



MyLynel – Take along Clinical Therapy

Stuttering is a disorder in the rhythm of speech in which an individual knows precisely what he or she wishes to say, but at the time is unable to speak¹. Typically, a little less than 1% of any population stutters. Statistically 4-5% of preschool-aged children will have a period of stuttering though most will outgrow it. Most teen and adult persons who stutter started as young children but some began at a later age as a result of injury or disease.

The causes of stuttering are not well understood and therapy by a speech-language pathologist (SLP) is the primary treatment. Stuttering therapy developed out of the work of Charles van Riper who created Stutter Modification Therapy beginning in 1936. It focuses on reducing the severity of stuttering by addressing the portions of speech in which a person stutters so that they are smoother, shorter, and less tense and hard. This approach attempts to reduce the severity and fear of stuttering, and teaches stutterers to stutter with control, and not to make the stutterer fluent. Stutter modification generally does not eliminate stuttering events, but it helps minimize the impact and occurrence of stuttering². Since its creation, many clinicians have improvised on Charles Van Riper's basic strategies.

Fluency Shaping is a later development in speech therapy that focuses on changing all the speech of the person who stutters, and not just the portions of speech in which he or she stutters³. It involves teaching the stutterer to use a speaking style that requires careful and prominent self-monitoring. Techniques taught may include one in which the stutterer slows his speech down and “smoothes” out all his words², or one in which the physical mechanisms used in the speech production are retrained to use, for example, continuous phonation⁴. Fluency shaping therapies do not address attitudes, feelings, and self-concept



issues under the assumption that eliminating the stuttering will eliminate these issues. Today, most speech therapists use techniques from stutter modification and fluency shaping to help their clients.

Contemporary devices used to treat stuttering work by creating the “choral effect”, a phenomenon in which person's stutter decreases or ceases completely when he or she is speaking in concert with a group of others. These hearing aid-like devices consist of microphone that picks up (mostly) the user’s speech and plays it back in his or her ear with a time delay, frequency shifting or other audio alterations. Called altered audio feedback (AAF), the theory is that these devices change the way the brain produces speech and the work very well for some people. The drawbacks for these devices are that they are usually only effectively if worn in one ear and that the microphone picks up and alters all sounds which can be bothersome to the user; they also affect hearing in this ear. Also, studies on the long-term outcome of these devices have not been published⁵.

Though the processes are not well understood, stuttering is believed to be related to differences in the brains of persons who stutter. Neuroimaging studies have indicated that stuttering may be associated both with an abnormality in the white matter and deficient structural connectivity in the left-hemispheric speech areas and a right-hemispheric hyperactivity. Magnetoencephalography (MEG) studies have indicated that during stuttered speech production, neuronal communication between the left sensorimotor cortex, inferior frontal speech regions, and temporal regions appears to be abnormal^{6,7,8}. In terms of functional neuroanatomy, stuttering is characterized by an abnormal recruitment of right-sided cortical regions during speech preparation and production^{9,10,11}.

After speech therapy, increases in activation were detected in the left hemispheric speech and bilateral temporal areas^{14,15,16}. Fluency shaping



techniques and stutter modification (behavioural fluency treatment) therapy techniques reorganize neuronal communication between left-sided speech motor planning, motor execution, and temporal areas¹⁷. In short, therapy probably remodels brain circuitry close to the source of the dysfunction and its success may be related to the effectiveness in mobilizing well-functioning cortical substrate located in the vicinity of functionally impaired neural tissue. In post-treatment functional Magnetic Resonance Imaging (fMRI) scans, activation changes are seen to reflect therapy effects in cortical reorganization; in a relapse the cerebral activations return to their pretreatment pattern^{17,18}. This is biological evidence that sustained practice of fluency techniques is essential to maintain the cortical reorganization that provides fluency.

MyLynel brings together the concepts of self-therapy, self-monitoring, and analysis to help the user gain a better understanding of his or her stuttering and improve their fluency.

MyLynel Speech Measurements

MyLynel uses the Average Magnitude Profile to provide a real-time display of the user's spoken utterance to provide visual feedback. The user can visually compare their average magnitude profile to a reference utterance and alter their speech to match as required. A typical AMP is shown in Figure 1. The onsets, amplitude, duration and correlation between the two average magnitude profiles are compared and a score is assigned to the user's performance in each of these categories. The user can repeat the utterance and alter their speech according to their performance based on these scores. The AMP functionality is as follows:

- Record and Playback of reference utterances: Recordings of the utterances are stored on the device for user's reference and can be individually selected for practice.



- Calculation of the Average Magnitude Profile: A plot of the AMP of the reference utterance is displayed. The user records the utterance and his or her average magnitude profile is displayed superimposed the reference. The display of average magnitude profile conveys the locations and differences between the user and the reference with respect to intensity and duration.
- Automated scoring of the user’s utterance with the reference is important essential for providing an indication of where to improve and focus therapy skills.

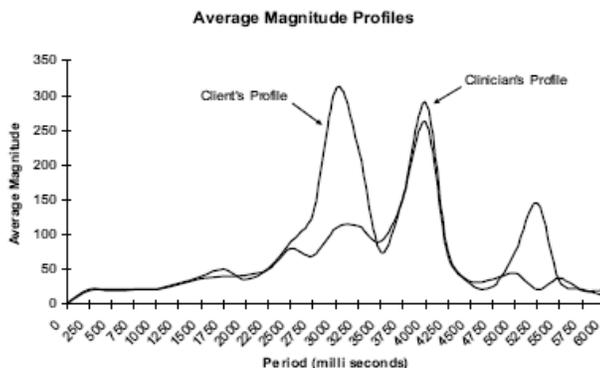


Figure 1: Average magnitude profile comparison

When you begin learning fluency shaping techniques you start off at a very slow speaking rate and gradually increase to normal as you are able to integrate the learned techniques into your normal speech. MyLynel allows you to objectively measure your speaking rate which is defined as the number of words spoken per minute, to provide feedback on practice and normal speech. Speaking rate is a basis of a stuttering treatment technique taught by SLP to control the cadence of speech. The algorithm implemented by MyLynel provides



a real-time value that can be used to practice maintaining a speaking rate within the limits set by their SLP.

Frequency of voicing is a speech measurement that can be used to guide speech production with right amount of voicing or energy. Most human speech sounds are generally classified as voiced or unvoiced. In voiced speech the vocal folds in the larynx are vibrating to form fundamental frequency of the sound. An example of a voiced sound is any vowel such as an /a/ as in bat; if you place your fingers on your throat while making a sustained /a/ you feel the vocal folds vibrating. Unvoiced sounds are made from pressure in the lungs without any vibration in the vocal folds. An example is the /h/ in hot; notice there is no vibration in the throat in a sustained /h/. MyLynel determines if a given segment of speech signal should be classified as voiced or unvoiced and displays a real-time display of voicing in the uttered phrase as shown in Figure 2. Values of '1' in the lower plot correspond to voiced segments of the speech plot on above. This measurement can be used to assist therapy techniques that are described herein.

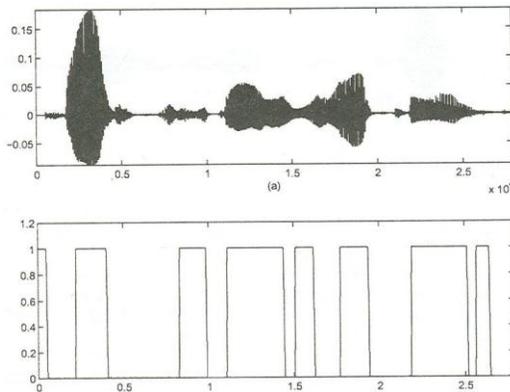


Figure 2:) Voice/unvoiced detection



Therapy Techniques

Self-therapy as pioneered by Malcolm Fraser, founder of the Stuttering Foundation of America and author of the book *Self-Therapy for the Stutterer*. It allows the user to practice and receive feedback on therapy techniques based on those taught by SLPs. In an Interview on stuttertalk.org, basketball great Bob Love talks about how he maintains fluency with daily practice of a set of speaking exercises.

Easy onsets are a technique taught in stuttering therapy where the phonation intensity is controlled. To practice it, take a relaxed breath with your diaphragm. Release a little air. Make an “ah” sound as you gradually increase your vocal fold tension. Feel your vocal folds begin to vibrate as you begin to say the word or sentence. Increase your vocal fold tension, until you reach normal speaking volume. At the end, gradually reduce vocal fold tension, until you reach silence. You should be able to say the practice phrase in one breath without reaching residual air. The built-in words are chosen for easy onset practice sibilants, stop-plosives and vowel-initials.

Continuous phonation is a technique that is at first exaggerated and abnormal but designed to eventually teach normal, fluent speech. It is also a technique that can be useful in very stressful situations. The goal is to “voice” as much speech as possible. Unvoiced consonants are replaced with similar voiced consonants so, for example, "pattie" becomes "baddy." (If you say each word slowly, with your fingers on your throat to feel your phonation, you'll feel your vocal folds switch on and off for "pattie," but stay on for "baddy.") If you shorten the consonants and stretch your vowels (producing a slower speaking rate), listeners won't hear the difference between "Patty" and "Baddy." With %Voiced measurements, MyLynel is able to determine the portion of a phrase is voiced to give feedback on your ability to integrate this technique during practice.



A Cancellation is a stutter modification technique used after a stuttering event has occurred. The speaker pauses a few seconds and then produces the word again in an easier manner that is slower and controlled and more fluent. .

For a Pullout, the speaker learns to catch themselves in a moment of stuttering and easily pulls themselves out of the stuttering event. The speaker must not rush through the rest of the word, but produce it slowly and in a controlled manner as when canceling a stuttered moment.

A Preparatory Set is used prior to the production of an upcoming word that the PWS anticipates will be stuttered. Using a slower rate and light articulatory contacts the speaker begins the first sound of the word slowly, smoothly, and easily. The word is completed in a slow, relaxed, smooth manner¹⁹.

Chunking is a technique there the speaker learns forward moving speech by grouping words together and adding pauses in places where natural breaks would occur.

Stretching teaches a slight stretch of the beginning sounds of words and phrases to ease into speech production.

Self-Monitoring and Analysis

A person who stutters wants to improve their fluency wants it to better in all aspects of their lives and not just in the confines of the speech clinic. To achieve this, an SLP may instruct the PWS to seek out speaking situations that are stressful to anyone such as public speaking or approaching strangers. MyLynel has a comprehensive recording function that will record eight sessions of up to ten minutes each for offline analysis. This allows the user to discretely record these real-world activities so that they can be reviewed later. The recordings will reveal how well the PWS was able to integrate speaking techniques learned in therapy into a real (and possibly stressful) situation.



In addition to recording real-world conversations, MyLynel includes reading passages have been selected because they are commonly used by SLPs in clinical therapy. This allows the user to practice and record these readings perhaps with emphasis on a therapy technique and then come back and review them to evaluate compliance.

Recorded sessions can be annotated with the results of a subjective questionnaire. This enables the user to track secondary behaviors that occurred during the conversation and a personal evaluation of progress. The recordings can be marked to identify stuttering position in the recorded sample with the type of dysfluency, if desired. The recordings and be analyzed for speaking rate and % voicing which can provide a measure for both the reading passages and the real-world situations.

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