

2009

**Harnsberger, J. D., Brown, W. S., Shrivastav, R., and Rothman, H. B. (in press) "Noise and tremor in the perception of vocal aging in males." *Journal of Voice*.** Summary: Objective/Hypothesis. To specify a set of acoustic cues for vocal aging and to establish their perceptual relevance. Study Design. Perceptual testing. Methods. To identify the acoustic and perceptual correlates of the aging voice, voice quality [in conjunction with speaking rate and fundamental frequency (F0)] was systematically manipulated using resynthesis to determine its effect on perceived age. Ten young male voices were resynthesized using two levels of noise (random modulation of F0 contour) and two levels of tremor (constant modulation of F0 contour with a low-amplitude wave) under a speaking-rate manipulation (an increase in speaking rate that is common to older male voices). These materials were submitted to 40 naive listeners in an age-estimation task. Two sets of comparison materials were also included for evaluation: unmanipulated samples from a 150 voice database of young, middle-aged, and older voices and disordered voice samples representing natural manifestations of the voice qualities of interest. Results. Speaking rate, highest degree of tremor, and highest degree of noise all shifted, in an additive manner, the mean perceived age of the young male voices by a maximum of 12 years on average; individual voices were observed being shifted by a generation. Fundamental frequency manipulations had no significant effect on perceived age. Conclusions. Voice quality (both tremor and noise) and speaking rate are all perceptually relevant cues of age in male voices.

2008

**Harnsberger JD, Shrivastav R, Brown WS Jr, Rothman H, Hollien H. Speaking rate and fundamental frequency as speech cues to perceived age. *J Voice*. 2008 Jan;22(1):58-69.** This study aimed to specify a set of acoustic cues fundamental to vocal aging and to establish their perceptual relevance, using acoustic analysis and perceptual testing. Three experiments were conducted to identify the perceptual correlates of the aging voice. The first experiment analyzed important voice parameters that signal a person's age for 16 older males and 14 younger males. In the second and third experiments, these acoustic patterns were systematically shifted through resynthesis to see if perceived age would be significantly influenced. In the second experiment, the older and younger male voices were resynthesized by manipulating speaking rate and fundamental frequency to shift the perceived age of the groups toward each other. In the third experiment, older and middle-aged male voices were resynthesized in a similar manner. In both perceptual studies, an age estimation task with naive listeners was used. The results of the first experiment showed that, in older speakers, sentence, word, and diphthong durations were all significantly longer and mean fundamental frequency was significantly higher than for the younger group. In the second experiment, only the manipulation of speaking rate resulted in a significant shift in perceived age, and it did so only for the older subjects. In the third experiment, a significant shift in age estimates was observed for the middle-aged, but not the older, voices when speaking rate was manipulated. The results of both perception tests suggest that speaking rate, but possibly not fundamental frequency, is a perceptually relevant cue to age in voice.

2007

**Brown WS Jr, Shrivastav R. Comfortable effort level in young children's speech. *Folia Phoniatri Logop*. 2007;59(5):227-33.** The variability in comfortable effort level across experimental sessions as assessed

by measures of speaking fundamental frequency (SFF) and vocal intensity (VI) has been reported for normal adult speakers. However, no such data are available for young children. The goal of this study was to determine the variability in SFF and VI seen in normally developing young children. Fifteen males and 14 females between the ages of 3 and 4 years were asked to repeat a vowel, a sentence, and four words at a comfortable speaking level on 3 separate days, each 1 week apart. SFF and VI were determined for each utterance. Statistical treatment of the data revealed that when combining all the data, there were no significant differences for mean SFF or VI across test sessions. However, the young females generally spoke with greater VI than young males. These results suggest that normal-speaking children at a very young age are, on the average, similar in the degree of variability to adults for SFF and VI across experimental sessions when asked to set their own level of output. These findings provide a baseline for the extent of variability in SFF and VI seen in normally developing young children.

**Wingate JM, Brown WS, Shrivastav R, Davenport P, Sapienza CM. Treatment outcomes for professional voice users. J Voice. 2007 Jul;21(4):433-49.** Professional voice users comprise 25% to 35% of the U.S. working population. Their voice problems may interfere with job performance and impact costs for both employers and employees. The purpose of this study was to examine treatment outcomes of two specific rehabilitation programs for a group of professional voice users. Eighteen professional voice users participated in this study; half had complaints of throat pain or vocal fatigue (Dysphonia Group), and half were found to have benign vocal fold lesions (Lesion Group). One group received 5 weeks of expiratory muscle strength training followed by six sessions of traditional voice therapy. Treatment order was reversed for the second group. The study was designed as a repeated measures study with independent variables of treatment order, laryngeal diagnosis (lesion vs non-lesion), gender, and time. Dependent variables included maximum expiratory pressure (MEP), Voice Handicap Index (VHI) score, Vocal Rating Scale (VRS) score, Voice Effort Scale score, phonetogram measures, subglottal pressures, and acoustic and perceptual measures. Results showed significant improvements in MEP, VHI scores, and VRS scores, subglottal pressure for loud intensity, phonetogram area, and dynamic range. No significant difference was found between laryngeal diagnosis groups. A significant difference was not observed for treatment order. It was concluded that the combined treatment was responsible for the improvements observed. The results indicate that a combined modality treatment may be successful in the remediation of vocal problems for professional voice users.

**CRARY, MICHAEL A.**

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2009

**Antonios N, Carnaby-Mann GD, Crary MA, Hubbard H, Miller L, Hood K, Sambandam R, Xavier A, Silliman S. Analysis of a physician tool for evaluating dysphagia on an inpatient stroke unit: The Modified Mann Assessment of Swallowing Ability. Journal of Stroke and Cerebrovascular Disease (In Press, March, 2009).**

**Carnaby-Mann GD, Lenius K, Crary MA. Update on assessment and management of dysphagia post-stroke. Northeast Florida Medicine. 2007;58:31-34.** Dysphagia (difficulty swallowing) following stroke is a common problem and is associated with significant morbidity. Early identification and management has been reported to result in improved outcomes for stroke patients and is now a

standard recommendation for all certified stroke centers in the USA. This article provides an update on issues surrounding current practices in screening, evaluation and treatment for dysphagia following stroke.

**Lenius K, Carnaby-Mann G, Crary M. The relationship between lingual-palatal pressures and submental surface electromyographic signals. J Oral Rehabil. 2009 Feb;36(2):118-23.** This study investigated the relationship between lingual-palatal pressures and submental surface electromyographic (sEMG) signals. During isometric and isotonic tongue press tasks, lingual-palatal pressures from the anterior, middle and posterior hard palate and submental sEMG signals were recorded. Peak values of both tasks and mean values of the isotonic task were analyzed using Pearson's correlations. The correlations ranged from slightly negative ( $r = -0.103$ ) between the posterior tongue bulb and sEMG peaks in the isotonic condition, to positive ( $r = 0.360$ ) between the posterior tongue bulb and sEMG peaks in the isometric condition. None of the correlations were statistically significant. Overall, the correlations between submental sEMG signals and lingual-palatal pressures were low. These results suggest that sEMG signals obtained from the submental region measure some of muscle activation during tongue press tasks, but are unable to capture discrete variations in lingual-palatal pressure.

2008

**Lagorio LA, Carnaby-Mann GD, Crary MA. Cross-system effects of dysphagia treatment on dysphonia: a case report. Cases J. 2008 Jul 30;1(1):67.** Traditionally, treatment of dysphagia and dysphonia has followed a specificity approach whereby treatment plans have focused on each dysfunction individually. Recently however, a therapeutic cross-system effect has been proposed between these two dysfunctions. At least one study has demonstrated swallowing improvement in subjects who completed a dysphonia treatment program. However, we are unaware of any evidence demonstrating the converse effect. In this paper, we present a case-report of a 74 year old male who demonstrated improvement in selected vocal parameters after completion of a dysphagia therapy program. Dysphagia therapy resulted in improved laryngeal function in this subject. Results implicate improved vocal fold tension with increased glottal closure. Further investigation into the potential for this cross-system effect is warranted.

**Carnaby-Mann GD, Crary MA. Adjunctive neuromuscular electrical stimulation for treatment-refractory dysphagia. Ann Otol Rhinol Laryngol. 2008 Apr;117(4):279-87.** Neuromuscular electrical stimulation (NMES) has been proposed as an adjunctive modality for the treatment of swallowing disorders. We present data from a prospective case series to define and measure effects of a systematic therapy for chronic pharyngeal dysphagia using adjunctive NMES. METHODS: Six adult patients with pharyngeal dysphagia received 15 sessions of a standardized protocol of swallowing exercises with adjunctive NMES. The patients completed clinical and instrumental baseline, posttreatment, and 6-month follow-up evaluations. Outcome measures included the proportion of patients who improved in clinical swallowing ability, functional oral intake, and change in body weight; patient perception of swallowing ability; and changes in kinematic aspects of swallowing. RESULTS: Significant change was demonstrated for clinical swallowing ability ( $p < .042$ ), functional oral intake ( $p < .02$ ), weight gain ( $p < .026$ ), and patient perception of swallowing ability ( $p < .043$ ). Hyoid and laryngeal elevation during swallowing demonstrated bolus-specific patterns of change. No patient experienced a treatment-related or swallowing-related complication. Patients (4 of 5) who were

followed out to 6 months after treatment maintained functional gains. **CONCLUSIONS:** A systematic therapy for chronic pharyngeal dysphagia using adjunctive NMES produced improvement in clinical swallowing ability and functional oral intake without significant weight loss or complications.

2007

**Carnaby-Mann GD, Crary MA. Examining the evidence on neuromuscular electrical stimulation for swallowing: a meta-analysis. Arch Otolaryngol Head Neck Surg. 2007 Jun;133(6):564-71.** To evaluate the effect of transcutaneous neuromuscular electrical stimulation (NMES) on swallowing rehabilitation. **DATA SOURCES:** MEDLINE, PubMed, CINAHL, NML, Cochrane Central Register of Controlled Trials, Cochrane Database of Systematic Reviews, doc online, Google, and EMBASE were searched for studies using NMES to treat dysphagia between January 1966 and August 2006. **STUDY SELECTION:** Included were published or unpublished, English-language, clinical trials with a quantifiable dependent variable. **DATA EXTRACTION:** Two researchers independently performed data extraction. A random-effects model was used to pool study results. The Cochran Q test was used to evaluate heterogeneity, and a funnel plot and Egger test were used to evaluate publication bias. A best-research synthesis using a methodological quality analysis was conducted. **DATA SYNTHESIS:** A total of 81 studies were reviewed. Seven were accepted for analysis. A significant summary effect size was identified for the application of NMES for swallowing (Hedges g, 0.66;  $P < .001$ ). Heterogeneity was significant for the combined trials ( $P < .10$ ). When 2 outlier trials were removed, heterogeneity was no longer significant ( $P < .08$ ). Publication bias was not identified on the funnel plot or Egger test ( $P = .25$ ). Best-evidence synthesis showed indicative findings in favor of NMES for swallowing. **CONCLUSIONS:** This preliminary meta-analysis revealed a small but significant summary effect size for transcutaneous NMES for swallowing. Because of the small number of studies and low methodological grading for these studies, caution should be taken in interpreting this finding. These results support the need for more rigorous research in this area.

**Yoshida M, Groher ME, Crary MA, Mann GC, Akagawa Y. Comparison of surface electromyographic (sEMG) activity of submental muscles between the head lift and tongue press exercises as a therapeutic exercise for pharyngeal dysphagia. Gerodontology. 2007 Jun;24(2):111-6.** The present study compared surface electromyographic (sEMG) activity obtained from the submental muscle group for a tongue press and a head lift exercise as potential therapeutic exercises for dysphagic elderly. **MATERIALS AND METHODS:** Fifty-three healthy volunteers with a mean age of 35.3 participated in this study. Subjects were required to perform an isometric task, pressing their tongue against the hard palate, and an isotonic task requiring sustained lingual force against the hard palate. Pressure sensors were used to measure the amount of lingual pressure against the hard palate. Submental sEMG data from these tasks were compared with those obtained from the isometric and isotonic aspects of a head lift exercise. **RESULTS:** No sEMG differences were identified between the isometric tongue press task and head lift exercise. Isotonic tongue press exercises resulted in significantly higher maximum and mean sEMG values compared with the isotonic head lift exercise ( $p < 0.05$ ). The submental sEMG activity from the tongue press exercise was equal (isometric) to, or greater (isotonic) than comparable muscle activation obtained during the head lift exercise. **CONCLUSIONS:** The tongue press exercise may be less strenuous than the head lift exercise while achieving the same therapeutic effect.

**Crary MA, Carnaby-Mann GD, Faunce A. Electrical stimulation therapy for dysphagia: descriptive**

**results of two surveys. Dysphagia. 2007 Jul;22(3):165-73.** Given the paucity of objective information on neuromuscular electrical stimulation approaches to dysphagia therapy, and the expanding utilization of this clinical approach, we designed and conducted two surveys to gather large-scale information regarding reported practice patterns, outcomes, complications, and professional perceptions associated with electrical stimulation approaches to dysphagia therapy. Self-administered questionnaires were mailed to 1000 randomly selected speech-language pathologists in each of two groups: (1) clinicians who had completed a formal electrical stimulation training course and were actively using these techniques, and (2) clinicians who were members of Special Interest Division 13 of the American Speech-Language and Hearing Association. Survey responses were anonymous and no incentive to respond was included. Acceptable response rates were achieved for both surveys (47% and 48%). Both groups of respondents were demographically similar and reported similar practice patterns. Stroke was the most common etiology of dysphagia treated with this approach. The majority of respondents identified no specific dysphagia criteria for application of electrical stimulation, used varied behavioral treatment methods, and did not follow patients beyond therapy. Clinicians reported positive outcomes with no treatment-related complications. Satisfaction with this approach was reported to be high among patients and professionals. Clinicians who did not report using these techniques indicated that they were waiting for more objective information on clinical outcomes and safety. Results of these surveys form an initial description of practice patterns and outcomes associated with electrical stimulation approaches to dysphagia therapy.

**Crary MA, Carnaby Mann GD, Groher ME. Identification of swallowing events from sEMG Signals Obtained from Healthy Adults. Dysphagia. 2007 Apr;22(2):94-9.** Surface electromyography (sEMG) is being used with increasing frequency to identify the occurrence of swallowing, to describe swallow physiology, and to treat impaired swallowing function in dysphagic patients. Despite this increased utilization, limited information is available regarding the validity and reliability of investigators and clinicians to interpret sEMG data in reference to swallowing. This study examines the validity and interjudge reliability of swallow identification using sEMG records obtained from healthy adults. Validity and reliability estimates were compared between experienced and naïve judges in the identification of swallows from graphic sEMG records. Multiple validity estimates were high, indicating a strong degree of accuracy in identification of swallows versus nonswallow movements from sEMG traces. Experienced judges were more accurate than naïve judges (classification accuracy: experienced = 90% vs. naïve = 81%;  $p = 0.006$ , kappa: experienced = 0.89 vs. naïve 0.62;  $p = 0.008$ ). Judges in both groups were more likely to classify swallows as nonswallow movements (false negatives) than to classify nonswallow movements as swallows (false positives). Interjudge reliability estimates indicated a high degree of agreement among judges in the identification of swallows versus nonswallow movements from the sEMG signal, with higher agreement among experienced judges (average kappa coefficient: experienced = 0.75 vs. naïve = 0.51). These results suggest that the sEMG graphic record is a valid and reliable tool for identifying normal swallows and that experience with this technique results in better identification and interjudge agreement.

**EDMONDS, LISA**

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2009

**Edmonds, L.A., Nadeau, S.E., & Kiran, S. (2009). Effect of Verb Network Strengthening Treatment (VNeST) on lexical retrieval of content words in sentences in persons with aphasia. Aphasiology,**

**23(3), 402-424.** Background: Verb Network Strengthening Treatment (VNeST) is a semantic treatment that aims to improve lexical retrieval of content words in sentence context by promoting systematic retrieval of verbs (e.g., measure) and their thematic roles—i.e., agent (doer of the action, e.g., carpenter, chef) and patient (receiver of the action, e.g., lumber, sugar). VNeST is influenced by Loverso and colleagues (e.g., Loverso, Selinger, & Prescott, 1979) who used “verb as core” treatment to improve sentence production with encouraging results, and McRae and colleagues who showed that verbs prime typical agents (e.g., pray-nun) and patients (arrest-criminal) (Ferretti, McRae, & Hatherell, 2001) and vice-versa (McRae, Hare, Elman, & Ferretti, 2005). Aims: There are four specific questions in this study. Does training a set of verbs using VNeST generalise to the ability to produce (1) an agent (carpenter), trained verb (measure), and patient (stairs) in response to novel picture stimuli and (2) an agent (nurse), untrained semantically related verb (weigh), and patient (baby) in response to novel picture stimuli? (3) Are generalisation effects maintained? (4) Does VNeST generalise to the ability to retrieve nouns and verbs not directly related to treatment items in single word naming, picture description, and connected speech tasks? Methods & Procedures: Four participants with aphasia participated. Participants received VNeST, which involves retrieval of agent-patient pairs (e.g., chef/sugar, surveyor/land) related to trained verbs (e.g., measure), twice per week. A single-participant, repeated probe, multiple baseline experimental design was used. Generalisation to sentence production for sentences containing trained verbs and untrained semantically related verbs was tested weekly. Outcomes & Results: Results demonstrated generalisation to lexical retrieval of content words in sentences with trained and untrained verbs across participants. Additionally, pre- to post-treatment generalisation was observed on single verb and noun naming and lexical retrieval in sentences across a variety of tasks across participants. Generalisation to connected speech was observed for three of four participants. Conclusions: Although preliminary, these results indicate that VNeST may be effective in promoting generalisation from single word naming to connected speech in persons with moderate aphasia. A number of clinical implications related to treatment efficiency are discussed.

2008

**Rogalski, Y., & Edmonds, L.A. (2008). Attentive Reading and Constrained Summarisation (ARCS) treatment in primary progressive aphasia: A case study. *Aphasiology*, 22(7/8), 763-775.** Background: Primary progressive aphasia (PPA) is a neurodegenerative disease characterised by isolated and gradual language decline that can negatively affect discourse. Behavioural treatments for PPA have typically targeted linguistic processes at the micro-structure (word or sentence) level rather than the macro-structure (discourse) level, with minimal generalisation to discourse. There is a growing consensus that non-linguistic mechanisms such as attention are imperative for complex language execution such as discourse. Intentional language use (Nadeau, Rothi, & Rosenbek, 2008) is another mechanism thought to promote language generalisation by encouraging verbal language to the exclusion of other modalities. Attentive Reading and Constrained Summarisation (ARCS) is a novel discourse-level treatment derived from cognitive principles and operating on macro-structure and micro-structure linguistic levels. Aims: In this case report of one participant with PPA we anticipated post-treatment discourse-level improvements in coherence, cohesion, and informativeness/efficiency with unlikely maintenance due to the neurodegenerative nature of PPA. Methods & Procedures: “Stanley”, a 76-year-old gentleman with PPA and concomitant attention impairments, received the ARCS treatment. ARCS focuses attention during reading and promotes intentional language use by summarisation with constraints. Outcomes & Results: Pre- to post-treatment and maintenance

improvements on coherence, cohesion, and percent correct information units were observed. Conclusions: The current findings are intriguing but must be interpreted with prudence given that this is a case study with limitations related to lack of experimental control. However, ARCS is a novel behavioural treatment for PPA and the post-treatment and 2-months maintenance results warrant consideration.

2007

**Edmonds, L.A. (2007). Automatic thematic role priming of related verbs in younger and older adults. *Brain and Language*, 103, 248-249.** Verbs are central to the semantics and syntax of a sentence via their relationship with their arguments/thematics. Online priming studies in young adults have found that verbs (arrest) provide immediate access to typical agents (policeman) and patients (criminal) by generating expectancies from a verb and its related thematic roles (Ferretti, McRae, & Hatherell, 2001) and vice versa (McRae, Hare, Elman, & Ferretti, 2005). These findings indicate a neural co-activation whenever either a verb or its closely related noun is selected in a relevant context. The specific aims of the current investigation are to (1) replicate agent and patient to verb priming results of McRae et al. (2005) in young adults (YA) and (2) investigate agent and patient to verb priming patterns in older adults (OA). It is hypothesized that older adults will show the same priming pattern as YA's, but they will exhibit overall slower reaction times.

#### **GERHARDT, KENNETH**

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#### **GRIFFITHS, SCOTT**

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#### **HALL, JAMES W 3rd**

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**McGuinness BF, Carroll CD, Zawacki LG, Dong G, Yang C, Hobbs DW, Jacob-Samuel B, Hall JW 3rd, Jenh CH, Kozlowski JA, Anilkumar GN, Rosenblum SB. Novel CXCR3 antagonists with a piperazinyl-piperidine core. *Bioorg Med Chem Lett*. 2009 Sep 1;19(17):5205-8.** High-throughput screening of an encoded combinatorial aryl piperazine library led to the identification of a novel series of potent piperazinyl-piperidine based CXCR3 antagonists. Analogs of the initial hit were synthesized via solid and solution phase methods to probe the influence of structure on the CXCR3 binding of these

molecules. Various functional groups were found to contribute to the overall potency and essential molecular features were identified.

**Grose JH, Mamo SK, Hall JW 3rd. Age Effects in Temporal Envelope Processing: Speech Unmasking and Auditory Steady State Responses. Ear Hear. 2009 Jul 23.** OBJECTIVE:: The purpose of this study was to determine whether temporal envelope processing is reduced in older listeners. Experiment 1 tested the hypothesis that older listeners exhibit reduced speech unmasking at higher modulation rates. Experiment 2 tested the hypothesis that auditory steady state response (ASSR) amplitudes are reduced in older listeners at high modulation rates. DESIGN:: Two groups of observers with relatively normal hearing (younger, mean age = 25.0 years and older, mean age = 68.7 years) participated in two experiments. Experiment 1 examined speech unmasking in modulated noise as a function of masker modulation rate (16 and 32 Hz) and target speech rate (normal and 33% time compressed). Experiment 2 measured ASSR amplitudes as a function of modulation rate (32 and 128 Hz) and carrier frequency (500 and 2000 Hz). RESULTS: Experiment 1 indicated that older listeners show reduced speech unmasking for normal-rate speech and reduced recognition of rapid speech in steady noise. However, for rapid speech, there is no age effect for speech unmasking and no difference in the magnitude of masking release as a function of modulation rate. In general, effects of listener age and masker modulation rate on the magnitude of masking release are observed only for normal-rate speech. Experiment 2 showed that the ASSR amplitudes of older listeners are reduced for a 128-Hz modulation rate but not for a 32-Hz modulation rate, irrespective of carrier frequency. CONCLUSION:: These results suggest that the reduced speech unmasking seen in older listeners for relatively slow modulation rates is not caused by deficits in envelope processing but rather is associated with the more constrained redundancy of the speech material available during the masker minima. Deficits in temporal envelope processing are evident in advanced age but only for relatively high envelope frequencies.

**Buss E, Whittle LN, Grose JH, Hall JW 3rd. Masking release for words in amplitude-modulated noise as a function of modulation rate and task. J Acoust Soc Am. 2009 Jul;126(1):269-80.** For normal-hearing listeners, masked speech recognition can improve with the introduction of masker amplitude modulation. The present experiments tested the hypothesis that this masking release is due in part to an interaction between the temporal distribution of cues necessary to perform the task and the probability of those cues temporally coinciding with masker modulation minima. Stimuli were monosyllabic words masked by speech-shaped noise, and masker modulation was introduced via multiplication with a raised sinusoid of 2.5-40 Hz. Tasks included detection, three-alternative forced-choice identification, and open-set identification. Overall, there was more masking release associated with the closed than the open-set tasks. The best rate of modulation also differed as a function of task; whereas low modulation rates were associated with best performance for the detection and three-alternative identification tasks, performance improved with modulation rate in the open-set task. This task-by-rate interaction was also observed when amplitude-modulated speech was presented in a steady masker, and for low- and high-pass filtered speech presented in modulated noise. These results were interpreted as showing that the optimal rate of amplitude modulation depends on the temporal distribution of speech cues and the information required to perform a particular task.

**van Zyl A, Swanepoel D, Hall JW 3rd. Effect of prolonged contralateral acoustic stimulation on transient evoked otoacoustic emissions. Hear Res. 2009 Aug;254(1-2):77-81.** Although the suppressive effect of the medial olivocochlear system (MOCS) on peripheral auditory active

mechanisms is well documented in humans, the effect of efferent inhibition over prolonged periods of acoustic stimulation is less well documented, especially as observed by transient evoked otoacoustic emission (TEOAE) suppression. The present study evaluated the relationship between the duration of contralateral acoustic stimulation and the suppression of TEOAE in 10 normal-hearing adults. TEOAE recordings with linear clicks (60 dB SPL) were measured at four intervals during 15 min of continuous contralateral white noise (45 dB SL), followed by two post-noise recordings. An identical within-subject control condition was recorded without contralateral noise. Experimental and control measurements were repeated three times, on separate days. Results revealed significant and sustained TEOAE amplitude reduction for the entire duration of contralateral stimulation. Suppression increased gradually for the duration of contralateral noise presented, but not sufficiently to be statistically significant. Three minutes after noise termination, TEOAE amplitudes increased to values significantly above control recordings. The MOCS is able to sustain suppression over a prolonged duration of contralateral stimulation, supporting its role as an active modulator of outer hair cell mechanics during ongoing stimuli.

**Buss E, Hall JW 3rd, Grose JH. Psychometric functions for pure tone intensity discrimination: slope differences in school-aged children and adults. J Acoust Soc Am. 2009 Feb;125(2):1050-8.** Previous work on pure tone intensity discrimination in school-aged children concluded that children might have higher levels of internal noise than adults for this task [J. Acoust. Soc. Am. 120, 2777-2788 (2006)]. If true, this would imply that psychometric function slopes are shallower for children than adults, a prediction that was tested in the present experiment. Normal hearing children (5-9 yr) and adults were tested in a two-stage protocol. The first stage used a tracking procedure to estimate 71% correct for intensity discrimination with a gated 500 Hz pure tone and a 65 dB sound pressure level standard level. The mean and standard deviation of these tracks were used to identify a set of five signal levels for each observer. In the second stage of the experiment percent correct was estimated at these five levels. Psychometric functions fitted to these data were significantly shallower for children than adults, as predicted by the internal noise hypothesis. Data from both stages of testing are consistent with a model wherein performance is based on a stable psychometric function, with sensitivity limited by psychometric function slope. Across observers the relationship between slope and threshold conformed closely to predictions of a simple signal detection model.

**Grose JH, Buss E, Hall JW 3rd. Within- and across-channel factors in the multiband comodulation masking release paradigm. Acoust Soc Am. 2009 Jan;125(1):282-93.** Maskers made up of comodulated narrow bands of noise can result in a signal detection advantage due to both within- and across-channel processes. The purpose of this study was to determine whether contributions from these processes could be differentiated on the basis of two stimulus manipulations: (1) onset/offset asynchrony across bands and (2) introduction of a random temporal fringe surrounding the comodulated bands. The hypothesis was that only masking release due to across-channel processing would be disrupted by these manipulations. Five-band comodulated maskers were constructed, and the availability of within- and across-channel cues was varied by adjusting the frequency spacing of the bands; both logarithmic and linear spacings were tested. The signal was a 1 kHz pure tone. Onset/offset asynchrony had different effects depending on the characteristics of the asynchrony. The results were consistent with an interpretation that across-channel, but not within-channel, masking release was disrupted when the flanking bands were presented continuously and the on-signal band was gated. However, the results suggested that both the across-channel and the within-channel masking release were disrupted in conditions where the on-signal band was continuous and the

flanking bands were gated on, as well as in conditions where a random temporal fringe was present.

2008

**Philbin MK, Robertson A, Hall JW 3rd. Recommended permissible noise criteria for occupied, newly constructed or renovated hospital nurseries. *Adv Neonatal Care*. 2008 Oct;8(5 Suppl):S11-5.**

**Republished from: *J Perinatol*. 1999 Dec;19(8 Pt 1):559-63.** OBJECTIVE: To base permissible noise criteria for occupied, new nurseries on research findings. STUDY DESIGN: An interdisciplinary group of clinicians reviewed the literature regarding the effect of sound on the fetus, newborn, and preterm infant and based recommended criteria on the best evidence. An external panel subsequently reviewed the criteria. RESULTS: The recommended criteria: Patient bed areas and the spaces opening onto them shall be designed to produce minimal ambient noise and to contain and absorb much of the transient noise that arises within the nursery. The overall, continuous sound in any bed space or patient care area shall not exceed: (1) an hourly Leq of 50 dB and (2) an hourly L10 of 55 dB, both A-weighted, slow response. The 1-second duration Lmax shall not exceed 70 dB, A-weighted, slow response. CONCLUSION: The permissible noise criteria will protect sleep, support stable vital signs, and improve speech intelligibility for many infants most of the time.

**Buss E, Hall JW 3rd. Factors contributing to comodulation masking release with dichotic maskers. *J Acoust Soc Am*. 2008 Oct;124(4):1905-8.** Detection threshold for a pure tone signal centered in a narrow band of noise may be reduced by inclusion of additional flanking masker bands, provided that they share coherent amplitude modulation (AM) across frequency. This comodulation masking release (CMR) associated with coherent AM across frequency is often much smaller if the signal and on-signal masker are presented to one ear and the flanking masker band(s) are presented contralaterally. An experiment was carried out to explore the role of peripheral effects (e.g., suppression) and central effects (e.g., grouping) in this finding. As frequently reported, CMR was smaller when two or more flanking maskers were presented contralaterally to the signal than when presented ipsilaterally. An intermediate condition, where a subset of flanking maskers was presented to each ear, provided comparable benefit to presenting all flankers ipsilateral to the signal. This result suggests that central effects may play a significant role in the reduced dichotic CMR under some conditions.

**Eapen RJ, Buss E, Grose JH, Drake AF, Dev M, Hall JW. The development of frequency weighting for speech in children with a history of otitis media with effusion. *Ear Hear*. 2008 Oct;29(5):718-24. Erratum in: *Ear Hear*. 2008 Dec;29(6):979.** OBJECTIVES: To determine the effect of chronic (recurrent) otitis media with effusion (OME) on frequency weighting in the perception of speech in noise. It was hypothesized that children with a history of OME weight speech information in the mid frequency region higher than control children. DESIGN: This is a matched cohort study looking at differences in frequency weighting in 12 children with a history of OME 1 to 2 wks after placement of tympanostomy tubes compared with 21 control children. Children were tested on their ability to identify key words in sentences presented in speech-shaped noise. The frequency content of the sentences was manipulated to determine the relative importance of frequencies in the regions of 1, 2, and 4 kHz. The frequency bands selected were 798 to 1212 Hz (low band), 1575 to 2425 Hz (mid band), and 3000 to 5000 Hz (high band). Initial testing involved adaptive runs where a speech-shaped masker was held at a constant level and the level of the speech with all three bands present varied. Once a level corresponding to 85% to 90% correct was identified, novel sentences were then presented at this signal-to-noise ratio in fixed block runs, with all bands present, or with one of the three bands

omitted. RESULTS: The children in the OME group achieved 85% to 90% correct at a lower signal-to-noise ratio than controls in the adaptive testing, where all three speech bands were present. Fixed block testing indicated that children with OME history gave more weight to speech frequencies in the region of 2000 Hz compared with the age-matched control group. CONCLUSIONS: The results are consistent with an interpretation that the development of frequency weighting in the perception of speech can be affected by a history of OME.

**Hall JW 3rd, Buss E, Grose JH. Spectral integration of speech bands in normal-hearing and hearing-impaired listeners. J Acoust Soc Am. 2008 Aug;124(2):1105-15.** This investigation examined whether listeners with mild-moderate sensorineural hearing impairment have a deficit in the ability to integrate synchronous spectral information in the perception of speech. In stage 1, the bandwidth of filtered speech centered either on 500 or 2500 Hz was varied adaptively to determine the width required for approximately 15%-25% correct recognition. In stage 2, these criterion bandwidths were presented simultaneously and percent correct performance was determined in fixed block trials. Experiment 1 tested normal-hearing listeners in quiet and in masking noise. The main findings were (1) there was no correlation between the criterion bandwidths at 500 and 2500 Hz; (2) listeners achieved a high percent correct in stage 2 (approximately 80%); and (3) performance in quiet and noise was similar. Experiment 2 tested listeners with mild-moderate sensorineural hearing impairment. The main findings were (1) the impaired listeners showed high variability in stage 1, with some listeners requiring narrower and others requiring wider bandwidths than normal, and (2) hearing-impaired listeners achieved percent correct performance in stage 2 that was comparable to normal. The results indicate that listeners with mild-moderate sensorineural hearing loss do not have an essential deficit in the ability to integrate across-frequency speech information.

**Blanks DA, Buss E, Grose JH, Fitzpatrick DC, Hall JW 3rd. Interaural time discrimination of envelopes carried on high-frequency tones as a function of level and interaural carrier mismatch. Ear Hear. 2008 Oct;29(5):674-83.** OBJECTIVES: The present study investigated interaural time discrimination for binaurally mismatched carrier frequencies in listeners with normal hearing. One goal of the investigation was to gain insights into binaural hearing in patients with bilateral cochlear implants, where the coding of interaural time differences (ITDs) may be limited by mismatches in the neural populations receiving stimulation on each side. DESIGN: Temporal envelopes were manipulated to present low frequency timing cues to high-frequency auditory channels. Carrier frequencies near 4 kHz were amplitude modulated at 128 Hz via multiplication with a half-wave rectified sinusoid, and that modulation was either in-phase across ears or delayed to one ear. Detection thresholds for nonzero ITDs were measured for a range of stimulus levels and a range of carrier frequency mismatches. Data were also collected under conditions designed to limit cues based on stimulus spectral spread, including masking and truncation of sidebands associated with modulation. RESULTS: Listeners with normal hearing can detect ITDs in the face of substantial mismatches in carrier frequency across ears. CONCLUSIONS: The processing of ITDs in listeners with normal hearing is likely based on spread of excitation into binaurally matched auditory channels. Sensitivity to ITDs in listeners with cochlear implants may depend on spread of current that results in the stimulation of neural populations that share common tonotopic space bilaterally.

**Hall JW 3rd, Buss E, Grose JH. Comodulation detection differences in children and adults. J Acoust Soc Am. 2008 Apr;123(4):2213-9.** This study investigated comodulation detection differences (CDD) in children (ages 4.8-10.1 years) and adults. The signal was 30-Hz wide band of noise centered on 2 kHz,

and the masker consisted of six 30-Hz wide bands of noise spanning center frequencies from 870 to 4160 Hz. The envelopes of the masking bands were always comodulated, and the envelope of the signal was either comodulated or random with respect to the masker. In some conditions, the maskers were gated on prior to the signal in order to minimize effects related to perceptual fusion of the signal and masker. CDD was computed as the difference between signal detection thresholds in conditions where all bands were comodulated and conditions where the envelope of the signal was random with respect to the envelopes of the maskers. Values of CDD were generally small in children compared to adults. In contrast, masking release related to masker/signal onset asynchrony was comparable across age groups. The small CDDs in children are discussed in terms of sensitivity to comodulation as a perceptual fusion cue and informational masking associated with the detection of a signal in a complex background, an effect that is ameliorated by asynchronous onset.

**Grose JH, Buss E, Hall JW 3rd. Gap detection in modulated noise: across-frequency facilitation and interference. J Acoust Soc Am. 2008 Feb;123(2):998-1007.** This study tested the hypothesis that a detection advantage for gaps in comodulated noise relative to random noise can be demonstrated in conditions of continuous noise and salient envelope fluctuations. Experiment 1 used five 25-Hz-wide bands of Gaussian noise, low-fluctuation noise, and a noise with increased salience of the inherent fluctuations (staccato noise). The bands were centered at 444, 667, 1000, 1500, and 2250 Hz, with the gap signal always inserted in the 1000-Hz band. Results indicated that a gap detection advantage existed in continuous comodulated noise only for Gaussian and staccato noise. Experiment 2 demonstrated that the advantage did not exist for gated presentation. This experiment also showed that the advantage bore some similarity to comodulation masking release. However, differences were also noted in terms of the effects of the number of flanking bands and the absence of a detection advantage in gated conditions. The detrimental effect of a gated flanking band was less pronounced for a comodulated band than for a random band. This study indicates that, under some conditions, a detection advantage for gaps carried by a narrow band of noise can occur in the presence of comodulated flanking bands of noise.

**Hall JW 3rd, Buss E, Grose JH. The effect of hearing impairment on the identification of speech that is modulated synchronously or asynchronously across frequency. J Acoust Soc Am. 2008 Feb;123(2):955-62.** This study investigated the effect of mild-to-moderate sensorineural hearing loss on the ability to identify speech in noise for vowel-consonant-vowel tokens that were either unprocessed, amplitude modulated synchronously across frequency, or amplitude modulated asynchronously across frequency. One goal of the study was to determine whether hearing-impaired listeners have a particular deficit in the ability to integrate asynchronous spectral information in the perception of speech. Speech tokens were presented at a high, fixed sound level and the level of a speech-shaped noise was changed adaptively to estimate the masked speech identification threshold. The performance of the hearing-impaired listeners was generally worse than that of the normal-hearing listeners, but the impaired listeners showed particularly poor performance in the synchronous modulation condition. This finding suggests that integration of asynchronous spectral information does not pose a particular difficulty for hearing-impaired listeners with mild/moderate hearing losses. Results are discussed in terms of common mechanisms that might account for poor speech identification performance of hearing-impaired listeners when either the masking noise or the speech is synchronously modulated.

**Hall JW 3rd, Buss E, Grose JH. Spectral integration and wideband analysis in gap detection and overshoot paradigms. J Acoust Soc Am. 2007 Dec;122(6):3598-608.** Several listening conditions show that energy remote from a target frequency can deleteriously affect sensitivity. One interpretation of such results entails a wideband analysis involving a wide predetection filter. The present study tested the hypothesis that both temporal gap detection and overshoot results are consistent with a wideband analysis, as contrasted with statistical combination of information across independent channels. For gap detection, stimuli were random or comodulated 50-Hz-wide noise bands centered on 1000, 1932, 3569, and 6437 Hz. For overshoot, the masker was an 8-kHz low-pass filtered noise, with 5-ms tone bursts presented at the same center frequencies used for gap detection. Signals were presented with either 0- or 250-ms delay after masker onset. In each paradigm, the target was introduced at only one frequency or at all four frequencies. Results from gap detection conditions did not favor a wideband analysis interpretation: Results in the random condition were consistent with an optimal combination of cues across frequency. An across-channel interference effect was also evident when only one of the four bands contained the gap. Although results from the overshoot conditions were consistent with a wideband analysis interpretation, they were more parsimoniously accounted for in terms of statistical combination of information.

**Blanks DA, Roberts JM, Buss E, Hall JW, Fitzpatrick DC. Neural and behavioral sensitivity to interaural time differences using amplitude modulated tones with mismatched carrier frequencies. J Assoc Res Otolaryngol. 2007 Sep;8(3):393-408. Epub 2007 Jul 27.** Bilateral cochlear implantation is intended to provide the advantages of binaural hearing, including sound localization and better speech recognition in noise. In most modern implants, temporal information is carried by the envelope of pulsatile stimulation, and thresholds to interaural time differences (ITDs) are generally high compared to those obtained in normal hearing observers. One factor thought to influence ITD sensitivity is the overlap of neural populations stimulated on each side. The present study investigated the effects of acoustically stimulating bilaterally mismatched neural populations in two related paradigms: rabbit neural recordings and human psychophysical testing. The neural coding of interaural envelope timing information was measured in recordings from neurons in the inferior colliculus of the unanesthetized rabbit. Binaural beat stimuli with a 1-Hz difference in modulation frequency were presented at the best modulation frequency and intensity as the carrier frequencies at each ear were varied. Some neurons encoded envelope ITDs with carrier frequency mismatches as great as several octaves. The synchronization strength was typically nonmonotonically related to intensity. Psychophysical data showed that human listeners could also make use of binaural envelope cues for carrier mismatches of up to 2-3 octaves. Thus, the physiological and psychophysical data were broadly consistent, and suggest that bilateral cochlear implants should provide information sufficient to detect envelope ITDs even in the face of bilateral mismatch in the neural populations responding to stimulation. However, the strongly nonmonotonic synchronization to envelope ITDs suggests that the limited dynamic range with electrical stimulation may be an important consideration for ITD encoding.

**Grose JH, Hall JW 3rd, Buss E. Gap duration discrimination for frequency-asymmetric gap markers: psychophysical and electrophysiological findings. J Acoust Soc Am. 2007 Jul;122(1):446-57.** This study investigated gap duration discrimination (GDD) for frequency-asymmetric gap markers, where one marker was a two-tone complex consisting of a primary tone and a secondary tone, and the other marker was the primary tone alone. Three experiments were undertaken to examine the order effect wherein performance is better when the two-tone marker is the leading marker than when it is the

trailing marker. Experiment 1 demonstrated that GDD for frequency-asymmetric markers is intermediate between the boundaries of within-frequency-channel versus across-frequency-channel processing. Experiment 2 compared psychophysical performance with auditory brainstem responses (ABRs) elicited by the same stimuli. Whereas GDD thresholds were elevated for a complex trailing marker relative to a within-frequency-channel baseline, ABRs elicited by the complex marker were more robust. Experiment 3 tested the hypothesis that poor GDD performance with frequency-asymmetric markers is due to some form of nonenergetic, or informational, masking. The results did not support a role for informational masking conferred by synthetic listening; however, informational masking conferred by the occurrence of novel spectral events provided a parsimonious account. One possible interpretation is that the capacity to accurately encode a gap is undermined by the occurrence of novel spectral events that engage limited attentional resources.

**Buss E, Hall JW 3rd, Grose JH. Individual differences in the masking level difference with a narrowband masker at 500 or 2000 Hz. J Acoust Soc Am. 2007 Jan;121(1):411-9.** The masking level difference (MLD) for a narrowband noise masker is associated with marked individual differences. This pair of studies examines factors that might account for these individual differences. Experiment 1 estimated the MLD for a 50 Hz wide band of masking noise centered at 500 or 2000 Hz, gated on for 400 ms. Tonal signals were either brief (15 ms) or long (200 ms), and brief signals were coincident with either a dip or peak in the masker envelope. Experiment 2 estimated the MLD for both signal and masker consisting of a 50 Hz wide bandpass noise centered on 500 Hz. Signals were generated to provide only interaural phase cues, only interaural level cues, or both. The pattern of individual differences was dominated by variability in NoSpi thresholds, and NoSpi thresholds were highly correlated across all conditions. Results suggest that the individual differences observed in Experiment 1 were not primarily driven by differences in the use of binaural fine structure cues or in binaural temporal resolution. The range of thresholds obtained for a brief NoSpi tonal signal at 500 Hz was consistent with a model based on normalized interaural correlation. This model was not consistent for analogous conditions at 2000 Hz.

## **HARNSBERGER, JAMES**

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2009

**Harnsberger, J. D., Brown, W. S., Shrivastav, R., and Rothman, H. B. (in press) "Noise and tremor in the perception of vocal aging in males." Journal of Voice.** Summary: Objective/Hypothesis. To specify a set of acoustic cues for vocal aging and to establish their perceptual relevance. Study Design. Perceptual testing. Methods. To identify the acoustic and perceptual correlates of the aging voice, voice quality [in conjunction with speaking rate and fundamental frequency (F0)] was systematically manipulated using resynthesis to determine its effect on perceived age. Ten young male voices were resynthesized using two levels of noise (random modulation of F0 contour) and two levels of tremor (constant modulation of F0 contour with a low-amplitude wave) under a speaking-rate manipulation (an increase in speaking rate that is common to older male voices). These materials were submitted to 40 naive listeners in an age-estimation task. Two sets of comparison materials were also included for evaluation: unmanipulated samples from a 150 voice database of young, middle-aged, and older voices and disordered voice samples representing natural manifestations of the voice qualities of interest. Results. Speaking rate, highest degree of tremor, and highest degree of noise all shifted, in an additive manner, the mean perceived age of the young male voices by a maximum of 12 years on

average; individual voices were observed being shifted by a generation. Fundamental frequency manipulations had no significant effect on perceived age. Conclusions. Voice quality (both tremor and noise) and speaking rate are all perceptually relevant cues of age in male voices.

**Hollien H, Harnsberger JD, Martin CA, Hill R, Alderman GA. Perceiving the Effects of Ethanol Intoxication on Voice. J Voice. 2009 Jun 15.** Many conditions operate to degrade the quality of the human voice. Alcohol intoxication is one of them. In this project, the objectives were to examine the ability of human listeners to accurately estimate both the presence and severity of intoxication from two types of speech samples. A review of available data suggests that, although listeners can often identify individuals who are intoxicated simply by hearing samples of their voice, they are less efficient at accurately determining the severity of this condition. A number of aural-perceptual studies were carried out to test these relationships. Populations of speakers, selected based on rigorous criteria, provided orally read and extemporaneous utterances when sober and at three highly controlled levels of intoxication. Listener groups of university students and professionals attempted to identify both the existence and specific level of intoxication present. It was found that these individuals were proficient in recognizing the presence of, and increases in, intoxication but were less accurate in gauging the specific levels. Several subordinate relationships were also investigated. In this regard, statistically significant differences were not found between male and female listeners or between professionals and lay listeners; however, they were found for different classes of speech. That is, it was shown that text difficulty correlated with severity of effect.

**Harnsberger JD, Hollien H, Martin CA, Hollien KA. Stress and deception in speech: evaluating layered voice analysis. J Forensic Sci. 2009 May;54(3):642-50.** This study was designed to evaluate commonly used voice stress analyzers--in this case the layered voice analysis (LVA) system. The research protocol involved the use of a speech database containing materials recorded while highly controlled deception and stress levels were systematically varied. Subjects were 24 each males/females (age range 18-63 years) drawn from a diverse population. All held strong views about some issue; they were required to make intense contradictory statements while believing that they would be heard/seen by peers. The LVA system was then evaluated by means of a double blind study using two types of examiners: a pair of scientists trained and certified by the manufacturer in the proper use of the system and two highly experienced LVA instructors provided by this same firm. The results showed that the "true positive" (or hit) rates for all examiners averaged near chance (42-56%) for all conditions, types of materials (e.g., stress vs. unstressed, truth vs. deception), and examiners (scientists vs. manufacturers). Most importantly, the false positive rate was very high, ranging from 40% to 65%. Sensitivity statistics confirmed that the LVA system operated at about chance levels in the detection of truth, deception, and the presence of high and low vocal stress states.

**Stemmer G., Spiegl W., Lasarczyk E., Kholhatkar V., Cassidy A., Potard B., Shum S., Song Y., Xu P., Beyerlein P., Harnsberger J. D., Noeth E. (in press). "Analyzing Features for Automatic Age Estimation on Cross-Sectional Data" Interspeech.** We develop an acoustic feature set for the estimation of a person's age from a recorded speech signal. The baseline features are Mel-frequency cepstral coefficients (MFCCs) which are extended by various prosodic features, pitch and formant frequencies. From experiments on the University of Florida Vocal Aging Database we can draw different conclusions. On the one hand, adding prosodic, pitch and formant features to the MFCC baseline leads to relative reductions of the mean absolute error between 4-20%. Improvements are even larger when perceptual age labels are taken as a reference. On the other hand, reasonable

results with a mean absolute error in age estimation of about 12 years are already achieved using a simple gender-independent setup and MFCCs only. Future experiments will evaluate the robustness of the prosodic features against channel variability on other databases and investigate the differences between perceptual and chronological age labels.

2008

**Harnsberger JD, Wright R, Pisoni DB. A new method for eliciting three speaking styles in the laboratory. *Speech Commun.* 2008 Apr 1;50(4):323-336.** In this study, a method was developed to elicit three different speaking styles, reduced, citation, and hyperarticulated, using controlled sentence materials in a laboratory setting. In the first set of experiments, the reduced style was elicited by having twelve talkers read a sentence while carrying out a distractor task that involved recalling from short-term memory an individually-calibrated number of digits. The citation style corresponded to read speech in the laboratory. The hyperarticulated style was elicited by prompting talkers (twice) to reread the sentences more carefully. The results of perceptual tests with naïve listeners and an acoustic analysis showed that six of the twelve talkers produced a reduced style of speech for the test sentences in the distractor task relative to the same sentences in the citation style condition. In addition, all talkers consistently produced sentences in the citation and hyperarticulated styles. In the second set of experiments, the reduced style was elicited by increasing the number of digits in the distractor task by one (a heavier cognitive load). The procedures for eliciting citation and hyperarticulated sentences remained unchanged. Ten talkers were recorded in the second experiment. The results showed that six out of ten talkers differentiated all three styles as predicted (70% of all sentences recorded). In addition, all talkers consistently produced sentences in the citation and hyperarticulated styles. Overall, the results demonstrate that it is possible to elicit controlled sentence stimulus materials varying in speaking style in a laboratory setting, although the method requires further refinement to elicit these styles more consistently from individual participants.

**Hollien H, Harnsberger JD, Martin CA, Hollien KA. Evaluation of the NITV CVSA. *Forensic Sci.* 2008 Jan;53(1):183-93.** The purpose of this study was to evaluate a commonly used voice stress analyzer, the National Institute of Truth Verification's (NITV) Computer Voice Stress Analyzer (CVSA), using a speech database containing materials recorded (i) in the laboratory, while highly controlled deceptive and shock-induced stress levels were systematically varied, and (ii) during a field procedure. Subjects were 24 each males/females (age range 18-63 years) drawn from a representative population. All held strong views on an issue and were required to make sharply derogatory statements about it. The CVSA system was then evaluated in a double-blind study using three sets of examiners: (i) two UF scientists trained/certified by NITV in CVSA operation, (ii) three experienced NITV operators provided by the manufacturer and (iii) five experimental phoneticians. The results showed that the "true positive" (or hit) rates for all examiners ranged from chance to somewhat higher levels (c. 50-65%) for all conditions and types of materials (e.g., stress vs. unstressed, truth vs. deception). However, the false-positive rate was just as high - often higher. Sensitivity statistics demonstrated that the CVSA system operated at about chance level.

**Harnsberger JD, Shrivastav R, Brown WS Jr, Rothman H, Hollien H. Speaking rate and fundamental frequency as speech cues to perceived age. *J Voice.* 2008 Jan;22(1):58-69.** This study aimed to specify a set of acoustic cues fundamental to vocal aging and to establish their perceptual relevance, using acoustic analysis and perceptual testing. Three experiments were conducted to identify the perceptual

correlates of the aging voice. The first experiment analyzed important voice parameters that signal a person's age for 16 older males and 14 younger males. In the second and third experiments, these acoustic patterns were systematically shifted through resynthesis to see if perceived age would be significantly influenced. In the second experiment, the older and younger male voices were resynthesized by manipulating speaking rate and fundamental frequency to shift the perceived age of the groups toward each other. In the third experiment, older and middle-aged male voices were resynthesized in a similar manner. In both perceptual studies, an age estimation task with naive listeners was used. The results of the first experiment showed that, in older speakers, sentence, word, and diphthong durations were all significantly longer and mean fundamental frequency was significantly higher than for the younger group. In the second experiment, only the manipulation of speaking rate resulted in a significant shift in perceived age, and it did so only for the older subjects. In the third experiment, a significant shift in age estimates was observed for the middle-aged, but not the older, voices when speaking rate was manipulated. The results of both perception tests suggest that speaking rate, but possibly not fundamental frequency, is a perceptually relevant cue to age in voice.

2007

**HOLMES, ALICE**

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2009

**Widén, S.E., Holmes, A.E., Johnson, T., Bohlin, M, & Erlandsson, S.I. Hearing, use of hearing protection and attitudes towards noise among young American students. *International Journal of Audiology*. Aug2009, Vol. 48 Issue 8, p537-545** The purpose of the present study was to investigate possible associations between college students' attitudes, risk-taking behaviour related to noisy activities, and hearing problems such as threshold shifts or self-experienced hearing symptoms. The sample included 258 students aged between 17 and 21 enrolled at the University of Pennsylvania, USA. A questionnaire measuring attitudes towards noise, use of hearing protection, and self-reported hearing symptoms was distributed among the students. After completing the questionnaire a hearing screening, including pure-tone audiometry and tympanometry, was conducted. The result revealed that 26% had thresholds poorer than the screening level of 20 dBHL. Attitudes were significantly related to self-experienced hearing symptoms, but not to threshold shifts. Attitudes and noise sensitivity was, significantly related to use of hearing protection. Hearing protection use was found in activities such as using firearms, mowing lawns, and when using noisy tools but was less reported for concerts and discotheques. It can be concluded that the young adults in this study expose themselves to hearing risks, since the use of hearing protection is in general very low.

2008

**Erlandsson, SI, Holmes, AE, Widen, S & Bohlin, M (2008). Cultural and social perspectives on attitudes, noise, and risk behavior in children and young adults. *Seminars in Hearing*, 29(1), 29-41.** Interdisciplinary research is critical to the prevention of hearing loss in children and young adults. To meet that goal, this paper focuses on the relationship between the prevalence of noise-induced hearing loss, attitudes to noise and exposure, and how hearing protection use seems to be linked to cultural and socioeconomic factors. Results of a series of studies point to attitudes as one explanatory

factor. Additionally, the experience of hearing symptoms such as tinnitus and noise sensitivity increases the likelihood that adolescents and young adults will choose to wear earplugs when attending clubs or discotheques. This behavior can be referred to as an important “trigger” mechanism for the development of health-related behavior. Some general theories on health behavior are discussed to understand the role attitudes play for hearing prevention in young people. Finally, the finding that adolescents seeking professional help for tinnitus appear to have strong fears related to anxious thoughts and reactions associated with the condition is addressed. These fears can be a sign of a phobic reaction, something that most often first appears during adolescence. For these reasons, interdisciplinary research in the investigation of tinnitus distress and hearing conservation in young people seems to be the most relevant approach.

2007

**Holmes AE, Widén SE, Erlandsson S, Carver CL, White LL. Perceived hearing status and attitudes toward noise in young adults. *Am J Audiol.* 2007 Dec;16(2):S182-9.** PURPOSE: To estimate the prevalence of perceived hearing loss, tinnitus, and temporary threshold shift (TTS) in community college students and to see whether those students' attitudes toward noise affected their perception of their own possible hearing loss, tinnitus, and TTS. METHOD: Young adults (N = 245; age 18-27) completed 3 questionnaires: the Hearing Symptom Description, Youth Attitude to Noise Scale, and Adolescents' Habits and Hearing Protection Use. RESULTS: Perceived TTS and pain associated with loud noise were the most common hearing related factors, followed by perceived tinnitus and hearing loss. The students' attitudes toward noise in their daily environment showed the most negative response, whereas attitudes toward noise and concentration indicated a more positive, or less harmful, response. Chi-square analysis indicated a significant correlation between perceived hearing loss and respondents' overall attitudes toward noise exposure. Hearing protection use was limited for all participants, with the majority reporting never having used hearing protection. CONCLUSION: Approximately 6% of respondents reported perceived hearing loss, and 13.5% reported prolonged tinnitus. In general, participants had neutral attitudes toward noise. Over 20% of participants reported ear pain, tinnitus, and/or TTS after noise exposure at least sometimes. Coincidentally, few participants reported consistent use of hearing protection.

**KRICOS, PATRICIA**

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2009

2008

2007

**Kricos PB. Hearing assistive technology considerations for older individuals with dual sensory loss. *Trends Amplif.* 2007 Dec;11(4):273-9.** This article focuses on the current state of the science related to audiologic rehabilitation of individuals with dual sensory impairment, with an emphasis on considerations for provision of appropriate hearing assistive technology for this population. A substantial increase in the number of older adults is predicted in the coming years, many of whom will have significant age-related impairments in hearing and vision. Thus, hearing care professionals will be called on increasingly to attend to the special needs of people with dual sensory impairments to

ensure maximal quality of life and independence for these individuals. Access to sound is critical for individuals who live with compromises in both vision and hearing. Hearing assistive technology may improve not only their speech perception but also their connection and orientation to the environment, as well as enable greater mobility. Thus, the audiologist's provision of appropriate and carefully selected hearing assistive technology may contribute dramatically to the quality of life of the individual with dual sensory loss. Prefitting, fitting, and postfitting considerations in providing hearing aids and other assistive technology to individuals with dual sensory impairment are reviewed.

**Kricos PB, Erdman S, Bratt GW, Williams DW. Psychosocial correlates of hearing aid adjustment. J Am Acad Audiol. 2007 Apr;18(4):304-22.** Despite considerable evidence regarding the detrimental effects of untreated hearing loss, there continues to be an underutilization of hearing aids by adults. The Long Term Follow-Up of Patients in the National Institute on Deafness and Other Communication Disorders/Veterans Affairs (NIDCD/VA) Hearing Aid Clinical Trial (Cooperative Studies Program [CSP] 418-A) provided the opportunity to compare a number of potential psychosocial influences and outcomes for hearing aid users and nonusers from the original CSP 418 study. The Communication Profile for the Hearing Impaired (CPHI) results provide compelling evidence of hearing aid benefit. Mean Communication Performance (CP) scores for hearing aid users on the Social, Work, and Home scales improved significantly from the original CSP 418 administration. For nonusers, there were no significant CPHI changes from the previous administration. Although hearing aid users and nonusers did not differ in optimism, this parameter was correlated with personal adjustment, measured via the CPHI. Hearing aid use was associated with the perception of major life events, such as illness, retirement, and so forth.

## **LEPRELL, COLLEEN**

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2009

**Bledsoe SC Jr, Koehler S, Tucci DL, Zhou J, Le Prell C, Shore SE. Ventral cochlear nucleus responses to contralateral sound are mediated by commissural and olivocochlear pathways. J Neurophysiol. 2009 Aug;102(2):886-900.** In the normal guinea pig, contralateral sound inhibits more than a third of ventral cochlear nucleus (VCN) neurons but excites <4% of these neurons. However, unilateral conductive hearing loss (CHL) and cochlear ablation (CA) result in a major enhancement of contralateral excitation. The response properties of the contralateral excitation produced by CHL and CA are similar, suggesting similar pathways are involved for both types of hearing loss. Here we used the neurotoxin melittin to test the hypothesis that this "compensatory" contralateral excitation is mediated either by direct glutamatergic CN-commissural projections or by cholinergic neurons of the olivocochlear bundle (OCB) that send collaterals to the VCN. Unit responses were recorded from the left VCN of anesthetized, unilaterally deafened guinea pigs (CHL via ossicular disruption, or CA via mechanical destruction). Neural responses were obtained with 16-channel electrodes to enable simultaneous data collection from a large number of single- and multiunits in response to ipsi- and contralateral tone burst and noise stimuli. Lesions of each pathway had differential effects on the contralateral excitation. We conclude that contralateral excitation has a fast and a slow component. The fast excitation is likely mediated by glutamatergic neurons located in medial regions of VCN that send their commissural axons to the other CN via the dorsal/intermediate acoustic striae. The slow component is likely mediated by the OCB collateral projections to the CN. Commissural neurons that leave the CN via the trapezoid body are an additional source of fast, contralateral excitation.

2008

2007

**Miller JM, Le Prell CG, Prieskorn DM, Wys NL, Altschuler RA. Delayed neurotrophin treatment following deafness rescues spiral ganglion cells from death and promotes regrowth of auditory nerve peripheral processes: effects of brain-derived neurotrophic factor and fibroblast growth factor. J Neurosci Res. 2007 Jul;85(9):1959-69.** The extent to which neurotrophic factors are able to not only rescue the auditory nerve from deafferentation-induced degeneration but also promote process regrowth is of basic and clinical interest, as regrowth may enhance the therapeutic efficacy of cochlear prostheses. The use of neurotrophic factors is also relevant to interventions to promote regrowth and repair at other sites of nerve trauma. Therefore, auditory nerve survival and peripheral process regrowth were assessed in the guinea pig cochlea following chronic infusion of BDNF + FGF(1) into scala tympani, with treatment initiated 4 days, 3 weeks, or 6 weeks after deafferentation from deafening. Survival of auditory nerve somata (spiral ganglion neurons) was assessed from midmodiolar sections. Peripheral process regrowth was assessed using pan-Trk immunostaining to selectively label afferent fibers. Significantly enhanced survival was seen in each of the treatment groups compared to controls receiving artificial perilymph. A large increase in peripheral processes was found with BDNF + FGF(1) treatment after a 3-week delay compared to the artificial perilymph controls and a smaller enhancement after a 6-week delay. Neurotrophic factor treatment therefore has the potential to improve the benefits of cochlear implants by maintaining a larger excitable population of neurons and inducing neural regrowth.

**Le Prell CG, Hughes LF, Miller JM. Free radical scavengers vitamins A, C, and E plus magnesium reduce noise trauma. Free Radic Biol Med. 2007 May 1;42(9):1454-63.** Free radical formation in the cochlea plays a key role in the development of noise-induced hearing loss (NIHL). The amount, distribution, and time course of free radical formation have been defined, including a clinically significant formation of both reactive oxygen species and reactive nitrogen species 7-10 days after noise exposure. Reduction in cochlear blood flow as a result of free radical formation has also been described. Here we report that the antioxidant agents vitamins A, C, and E act in synergy with magnesium to effectively prevent noise-induced trauma. Neither the antioxidant agents nor the magnesium reliably reduced NIHL or sensory cell death with the doses we used when these agents were delivered alone. In combination, however, they were highly effective in reducing both hearing loss and cell death even with treatment initiated just 1 h before noise exposure. This study supports roles for both free radical formation and noise-induced vasoconstriction in the onset and progression of NIHL. Identification of this safe and effective antioxidant intervention that attenuates NIHL provides a compelling rationale for human trials in which free radical scavengers are used to eliminate this single major cause of acquired hearing loss.

**Le Prell CG. Role for the lateral olivocochlear neurons in auditory function. Focus on "Selective removal of lateral olivocochlear efferents increases vulnerability to acute acoustic injury". J Neurophysiol. 2007 Feb;97(2):963-5. Epub 2006 Dec 20. Comment on: J Neurophysiol. 2007 Feb;97(2):1775-85. Comment / Editorial.**

**Le Prell CG, Yamashita D, Minami SB, Yamasoba T, Miller JM. Mechanisms of noise-induced hearing**

**loss indicate multiple methods of prevention. Hear Res. 2007 Apr;226(1-2):22-43.** Recent research has shown the essential role of reduced blood flow and free radical formation in the cochlea in noise-induced hearing loss (NIHL). The amount, distribution, and time course of free radical formation have been defined, including a clinically significant late formation 7-10 days following noise exposure, and one mechanism underlying noise-induced reduction in cochlear blood flow has finally been identified. These new insights have led to the formulation of new hypotheses regarding the molecular mechanisms of NIHL; and, from these, we have identified interventions that prevent NIHL, even with treatment onset delayed up to 3 days post-noise. It is essential to now assess the additive effects of agents intervening at different points in the cell death pathway to optimize treatment efficacy. Finding safe and effective interventions that attenuate NIHL will provide a compelling scientific rationale to justify human trials to eliminate this single major cause of acquired hearing loss.

## **LOGAN, KENNETH**

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2009

**Gillam, R.B., Logan, K.J., & Pearson, N. (2009). Test of Childhood Stuttering. Austin, TX: Pro-Ed.** The Test of Childhood Stuttering (TOCS) provides clinicians and researchers with an efficient method for assessing speech fluency skills and stuttering-related behaviors in children 4 through 12 years of age. Its main clinical purposes are to (1) identify children who stutter, (2) determine the severity of a child's stuttering, and (3) document changes in a child's fluency functioning over time. The TOCS is comprised of a standardized Speech Production Measure, two standardized Observational Rating Scales, and seven informal supplemental clinical measures.

2008

**Logan, K.J., Mullins, M.S., & Jones, K.M. (2008). The depiction of stuttering in contemporary juvenile fiction: Implications for clinical practice. Psychology in the Schools, 45(7), 609-626.** We reviewed 29 contemporary juvenile fiction books featuring characters who stutter to assess the presentation of stuttering-related content. Although plots varied widely, most characters displayed attributes or accomplishments that offset their communication impairment. Many characters improved social and/or communicative functioning during the stories, though rarely in conjunction with professionally administered intervention. Most books depicted listener responses to stuttering, including impatience, teasing, ridicule, and bullying. Some books contained incorrect or distorted information, which could convey the mistaken impression that stuttering is simply a symptom of emotional distress. Nonetheless, most portrayals of stuttering seemed sufficient for the books to be considered for use as an instructional tool in certain education and intervention activities. Potential applications of the books in these contexts are discussed.

2007

**Logan, K.J., & Haj Tas, M.A. (2007). Effect of sample size on the measurement of stutter-like disfluencies. Perspectives on Fluency and Fluency Disorders, 17(3), 3-6.** In recent years, clinicians have debated about the length of speech samples that are required for valid assessment of stuttering behaviors. The present study examined this issue by analyzing 1800-syllable-long narrative speech samples from 10 adults who stutter. Resulting speech samples were parsed into 300-syllable

segments, and the frequency of stutter-like disfluency (SLD) within each segment was compared. SLD differences across segments were not statistically significant. Disfluency differences for segments with the most and least SLD disfluency exceeded 50% for 8 of 10 participants; however, location of these segments varied widely across participants. SLD frequencies were also computed for the six possible cumulative sample lengths (i.e., 300, 600, 900, 1200, 1500, 1800 syllables). Maximum SLD frequencies were just as likely to be attained from a 300-syllable sample as from an 1800-syllable. Results suggest that longer samples do not necessarily provide clinicians with information about an adult's maximum level of disfluency. Suggestions for more strategic approaches to sampling are provided.

## **LOMBARDINO, LINDA**

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2009

2008

**Puranik CS, Lombardino LJ, Altmann LJ. Assessing the microstructure of written language using a retelling paradigm. *Am J Speech Lang Pathol.* 2008 May;17(2):107-20.** PURPOSE: The primary goal of this study was to document the progression of the microstructural elements of written language in children at 4 grade levels. The secondary purpose was to ascertain whether the variables selected for examination could be classified into valid categories that reflect the multidimensional nature of writing. METHOD: Written language samples were collected and transcribed from 120 children in Grades 3 through 6 using an expository text-retelling paradigm. Nine variables at various levels of language were analyzed. RESULTS: Using a text-retelling paradigm, measures of productivity (e.g., total number of words and ideas) improved steadily with age, whereas measures of complexity (e.g., mean length of T-unit) did not. Results for measures of accuracy (e.g., spelling and writing conventions) were mixed, with some showing improvement across grades. Grade 3 students showed consistently poorer performance than students in Grades 4, 5, and 6. Grade 4 students showed poorer performance than students in Grades 5 and 6. Exploratory factor analysis suggests that writing can be represented by 3 factors: Productivity, Complexity, and Accuracy. CONCLUSIONS: Clinicians can use this multidimensional scheme for examining writing skills using text-retelling formats with children from Grades 3 through 6. This empirically based framework for measuring microstructural variables of writing provides clinicians with a 3-prong conceptual framework for determining children's strengths and weaknesses within the translational stage of writing.

**Eckert MA, Lombardino LJ, Walczak AR, Bonihla L, Leonard CM, Binder JR. Manual and automated measures of superior temporal gyrus asymmetry: concordant structural predictors of verbal ability in children. *Neuroimage.* 2008 Jul 1;41(3):813-22.** The planum temporale is a region on the posterior surface of the temporal lobe that exhibits robust leftward structural asymmetry, which has been linked to verbal ability in children and adults. Traditionally, structural asymmetry has been quantified with manual assessment of high resolution MRI scans. Such measures require subjective and frequently unreliable determination of highly variable anatomical boundaries. Methodological developments in automated image processing (voxel-based morphometry - VBM) offer the opportunity to obtain objective and reliable measures of structural variation. This study examined the extent to which a VBM measure of gray matter asymmetry in the posterior superior temporal gyrus (pSTG) characterized the same individual variation as a manual measure of planum temporale asymmetry in 99 healthy adults and 39 typically developing children. Planum temporale asymmetry was significantly correlated

with pSTG gray matter asymmetry in the samples of adults and children. As a measure of validity we examined the extent to which the VBM measure of pSTG gray matter asymmetry predicted measures of verbal ability that were associated with the manual measure of planum temporale asymmetry in the same children. The two asymmetry measures predicted the same variance in verbal ability. The automated measure of pSTG gray matter asymmetry predicted additional significant variance in verbal ability, however. In addition, a posterior STS region was also identified that significantly predicted verbal ability. These results demonstrate significant advantages of an automated voxel-based measure over a manual measure of planum temporale asymmetry.

**Altmann LJ, Lombardino LJ, Puranik C. Sentence production in students with dyslexia. *Int J Lang Commun Disord.* 2008 Jan-Feb;43(1):55-76.** BACKGROUND: While spoken language deficits have been identified in children with developmental dyslexia, microanalysis of sentence production proficiency in these children is a largely unexplored area. AIMS: The current study examines proficiency of syntactic production in children and young adults with dyslexia and typically developing age-matched controls on a constrained sentence production task targeting two advanced argument structures, theme-experiencer verbs and irregular past participles. METHODS & PROCEDURES: Participants aged between 8 and 22 years produced sentences that included three stimulus words, a proper name, an inanimate noun and a verb from one of three categories: control verbs (agent-patient verbs with regular morphology); theme-experiencer verbs, which require an inanimate subject in active sentences (e.g. The book bored Sarah); and irregular past participles, which require awareness of the syntactic requirements associated with the -en past participle ending, i.e. that this verb form cannot be used as a simple past tense (e.g. \*Mary \_\_\_ hidden the candy). OUTCOMES & RESULTS: Students with dyslexia produced more dysfluent, ungrammatical and incomplete responses than normal readers; however, the developmental trajectories of the verb types varied between groups. Normal readers performed similarly with both experimental verb types, but those with dyslexia were particularly impaired using irregular past participles in sentences. CONCLUSIONS: The findings support a model of lexical representation in which development of grammar hinges on the acquisition of lexical knowledge. Furthermore, the data suggest that individuals with dyslexia may have difficulties with sentence formulation that persist into adulthood.

2007

**King WM, Giess SA, Lombardino LJ. Subtyping of children with developmental dyslexia via bootstrap aggregated clustering and the gap statistic: comparison with the double-deficit hypothesis. *Int J Lang Commun Disord.* 2007 Jan-Feb;42(1):77-95.** BACKGROUND: The marked degree of heterogeneity in persons with developmental dyslexia has motivated the investigation of possible subtypes. Attempts have proceeded both from theoretical models of reading and the application of unsupervised learning (clustering) methods. Previous cluster analyses of data obtained from persons with reading disabilities have suffered from the inherent limitations of unsupervised learning methods. Specifically, the reliability and stability of cluster solutions have proven difficult to determine. Recent developments in the clustering literature have addressed these concerns by permitting checks on the internal validity of the solution. Resampling methods produce consistent groupings of the data independent of initialization effects, while the gap statistic provides a confidence measure for the determination of the optimal number of clusters present in the data. Combining these methods produces a robust data-driven classification that can be compared with theoretically based subtypes to produce better-informed models of developmental dyslexia. AIMS: The present study is a novel application of

resampling (bootstrap aggregating or bagging) methods and the gap statistic to the subtyping of children with developmental dyslexia. The specific aims of this study are: (1) to illustrate the use of bagging methods and the gap statistic in multivariate data obtained from children with developmental dyslexia; and (2) to compare the bagged clustering thresholded by the gap statistic against the predictions of the double-deficit hypothesis. The double-deficit hypothesis is a prominent theoretical model of developmental dyslexia, which predicts three subtypes: phonological, rate, and phonological-rate impaired readers. **METHODS & PROCEDURES:** Three simulated data sets with known cluster structure were created to check the validity and illustrate the utility of the bagged clustering with the gap statistic in data with known structure. Subsequently, a clinical database of standardized test data (eight tests) from 93 children with developmental dyslexia was clustered using these methods. This procedure was repeated on a database of 93 children without reading disability matched for gender and age as a control. Finally, the clustering was repeated on the entire database of 186 participants. Cluster solutions were obtained for an increasing number of clusters (1-10) and were tested against the null hypothesis that no subtypes were present, i.e. the data represented a single cluster. **OUTCOMES & RESULTS:** Four clusters were identified in the children with developmental dyslexia. There was no evidence of significant cluster structure in the children without dyslexia. Two clusters were identified when children with and without reading impairments were considered together. Among the participants with developmental dyslexia, there was evidence of a phonological-deficit cluster, a rapid-naming cluster, and a cluster showing both depressed phonological processing and rapid naming. These accounted for 73 of the 93 participants (78%). All three are predicted by the double-deficit hypothesis. The fourth cluster consisted of children with normal phonological and rapid naming ability incommensurate with their high verbal ability. An analysis of variance with post-hoc multiple comparisons demonstrated that the phonological, rapid-naming, and double deficit clusters did not differ significantly in age, but the fourth cluster was comprised of significantly older children. The mixed data set revealed two clusters. One cluster consisted almost entirely of the double-deficit and phonological subtypes. The other consisted of the participants without dyslexia and the children with dyslexia demonstrating either a single rapid naming deficit or standardized test scores in the normal range. A silhouette analysis indicated that the four-cluster solution for the children with developmental dyslexia was superior to the two-cluster solution obtained for the entire data set. **CONCLUSIONS:** The study provides support for the presence of distinct subtypes in children with developmental dyslexia and for the double-deficit hypothesis. Specifically, this study finds three subtypes predicted by the double-deficit hypothesis without the assumption of an a priori theoretical model of reading. Taken together, these subtypes account for 79% of the participants with dyslexia. Further, the percentages of children in each subtype are in good agreement with previous studies. The participants in the subtype not predicted by the double-deficit hypothesis were significantly older than the other three groups. Recent advances in unsupervised learning can be expected to aid the improvement and refinement of the definition of developmental dyslexia. If reliable and consistent subtypes can be identified among persons with developmental dyslexia, it is reasonable to assume that diagnostic and intervention efforts will be greatly improved.

**REILLY, JAIME**

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2009

Reilly, J., & Grossman, M. (2009). *Language Processing in Dementia*. In A. Budson and N. Kowell (eds.) *Alzheimer's Disease and other Dementias*. Blackwell Synergy Press, London, UK.

Lamy, M., Reilly, J, & Neils-Strunjas, J. (in press). *The Dementias: An overview of Alzheimer's disease and related disorders*. In M. Kimbarow (ed). *Cognitive Communication Disorders*. Plural Publishing, San Diego, CA

2008

**Antonucci SM, Reilly J. Semantic memory and language processing: a primer. *Semin Speech Lang.* 2008 Feb;29(1):5-17.** Semantic memory refers to our long-term knowledge of word and object meaning. There is increasing evidence that rather than being a passive warehouse of knowledge, semantic memory is a dynamic system whose effectiveness relies on the coordination of multiple components distributed across a large network of cortical regions. Damage to one or more of these components produces distinct profiles of impairment in aphasia and dementia. Furthermore, such differences are associated with different responses to behavioral treatment. That is, effective treatment for semantically based language disorders in aphasia may have very limited success in dementia. We argue that treatment specificity demands a comprehensive understanding of the structure of semantic memory and the nature of its compromise. Here, we review several neuroanatomically informed theories of semantic organization with respect to the effects of semantic impairment on language processing in aphasia and neurodegenerative disease.

**Reilly J, Peelle JE. Effects of semantic impairment on language processing in semantic dementia. *Semin Speech Lang.* 2008 Feb;29(1):32-43.** Semantic dementia is a neurodegenerative disease characterized by progressive loss of conceptual and lexical knowledge. Cortical atrophy remains relatively isolated to anterior and inferior portions of the temporal lobe early in semantic dementia, later affecting more extensive regions of temporal cortex. Throughout much of the disease course, frontal and parietal lobe structures remain relatively intact. This distribution of cortical damage produces a unique language profile. Patients with semantic dementia typically experience profound deficits in language comprehension and production in the context of relatively well-preserved functioning in domains such as phonology, executive function, visuospatial processing, and speech perception. We discuss the effects of semantic impairment on language processing in semantic dementia within the context of an interactive theory of semantic cognition that assumes the active coordination of modality-neutral and modality-specific components. Finally, we argue the need for an etiology-specific language intervention for this population.

2007

**Reilly J, Chrysikou EG, Ramey CH. Support for hybrid models of the age of acquisition of English nouns. *Psychon Bull Rev.* 2007 Dec;14(6):1164-70.** Age of acquisition (AoA) is a psycholinguistic construct that refers to the chronological age at which a given word is acquired. Contemporary theories of AoA have focused on lexical acquisition with respect to either the developing phonological or semantic systems. One way of testing the relative dominance of phonological or semantic contributions is through open-source psycholinguistic databases, whereby AoA may be correlated with other variables (e.g., morphology, semantics, phonology). We report two multiple regression analyses conducted on a corpus of English nouns with, respectively, subjective and objective AoA measures as the dependent variables and a combination of 10 predictors, including 2 semantic, 4 phonological, 2 morphological, and 2 lexical. This multivariate combination of predictors accounted for significant proportions of the variance of AoA in both

analyses. We argue that this evidence supports hybrid models of language development that integrate multiple levels of processing-from sound to meaning.

**Reilly J, Troiani V, Grossman M, Wingfield A. An introduction to hearing loss and screening procedures for behavioral research. Behav Res Methods. 2007 Aug;39(3):667-72.** Hearing loss is a confounding variable that is rarely addressed in behavioral research despite its prevalence across the life span. Currently, the most common method of experimental control over hearing acuity is through self report of perceived impairment. We argue that this technique may lack sensitivity and that researchers should more commonly utilize standardized hearing screening procedures. Distinctive patterns of hearing loss are reviewed with attention to populations that commonly participate in behavioral research. We explain standard techniques for conducting pure tone hearing screening using a conventional portable audiometer and outline a procedure for how researchers can modify a conventional laptop computer for audiometric screening when a standard audiometer is unavailable. We offer a sample hearing screening program that researchers may use toward the development of their own protocol. This program is freely available for download at [www.psychonomic.org/archive](http://www.psychonomic.org/archive).

## **ROSENBEK, JOHN**

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2009

**Plowman-Prine EK, Sapienza CM, Okun MS, Pollock SL, Jacobson C, Wu SS, Rosenbek JC. The relationship between quality of life and swallowing in Parkinson's disease. Mov Disord. 2009 Jul 15;24(9):1352-8.** Few studies exist in the literature investigating the impact of idiopathic Parkinson's Disease (IPD) on swallow-related quality of life. We therefore aimed in this project to: (1) evaluate swallow-specific quality of life in IPD; (2) delineate potential relationships between IPD duration and severity with swallow-specific quality of life; (3) investigate relationships between swallow-specific quality of life and general health-related quality of life; and (4) investigate relationships between swallow-specific quality of life and depression. Thirty-six patients diagnosed with IPD with and without dysphagia filled out self-report assessments of the SWAL-QOL, Parkinson's Disease Questionnaire-39 (PDQ-39), and Beck Depression Inventory (BDI). A series of Mann Whitney U tests were performed between non-dysphagic and dysphagic groups for the total SWAL-QOL score and the 10 SWAL-QOL domains. Spearman's Rho correlation analyses were performed between the SWAL-QOL and (1) PDQ-39; (2) Hoehn and Yahr stage; (3) PD disease duration; (4) UPDRS "on" score; and (5) the BDI. The dysphagia swallowing group reported significant reductions compared to the non-dysphagic group for the total SWAL-QOL score ( $P = 0.02$ ), mental health domain score ( $P = 0.002$ ) and social domain score ( $P = 0.002$ ). No relationships existed between swallow-specific quality of life and disease duration or severity. Significant relationships existed between swallow-specific quality of life and general health-related quality of life ( $r(s) = -0.56$ ,  $P = 0.000$ ) and depression ( $r(s) = -0.48$ ,  $P = 0.003$ ). These exploratory data highlight the psychosocial sequelae that swallowing impairment can have in those with IPD and suggest a possible association between swallowing, social function, and depression. 2009 Movement Disorder Society.

**Plowman-Prine EK, Okun MS, Sapienza CM, Shrivastav R, Fernandez HH, Foote KD, Ellis C, Rodriguez AD, Burkhead LM, Rosenbek JC. Perceptual characteristics of Parkinsonian speech: a comparison of the pharmacological effects of levodopa across speech and non-speech motor systems. NeuroRehabilitation. 2009;24(2):131-44.** The purpose of this study was to: (1) define perceptual

speech characteristics of idiopathic Parkinson disease (IPD) across 35 speech dimensions adapted from Darley et al. [19] and grouped under six speech-sign clusters (respiration, phonation, resonance, articulation, prosody and rate); (2) examine the effects of levodopa on the 35 perceptual speech dimensions and speech-sign clusters; and (3) to compare the relative effectiveness of levodopa on global motor functioning vs. speech production. Sixteen patients with IPD read the 'Grandfather Passage' both 'on' and 'off' levodopa. Three blinded speech-language pathologists performed perceptual speech analyses using a seven-point scale. The diagnosis of IPD was made by a movement disorders fellowship trained neurologist who applied UK Brain bank criteria and administered the Unified Parkinson Disease Rating Scale. Concordant with previous studies, the results of this experiment indicated that IPD disrupted multiple speech production subsystems, with prosody being the most severely affected domain. The perceptual dimensions that were most severely affected included: (1) sound imprecision; (2) mono-loudness; (3) mono-pitch; (4) reduced stress and (5) harsh voice. No significant differences were obtained between medicated states ('on'/'off') for any of the 35 individual speech dimensions and speech-sign clusters. Global motor function significantly improved following dopaminergic medications.

2008

**Donovan NJ, Kendall DL, Young ME, Rosenbek JC. The communicative effectiveness survey: preliminary evidence of construct validity. Am J Speech Lang Pathol. 2008 Nov;17(4):335-47.**

**PURPOSE:** To provide preliminary evidence of the construct validity of the Communicative Effectiveness Survey (CES) for individuals with dysarthria and idiopathic Parkinson's disease (PD).

**METHOD:** In a prospective, quasi-experimental design, 25 participants each were assigned to 3 groups (N = 75): PD and dysarthria, non-PD and no dysarthria, and PD significant others (SOs). Mean CES ratings were used to test for significant differences between the PD and non-PD group, and PD and SO rating of PD's communicative effectiveness. Multiple linear regression tested for significant predictors of CES ratings for PD group only using sentence intelligibility and spontaneous speech intelligibility scores as predictor variables. **RESULTS:** The PD group rated their CES significantly lower than did the non-PD group. The PD group rated their CES significantly higher than their SOs rated them. Neither speech intelligibility score was a significant predictor of CES ratings. In follow-up analysis, the Hoehn and Yahr PD staging accounted for 47% of the variability in CES ratings for the PD group participants. **CONCLUSIONS:** This study provides preliminary evidence of the CES's construct validity. Clinicians and researchers who assess and treat individuals with PD may consider adding an additional assessment to the traditional clinical measures (i.e., speech intelligibility) by obtaining a measure of communicative effectiveness).

**Wheeler-Hegland KM, Rosenbek JC, Sapienza CM. Submental sEMG and hyoid movement during Mendelsohn maneuver, effortful swallow, and expiratory muscle strength training. J Speech Lang Hear Res. 2008 Oct;51(5):1072-87.**

**PURPOSE:** This study investigated the concurrent biomechanical and electromyographic properties of 2 swallow-specific tasks (effortful swallow and Mendelsohn maneuver) and 1 swallow-nonspecific (expiratory muscle strength training [EMST]) swallow therapy task in order to examine the differential effects of each on hyoid motion and associated submental activation in healthy adults, with the overall goal of characterizing task-specific and overload properties of each task. **METHOD:** Twenty-five healthy male and female adults (M = 25 years of age) participated in this prospective, experimental study with 1 participant group. Each participant completed all study tasks (including normal swallow, Mendelsohn maneuver swallow, effortful

swallow, and EMST task) in random order during concurrent videofluoroscopy and surface electromyography recording. RESULTS: Results revealed significant differences in the trajectory of hyoid motion as measured by overall displacement and angle of elevation of the hyoid bone. As well, timing of hyoid movement and amplitude differences existed between tasks with regard to the activation of the submental musculature. CONCLUSIONS: Study results demonstrated differential effects of the 3 experimental tasks on the principles of task specificity and overload. These principles are important in the development of effective rehabilitative programs. Subsequent direction for future research is suggested.

**Plowman-Prine EK, Triggs WJ, Malcolm MP, Rosenbek JC. Reliability of transcranial magnetic stimulation for mapping swallowing musculature in the human motor cortex. Clin Neurophysiol. 2008 Oct;119(10):2298-303.** OBJECTIVE: Although transcranial magnetic stimulation (TMS) has been widely used to study motor cortex organization and excitability, the reliability of this technique has not been thoroughly investigated. Furthermore, previous reports of TMS reliability have been restricted to upper limb musculature. We sought to determine the test-retest reliability for TMS mapping of motor representations for swallowing musculature. METHODS: Twenty healthy volunteers were tested twice over two weeks using TMS to determine motor threshold, map area, map volume, maximal MEP site location and maximal MEP site size for the suprahyoid complex and pharyngeal musculature. RESULTS: Good test-retest reliability was found in both swallowing muscle sites for the following test parameters: motor map area, maximal MEP site location: lateral coordinate, maximal MEP site size and motor threshold (ICC=0.76-0.98). Moderate reliability was observed for motor map volume and maximal MEP site location: anterior-posterior coordinate (ICC=0.68-0.74). CONCLUSIONS: TMS assessments of motor representation size, location and excitability appear to be highly reproducible, although the reliability of these measures may vary according to the specific muscle under investigation. SIGNIFICANCE: These works provide much needed psychometric data to validate the use of TMS to assess the cortical representation of swallowing musculature.

**Pitts T, Bolser D, Rosenbek J, Troche M, Sapienza C. Voluntary cough production and swallow dysfunction in Parkinson's disease. Dysphagia. 2008 Sep;23(3):297-301.** Cough is important for airway clearance, particularly if penetration/aspiration of foreign material occurs during swallow. Measures of voluntary cough production from ten male participants with stage II-III Parkinson's disease (PD) who showed no videofluorographic evidence of penetration/aspiration (Group 1) were examined and compared with those of ten male participants with stage II-III PD who showed videofluorographic evidence of penetration/aspiration (Group 2). The degree of penetration/aspiration was expertly judged from the videofluorographic examinations of the participants' sequential swallow of a thin, 30-cc bolus. Measured cough parameters included inspiratory phase duration, inspiratory peak flow, compression phase duration, expiratory peak flow, expiratory rise time, and cough volume acceleration. Results indicated significant group differences for the majority of cough measures, except for inspiratory phase duration and inspiratory peak flow. A modest relationship existed between voluntary cough parameters and penetration/aspiration scores. Decreased ability to adequately clear material from the airway with voluntary cough may exacerbate symptoms resulting from penetration/aspiration, particularly for those with neurodegenerative disease. Measurement of voluntary cough may be useful for the evaluation of airway clearance ability.

**Kendall DL, Rosenbek JC, Heilman KM, Conway T, Klenberg K, Gonzalez Rothi LJ, Nadeau SE. Phoneme-based rehabilitation of anomia in aphasia. Brain Lang. 2008 Apr;105(1):1-17.** This study

investigated the effects of phonologic treatment for anomia in aphasia. We proposed that if treatment were directed at the level of the phonologic processor, opportunities for naming via a phonological route, as opposed to a strictly whole word route, would be enhanced, thereby improving naming. The participants, ten people with anomia and aphasia due to left hemisphere stroke, received 96 h of phoneme based treatment in 12 weeks. To learn if treatment improved naming, a single-subject, repeated probe design with replication was employed. The primary outcome measure was confrontation naming. Secondary outcome measures included phonologic production, nonword repetition and discourse production. Results suggest a positive treatment effect (confrontation naming), improvements in phonologic production and nonword repetition, and generalization to discourse production. When tested 3 months after the completion of treatment the effects appeared to be maintained.

**Robbins J, Butler SG, Daniels SK, Diez Gross R, Langmore S, Lazarus CL, Martin-Harris B, McCabe D, Musson N, Rosenbek J. Swallowing and dysphagia rehabilitation: translating principles of neural plasticity into clinically oriented evidence. J Speech Lang Hear Res. 2008 Feb;51(1):S276-300.**

**PURPOSE:** This review presents the state of swallowing rehabilitation science as it relates to evidence for neural plastic changes in the brain. The case is made for essential collaboration between clinical and basic scientists to expand the positive influences of dysphagia rehabilitation in synergy with growth in technology and knowledge. The intent is to stimulate thought and propose potential research directions. **METHOD:** A working group of experts in swallowing and dysphagia reviews 10 principles of neural plasticity and integrates these advancing neural plastic concepts with swallowing and clinical dysphagia literature for translation into treatment paradigms. In this context, dysphagia refers to disordered swallowing associated with central and peripheral sensorimotor deficits associated with stroke, neurodegenerative disease, tumors of the head and neck, infection, or trauma. **RESULTS AND CONCLUSIONS:** The optimal treatment parameters emerging from increased understanding of neural plastic principles and concepts will contribute to evidence-based practice. Integrating these principles will improve dysphagia rehabilitation directions, strategies, and outcomes. A strategic plan is discussed, including several experimental paradigms for the translation of these principles and concepts of neural plasticity into the clinical science of rehabilitation for oropharyngeal swallowing disorders, ultimately providing the evidence to substantiate their translation into clinical practice.

**Gonzalez Rothi LJ, Musson N, Rosenbek JC, Sapienza CM. Neuroplasticity and rehabilitation research for speech, language, and swallowing disorders. J Speech Lang Hear Res. 2008 Feb;51(1):S222-4.**

**PURPOSE:** This article introduces a collection of consensus statements regarding the application of neuroplasticity principles to rehabilitation of dysphagia, dysarthria, apraxia, and aphasia.

**Troche MS, Sapienza CM, Rosenbek JC. Effects of bolus consistency on timing and safety of swallow in patients with Parkinson's disease. Dysphagia. 2008 Mar;23(1):26-32.** Aspiration pneumonia is the leading cause of death in Parkinson's disease (PD) patients. In clinical practice, the videofluoroscopic examination (VFE) is the most common method for evaluation of swallowing disorders. One of the variables manipulated during the VFE is consistency of the bolus. The results of this examination greatly influence the recommendations made by speech-language pathologists regarding swallow therapy and/or intervention. The primary aim of this study was to investigate the effects of bolus consistency on penetration-aspiration (P-A) score and timing of swallow of persons with PD. The videoradiographic images of ten participants with PD swallowing six thin and six pudding-thick boluses

were analyzed. Swallow timing and P-A were measured. (i.e., oral transit time, pharyngeal transit time, number of tongue pumps, and P-A score). The results demonstrated various significant differences and relationships among the dependent variables. Implications for further research and clinical practice are discussed.

2007

**Donovan NJ, Kendall DL, Moore AB, Rosenbek JC, Rothi LJ. Why consider impaired social language usage in a case of corticobasal degeneration? Clin Neuropsychol. 2007 Jan;21(1):190-203.** The purpose of this case study was to examine the integrity of cognitive skills, language usage, and language structure components in a patient with corticobasal degeneration (CBD). CBD is a levodopa-nonresponsive, degenerative neurologic movement disorder that is generally accompanied by cognitive (frontal executive dysfunction, dementia) and linguistic (aphasia) disorders. However, no one has reported on social language usage deficits in cases of CBD. The reported frontal executive dysfunction found in CBD led us to expect social language usage deficits in the present case study. Consistent with the literature, the patient demonstrated motor, cognitive (severe apraxia, frontal executive deficits, dementia), and linguistic deficits (aphasia). However she also demonstrated significantly abnormal social language usage previously unreported in the literature.

**Daniels SK, Schroeder MF, DeGeorge PC, Corey DM, Rosenbek JC. Effects of verbal cue on bolus flow during swallowing. Am J Speech Lang Pathol. 2007 May;16(2):140-7.** PURPOSE: To examine the effects of verbal cuing to initiate swallowing on bolus flow measures in healthy adults. METHOD: Videofluoroscopic examinations were completed in 12 healthy older adults (median age=69 years) as they swallowed 5 ml of self-administered liquid barium in 2 conditions: verbally cued and noncued swallows. In the cued condition, participants held the liquid in their mouths until instructed to swallow. In the noncued condition, participants swallowed in their usual manner. RESULTS: Verbal cue affected bolus position at onset of timing measures, thereby influencing duration. The bolus was positioned more posterior in the oral cavity at onset of oral transit for cued as compared with noncued swallows. The leading edge of the bolus at onset of the pharyngeal swallow was more superior in the pharynx for cued as compared with noncued swallows. Durations of the cued swallows were significantly shorter than for noncued swallows for all timing measures. Bolus direction scores were not significantly different between conditions. CONCLUSIONS: Findings suggest that swallowing is altered by the use of verbal cues to initiate swallowing in healthy adults. Determining whether shorter durations with implementation of verbal cues are evident in individuals with dysphagia and whether effects are beneficial or deleterious requires continued research.

**Burkhead LM, Sapienza CM, Rosenbek JC. Strength-training exercise in dysphagia rehabilitation: principles, procedures, and directions for future research. Dysphagia. 2007 Jul;22(3):251-65.** Dysphagia rehabilitation, historically, has focused a great deal on various compensations during swallowing to prevent aspiration and/or improve safety and efficiency. Exercise, in general, has been a part of the dysphagia rehabilitation landscape. However, heightened discussions in the field regarding best practices for exercise training, particularly strengthening, raise more questions than answers. The intent of this paper is to (1) explore the overriding principles of neuromuscular plasticity with regard to strength training, (2) evaluate how current exercise-training interventions in dysphagia rehabilitation correspond to these principles, and (3) postulate directions for future study of normal and disordered swallowing and determine how to incorporate these principles into dysphagia

rehabilitation.

**Bunton K, Kent RD, Duffy JR, Rosenbek JC, Kent JF. Listener agreement for auditory-perceptual ratings of dysarthria. J Speech Lang Hear Res. 2007 Dec;50(6):1481-95.** PURPOSE: Darley, Aronson, and Brown (1969a, 1969b) detailed methods and results of auditory-perceptual assessment for speakers with dysarthrias of varying etiology. They reported adequate listener reliability for use of the rating system as a tool for differential diagnosis, but several more recent studies have raised concerns about listener reliability using this approach. METHOD: In the present study, the authors examined intrarater and interrater agreement for perceptual ratings of 47 speakers with various dysarthria types by 2 listener groups (inexperienced and experienced). The entire set of perceptual features proposed by Darley et al. was rated based on a 40-s conversational speech sample. RESULTS: No differences in levels of agreement were found between the listener groups. Agreement was within 1 scale value or better for 67% of the pairwise comparisons. Levels of agreement were lower when the average rating fell in the mid-range of the scale compared with samples that had an average rating near either of the scale endpoints; agreement was above chance level. No significant differences in agreement were found between the perceptual features. DISCUSSION: The levels of listener agreement that were found indicate that auditory-perceptual ratings show promise during clinical assessment for identifying salient features of dysarthria for speakers with various etiologies.

**SAPIENZA, CHRISTINE**

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**Troche, M.S., Okun, M.S., Rosenbek, J.C., Musson, N., Fernandez, H.H., Rodriguez, R.R., Romrell, J., Pitts, T., Wheeler-Hegland, K., & Sapienza, C.M. (submitted). Aspiration and Swallowing in Parkinson's Disease and Rehabilitation with EMST: The ASPIRE Study. JAMA.** Background : Dysphagia is the main cause of life-threatening morbidity in Parkinson's Disease (PD) with no established restorative behavioral treatment to date. Reduced swallow safety may be related to decreased elevation and excursion of the hyolaryngeal complex. Increased submental muscle force generation resulting in increased hyolaryngeal complex movement provides a strong rationale for use of expiratory muscle strength training (EMST). Objective: To test the outcome of a 4-week device-driven, EMST program on swallow safety and define the treatment outcome mechanism(s) through measures of swallow timing and hyoid displacement. Methods: Randomized, blinded, sham-controlled EMST trial performed at an academic center between June 1, 2004 and June 31, 2008 involving 72 PD patients. Intervention: EMST, 4 weeks, 5 days per week, for 20 minutes per day, using a calibrated or sham device. Main Outcome Measures: Measures of swallow function including judgments of swallow safety (Penetration-Aspiration [P-A] scale scores) and hyoid movement were made from videofluoroscopic images. Findings: No baseline group differences existed. The active treatment (EMST) group demonstrated improved swallow safety compared to the sham group as evidenced by improved PA scores. The active group demonstrated maintenance and/or improvement of hyolaryngeal function, findings not evident for the sham group. Interpretation: EMST may serve as a restorative treatment option for dysphagia in those with PD. Swallow safety as defined by PA score improved post EMST. The mechanism may be explained by improved movement of the hyolaryngeal complex.

**Nocera, J., Altmann, L., Sapienza, C.M., Okun, M., & Hass, C. (submitted). Can Exercise improve**



















