagues have provided many other valuable insights into what stuttering looks like very close to its onset,

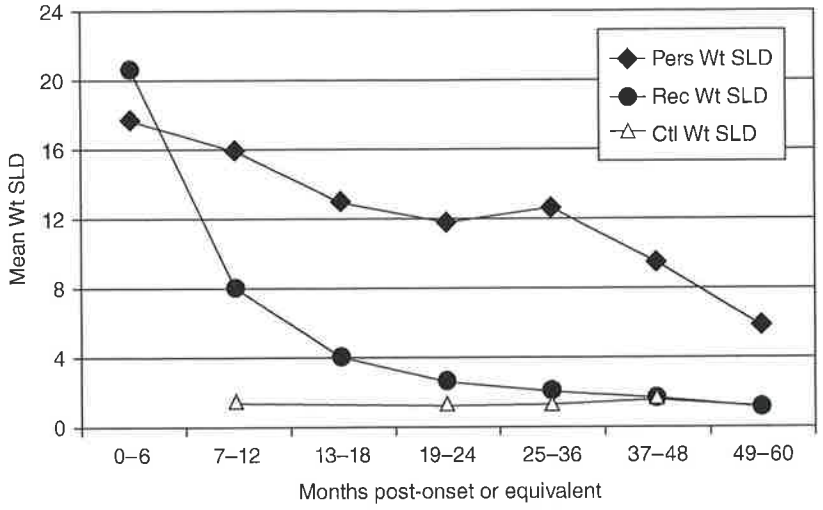

Figure 19.1 Trends in recovery from stuttering. Note the rapid decrease in stuttering for the "recovered group" (●), while a slower decrease is noted for the "persistent group" (◆). The control group shows little change (△).

how it develops over time, and how it is either different from, or similar to, nonstuttering disfluent children. The findings are summarized in Table 19.4. Once again, the contributions of Yairi, Ambose, and colleagues have left a mark on the understanding of stuttering in children.

19.3.2 *Longitudinal Studies with Older Children*

Beyond the work of Yairi and colleagues at the University of Illinois, a multi-year, longitudinal study has been taking place at Purdue University. Their studies are based on a multifactorial dynamic pathways (MDP) model of stuttering which hypothesizes that stuttering is a heterogeneous disorder that begins as an impairment in speech sensorimotor processes and then is strongly impacted by motor, language, and emotional components (Smith & Weber, 2017). By studying these factors over time, they have found predictors that show which children will likely continue to stutter and which children are more likely to recover. These researchers tracked two cohorts of children who stuttered and persisted (CWS-p) over 5 years beginning at age 4 or 5 and being followed until age 9 or 10. The importance of this study lies in that they also tracked children who stuttered and recovered (CWS-r) and a nonstuttering control group (CWNS). These findings can further predict which children are stuttering versus those who do not stutter, and to predict which diagnosed children are more likely to recover from stuttering. This is an important point in that children who participated in this study were evaluated by two measures of stuttering, the Test of Childhood Stuttering (TOCS; Gillam, Logan, & Pearson, 2009) and a Weighted Stuttering Index (Ambrose & Yairi, 1999). Results

Table 19.4 Other Contributions of Yairi, Ambrose, and the Illinois Longitudinal Studies (Yairi & Ambrose, 2005).

- CWS have more nonfluencies than CWNS.
- CWS have more repetitions per unit than CWNS.
- CWS have more prolongations than CWNS.
- All disfluency types noted in CWS were also noted in normally disfluent children.
- Children have a significant awareness of their stuttering as early as 5 or 6 years, and many even earlier.
- Children who develop into CWS have faster speech rates than CWNS.
- The proportion of SLD to overall disfluency is about 65% in CWS.
- Stuttering may begin in any mode (mild, moderate, or severe).
- The majority of stuttering begins near a period of stress (emotional, linguistic, physical, etc.).
- Secondary symptoms may accompany early stuttering, but were noted in only about 50% of cases.
- Parental ratings of stuttering (of their children) change in the same manner that %SLD changes.

indicate that a Weighted Stuttering Index Score of 10 or higher at age 4 or 5 was a strong predictor of persistent stuttering. In addition, ratings of stuttering severity were made on an ordinal scale by both an experienced speech-language pathologist and a parent. Correlations at the end of the study showed a statistically significant correlation between the speech pathologist's rating of stuttering and both the TOCS and Weighted Stuttering Index. The correlations with parent ratings were not statistically significant. This shows the validity of the ratings by an experienced speech-language pathologist, but the true purpose of these longitudinal studies was to find predictors of persistent stuttering in young children.

The results of the 150 CWS and 70 controls indicated that CWS-p had less mature linguistic systems as tracked through event-related potentials (ERPs) than either the CWS-r or CWNS. In addition, neurophysiologic signals were measured through regional blood flow studies in these children using functional near-infrared spectroscopy (fNIRS). Three areas of the brain were identified as being important for speech production that were differentially distinguishable between CWS-p and CWNS. A later follow-up study was also 71% correct at identifying CWS-r as CWNS based on fNIRS. These predictions are based on differences in activity in the left inferior temporal gyrus, left premotor cortex and left superior temporal gyrus. The results of the Purdue studies show that physiological measures can predict which children are more likely to stutter persistently.

Children were also assessed for temperamental qualities related to emotional reactivity and self-regulation. The study made use of physiological measures (heart rate, etc.) to verify the children's emotional responses to speech tasks and later compared the results to behavioral assessment tools such as the Children's Behavioral

Questionnaire (CBQ; Putnam & Rothbart, 2006). The results indicate higher arousal levels in CWS than CWNS during speech tasks, even though there was no difference between the groups at baseline. Another part of their study revealed higher physiological responses in CWS when stuttering than in CWS when not stuttering. These findings indicate higher emotional reactivity (as measured by physiological measures and CBQ) in CWS than controls, and later found higher reactivity in CWS when stuttering than in CWS when not stuttering. There appears to be a measurable temperamental score difference between CWS and CWNS and measurable physiological/emotional reactions in CWS when stuttering.

Finally, the Purdue research team assessed motor speech abilities in these young children. Findings indicate a significant difference in motor speech abilities of CWS compared with CWNS, even when no stuttering was observed. The effects are even greater when motor and linguistic complexity is increased. These findings indicate less coordinated motor abilities in CWS (both CWS-r and CWS-p). Since this study was longitudinal in nature, children were tested over the years and it was found that CWS-r caught up in their speech motor development to CWNS, while the CWS-p still showed significant differences. Motor speech abilities are a key indicator of stuttering persistence.

The results of this multi-year study were also compared with practical tools used by speech-language pathologists in their assessment of suspected speech and language disorders. This was an attempt to allow the findings into the clinical realm and not just the research laboratory. The results found that low scores on articulation and phonological testing significantly correlated with persistent stuttering. Agreement with prior studies by Yairi and the Illinois longitudinal studies were found for gender (boys more likely to persistently stutter; girls more likely to recover), having a relative who stutters (CWS-p are more likely to have a close relative who stutters), and trajectory of stuttering (CWS-p are likely to show little change in stuttering over time). However, the Purdue study showed that severity of stuttering at age 4 and 5 was a strong predictor of persistent stuttering. This is in contrast to the Yairi studies, which did not show stuttering severity at age 2 or 3 to be a predictor of persistence.

Overall, the search for a valid regression model to predict stuttering has made significant strides through the Illinois and Purdue studies. Both validate the need for a comprehensive assessment by skilled speech-language pathologists to identify and predict the course of stuttering in young children.

19.4 Causes of Stuttering

Throughout history, there has been a tremendous interest in the cause of stuttering. For many years, causality has been attributed to single causes, such as neurological theories (e.g., Cerebral Dominance Theory; Orton & Travis, 1929), inheritance/genetic theories (e.g., Felsenfeld, 2002), environmental and learning theories (e.g., Diagnosogenic Theory; Johnson, 1942), theories that rely on linguistic breakdowns as a cause of stuttering (e.g., Bernstein Ratner &

Silverman, 2000), and theories that rely on cognitive/planning breakdowns as a cause of stuttering (e.g., Covert Repair Hypothesis, Postma & Kolk, 1993). Most of these theories have lent support to understanding stuttering, and most have served as building blocks for today's more current view of stuttering. Modern theories are generally multifactorial in nature and will be discussed later in this chapter.

The one theory that has stirred quite a bit of interest, though, in the past decade or two, has really centered on a neurological basis for stuttering. Rapid advances in imaging techniques have led to an explosion of data in this area. Positron emission tomography (PET) studies have found that there is decreased blood flow in the left frontal and left temporal language centers when stuttering was observed in PWS (Pool, Devous, Freeman, Watson, & Finitzo, 1991). In addition, Wu et al. (1995) found decreased blood flow in the left caudate nucleus of the basal ganglia. Fox et al. (1996) found additional activity in the right hemisphere as well as the in the motor areas of the cerebellum. More recently Fox et al. (2000) found decreased activation in the right superior and middle temporal gyri. These studies all seem to indicate an underlying neurological cause for stuttering. At this point, however, it is not perfectly clear whether these differences are a cause of stuttering, or whether they are a reaction to stuttering.

Advances in science have led to the combining of findings in neurology and genetics. Certain genetic profiles have been identified in stuttering. Recent study has connected lysosomal dysfunction and its effect on the organization of speech neuronal circuits. This study is the first to identify links between gene mutations and problems in brain connectivity in stuttering (Benito-Aragon et al., 2020).

19.4.1 *Multifactorial Theories*

As noted earlier, today's most popular theories of stuttering are multifactorial in nature. One of the earliest yet simplest of these theories is labeled as the Demands and Capacities Model (Starkweather & Gottwald, 1990). In this model, the genetic contribution to stuttering is considered as the inherited capacity of an individual to speak fluently. In this model, each individual is born with various levels of innate capacity to speak fluently. Some have considerably less of this fluent speech capacity than others, which is consistent with studies that show higher prevalence of stuttering within family groups (Felsenfeld, 2002; Howie, 1981). This genetic predisposition then interacts with varying degrees of environmental demand. This demand can come from increased linguistic demand to use longer and more complex utterances, increased social demands to speak in more demanding and difficult situations, increased motor demands to speak faster or with more rapid movements, or any other type of environmental demand. In this model, whenever environmental demand exceeds genetic capacity, fluency can break down (see Figure 19.2). Thus, a person with little genetic capacity for fluent speech may never develop stuttering if environmental demands were kept very low. On the other hand, a person with quite a

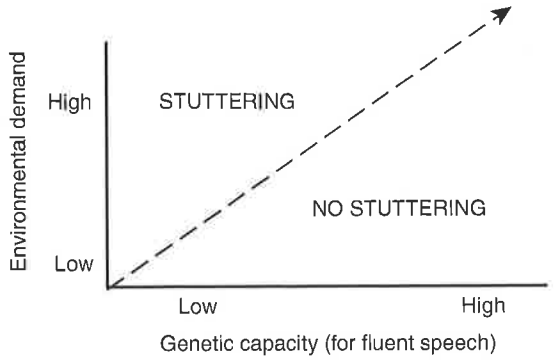

Figure 19.2 The demands and capacities model—whenever demand exceeds capacity, stuttering can occur.

bit of genetic capacity for fluent speech could develop stuttering if they continuously faced very high environmental demands.

The simple model proposed by Starkweather and Gottwald is a forerunner to the many other multifactorial models that exist today. These include the neuropsycholinguistic model (Perkins et al., 1991) that expands upon the multiple factors leading to stuttering, but adds a component of internal time pressure to produce fluent speech as a key to whether nonfluent speech will be either stuttered or disfluent. Smith and Kelly (1997), in their multifactorial, dynamic model of stuttering and their later MDP (Smith & Weber, 2017), add the synergistic aspect of various levels of breakdown that can lead to stuttering. These factors include central and peripheral nervous system correlates, as well as motor indices of speech production. Conture et al. (2006) add emotional and temperamental components to the genetic capacities and environmental demands described earlier to provide a more thorough model of how stuttering develops. In summary, today's theories of stuttering account for more factors, and view stuttering as a more complex phenomenon than earlier theories of stuttering.

19.5 Treatment Techniques and Efficacy

With current theories of stuttering becoming more complex in nature, there are multiple measures to treat stuttering and document success. Within this context, there is also a great deal of emphasis on "evidence-based" practice, treatment outcomes, and other hallmarks of effective and efficient therapy (e.g., Sackett, 1998). This has certainly had a significant influence in the treatment of stuttering and other fluency disorders. This is magnified in the debate between behaviorally based therapy versus more constructivist-based interventions. Traditionally, stuttering therapies have been broken into two categories: fluency shaping and stuttering modification (see Table 19.5).

Table 19.5 Major Differences Between Fluency Shaping and Stuttering Modification Therapies.

Aspect of strategy	*Fluency shaping*	*Stuttering modification*
Primary goal	Modify all speech	Modify moments of stuttering
Role of clinician	Reinforce technique use	Educate, desensitize, and counsel
Data tracking	Highly objective	More qualitative
Primary basis of success	Reduction/elimination of stuttering	Functional communication

19.5.1 *Fluency Shaping*

Fluency shaping strategies of therapy are based on the premise that the clinician should guide the PWS through a hierarchy of tasks while speaking in a manner that is "incompatible" with stuttering. Many of these strategies are listed in Table 19.1. The efficacy of this treatment model is dependent upon the success of the client using the selected form of speech throughout *all* of their communication. These techniques may be a slowing of the rate by prolonging speech, taking longer pauses, modifying breathing patterns or other changes in the act of producing speech. Some therapies have used artificial devices to assist in this role. These devices include the use of delayed auditory feedback (DAF), frequency altered feedback (FAF), masking, rhythmic speech, and combinations of these techniques. These devices include microphone and speaker combinations that, through advancements in microprocessor technologies, have become as small as the tiniest "in-the-canal" hearing aids. These devices are used to simply change speech to a pattern that reduces stuttering. Consistent with fluency shaping approaches, the goal is to modify the way a person speaks so that they can eliminate or greatly reduce stuttering. The role of the clinician is to reinforce correct use of the technique, build therapeutic hierarchies, and track data.

The issue of treatment efficacy is handled in a very straightforward manner in fluency shaping therapies. The validity of the therapy is simply ensured by the reduction and/or elimination of stuttering events that can be readily detected by observers. There has been a great deal of attention paid to the documentation of outcomes using fluency shaping therapies in the literature. A great deal of these data come from the efforts of the Lidcombe therapy consortium operating out of Australia (Onslow, Packman, & Harrison, 2003). The Lidcombe Program is a behaviorally based stuttering intervention program that lists its primary goal as the elimination of stuttering (Onslow et al., 2003). This is accomplished through a parent-training program that teaches parents to reinforce unambiguous fluent speech. The reinforcement of fluent speech by parents has shown to be highly successful in eliminating stuttering in young children. A meta-analysis of the success

of the program (Jones, Onslow, Harrison, & Packman, 2000), indicated that 250 out of 261 children who began the Lidcombe treatment program before the age of 6 met the objective of near-zero stuttering. Furthermore, the median number of sessions to meet this goal was 11 sessions. Based upon the success of this model, it is clear that fluency shaping strategies can be effective for the treatment of young children who stutter. Other successful fluency shaping strategies include Extended Length of Utterance (ELU; Costello, 1983), Gradual Increase in the Length and Complexity of Utterances (GILCU; Ryan, 1974), and Prolonged Speech (the Camperdown Program; O'Brian, Onslow, Cream, & Packman, 2003). Although assorted other measures were used to evaluate success, the primary component validating success in these programs was a decrease in % SS.

19.5.2 *Stuttering Modification*

Stuttering modification refers to a group of therapies initiated by Charles Van Riper (see Van Riper, 1973, for a review) that was based upon the concept of limiting the effects of stuttering. To many individuals, this may mean stuttering less severely, while to others it may mean understanding and coping with stuttering. The key components in stuttering modification therapies include the *identification* of stuttering and associated behaviors, *desensitization* to stuttering, variation or *modification* of the speech signal to a method that greatly reduces the degree, severity and tension of stuttering, and *stabilization* of the techniques. As noted in Table 19.5, the role of the clinician is to provide education and counseling for the PWS. Following the identification phase of therapy, the client is trained to become desensitized to the effects of stuttering. This takes place through a series of exercises to reduce the impact of stuttering. This may include tasks such as advertising stuttering (telling others that you may stutter) or voluntary stuttering (stuttering on purpose without loss of control; Dunlap, 1932) to minimize the anxiety and fear of stuttering. In the stabilization phase the PWS modifies their speech to lessen the severity of stuttering through cancellations (regrouping and modifying stuttering after it occurs), pullouts (modifying stuttering during the moment when it occurs), and preparatory sets (changing speech to lessen the likelihood and severity of stuttering just prior to stuttering occurrences). These strategies are then stabilized and used in increasingly more challenging tasks and situations.

The efficacy of these types of treatments, whether in their pure form or hybrids of the original form, is a bit more contentious in their measures of efficacy. That is, efficacy is not measured only by a decrease in stuttering, but effectiveness may be measured by other factors that may be internal to the PWS. For example, effectiveness of treatment may be marked by the PWS feeling better about themselves, avoiding fewer communication opportunities, having increased self-esteem, or other improvements that are not as readily observable. Programs that have been evaluated in this manner include the Successful Stuttering Management Program (SSMP; Blomgren, Roy, Callister, & Merrill, 2005), the ISTAR Comprehensive Stuttering Program (Kully, Langevin, & Lomheim, 2007), and the family-focused treatment approach for children (Yaruss, Coleman, & Hammer, 2006). Although

these programs did not all meet the strict criteria of eliminating stuttering as established by most fluency shaping programs, they did show gains in fluency and also showed improvements in other measures including anxiety and avoidance measures. In summary, this method showed successful therapeutic outcomes in the goals that were established by each program's philosophy. That is, the effectiveness of these programs was measured by their clients' ability to stutter less severely and eliminate various handicapping conditions of stuttering.

Updated approaches that focus on acceptance of stuttering have also emerged. Avoidance Reduction Therapy for Stuttering (ARTS; see Sheehan & Sisskin, 2001, for review) is a treatment that focuses on "letting your stutter out" and not engaging in any of the secondary behaviors that might emerge from avoiding stuttering. People participating in ARTS focus not on avoiding stuttering, but on embracing stuttering on the actual word one is trying to say. This approach is meant to reduce the "fight" against stuttering and result in a more forward-moving speech.

Another approach that focuses on approach and not avoidance is cognitive-behavioral therapy (CBT; see Menzies, Onslow, Packman, & O'Brian, 2009, for review). In this model, the focus is on reframing less helpful thoughts about stuttering (e.g., black and white thinking, catastrophizing) that may lead to avoidance of speaking situations. Clients are guided to look for evidence to support their thoughts and to reframe them in a more productive manner. Narrative therapy is an additional approach that focuses on reframing thoughts about stuttering by rewriting one's story of stuttering (DiLollo, Neimeyer, & Manning, 2002). Clients create characters to externalize and objectify their stuttering and work to rewrite the story of this character over time.

Acceptance and Commitment Therapy (ACT) is a stuttering treatment that focuses on thoughts, but on accepting those thoughts rather than trying to change or reframe them (Beilby & Byrnes, 2012). It focuses on the client defining their values, and making sure that their goals fit within their values. For example, a person who values spontaneous communication may have goals to openly stutter rather than to use fluency shaping methods to avoid stuttering. Clients also focus upon being flexible and having a positive self-concept in spite of stuttering.

Recently, meta-analytic studies have been implemented to examine the success of stuttering intervention. When applied to successful outcomes in young children who stutter, a meta-analytic study by Herder et al. (2006) showed that treatment is superior to no treatment and that no method is superior to others. A recent meta-analytic study explored trends in treatment for adolescents and found moderate or greater effect sizes for various treatments as diverse as fluency shaping, awareness training, and modified breathing (Murza, Vanryckeghem, Nye, & Subramanian, 2019). Years have passed since the same strategies were employed for adults, but Andrews, Guitar, and Howie (1980) found that interventions with the greatest effect were prolonged speech, gentle onset, and rhythm. Furthermore, results found the best predictor of treatment efficacy was the number of hours spent in therapy. These various studies have used different criteria for inclusion in their analyses, but they seem to show that treatment can be effective for stuttering;

however, the key dependent variables determine the success of each intervention strategy. Basically, treatments aimed at reducing stuttering will reduce stuttering, but the debate remains whether this is the most valid measure of success in stuttering treatment. The constructivist view would argue that QoL and personal validation of gain are truly the key variables of success in stuttering treatment.

19.5.3 *Pharmacological Treatment*

In recent years, various different pharmaceutical agents were introduced to treat stuttering. These drug therapies can be grouped into several classifications that include dopamine D2 receptor blockers, such as haloperidol; norepinephren reuptake inhibitors, such as desipramine; serotonin selective reuptake inhibitors, such as clomipramine; and GABA selective receptor modulators, such as pagaclone. A review of the effectiveness of these drugs (Maguire, Yu, Franklin, & Riley, 2004) indicates that although these drugs may either moderate stuttering or decrease anxiety surrounding stuttering, most are not recommended at this time due to limited effectiveness or substantial negative side-effects. The drug therapy that appears to show the most promise at this time is pagaclone, which has reported some effectiveness after completing multi-center phase II trials. At this point, there are some promising but still unconfirmed effectiveness issues regarding pharmaceutical intervention for the treatment of stuttering.

19.5.4 *Fluency Enhancing Devices*

As noted earlier in this chapter, there are devices that improve fluency in many PWS. Over the years, these have been used as adjuncts to therapy (e.g., Ryan & Van Kirk, 1974); however, recent advances in microelectronics have brought about devices that are used all of the time, rather than just as an aid to assist in achieving fluency. The most popular of these devices in the SpeechEasy, which combines DAF and FAF in a very small portable package that can all fit in the ear. A series of studies by the developers report impressive gains of fluency (e.g., Stuart, Kalinowski, Saltuklaroglu, & Guntupalli, 2006); however, reports by others (Molt, 2007; O'Donnell, Armson, & Kiefte, 2008) indicate less than impressive long-term results and limitations on out-of-clinic success. Although fluency enhancing devices can serve as a valuable adjunct to speech therapies, their long-term efficacy has yet to be established.

19.5.5 *Evolution of Preschool Stuttering Treatment*

Preschool stuttering treatment reflects focus on the family as the center of treatment. Treatment methods have evolved from indirect to more direct. Indirect methods focus on family modifications to speech rate and demands, to be more in line with the child's presumed capacities. Offshoots of this model, such as the Palin Parent–Child Interaction (PCI) Therapy approach, employ modifications to family speech but also focus on more direct treatment surrounding communication, such as

directly working to build a child's confidence with speaking (Kelman & Nicholas, 2008). As mentioned, the Lidcombe program offers the most direct approach to managing specific moments of stuttering rather than overall communication. This divide between focus on stuttering vs. focus on communication effectiveness is another reflection of the behavioral vs. constructivist view of stuttering.

In 2015, a groundbreaking study led to strong conclusions regarding preschool stuttering therapy. In a treatment study conducted on 199 preschoolers who stuttered, participants were randomly placed in either a direct Lidcombe-based program or an indirect RESTART-Demands/Capacities Model approach (de Sonneville-Koedoot, Stolk, Rietveld, & Franken, 2015). Results showed that while direct approaches worked best within 3 months of stuttering onset, both direct and indirect approaches were equally successful at 18 months since onset. Results of this study give credence to the value of early intervention for stuttering treatment, regardless of type of approach.

19.6 Developmental Trends in Stuttering and Stuttering Theory: Yesterday and Today

It is clear from this discussion that there are multiple factors that led to the present understanding of stuttering. Theories of the past have tried to find a single cause for stuttering, while today's theories are mutifactorial in nature. A result of this is that today's stuttering researchers are exploring multiple contributing factors of stuttering and subgroups of stuttering. Within this exploration, the contributions of early pioneers such as Charles Van Riper and Oliver Bloodstein are still relevant.

Van Riper (1982) classified the development of stuttering into tracks, based upon the course of development he and his workers observed among the records of 300 stuttering clients first seen in childhood, 44 of which he followed longitudinally. Although his work lacked the scientific rigor called for in today's refereed journals, Van Riper identified significant patterns of development that are echoed in the current epidemiological research. From his client files, Van Riper was able to identify four tracks of stuttering development. Parallels can be seen between each of the tracks and types of stuttering that clinicians and researchers alike have identified in their work today. Van Riper's Track I stutterers appear to be the same as what is today known as resolved and unresolved cases of developmental stuttering. Track II mirrors what to some today would be known as cluttering (Van Riper even suggests that some of the cases in Track II, whom he says all turn out to be stutterers, might in fact have cluttering characteristics as well), and to others, who do not include language difficulties as a component of cluttering, perhaps children who stutter with concomitant speech and/or language disorders. Track III in some cases bears similarity to psychogenic stuttering, yet is more reflective of Track I stutterers who begin stuttering with severe blocks rather than easy repetitions. Track IV by description mirrors what we know today as a conversion reaction for secondary gain. It is important to note, however, that Van Riper is clear that his

tracks are merely examining *patterns* of stuttering development rather than possible etiology. Nonetheless, Van Riper saw trends that researchers continue to see today. In the current stuttering literature, possible subgroups of stutterers are suggested in the discussion and/or conclusion sections of many research articles (Schwartz & Conture, 1988; see Yairi, 2007, for a review).

Bloodstein (1995) also proposed four phases of stuttering after following 418 stutterers over a six-year period. However, his phases are less a reflection of specific subtypes of stuttering and more a tracing of stuttering's development from early stages in preschool to more confirmed and severe cases of stuttering in adulthood. Although the development of stuttering can certainly be traced through such stages today in many cases, Bloodstein's continuity hypothesis may have reflected the most foresight into how we view nonfluencies today, particularly during preschool development, when the lines between disfluency and chronic patterns of stuttering can often become blurred:

> The question, quite simply, is whether we are dealing with a problem like a broken collarbone or a case of pneumonia, in which the diagnosis is either yes or no, or whether stuttering is more like hearing loss, high blood pressure, emotional maladjustment, mental retardation [now intellectual disability], or innumerable other ills that merge by fine degrees of normal. The continuity hypothesis holds that stuttering belongs to the second group. (p. 404)

Both Van Riper and Bloodstein saw anticipatory struggle playing some role in stuttering, but not explaining the entire disorder as was originally proposed by Sheehan (1953). Bloodstein (1995) pointed out that speech pressures may (or may not) come from within a child's personality. Following this trend, stuttering researchers today recognize the contribution of multiple factors to the development and maintenance of stuttering (e.g., Conture et al., 2006; Perkins et al., 1991; Smith & Kelly, 1997). Currently, research has been ongoing regarding the possible sensitive temperaments of individuals who stutter, and significant differences in the sensitivity traits of preschoolers who stutter. Specifically, Anderson, Pellowski, Conture, and Kelly (2003) administered a behavioral checklist to parents of 31 CWS between 3 years and 5 years, 4 months of age, and 31 age-matched controls. Significant differences were found in parental responses in three areas: hypervigilance, nonadaptability to change, and irregular biological functions. The authors contend that these three differentiating temperamental factors may be related to differences in those preschoolers who recover from stuttering and those who do not. As with Van Riper and Bloodstein, the authors recognize the contribution of such factors as temperament as significant, but not complete enough to explain the development of stuttering in all children who stutter. More recent study has advanced to examining a preschool child's emotional and linguistic capacities compared with the emotional/linguistic demands of speaking situations. The model that proposes this relationship is known as the dual diathesis stressor model. In a study of a small group of preschoolers with persistent stuttering, recovered stuttering, and no stuttering, Hollister, Owen Van Horne, and Zebrowski (2017)

found that grammatical abilities served as a protective factor in persistent disfluency. Further investigation of the emotional component by the Purdue longitudinal studies verified the impact of temperament on stuttering.

In later years, Bloodstein (2002) proposed incipient stuttering as a language disorder, possibly related to retrieval, syntax, or "motor planning of a phrase or sentence." Bloodstein proposed that what first sold him on this idea were two things: first, the fact that when children repeat words, it indicates that they are not having difficulty saying the word; and second, the fact that stuttering rarely occurs at ends of words; therefore, incipient stuttering must be related to some type of formulation issue, be it syntactical or word retrieval. This concept seemed to arrive in the midst of the ongoing research regarding the relationship between mean length of utterance, utterance complexity, and stuttering (Bernstein Ratner & Sih, 1987; Gaines, Runyan, & Meyers, 1991; Tetnowski, 1998; Zackheim & Conture, 2003). While much of what Bloodstein contends is true, in that the majority of stuttering does not occur at the ends of words, increased incidences of cases of word-final disfluencies, including word-final syllable and sound repetitions, prolongations and blocks are emerging in the literature. Many of these cases are emerging among those who in fact would have concomitant language disorders, and/or other diagnoses, such as those with mental retardation (Stansfield, 1995) or autism spectrum disorders (Hietala & Spillers, 2005; Scaler Scott, Grossman, Abendroth, Tetnowski, & Damico, 2006; Sisskin, 2006). Increasing evidence supports the hypothesis that these atypical disfluencies may be related to difficulties with formulation (Humphrey, 1997). Hakim and Bernstein Ratner (2004) pointed out that the measures used thus far to measure language development in children who stutter may not be specific enough to detect subtle difficulties. Likewise, in terms of cluttering, there is current debate as to whether true language disorders are part of the disorder, or whether the disorder is more in the area of executive functioning (Scaler Scott et al., 2018).

As technology and science has become more sophisticated, those subtle difficulties that in the past were unable to be detected by standardized language tests are starting to be recognized. Given differences in response to semantic violations between the groups, Kreidler, Hampton Wray, Usler, and Weber (2017) hypothesized that the maturation of semantic processing measured by event-related potentials (ERPs) was slower for 5-year-old children who persisted in stuttering compared with those who recovered from stuttering. This is the first study to confirm subtle differences in a specific area of language. Even if it cannot be characterized as an overt language disorder, it seems that subtle language differences may occur at some level in people who stutter, people with atypical disfluencies, and people with cluttering.

19.7 Summary

In summary, the field of stuttering continues to advance dramatically since earlier versions of the *Handbook of Speech Pathology* (Travis, 1957). Increased connection of neurology and genetics dominate the new findings in causality. Further findings

from two major longitudinal studies show increased understanding of central neurological function, peripheral neural function, motor abilities, temperament, and linguistic skills, and their relationship to persistence or recovery of stuttering. Recent research has supported the efficacy of treatment in young children. At the same time, more psychometrically advanced tools such as the OASES are finding ways to evaluate stuttering and other fluency disorders by looking at factors other than just the overt symptoms that mark stuttering. As a result of this onslaught of information, stuttering theories, and even the factors that define stuttering and other fluency disorders, are rapidly changing and developing to encompass these new advances. A great deal has changed in the field of stuttering over the past 40 years!

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