HEARSAY

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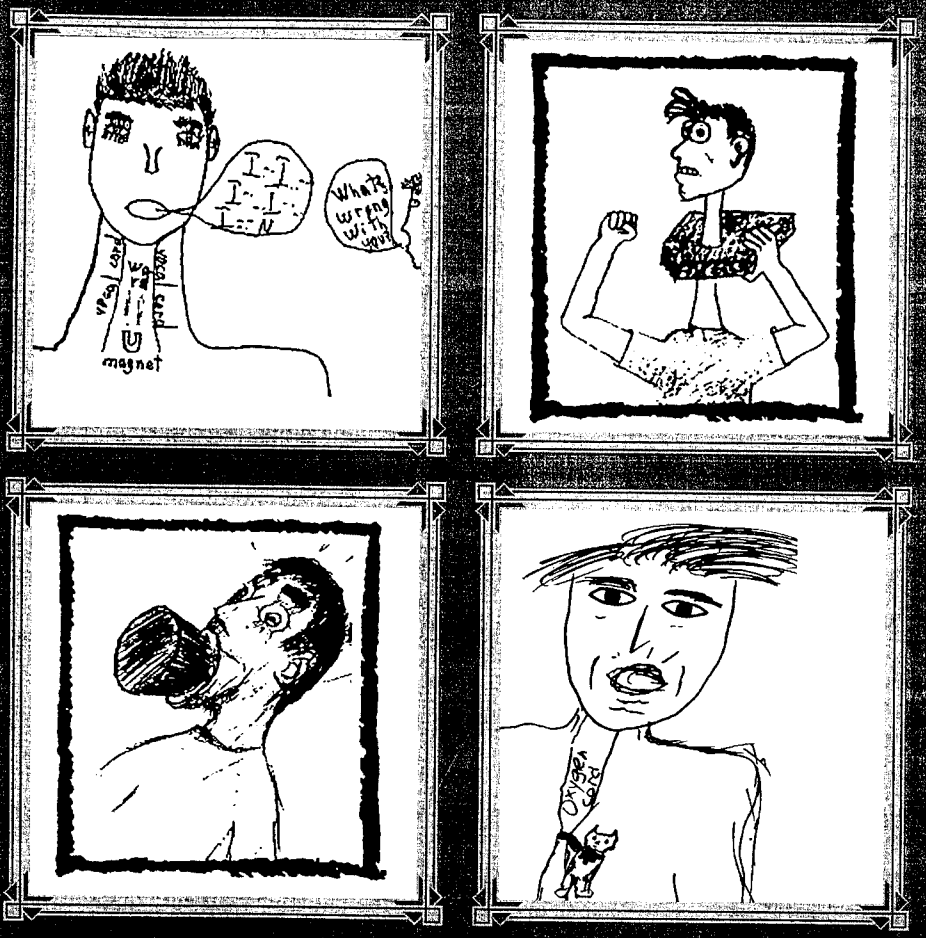

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The Research Basis for the SpeechEasy™ Device: A Response to Bryant

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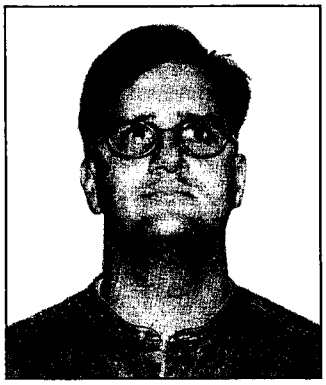

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SpeechEasy™ is a hot topic at the moment in the treatment of fluency disorders, with its immediate and dramatic effects demonstrated on national television. *Hearsay's* purpose is to educate and inform speech/language pathologists, audiologists and consumers. We do this by publishing both evidence based clinical articles and research. Leslie Bryant shared information about her clinical practice but did not describe any of the controls needed for the report to be evaluated as a research paper. The regular editors and guest consultants decided to publish Bryant's article in the interest of open discussion about a controversial topic. We then decided to balance the scales by writing an editorial that presents some of the research behind auditory feedback altering devices such as the SpeechEasy™. We will address the question of whether this particular device has been shown to promote long term, generalized fluency in persons who stutter.

Laboratory Studies of the Effects of Altered Auditory Feedback

Research that measures the effects of two types of altered auditory feedback (AAF), namely delayed auditory feedback (DAF) and frequency altered feedback (FAF), or a combination of the two, has a long history of use in stuttering therapy. Many of the reports on AAF provide results of research conducted under controlled conditions where speakers' productions of discrete tasks are carefully examined. For example, Zimmerman, Kalinowski, Stuart, and Rastatter (1997) reported that using DAF and FAF together resulted in more fluent speech during scripted telephone conversations. Armson, Foote, Witt, Kalinowski, and Stuart (1997), found a statistically significant reduction in stuttering frequency under FAF for their users regardless of number of listeners in their audience. Kalinowski, Stuart, Sark, and Armson (1996) reported that a slow rate of speech was not necessary for fluency improvement under AAF. Monaural presentation of DAF and FAF was found to be effective, but less effective than binaural alterations under read aloud conditions (Stuart, Kalinowski, & Rastatter, 1997). Studies such as these show the statistically significant effects of AAF on small samples of speakers in prescribed circumstances.

Other studies such as Hargrave, Kalinowski, Stuart, Armson, and Jones (1994) defined the parameters for the most effective presentations of FAF and DAF, relative to the magnitude of frequency alteration and the duration of feedback delay. Again, however, this study used a small sample and limited laboratory conditions in order to determine the technical parameters of AAF devices.

Is the SpeechEasy™ New and Different?

The SpeechEasy™ is an updated version of DAF and FAF devices. It is smaller and utilizes digital technology. It is not a novel idea, just a new technology. Stuart, Xia, Jiang, Jiang, Kalinowski, and Rastatter (2003) described the design and operating characteristics of the first self contained in-the-ear device to deliver AAF and its application for persons who stutter. The inconspicuous device incorporates a micro-digital signal processor core that delivers DAF and FAF signals in combination

or isolation. The device is programmed through a personal computer interface.

The Search for the Neurological Substrates of Disfluency

The SpeechEasy™ was an outgrowth of research that documented differences in brain activity in fluent and disfluent speakers fitted with AAF devices. In one study (Rastatter, Stuart, Kalinowski, 1998) electroencephalograms showed that persons who stutter displayed aberrant Beta band hyper-reactivity during non-altered auditory feedback, with the right temporal-parietal lobe region showing the greatest activity. Under conditions of DAF and FAF, these same speakers displayed a decrease in stuttering accompanied by a strong reduction in Beta activity for the right temporal-parietal electrode sites, while the left hemisphere posterior sites evidenced a larger area of reactivity. These findings suggested that an alteration in the electrical fields of the cortex occurred under DAF and FAF that more closely resembled the brain activity of non-stuttering speakers.

Studies that have used AAF to explore brain activity during stuttering don't necessarily have the primary purpose of documenting a reduction in stuttering when feedback devices are in use. Rather, the stated purposes are to reveal performance differences between persons who stutter and fluent speakers in auditory processing, speech timing, motor control of the speech mechanism, or regional activation in the brain during speech when using AAF.

Why Might Altered Auditory Feedback Induce Fluency?

Presently there are many theoretical explanations for why AAF induces fluency in laboratory studies. Armson and Kalinowski (1994) and Rastatter and Dell (1985) proposed that persons who stutter possess temporal motor deficits that are ever present and causal to stuttering but amenable to alleviation in the presence of AAF. Since this hypothesis has not been confirmed by empirical investigation, it's not possible to say how AAF affects changes in the temporal motor control needed for fluent speech. Another interesting hypothesis to explain the fluency enhancing effect of AAF is related to the phenomenon that fluency can be stimulated in persons who stutter when they speak in chorus with fluent persons. Kalinowski and Saltuklaroglu (2003) posited that the choral speech effect is a form of direct imitation that is possibly mediated at the neuronal level by "mirror neurons." Mirror systems link observations and actions and may be a neuronal substrate responsible for gestural language acquisition. The engagement of mirror systems allows gestural sequences, including speech, to be fluently replicated with proper timing. Speaking under conditions of altered feedback of one's own speech may stimulate the mirror neurons. To further explore the mirror neuron hypothesis, Saltuklaroglu, Kalinowski, Dayalu, Guntupalli, Stuart, and Rastatter (2003) asked adults who stutter to read aloud while listening to presentation of vowel sounds. In their study, hearing exogenous speech, not one's own speech, enhanced speakers' fluency, suggesting to the authors that the external speech source engaged mirror neurons for stuttering inhibition. Again, these interesting speculations do not yet provide testable hypotheses for determining exactly how AAF promotes fluency in persons who are disfluent.

The Need for Longitudinal Research

Very few studies have documented the effects of long term use of AAF devices. Van Borsel, Reunes, and Van den Bergh (2003) found that repeated exposure to DAF over three months with minimal clinical guidance resulted in significantly reduced stuttering. Despite the credibility of this study, three months is probably not a long enough period of fluency to impress most clinicians and consumers. Users' self-reports of their experiences with AAF, both pro and con, abound on the Internet, but documented evidence of the benefits of long term use of AAF is difficult to obtain. Bryant did not report the specific measurements used to demonstrate long term changes in her clients, which we hope will be forthcoming.

There is a need for research in the form of intrasubject time series measures to verify longitudinal changes (Ingham, 1997). Additionally, other fluency validation issues remain unresolved, such as how to measure instances of stuttering, whether to use the self-reports of persons who stutter or the judgments of other observers, and what behaviors might constitute "speech naturalness" (Cordes & Ingham, 1995; Cordes & Ingham, 1996; Ingham & Cordes, 1997; Ingham, Cordes, Ingham, & Gow, 1995; Ingham, Sato, Finn, & Belknap, 2001).

In conjunction with outcomes research, a variety of interesting exploratory research questions arises as clinicians and clients dialogue about their experiences with SpeechEasyTM. For instance, is it difficult to use the device where there is loud ambient noise? Is successful use of the device consistent or inconsistent? Does a speaker's ability to use the device diminish when the speaker is fatigued? The use of the SpeechEasy™ requires phonation -- do clients who experience blocking have difficulty adapting to the device? Do children's developing neurological and auditory systems render them less appropriate candidates for the device than adults?

A Word from the Detractors of Altered Auditory Feedback

Bloodstein (1999) offered three observations on why AAF may reduce stuttering temporarily. First, virtually any changes in manner of speaking can reduce disfluency. Second, AAF serves as a distraction from stuttering; any novel or absorbing stimuli will achieve the same result. Third, the beliefs and feelings of the person who stutters can influence attainment of fluency. An individual who

has faith in the device may achieve greater fluency based on increased self-confidence and the expectation that fluency is attainable.

Other observers point out that the use of AAF alone is in no way similar to teaching persons who stutter to use physiologically different speaking techniques to enhance fluency. As Stager and Ludlow (1998) demonstrated, DAF induced fluency in research participants but its use did not stimulate the use of airflow prior to voicing. Speaking under DAF conditions did not significantly increase breathy onsets. Without modifications in voice onset behaviors, some clients will not experience improvements in fluency. The same cautions hold true for other fluency enhancing speaking techniques, such as rate control, easy onset, continuous phonation, etc. These techniques need to be introduced during direct treatment, to meet each client's individual needs.

Opportunity Awaits

It has not yet been established that the SpeechEasy™ device insures generalized, long term fluency in persons who stutter. Researchers and clinicians interested in evaluating the effectiveness of the SpeechEasy™ in users' natural environments have the opportunity to explore new territory in fluency treatment. Leslie Bryant's perspective as one SpeechEasyTM distributor is the beginning of this area of inquiry. Clinicians' and consumers' self-reports are the first adjunct to laboratory studies of AAF and will help move the field toward longitudinal research that will apply more rigorous definition and control of the variables under investigation and will clarify the efficacy of the SpeechEasyTM device or other new technological innovations. •

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